SOCIAL TRANSFORMATION

Proceedings of the 23rd UK Academy for Information Systems (UKAIS) International Conference

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Preface

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On behalf of the UKAIS and its committee, we welcome you to the conference proceedings for UKAIS 2018. This volume contains the papers presented at UKAIS2018: UK Academy for Information Systems, Annual International Conference 2018 held on March 18-21, 2018 at St Anne’s College in Oxford, UK. There were 36 submissions. Each submission was reviewed by at least 1 reviewer, and the programme committee decided to accept 30 papers. The program also includes 3 Keynote presentations - Prof. Bernd Stahl (DMU), Angela Maurer (Head of Tesco Labs) and Prof. Ben Light (University of Salford).

The UKAIS conference is the premier academic event in the Information Systems calendar within the UK, and attracts leading scholars from the UK and overseas. It is a charity, whose aims are to enhance the recognition and knowledge of IS within the UK, and to provide a forum for discussing issues in IS teaching and research. UKAIS recognises the importance of including practitioners in its work.

The UK Academy for Information Systems was established in 1994 to foster a better understanding of the Information Systems field within the UK. We provide a forum for discussing issues in IS teaching and research and lobby professional/policy bodies on behalf of our field, such as HEFCE, the UK Research Councils, UK business and Government. There is a conference every year, normally held in Oxford, which is preceded by a PhD consortium.

UKAIS Aims:

- To promote a better knowledge and understanding of information systems within the United Kingdom.
- To improve the practice of information systems teaching and research.
- To enable successful knowledge transfer of IS research into teaching and practice in order to provide a positive economic and societal impact.

Many thanks to all those that have given of their time so freely to review papers for the academy, it is much appreciated.

Also a huge thanks to our conference administrator, Abi Hopkins, who really does keep the wheels rolling on this wagon.

This year we have received some sponsorship from the MDPI journal 'Informatics', which we gratefully acknowledge.

- Informatics (ISSN 2227-9709) is an international, peer-reviewed, open access journal, which publishes original theoretical and empirical work on the science of informatics and its application in multiple fields. Our concept of Informatics includes technologies of information and communication as well as the biological, social, linguistic and cultural changes that initiate, accompany and complicate their development.

Finally thanks to EasyChair who have supported the collection and review of papers, as well as the collation of papers into this volume for the proceedings.

March, 2018
Oxford
Laurence Brooks
Rachel Mclean
Marie Griffiths
# Table of Contents

<table>
<thead>
<tr>
<th>Paper</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>An Analysis Of The Moderating Effect Of Age On Smartphone Adoption And Use In The United Arab Emirates</td>
<td>1</td>
</tr>
<tr>
<td><em>Nisreen Ameen and Robert Willis</em></td>
<td></td>
</tr>
<tr>
<td>The Role of Workarounds in Benefits Realisation: Evidence from a Field Study in Saudi Arabia</td>
<td>3</td>
</tr>
<tr>
<td><em>Albayan Alraddadi, Donna Champion and Andrea Lagna</em></td>
<td></td>
</tr>
<tr>
<td>Social Media? What Social Media?</td>
<td>4</td>
</tr>
<tr>
<td><em>Maxim Wolf, Julian Sims and Huadong Yang</em></td>
<td></td>
</tr>
<tr>
<td>Digital Literacy And Exclusion In The Social Media Age</td>
<td>6</td>
</tr>
<tr>
<td><em>Julian Sims, Magda Fusaro and Maxim Wolf</em></td>
<td></td>
</tr>
<tr>
<td>Intervention Evolution Engine - An Intelligent eHealth Service Delivery Platform</td>
<td>7</td>
</tr>
<tr>
<td><em>Bakhtiyar Ahmed, Thomas Dannhauser and Nada Philip</em></td>
<td></td>
</tr>
<tr>
<td>Exploring The Collaborative Activities Of Home-Based Businesses In OECD Countries</td>
<td>8</td>
</tr>
<tr>
<td><em>David Hastings, Muhammad Naveed Anwar and Gobinda Chowdhury</em></td>
<td></td>
</tr>
<tr>
<td>Communication-Driven Usefulness Hypothesis for Online Healthcare Applications</td>
<td>9</td>
</tr>
<tr>
<td><em>Makoto Nakayama and Steven Leon</em></td>
<td></td>
</tr>
<tr>
<td>Theory Choice In Critical Realist Information Systems Research</td>
<td>10</td>
</tr>
<tr>
<td><em>Chidi Ononwua, Irwin Brown and Sven Carlsson</em></td>
<td></td>
</tr>
<tr>
<td>Knowledge Diffusion Via Specialist Best Practice</td>
<td>11</td>
</tr>
<tr>
<td><em>Mounir Kehal</em></td>
<td></td>
</tr>
<tr>
<td>Different Languages, Different Questions: Language Versioning in Q&amp;A</td>
<td>12</td>
</tr>
<tr>
<td><em>Andrew Vargo, Benjamin Tag, Kai Kunze and Shigeo Matsubara</em></td>
<td></td>
</tr>
<tr>
<td>An Investigation Of The Factors Affecting The Collaborative Propensity Of Home-Based Businesses: An Outline Of The Initial Study</td>
<td>14</td>
</tr>
<tr>
<td><em>David Hastings and Muhammad Naveed Anwar</em></td>
<td></td>
</tr>
<tr>
<td>Transforming Health through Big Data: Challenges and Considerations</td>
<td>15</td>
</tr>
<tr>
<td><em>Andrew Boilson, Anthony Staines, Regina Connolly, Justin Connolly and Paul Davis</em></td>
<td>16</td>
</tr>
<tr>
<td>Implications Of Industry 4.0 To Supply Chain Management And Human Resources Management</td>
<td>17</td>
</tr>
<tr>
<td><em>Ayse Begum Kilic and Sevgi Ozkan</em></td>
<td></td>
</tr>
<tr>
<td>Analysis Of Electronic Voting Schemes In The Real World</td>
<td>18</td>
</tr>
<tr>
<td><em>Voke Augoye and Allan Tomlinson</em></td>
<td></td>
</tr>
<tr>
<td>Factors That Affect The Acceptance Of New Technologies In The Workplace: A Cross Case Analysis Between UK And Hong Kong</td>
<td>19</td>
</tr>
<tr>
<td><em>Dimitra Skoumpopoulou, Adam Wong, Peggy Ng and Man Fung Lo</em></td>
<td></td>
</tr>
<tr>
<td>The Servitization Of The IT Function: Implications For The IT Professional</td>
<td>20</td>
</tr>
<tr>
<td><em>Clive Trusson</em></td>
<td></td>
</tr>
</tbody>
</table>
The Impact Of Robo-Advice On Financial Advisers: A Qualitative Case Study ........................ 20
  
  Crispin Coombs and Alex Redman

Tourist Expectations and Behaviour towards Sport Tourism in Thailand ............................... 22
  
  Witthaya Inpongpan

Smart Classroom - New Dimension of Learning: the case study of Suan Dusit University Thailand ................................................................. 23
  
  Suwitcha Niamsorn

Encountering camera surveillance and accountability at work – case study of the Swedish police ..................................................................................... 26
  
  Marie Eneman, Jan Ljungberg, Bertil Rolandsson and Dick Stenmark

An Overview of User-level Usage Monitoring in Cloud Environment .................................... 27
  
  Manoj Kesavulu, Duc-Tien Dang-Nguyen, Markus Helfert and Marija Bezbradica

Inherent Game Characteristics of Electronic Negotiations ....................................................... 28
  
  Andreas Schmid and Mareike Schoop

Small Steps: Improving Healthcare With Local Innovation .................................................... 29
  
  Nancy Russo, Jeanette Eriksson, Sue Harden Mugelli and Javier Marin

Qualitative Critical Realism in Information Systems Research .............................................. 31
  
  Vahid Javidroozi, Hanifa Shah and Gerald Feldman

Agility in Information Systems – A Literature Review on Terms and Definitions .................. 32
  
  Amelie Kim Schirrmacher and Mareike Schoop

Information Technology Outsourcing Configurations And Organizational Outcomes ............. 33
  
  Quang Bui, Olayele Adelakun and Ezekiel Leo

Personalised Context Aware Content Relevant Disease Prediction And Diet
Recommendation System ........................................................................................................ 34
  
  Ramakrishnudu Tene and Balakrishna Tangedipalli

  
  Majed Algarni and Dr. Ahmad Alsanad

Encountering camera surveillance and accountability at work – case study of the Swedish police ..................................................................................... 38
  
  Marie Eneman, Jan Ljungberg, Bertil Rolandsson and Dick Stenmark

The General Data Protection Regulation (GDPR), Emerging Technologies and UK Organisations: Awareness, Implementation and Readiness ........................................ 39
  
  Maria Chiara Addis and Maria Kutar

Digital Business Evolution: lessons from a decade of KTP industry projects ...................... 40
  
  Marie Griffiths, Aleksej Heinze, Alex Fenton and Gordon Fletcher
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AN ANALYSIS OF THE MODERATING EFFECT OF AGE ON SMARTPHONE ADOPTION AND USE IN THE UNITED ARAB EMIRATES

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Abstract

This paper investigates the adoption of smartphones among different age groups in the youth segment of the population in the United Arab Emirates (UAE). The proposed model is based on an extension of the extended unified theory of acceptance and use of technology (UTAUT2). A total of 437 questionnaires were distributed face to face to smartphone users in Dubai. The findings showed that age is a significant moderator in the proposed model, as significant differences were found between smartphone users in the UAE aged 18–22 and those aged 23–29. Specifically, age moderated the relationship between behavioural intention and five independent factors included in the proposed model: culture-specific beliefs and values, perceived relative advantage, price value, effort expectancy, and enjoyment. In addition, age moderated the effect of habit on actual use of smartphones. Accordingly, this research provides information that can help mobile companies and developers of mobile applications to improve the way they target customers in the UAE.

Keywords Smartphone adoption, Age as a moderator, Young people in the UAE, Adoption of mobile applications, Partial least squares, UTAUT2

1. Introduction

Smartphones have been proved to be an important tool in both developed and developing countries, as they enable people to access and use mobile applications (apps) for the purposes of education, government services, banking services, shopping and playing games (Almuraqab, 2017). Shiraishi et al. (2011, p.3) define the smartphone as “A mobile phone or PHS [personal handy-phone system] that incorporates a public general-purpose operating system, to which users can freely add applications, extend functionality, or customize”. These mobile services/apps have a significant influence on the use of mobile phones (Sabry et al., 2011). According to Gulf News (2017), the Middle East is an untapped resource for local and international application developers: many demographic segments of the population are not yet actively using mobile applications. In addition, there is a gap in the market in terms of catering for the specific needs of individuals in the Arab region (Gulf News, 2017).
The UAE was selected as ‘the country young Arabs like to live in’, as they see it as an ideal country with a strong economy and an outstanding infrastructure (ASDA’A Burson-Marsteller, 2014). At 83%, the UAE has the highest smartphone penetration rate in the world (GSMA, 2016). However, the rate of adoption for mobile applications is lower than that (Shabeeh, 2015). According to Shabeeh (2015), out of all Internet users in the UAE, “52 per cent use social media apps, while 45 per cent regularly watch videos on their mobile phones. The percentage of the population who play games on their mobile phones stands at 33 per cent, and nearly 31 per cent use mobile banking services”. A number of studies have investigated the factors that can affect the adoption and use of individual mobile applications; for instance, mobile banking (Aboelmaged and Gebba, 2013; Ryalat, 2017), mobile government (Almuraqab, 2017) and mobile learning (Shorfuzzaman and Alhussein, 2016). However, there is a gap in the literature in terms of studying the adoption of smartphones themselves (Dennison et al., 2013). This is an important area that needs to be investigated, as individuals must interact with smartphones before they can access any of these mobile applications and services. Smartphones present tremendous opportunities for individuals, companies and the government in the UAE (Nielsen, 2014).

The existing literature is a rich source of theories of technology acceptance; for example, the technology-acceptance model (TAM) developed by Davis (1989), the (1985) theory of planned behaviour (TPB) developed by Ajzen (1985), the diffusion of innovation theory (Rogers, 2003), the unified theory of acceptance and use of technology (UTAUT) developed by Venkatesh et al. (2003), and the extended unified theory of acceptance and use of technology (UTAUT2) developed by Venkatesh et al. (2012). However, few studies have tested how these models fit different demographic profiles of consumers.

Venkatesh et al. (2003) integrated some moderators (including age, gender, experience, and voluntariness) into the original UTAUT, and Williams et al. (2015) recommended testing the UTAUT with the inclusion of demographic factors. Outside the context of the Middle East, studies have found that the behaviour of individuals in relation to smartphones varies depending on gender and age (Anshari et al., 2016). In their recent study, Venkatesh et al. (2016) reviewed the literature on the UTAUT (Venkatesh et al., 2003) and the UTAUT2 (Venkatesh et al., 2012). Venkatesh et al. (2016) evaluated how the theory had been extended in studies that were conducted between September 2003 and December 2014. Venkatesh et al. (2016) stated that there is a gap in literature on the effects of moderating factors, including age. This was also identified in a more recent study conducted by Dwivedi et al. (2017). In particular, the moderating effects of age have received relatively little attention in the literature (Tarhini et al., 2014).

Older generations are greatly influenced by younger generations. In fact, younger generations are not only early adopters but also strong influencers on users from the other age groups, especially the older generation (Mallenius et al., 2007). They can motivate older generations to use smartphones for the first time. Social influence has a stronger effect on older people than younger people (Venkatesh et al., 2003;
Mallenius et al., 2007). Even in developed countries, where a larger proportion of the population is older (Kalba, 2008), there has been an interest in studying technology adoption among younger generations (e.g. Taylor et al., 2011). This is due to two main reasons. First, younger people tend to have more interest in adopting new technologies (Aoki and Downes, 2003). Second, younger people have a strong influence on older people (Mallenius et al., 2007).

The 15–29 age group is the largest segment of the Arab population (Dhillon and Yousef, 2009; Hayutin, 2009; Kronfol, 2011; GSMA, 2013, 2014). The 2014 GSMA report states that one out of five in the region is aged 15–24 and more than 60% of the population is under the age of 30 (GSMA, 2014). Moreover, a study by Kavanaugh et al. (2012), focusing on social media via mobile phone adoption and usage in Egypt, added that 15–29 year olds form a large segment of the population of Internet users in the Arab region. The authors state:

There is a high percentage of young people (aged 15–29) among the total population in most Middle Eastern countries, and a high proportion of Internet and social media users among young people. These two factors allow this segment of the population to draw on many online sources of information besides the more widely used mainstream media of television and newspapers (Kavanaugh et al., 2012, p.8).

In addition, young people form a large segment of the population in the UAE (UNDP, 2014). In the UAE, 51% of the population is under the age of 30 (United Arab Emirates National Bureau of Statistics, 2015). However, there is a lack of research on this segment of the population. In particular, few studies investigate the differences in smartphone adoption and use (including mobile applications) among subgroups of the main under-30 group. For example, studying the differences between the 15–22 age group, which contains mostly students, and the 23–29 age group, which includes people who are employed, who have a higher level of income and who are expected to be more responsible. Studying differences in smartphone adoption and use between these two age groups would provide a more in-depth understanding of the behaviour of young people aged 18-29 years old in terms of smartphone adoption and use.

Based on the above, this study addresses three gaps from a theoretical perspective. First, it fills the gap in research in studying young people’s adoption and use of smartphones, along with different mobile applications in UAE. Second, it analyses the effects of the moderator variable age in the UTAUT2 to provide further understanding of how the model fits with individuals from different age groups. Third, it closes the gap in research on the differences between two narrower age groups in the youth segment. This study fills these gaps by investigating the adoption of smartphones and mobile applications among two different age groups in the youth segment of the population in the UAE.

This research studied the adoption and use of smartphone handsets in addition to the mobile applications that can be accessed through them in order to fully understand the impact of age. Mobile applications are developed and used for many different, but
specific, purposes; and users’ adoption and usage patterns of these applications varies. Therefore, this research only studies the adoption of mobile applications in general in order to complement smartphone adoption. It does not investigate the factors that can affect each the adoption of each type of mobile application separately (for example, mobile learning, m-commerce, mobile government or mobile banking), because each of these applications may involve additional factors that are specific to its adoption. This is beyond the scope of this research and has been investigated previously; for example, in studies conducted by Alkhunaizan and Love (2012), Nassuora (2012), Al Mashaqba and Nassar (2012), AlOtaibi (2013) and Baabdullah et al. (2015).

The following sections are organised as follows. Section two presents the conceptual framework, including the main factors and the hypothesised relationships between them. Section three explains the methodology adopted in this research. This is followed by the results of the data analysis and a discussion of the findings. Finally, implications for theory and practice, conclusions, and areas for future research are provided.

2. Conceptual framework

This conceptual framework proposed in this research is based on the extended unified theory of acceptance and use of technology (UTAUT2), which was developed by Venkatesh et al. (2012). This research extends the model further. The UTAUT2 was selected for three reasons. First, it was developed specifically to fit the context of consumer adoption of technology based on as an extension of the original UTAUT (Venkatesh et al., 2003), which combined and analysed eight theories of technology acceptance that were widely acknowledged in the existing body of literature. These included the TRA (Ajzen and Fishbein, 1980), the TAM (Davis, 1989), the motivational model (Davis et al.,1992), the TPB (Ajzen, 1991), the combined TAM and TPB (known as the A-TAM) (Taylor and Todd, 1995), the model of PC utilisation (Thompson et al., 1994), the diffusion of innovation theory (Rogers, 2003), and social cognitive theory (Bandura, 1986). Later, Venkatesh et al. (2012) extended their theory (UTAUT2) for use in the context of consumer adoption of technology. The UTAUT2 combined the concepts from these eight theories, which used different labels but thematically overlapped. Second, the framework created by Venkatesh et al. (2012) was tested with actual users of mobile Internet, which is similar to the context of smartphone adoption and provides a customer perspective. Third, Venkatesh et al. (2012) suggested testing the theory in different countries. Thus, the UTAUT2 was selected to form the basis of the framework developed in this study.

The conceptual model includes the following independent factors: perceived relative advantage, effort expectancy, price value, enjoyment and habit. It includes two additional independent factors – culture-specific beliefs and values and national IT development – as proposed by Ameen and Willis (forthcoming). The dependent factors are behavioural intention and actual use. Social influence and facilitating conditions were omitted. Facilitating conditions are defined as “consumers’ perceptions of the resources and support available to perform a behaviour” (Venkatesh
et al., 2012, p.159). Social influence is defined as “the extent to which consumers perceive that important others (e.g., family and friends) believe they should use a particular technology” (Venkatesh et al., 2012, p.159). Both factors were found to be insignificant in previous studies on technology adoption in Arab countries (Abu-Shanab and Pearson, 2007; Abu-Shanab et al., 2010; Al-Gahtani et al., 2007; Allmarah et al., 2013; Alkhunaizan, and Love, 2012; Al-Qeisi et al., 2014; Al-Qeisi et al., 2015; Ameen and Willis (forthcoming); Nassuora, 2012). In addition, Venkatesh et al. (2003) explain that the effect of facilitating conditions can be overridden by the presence of effort expectancy in the model, while the effect of social influence can diminish when users have a substantive experience of using a technological product. This is the case for individuals in UAE (GSMA, 2016). Thus, these two factors were excluded from the model.

The next section provides definitions of the factors of the model. It explains the hypothesised relationships between the constructs when they are moderated by age. The expected differences in the significance of the constructs among older and younger people are highlighted.

2.1 Behavioural intention (BI)

Behavioural intention is defined as “A user’s readiness to carry out a particular behaviour” (Ajzen, 1991). It has been found to be significant in many theories related to technology acceptance, including the TAM (Davis, 1989), the TPB (Ajzen, 1991), the motivational model (Davis et al., 1992), the augmented theory of planned behaviour (A-TPB) (Taylor and Todd, 1995), the extended technology acceptance model (TAM2) (Venkatesh and Davis, 2000), the UTAUT (Venkatesh et al., 2003), the UTAUT2 (Venkatesh et al., 2012) and the mobile phone technology acceptance model (MOPTAM) (Van Biljon and Kotze, 2008). Behavioural intention is one of the dependent variables in this study, as it is affected by the independent variables. In the context of smartphone adoption and use in the UAE, behavioural intention was expected to have a significant effect among younger and older individuals, since the adoption rate is high for the population as a whole (GSMA, 2015; 2016). Therefore, it was hypothesised that:

H1. The effect of behavioural intention on actual use of smartphones is significant among older and younger individuals.

2.2 Perceived relative advantage (usefulness) (PRA)

Rogers (2003, p.229) defines relative advantage as “the degree to which an innovation is perceived as being better than the idea it supersedes”. Moore and Benbasat (1991) suggested that the term relative advantage is more detailed and perceptive to the user than the term perceived usefulness. Based on this suggestion, Igbal and El-Gohary (2014) used the term perceived relative advantage (usefulness). This term stems from the factors perceived usefulness and performance expectancy, which have proved to
have a strong influence on behavioural intention in previous theories of technology acceptance (e.g., Davis, 1989; Venkatesh et al., 2012; Alwahaishi and Snášel, 2013).

Previous studies have shown that perceived usefulness is a significant determinant of behavioural intention (Davis, 1989; Davis and Venkatesh, 1996). Therefore, perceived relative advantage (usefulness), adapted from a study by Moore and Benbasat (1991), was expected to have a significant effect on behavioural intention in this research. Venkatesh et al. (2003) found that the effect of performance expectancy was stronger among younger individuals. Young people tend to interact with technology more than older people do (Olson, 2011). Moreover, they form a large segment of the population in the UAE, which has a high smartphone adoption rate (GSMA, 2016). Therefore, since the research targets younger people, it was expected to have a higher level of awareness of the benefits of using smartphones. Thus:

H2. The effect of perceived relative advantage (usefulness) on behavioural intention to use smartphones is stronger among younger individuals.

2.3 Effort expectancy (EE)
Effort expectancy is defined as “the degree of ease associated with consumers’ use of technology” (Venkatesh et al., 2012, p.159). Effort expectancy was found to be significant in the UTAUT2 (Venkatesh et al., 2012) and other studies (e.g., Davis, 1989; Davis et al., 1992; Taylor and Todd, 1995; Venkatesh and Davis, 2000). Previous studies have found that effort expectancy, or how easy the system is to use, is more important among older individuals than younger ones (e.g., Czaja, 2007; Venkatesh et al., 2003; Venkatesh et al., 2012). This is because as age increases, paying attention to information and completing complex tasks (such as using a smartphone and mobile applications) becomes more difficult (Czaja, 2007). Thus:

H3. The effect of effort expectancy on behavioural intention to use smartphones such is stronger among older individuals.

2.4 Enjoyment (Enj)
Hedonic motivation is defined by Venkatesh et al. (2012, p.161) as “the fun or pleasure derived from using a technology”. Enjoyment was expected to be important for the adoption of smartphones due to the high number of mobile applications for gaming and entertainment. It has been found to be significant in previous studies (e.g., Kamel and Farid, 2007; Nysveen et al., 2005). Enjoyment was represented by the construct hedonic motivation in the UTAUT2 (Venkatesh et al., 2012). In the context of this research, it was expected that age moderates the relationship between enjoyment and behavioural intention and that its effect is stronger among younger individuals. Younger people are more interested in using games and social media on mobile devices; in other words, they are more interested in using smartphones and mobile applications for fun (Ameen and Willis, forthcoming). Therefore, enjoyment was expected to have a more significant effect on the younger age group. Thus:
H4. The effect of enjoyment on behavioural intention to use smartphones is stronger among younger individuals.

2.5 Habit (HT)

Habit was found to be important in the UTAUT2 (Venkatesh et al., 2012). Although Carbonell et al. (2013) stated that it might not be appropriate to regard the extensive use of mobile phones as an addiction, the authors did emphasise that when a mobile phone is overused, a habit develops automatically and changes people’s behaviour. The direct effect of habit on actual use (that is, without behavioural intention as a mediator) was also discussed in a study by Limayem et al. (2007). The authors stated that when habit is formed (by using technology frequently for a certain period of time in a stable environment), it becomes a key driver of actual use that can override the effect of behavioural intention (Limayem et al., 2007).

The effect of habit on behavioural intention and actual use was tested following the research carried out by Venkatesh et al. (2012). According to a Nielson report on the UAE, almost one in every two young people access the Internet via their mobile phones more than five times a day (Nielsen, 2014). This means that young people may have developed habits around using smartphones. In the context of this research, age was expected to moderate the effect of habit on behavioural intention and actual use. The effect was expected to be stronger among older individuals, since they develop habits relating to the use of technology faster than younger people do (Moura et al., 2017). Thus:

H5. The effect of habit on behavioural intention to use smartphones is stronger among older individuals.

H6. The effect of habit on behavioural intention to use smartphones is stronger among older individuals.

2.6 Price value (PV)

Price value has been defined as “consumers’ cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them” (Venkatesh et al., 2012, p.161). Price value was found to have an important effect on behavioural intention in the UTAUT2 (Venkatesh et al., 2012). Van Biljon and Kotze (2008) explained that price value, along with infrastructure and service, are relevant to whether or not an individual adopts mobile technology. The price factor has also been highlighted in other previous studies (e.g., Alrawabdeh et al., 2012; Kalba, 2008; Kamel and Farid, 2007; Mallenius et al., 2007; UNDP, 2013). In addition, it has been found to be important for Arab users (e.g., Alrawabdeh et al., 2012; Kamel and Farid, 2007; Puumalainen et al. 2011).

The effect of price can be associated with an individual’s income. According to Alrawabdeh et al. (2012), the higher the GDP per person, the lower the chance that cost will be a barrier. However, findings by Kalba (2008) suggest that GDP should not
be considered as a factor that can independently affect technology adoption. Price can still be important to consumers on a high level of income (Mallenius et al., 2007). The GDP PPP (purchasing power parity) in the UAE is USD 604.96 billion, which is one of the highest in the world (ASDA’A Burson-Marsteller, 2015). Users compare the benefits of using smartphones and applications with their cost. Venkatesh et al. (2012) found that price value is affected by age in such a way that price value has a stronger influence on the behavioural intention of older individuals. This was expected to be the case in this research: although older individuals are more likely to be employed in higher-paid roles, they are also more likely to be responsible for their families, which makes them more cautious about spending money. Therefore:

H7. The effect of price value on behavioural intention to use smartphones is stronger among older individuals.

2.7 National IT development (ND)
National IT development is defined as “specific technology policies that guide the development of information systems in a specific country together with the existing structure of computing and communication capabilities and the ability of the population to operate and utilise these capabilities. The overall construct reflects the level of support for technological development within a given nation” (Straub et al., 2001, p.9). This construct refers to a country’s IT policies and technological infrastructure. It was included in the model to test the effect of national policies and ICT development on smartphone consumers’ behavioural intention. National IT development was included in studies conducted by Straub et al. (2001) and Loch et al. (2003). It has been proved to be significant for individuals in Arab countries in the context of smartphone adoption (Ameen and Willis, forthcoming). A further reason for testing the effect of national IT development on actual use is that this construct was expected to affect how young people use their smartphones; for example, frequency of use and the use of different mobile applications in terms of mobile tariffs or restrictions. As younger people use technology more frequently than older people do (Alkhunaizan and Love, 2012), the effect of national IT development on behavioural intention and actual use was expected to be stronger among younger people. Thus:

H8. The effect of national IT development on behavioural intention to use smartphones is stronger among younger individuals.

H9. The effect of national IT development on actual use of smartphones is stronger among younger individuals.

2.8 Culture-specific beliefs and values (CSBV)
Culture-specific beliefs and values were found to be important in the studies conducted by Ameen and Willis (forthcoming), Hill et al. (1998), Loch et al. (2003) and Straub et al. (2001). This construct was included in the conceptual framework of this research because the characteristics of Arab culture were expected to have a significant effect on Arab users. Straub et al. (2001) contend that studying culture as a whole is
misleading, as it is too generic. Therefore, when studying how culture affects the adoption of technology, it is more accurate to use the term culture-specific beliefs and values: this indicates that the study only includes the aspects of culture that are relevant to the specific technology to be adopted. Straub et al. (2001) found that culture-specific beliefs and values affect “IT system outcomes”, which the authors refer to as actual use or intention to use a technology system. Rose and Straub (1998) and Straub et al. (2001) indicated that a preference for face-to-face meetings is an important value in Arab culture.

In this research, culture-specific beliefs and values were expected to influence behavioural intention to use smartphones. For this study the preference for face-to-face versus technology-mediated meetings was selected, as this is closely related to people’s decision to adopt and use smartphones. It is important to stress that communication via mobile devices is only supplementary to face-to-face communication. Straub et al. (2002) recommended studying a subset of cultural values at the individual level that are related to the key area of enquiry. Therefore, the preference for face-to-face meetings or technology-mediated meetings was tested at the individual user level. Face-to-face interaction was identified by Hill et al. (1998) as crucial for the transfer and adoption of technology in Arab countries. Therefore, it is important to understand how this can affect smartphone adoption and use in Arab culture. Because older people are less familiar with technology and use it less (Alkhunaizan and Love, 2012), it was expected that a preference for face-to-face meetings would be more prevalent among older people. In addition, the applications through which mobile-mediated meetings can take place, such as Viber, WhatsApp and Skype, are generally restricted in the UAE (Ameen and Willis, 2016). Therefore:

H10. The effect of culture-specific beliefs and values is stronger among younger individuals, as manifested in a preference for mobile-mediated meetings.

Figure 1 shows the proposed conceptual framework with age as the moderating factor.
3. Methodology

3.1 Sampling and data collection

The sample consisted of individuals aged 18–29 in households in the UAE. As mentioned previously, 51% of the population in the UAE is under the age of 30 (United Arab Emirates National Bureau of Statistics, 2015). Therefore, targeting this segment of the population is particularly important. Multi-stage cluster sampling is common in research carried out in developing countries (Yansanah, 2005); thus, it was used in this research. This sampling technique is appropriate when no list of target units is available. We followed the probability proportional to size method proposed by Bennet et al. (1991) when selecting the districts to include in the data collection. The questionnaires were distributed face-to-face to individuals aged 18–29 in three districts of Dubai: Al-Twar, Jumeirah, and Al-Barshaa. The questionnaires were distributed in all communities in these selected districts. Based on Yamane’s (1967) formula, the sample size was 400 plus 25%: 533 in total. Of these, 437 questionnaires were completed.

3.2 Survey instrument and measures

The first section of the survey included questions to gather demographic information about the respondents, including their age, gender, education, income and employment. The second section contained questions about whether respondents owned a smartphone and, if yes, what make they owned. In addition, this section
included a question about how frequently the respondents used particular mobile applications. The third section included the measures for each construct in the model. These measurement items and their sources are listed in Appendix A. Participants were asked to respond to a set of statements using a seven-point Likert scale where 1 = strongly disagree and 7 = strongly agree. This scale was used in a study by Venkatesh et al. (2012). A seven-point Likert scale has also been used in other studies on technology acceptance (e.g., Al-Gahtani et al., 2007; Malhotra and Galletta, 1999).

### 3.3 Analysis

The collected data were analysed using partial least squares-structural equation modelling (PLS-SEM) and SmartPLS 3.0 software. In line with the categories developed by Jarvis et al. (2003), the constructs actual use and national IT development were formative, while the remaining constructs were reflective. The data were analysed in two stages. The first stage tested the reflective measurement model and then the formative measurement model. The second stage assessed the relationships using non-parametric partial least squares-multi-group analysis (PLS-MGA).

Sarstedt et al. (2011) proposed the non-parametric confidence set approach. PLS-MGA is based on estimating the path model for each group, which is assessed using a separate bootstrap analysis (Henseler, 2012). In this approach, the analysis relies on assessing the observed distribution of the bootstrap outcomes instead of making distributional assumptions (Henseler, 2012). First, the centred bootstrap estimates of the groups are compared. Then the difference between the groups is divided by the total number of bootstrap samples. This calculates the probability that the significance in the second group is greater than in the first group. The difference is evaluated using the $p$ value (Henseler, 2009). $P$ values of 0.05 or lower or 0.95 or higher indicate that there are significant differences between the paths in the groups (Henseler et al., 2009). PLS-MGA is a non-parametric approach and includes a set of different techniques to compare PLS model estimates (Hair et al., 2014). Since the collected data were not normally distributed, this method was appropriate to compare the groups.

### 4. Results

#### 4.1 Descriptive statistics

In the UAE, the sample was distributed almost evenly between the two age groups: 51.7% were aged 18–22 and 48.3% were aged 23–29. The split between the genders was also fairly even: 52.9% were male and 47.1% were female. In terms of education, 55.4% of the respondents had a bachelor’s degree, 7.6% had a master’s degree and 8% had a PhD. The results revealed that all the respondents were smartphone users with a high level of experience: 68% had more than ten years’ experience in using smartphones, 13% had between seven and ten years’ experience, and 11.4% had between five and seven years’ experience. Only a small percentage had between three and five years’ experience (3.9%) or less than three years’ experience (3.7%).

In terms of employment status, the largest percentage of respondents were employed (53.3%). This was followed by students (34.6%). A small percentage of the participants were self-employed (5.3%) or looking for work (5.3%), while only 1.4% were unemployed and not looking for work. Only one respondent (0.2%) selected
“other”. Analysing the responses to the questions about income shows that 31.1% of the respondents had an annual income of less than $10,000, 14.6% had an annual income of between $10,000 and $19,000, 20.8% had an annual income of between $20,000 and $29,000, and 21.5% had an annual income of between $30,000 and $39,000. A smaller percentage of respondents indicated that their annual income was between $40,000 and $49,000 (4.8%) and 7.1% had an income of $50,000 or more per year.

Responding to the question about smartphone types, the highest percentage of respondents reported they were using an iPhone (41.2%). This was followed by Samsung (23.3%) and Nokia (10.3%). Other smartphones included HTC (6.4%), BlackBerry (4.6%), HUAWEI (3.7%), LG (3.4%), Sony (2.7%), Lenovo (2.3%) and Motorola (0.2%). Eight respondents did not provide information about the type of smartphone they were using.

The results showed that the respondents used the following mobile applications frequently: making calls (mean = 5.38; standard deviation = 0.976), mobile applications (mean = 5.26; standard deviation = 0.891), mobile Internet (mean = 6.06; standard deviation = 1.388), mobile social media (mean = 6.02; standard deviation = 1.476), SMS or text messaging (mean = 5.69; standard deviation = 1.589), mobile email (mean = 5.58; standard deviation = 1.597) and games (mean = 5.37; standard deviation = 1.800). The respondents used mobile banking and m-commerce less frequently than they used the other applications, with a mean of 2.56 and standard deviation of 1.543 for mobile banking and a mean of 2.27 and standard deviation of 1.422 for m-commerce. The two most frequently used applications among the respondents were mobile Internet and mobile social media.

### 4.2 Reflective measurement model

The average variance extracted (AVE) values for all the reflective constructs were well above the threshold value of 0.50 (Hair et al., 2014). The AVE values ranged from 0.789 to 0.922. This showed satisfactory results for convergent validity. In addition, the values for composite reliability were well above 0.70, ranging from 0.918 to 0.959. Similarly, the values for Cronbach’s alpha were above 0.70, ranging from 0.866 to 0.946. The values for composite reliability and Cronbach’s alpha showed a high level of reliability and internal consistency among the reflective constructs for the sample. The factor loadings were also above the threshold value of 0.7 (Hair et al. 2014). Table 1 shows the results of the assessment of convergent validity and reliability.

**Table 1. Assessment of convergent validity and reliability**

<table>
<thead>
<tr>
<th></th>
<th>AVE</th>
<th>Cronbach's Alpha</th>
<th>Composite Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI</td>
<td>0.802</td>
<td>0.915</td>
<td>0.941</td>
</tr>
<tr>
<td>CSBV</td>
<td>0.825</td>
<td>0.894</td>
<td>0.934</td>
</tr>
<tr>
<td>EE</td>
<td>0.823</td>
<td>0.946</td>
<td>0.959</td>
</tr>
<tr>
<td>Enj</td>
<td>0.922</td>
<td>0.915</td>
<td>0.959</td>
</tr>
</tbody>
</table>
In terms of assessing the discriminant validity, the cross-loadings showed that each construct loaded higher on its own indicators than on the indicators of the other constructs. The results of the Fornell-Larcker criterion showed that the constructs shared more variance with their own indicators than they shared with the indicators of the other constructs (Hair et al., 2014). The correlations of each construct with its own indicators were higher than the correlations between each construct and any other construct in the model.

### 4.3 Formative measurements model

The first stage of assessing the formative model was to assess its collinearity. The tolerance values and variance inflation factor (VIF) values of all the formative indicators were within the normal range, with VIF values lower than 5 and tolerance values higher than 0.20 (Hair et al., 2006). Collinearity was assessed using behavioural intention as the dependent variable in linear regression in SPSS software. All the VIF values of the formative indicators were below the threshold of 5. Only two indicators had a VIF that was higher than 3: ND1 (VIF = 3.223 and tolerance = 0.310) and ND2 (VIF = 3.366 and tolerance = 0.297). The VIF values of the remaining formative indicators ranged from 1.170 to 2.253 and all tolerance values were above 0.20. The results were satisfactory, showing that collinearity was not an issue in the formative measurement model.

The second stage was to assess the significance and relevance of the formative indicators. To assess their significance, the bootstrapping procedure was run in SmartPLS software with 5,000 samples and no sign changes at a significance level of 0.05 \((p \leq 0.05)\). No issues were found in the UAE sample regarding the significance and relevance of the formative indicators.

### 4.4 Multi-group analysis

The age variable was separated into two groups: “younger users”, which contained 226 respondents aged 18–22, and “older users”, which contained 211 respondents aged 23–29. The model explained 80% of the variance in BI \((R^2 = 0.800)\) and 39% of the variance in USE \((R^2 = 0.394)\) in the group of younger users. In the group of older users, the \(R^2\) value for BI was 0.877 (88%) and for USE it was 0.558, which indicates that the model can explain 56% of the variance in USE among the older users. The results showed that there were significant differences between the groups in five paths: CSBV->BI \((p = 0.999)\; \text{the effect of CSBV on BI was stronger among older users})\), EE->BI \((p = 0.974)\; \text{the effect of EE on BI was stronger among older users})\), Enj->BI \((p = 0.005)\; \text{the effect of Enj on BI was stronger among younger users})\), PRA->BI \((p = 0.001)\; \text{the effect of PRA on BI was stronger among younger users})\), PV->BI \((p = 0.999)\; \text{the effect of PV on BI was stronger among older users})\) and HT->USE \((p = 0.981)\; \text{the effect was stronger among older users})\). Therefore, H2, H3, H4, H6 and H7 were supported. In addition, H1 was supported, as BI had a strong influence on USE in both groups.
H10, on the differences between the effect of CSBV on BI among older and younger users, was partially supported: age moderated the relationship, but it was more significant among the group of older users. On the other hand, H5, H8 and H9 were not supported: ND→BI (p = 0.212), ND→USE (p = 0.641) and HT→BI (p = 0.758).
### Table 2. Summary of the moderating effect of age in the proposed model

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Relationship</th>
<th>Subsample (1) Younger Users (18-22) years old</th>
<th>Subsample (2) Older users (23-29) years old</th>
<th>Path Coefficients</th>
<th>p-Value (Younger users) vs Older users</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Path Coefficients</td>
<td>Standard Error</td>
<td>t value</td>
<td>p value</td>
<td>Path Coefficients</td>
</tr>
<tr>
<td>H10</td>
<td>CSBV -&gt; BI</td>
<td>0.035</td>
<td>0.024</td>
<td>1.464</td>
<td>0.144</td>
<td>0.999</td>
</tr>
<tr>
<td>H3</td>
<td>EE -&gt; BI</td>
<td>0.044</td>
<td>0.038</td>
<td>1.133</td>
<td>0.258</td>
<td>0.974</td>
</tr>
<tr>
<td>H4</td>
<td>Enj -&gt; BI</td>
<td>0.147</td>
<td>0.043</td>
<td>3.407</td>
<td>0.001</td>
<td>0.005</td>
</tr>
<tr>
<td>H5</td>
<td>HT -&gt; BI</td>
<td>0.091</td>
<td>0.047</td>
<td>1.926</td>
<td>0.055</td>
<td>0.758</td>
</tr>
<tr>
<td>H8</td>
<td>ND -&gt; BI</td>
<td>0.235</td>
<td>0.070</td>
<td>3.342</td>
<td>0.001</td>
<td>0.212</td>
</tr>
<tr>
<td>H9</td>
<td>ND -&gt; USE</td>
<td>0.300</td>
<td>0.120</td>
<td>2.496</td>
<td>0.013</td>
<td>0.641</td>
</tr>
<tr>
<td>H2</td>
<td>PRA -&gt; BI</td>
<td>0.426</td>
<td>0.093</td>
<td>4.600</td>
<td>0.000</td>
<td>0.001</td>
</tr>
<tr>
<td>H7</td>
<td>PV -&gt; BI</td>
<td>0.149</td>
<td>0.046</td>
<td>3.235</td>
<td>0.001</td>
<td>0.999</td>
</tr>
<tr>
<td>H6</td>
<td>HT -&gt; USE</td>
<td>0.041</td>
<td>0.065</td>
<td>0.641</td>
<td>0.522</td>
<td>0.981</td>
</tr>
<tr>
<td>H1</td>
<td>BI -&gt; USE</td>
<td>0.431</td>
<td>0.169</td>
<td>2.547</td>
<td>0.011</td>
<td>0.280</td>
</tr>
</tbody>
</table>

*S: Supported, PS: Partially Supported, NS: Not Supported
5. **Discussion**

This study aimed to investigate the adoption and use of smartphones and the mobile applications that can be accessed through these devices among two age groups in the youth segment of the population in the UAE. The study provided a more in-depth understanding of these young people’s adoption and usage behaviour in the context of smartphones and mobile applications. We found that age is a significant factor, as it moderates many of the relationships in our proposed model. In fact, we found that age is a significant moderator among the younger generations in the UAE, more specifically those aged 18–22 and 23–29.

The results support the findings of Venkatesh et al. (2003) and Venkatesh et al. (2012) that it is important to include moderators if we are to gain a full understanding of how models of technology acceptance fit in different contexts. The findings also address the question raised by Dwivedi et al. (2017) about whether it is important to include demographic factors as moderators in the UTAUT model.

Our findings indicate that age is a significant factor that moderates the relationship between CSBVs and BI. However, in contrast to what was hypothesised, the effects of CSBVs were stronger among older users in the youth segment. This may be due to their lifestyle, as they are working adults who might prefer to have mobile-mediated meetings to save time. The significance of EE for the group of older users is justified, as they tend to prefer tasks that are easy to do (Czaja, 2007). The effect of Enj. was more significant among the younger age group, supporting the findings of Kamel and Farid (2007), Nysveen et al. (2005) and Venkatesh et al. (2012). This indicates that this age group likes to use mobile applications that are associated with fun and enjoyment, such as mobile gaming or mobile social media.

While HT did not have a significant effect on BI, it had a significant effect on USE. Its effect was stronger among the older age group, which supports the findings of Venkatesh et al. (2012). Surprisingly, age did not moderate the relationships between ND and BI and between ND and USE. A closer examination of the results suggested that the effect of ND on both BI and USE was significant among both age groups, with no significant differences between them. The findings also emphasise the importance of ND as a factor that influences BI and USE, which supports the findings of Straub et al. (2001), Loch et al. (2003) and Ameen and Willis (forthcoming). This shows that individuals in both age groups are aware of how national IT development and policies can influence the adoption of smartphones and mobile applications. In addition, BI had a significant influence on USE in both groups, with no significant differences. The results support our hypotheses on the effects of PRA on BI among younger people in the UAE, which agrees with the findings of Venkatesh et al. (2003) and Venkatesh et al. (2012). Despite the high level of income in the UAE in general, including the respondents in this research, PV had a significant effect on BI in both age groups. However, it was more important among the older age group, as they are mature (23–29) and are more likely to be responsible for a family. This confirms the findings of the previous studies conducted by Alrawabdeh et al. (2012), Kamel and Farid (2007) and Puumalainen et al. (2011).
The findings indicate that there are differences between older and younger smartphone users in the youth segment of the population in the UAE, more specifically those aged 18–22 and those aged 23–29. These differences should be taken into consideration by mobile companies and developers of mobile applications in the UAE.

6. Implications for theory and practice

The findings have implications for academics and practitioners. First, the findings show that it is important to include age as a moderating factor in models of technology adoption, because age influences the relationships between independent and dependent factors in these models. This is important even when the whole sample is made up of “young” people, as significant differences can still be found between age groups. The UTAUT model (Venkatesh et al., 2003) has been cited extensively in the existing literature, and the UTAUT2 is gaining attention and interest from many academics in the field. However, more accurate results may be gained by testing and extending the model with the inclusion of moderating factors, such as age, gender, income and education. Therefore, future studies should investigate the effects of these factors in their models.

Our findings have several implications for mobile companies and developers of mobile applications operating in the UAE. The results show that there are significant differences between different age groups among the youth segment of the population in the UAE (those aged 18–29). Although previous studies have shown that there is a preference for face-to-face meetings in Arab culture (Rose and Straub, 1998; Straub et al., 2001), our findings suggest that older individuals in the youth segment prefer mobile-mediated meetings. Therefore, enabling the use of VOIP services will allow this age group to save time and effort by holding mobile-mediated meetings. In addition, ease of use is an important factor for people in the older age group when adopting smartphones and mobile applications. Therefore, manufacturers and developers should carefully consider design and usability aspects when developing handsets and mobile applications. In addition, developers of mobile applications can target the 18–22 age group when creating applications for entertainment, as enjoyment is a significant factor for this group.

Policy makers and mobile companies need to work together to develop an effective and transparent regulatory environment and the associated policies, as the factor national IT development had a strong influence on both age groups in terms of their intention to use smartphones and their actual use of smartphones. For example, it is vital to reduce the restrictions on the use of VOIP services to enable mobile-mediated meetings, and transparency is needed in tariffs for using mobile Internet and mobile applications. This is possibly more important for older people in the youth segment, since they are more sensitive to price when choosing smartphones and mobile applications. Finally, developers of mobile applications should highlight the benefits of their applications in a more creative way that can attract this segment of the population.
7. Conclusions and future research

This research analysed the factors that can affect behavioural intention and actual use of smartphones among two different age groups in the youth segment of the population in the UAE. Our proposed model was based on an extension of the UTAUT2. Our findings suggested that there are significant differences between the two age groups compared in the study with regard to the adoption and use of smartphones and their applications.

Although this research has provided interesting and important findings, there are a number of limitations, which can be addressed in future work. This research investigated the adoption of smartphones and the mobile applications that can be accessed through smartphones. The adoption of mobile applications was analysed in general, rather than for individual types of application. Future studies can integrate the factors associated with smartphone adoption into research on the adoption of a specific mobile application.

Our research was concerned with the youth segment of the population in the UAE. Future studies can investigate the adoption and use of smartphones and mobile applications among older segments of the population and compare their results with the results of this research. In addition, this study investigated how the proposed model fits with people in different age groups. Future studies can test how the model fits with different demographic segments; for example, by using gender, education or income as moderating factors.

References


Appendix A
Items for each construct and their sources

<table>
<thead>
<tr>
<th>Item by variable</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enjoyment</strong></td>
<td></td>
</tr>
<tr>
<td>Enj1. Using mobile phones is fun.</td>
<td>Venkatesh et al. (2012)</td>
</tr>
<tr>
<td>Enj2. Using mobile phones is enjoyable.</td>
<td>Venkatesh et al. (2012)</td>
</tr>
<tr>
<td>Enj3. Using mobile phones is very entertaining.</td>
<td>Venkatesh et al. (2012)</td>
</tr>
<tr>
<td><strong>Price value</strong></td>
<td></td>
</tr>
<tr>
<td>PV1. Mobile phones are reasonably priced.</td>
<td>Venkatesh et al. (2012)</td>
</tr>
<tr>
<td>PV2. Mobile applications are reasonably priced.</td>
<td>Authors’ own</td>
</tr>
<tr>
<td>PV3. My mobile phone is good value for money.</td>
<td>Venkatesh et al. (2012)</td>
</tr>
<tr>
<td>PV4. Mobile applications are good value for money.</td>
<td>Authors’ own</td>
</tr>
<tr>
<td>PV5. At the current price, mobile phones provide good value.</td>
<td>Venkatesh et al. (2012)</td>
</tr>
<tr>
<td>PV6. At current prices, mobile applications provide good value.</td>
<td>Authors’ own</td>
</tr>
<tr>
<td><strong>Habit</strong></td>
<td></td>
</tr>
<tr>
<td>HT1. The use of mobile phones has become a habit for me.</td>
<td>Venkatesh et al. (2012)</td>
</tr>
<tr>
<td>HT2. I am addicted to using mobile phones.</td>
<td>Venkatesh et al. (2012)</td>
</tr>
<tr>
<td>HT3. I must use mobile phones.</td>
<td>Venkatesh et al. (2012)</td>
</tr>
<tr>
<td><strong>Perceived relative advantage (PRA) (usefulness)</strong></td>
<td></td>
</tr>
<tr>
<td>PRA1. I find that a mobile phone is useful in my daily life.</td>
<td>Venkatesh et al. (2012)</td>
</tr>
<tr>
<td>PRA2. Using a mobile phone helps me to achieve things more quickly.</td>
<td>Venkatesh et al. (2012) and Moore and Benbasat (1991)</td>
</tr>
<tr>
<td>PRA3. Using a mobile phone helps me to stay connected to people.</td>
<td>Authors’ own</td>
</tr>
</tbody>
</table>
PRA4. Using a mobile phone makes it easier to carry out my daily activities.

Moore and Benbasat (1991), with minor modifications

**Effort expectancy (EE)**

EE1. Learning how to use mobile phones is easy for me.
Venkatesh et al. (2012)

EE2. Learning how to use mobile applications is easy for me.
Authors’ own

EE3. My interaction with mobile phones is clear and understandable.
Venkatesh et al. (2012)

EE4. I find mobile applications easy to use.
Authors’ own

EE5. It is easy for me to become skilful at using mobile phones.
Venkatesh et al. (2012)

**Behavioural intention (BI)**

BI1. I intend to continue using mobile phones in the future.
Venkatesh et al. (2012)

BI2. I will always try to use mobile phones in my daily life.
Venkatesh et al. (2012)

BI3. I plan to continue to use mobile phones frequently.
Venkatesh et al. (2012)

BI4. I envisage using mobile phones in the future.
Authors’ own

**Actual usage (USE)**

The usage frequency for each of the following:

Initially adopted from Venkatesh et al.’s (2012) study. Additional items related to mobile services are the authors’ own

a. Mobile phone (for making calls)

b. SMS

c. Mobile Internet

d. Mobile games

e. Mobile e-mail

f. Mobile messaging apps (e.g., Viber, Skype, or WhatsApp)

g. Mobile social media

h. Mobile banking
i. M-commerce.

**Culture-specific beliefs and values (CSBV)**

CSBV1. The fact that a mobile phone supports technology-mediated meetings is an important element in its ultimate success or failure. Originally adopted from Straub et al.’s (2001) study, with some modifications to fit face-to-face vs technology-mediated meetings and smartphone adoption.

CSBV2. My focus on technology-mediated meetings is a factor in the final outcome. Originally adopted from Straub et al.’s (2001) study, with some modifications to fit face-to-face vs technology-mediated meetings and smartphone adoption.

CSBV3. I prefer technology (mobile) mediated meetings rather than face-to-face meetings. Authors’ own, based on Straub et al.’s (2001) study.

**National IT development (ND)**

ND1. I find that the current demand for IT is high. Loch et al. (2003)

ND2. I find that the current supply of IT is high. Loch et al. (2003)

ND3. Government IT initiatives in policy making are working well. Loch et al. (2003) (with adjustments)

ND4. I find current mobile tariffs acceptable. Loch et al. (2003)

ND5. I find that currently there are no restrictions on using different mobile applications. Based on Loch et al.’s (2003) study with some modifications to test restrictions on mobile applications.
The Role of Workarounds in Benefits Realisation: Evidence from a Field Study in Saudi Arabia

Research-in-Progress

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Abstract
Recent studies show that more than half of Saudi Arabian (SA) organisations fail to realise business benefits from their IS investments. This has been largely attributed to the contextual misalignment between information technologies and the needs of developing countries. In the IS literature on benefits realisation, the application of benefits dependency networks (BDN), have been established as being helpful in improving IS projects outcomes. This research investigates current IT development practice in SMEs in Saudi Arabia and reports on some of the challenges that these businesses need to overcome to achieve benefits from their IT investments. Evidence from the literature and a field study suggests that workarounds are widely used when implementing new IT, particularly to facilitate the continuation of embedded cultural practices. The paper argues that integrating the Theory of Workarounds into frameworks for benefits realisation would offer a useful conceptualisation of IT implementation practice to support businesses in developing countries such as Saudi Arabia to improve outcomes when investing in IT.

Keywords: Benefits Realisation, Benefits Dependency Network, Theory of Workarounds, Developing Country Context, Enterprise Resource Planning.
1.0 Introduction

Despite a considerable increase in information technology (IT) investments, the failure rate of IT projects remains high over the past forty years (Doherty, 2014). Information systems (IS) failure has been described as a global phenomenon. Shpilberg et al. (2007) report 74 percent of IT projects failed to deliver expected value. Similarly, a report by British Computer Society (BCS) indicates that only around 16 percent of IT projects can be considered successful (BCS, 2004). More recently, CHAOS report (2015) shows that between 2011 to 2015, only around 29 percent of IT projects worldwide are considered successful being delivered on time, on budget and with the required features and functions. The report indicates more than half (52 percent) of the projects are regarded as challenged projects which means they are delivered over budget, over time, or with unsatisfied results, while 19 percent has failed having been cancelled before completed, or delivered but never used (Hastie and Wojewoda, 2015). In developing countries (DCs), the level of IT failure is higher than the figures reported in developed nations (Heeks, 2002; Hawari and Heeks, 2010; Bitsini, 2015). For example, a recent study has estimated the failure rate of IT projects to reach 52 percent of the total IT investments in Saudi Arabia (SA) (Alfaadel et al., 2012).

Although many researchers have sought to identify the underlying factors for IT failure, resulting reasons are still divergent, complex and interdependent (Dwivedi et al., 2013; Dwivedi et al., 2015). Heeks (2002, 2006) has attributed the IS failure in DCs to the design-actuality gap between how designers of software in the western, industrialized nations have embedded ‘best practices’ that do not support the local actuality of DCs users. According to Barrett et al. (2001), most information technologies are primarily artifact of industrial societies in the developed world and have been introduced to DCs through a process of technology transfer. Yet, the literature suggests that software designed for application in industrialized countries is often incompatible with the context of DCs users in physical, cultural, economic and many other ways. This contextual misalignment is seen as a primary cause of IS failure in DCs (Heeks, 2002, 2006; Hawari and Heeks, 2010; Bitsini, 2015).

Consequently, there is a pressing need for establishing new ways of achieving fit between information technologies and the social contexts in which they are intended to operate (Doherty, 2014; Malaurent and Avison, 2015). Benefits realisation (BR),
The Role of Workarounds in Benefits Realisation

also known as benefits management (BM), is one potentially important mechanism for ensuring contextual alignment between IT project and organisation’s established practices (Doherty, 2014). BM refers to “the process of organising and managing such that the potential benefits arising from the use of IS/IT are actually realised” (Ward and Elvin, 1999, p.197). Yet, the approach is still in its relative infancy and might not be sufficient to ultimately resolve all practical issues (Ahlemann et al., 2013; Doherty, 2014; Coombs, 2015) particularly the issues associated with the design-actuality gap between the best practice embedded into imported ERP systems and the context of DCs organisations. Which may explain the low adoption of BR in DCs firms (Breese et al., 2015). Thus, the literature suggests BM tools need to be improved for effective application and greater adoption by organisations (Breese et al., 2015; Hesselmann et al., 2015; Doherty, 2016).

Emerging IS literature has introduced the concept of workarounds as a mean to make the technology works despite perceived contextual misfits and thereby realise IS benefits. For example, Orlikowski and Iacono (2001, p. 132) call for research on workarounds that “enable people to make dynamically complex systems work in practice”. Alter (2014) formulates the theory of workarounds in IS and defines workarounds as adaptations, improvisations, or other changes implemented to overcome or minimize the impact of obstacles, exceptions, anomalies, or constraints that prevent the achievement of a desired level of efficiency, effectiveness, or other organisational or personal goals. The workarounds mechanism can be utilized by DCs organisations as ‘local improvisations’ to address the design-reality gaps between imported systems and the organisational context. Local improvisations include actuality improvisation which aims at changing local actuality to make it closer to IS design, and design improvisation which seeks to change the imported IS design to make it closer to DC user actuality (Heeks, 2002, 2006; Hawari and Heeks, 2010). The aim of this research in-progress is to explore how workarounds can potentially address the context incompatibility and therefore contribute to improved benefits realisation in DCs SMEs.

The paper will be structured as following. The first section will review the literature on SA SMEs context, benefits realisation and workarounds theory and identify the literature gap. Next, the research framework is introduced followed by research approach and methods. The paper concludes with the anticipated contributions of this ongoing study.
2.0 Literature Review

2.1 Contextual Factors Affecting ERP Implementation in SA SMEs

Enterprise resource planning (ERP) systems can be described as off-the-shelf packaged software designed to support generic rather than specific business requirements based on industry ‘best practice’ business processes (Strong and Volkoff, 2010). Finding the right fit between ERP systems and the business processes of the target organisation is critical for successful ERP implementation (Hong and Kim, 2002).

Yet, the literature and preliminary insights from ongoing case studies suggest that SA SMEs have a unique organisational structure and business practice that differentiate Saudi context from the best practice embedded into ERP systems which forms a potential source of system failure. These differences are evident in four dimensions discussed as following.

First, SA SMEs are mostly family-owned businesses run by different family members and sometimes with additional business partners (Al-Mahdi, 2009). This complex ownership influences the decision making process (Carlock and Ward, 2001; Kaslow, 2006) and how the ERP projects are planned, selected and implemented.

Second, in order to overcome the resource constraints, SMEs tend to work in a shared services environment and adopt shared IT investments. A sharing approach is believed to save expenses, increase resilience, overcome resource shortages, and enhances growth and survival among small firms (Chang and Hong, 2000; Hong et al., 2014; Choi et al., 2014). Again, this business practice often appears in family-owned businesses when different businesses are run by the same family. In this case, they prefer to share their business resources such as assets, offices, and business units including IT, finance and HR departments. Yet, this business model can bring about further challenges in terms of management, decision making (Kaslow, 2006), and IS planning and implementation (Choi et al., 2014).

Further, due to conservative traditional values, SA organisations operate in a gender-segregated environment where the female employees are working in a separated workplace (Alotaibi and Kuk, 2011; Alkahtani et al., 2013). Literature suggests female department often struggles with poor communication with male employees and do not usually get involved in the decision making process which may affect their
productivity and ability to engage with new technologies introduced in the workplace (Alkahtani et al., 2013).

Finally, SA SMEs have relied heavily on foreign workers. A recent government report shows 83 percent of the workforce in Saudi private sector consists of expatriate (MLSD, 2016). This cultural diversity in a workplace can bring some disadvantages including an increase in the cost of training, dysfunctional conflicts, lost productivity, and difficulty to achieve harmony in group settings (Henry and Evans, 2007). Benibo (1997) suggests this conflict can reflect on the level of acceptance and use of IS in the workplace.

These distinct features of SA SMEs context can increase the challenge of achieving the benefits from ERP investments. This research seeks to learn how SA firms can bridge the gap between the system’s best practice and their local conditions through the application of workarounds and thereby realise the business values from ERP implementation.

### 2.2 Benefits Realisation

Fundamentally, BR is an approach to plan and manage IS investment and increase the likelihood of its planned benefits being ultimately realised (Peppard et al., 2007). Business benefits from IS implementations can range from providing ‘problem-based solutions’ to address certain problems or constraints to ‘innovation-based solutions’ which aimed at creating competitive advantage for the organisation (Peppard et al., 2007). BM approach provides different tools, such as Benefit Dependency Network (BDN), to help planning how expected benefits will be delivered. BDN is a framework that explicitly links the investment objectives and their resulting benefits with the business, organisational and IS/IT changes required to deliver those benefits (Ward and Daniel, 2006; Peppard et al., 2007).

The investment objectives are the organisational targets agreed for the investment. Each objective will result in a number of benefits, and each benefit will then be associated with business changes necessary to realise those benefits. The business changes are linked to prerequisites called enabling changes and IT functions required to drive and enact desired business changes (Coombs, 2015). The resulting framework can then be used as a guideline throughout the IS/IT project lifecycle (Peppard et al., 2007). Aitken et al. (2015) suggest two main purposes for developing a benefits map.
First, to ensure the focus will mainly remain on delivering business benefits instead of solely considering the successful delivery of a new system. Second, the visual nature of the benefits map will allow key stakeholders to envisage the benefits and develop a plan to deliver identified benefits and indicate the order in which these benefits will be realised.

Although BDN combines elements support both the technical and organisational perspectives related to IS implementation (Ahlemann et al., 2013; Coombs, 2015) the framework does not give specific attention to the contextual issues that inhibit effective organisational change necessary for benefits achievement. Therefore, additional enhancements are required for the effective utilization of BDN framework and consequently improving BR practice (Coombs, 2015). The following section will further discuss the potential of workarounds mechanism to address the context incompatibility issues and improve BR approach.

2.3 Workarounds Perspective

A general sense of workaround is described as “when a path to a goal is blocked, people use their knowledge to create and execute an alternate path to that goal” (Koopman and Hoffman, 2003, p. 71). The researchers note that the introduction of IS within organisations often results in workarounds behaviour or use of the systems in unintended ways (Boudreau and Robey, 2005; Ferneley and Sobreperez, 2006; Azad and King, 2008). This often occurs with newer technologies, particularly ERP systems, which continue to be associated with the agenda of organisational transformation and assumed to represent a “hard” constraint on human actions (Boudreau and Robey, 2005).

Although system workarounds have been thought to bring negative consequences to the organisation (Ignatiadis and Nandhakumar, 2009; Ferneley and Sobreperez, 2006), emerging IS literature has highlighted some advantages of workarounds, particularly, the impact of workarounds on making the technology works (Orlikowski and Iacono, 2001; Malaurent and Avison, 2015). A group of IS researchers argues that workarounds, which might seem inherently ad hoc, can make the difference between system success and failure in many situations (Koopman and Hoffman, 2003; Azad and King, 2012; Malaurent and Avison, 2015; Röder et al., 2016). For example, Malaurent and Avison (2015) describe a case where an implementation of a French
multinational corporation’s ERP system in its subsidiaries in China was largely unsuccessful due to the misfits between the features imposed by the ERP template and the Chinese context. Instead of completely resisting the system, the Chinese users worked around the misfits by inventing their own solutions which enabled the ERP system to be workable and accepted by both the users and management (Malaurent and Avison, 2015).

While workarounds have been criticized for being temporary means that have a short term effect, some recent studies suggest that technology workarounds can be institutionalized and persistent (Koopman and Hoffman, 2003; Kobayashi et al., 2005; Azad and King, 2012; Malaurent and Avison, 2015). Thus, a better understanding of the role of workarounds on IS implementation may provide a significant improvement in realising benefits from IS/IT investments in DCs SMEs.

2.4 Literature Gap: The Role of Workarounds in Benefits Realisation

Although former research acknowledges the fact that workarounds can be necessary for system implementation (Koopman and Hoffman, 2003; Malaurent and Avison, 2015) and how workarounds can be implemented (Alter, 2014), the literature is not clear whether or not these workarounds result in improved realisation of IS benefits. Further, some studies suggest a link between system workarounds and the benefits (e.g Koopman and Hoffman, 2003; Alter 2014; Malaurent and Avison, 2015; Li et al., 2017) but they do not examine the impact of different workarounds, social or technical, on the benefits derived from the system. Thus, examining how workarounds can be integrated with existing BR frameworks such as BDN is significant for the whole BR process.

Accordingly, this research initially investigates the contextual challenges encounter SA SMEs and lead to the implementation of workarounds. This will be followed by further exploration of how workarounds are triggered and developed during ERP implementation. Finally, examining the relationship between each type of workarounds, social and technical, and the realisation of system benefits. The following research framework has been developed to guide the research to investigate how workarounds can potentially contribute to the benefits realisation from ERP investments in SA SMEs.
3.0 Research Framework

Figure 1 shows a prototype framework that combines BDN and workaround process. The main goal of this framework is to examine how can workarounds potentially contribute to the benefits realisation from IS/IT investments in DCs SMEs. BR literature argues that effective organisational change is the cornerstone to deliver business benefits from IS projects. Thus, ‘inhibitors’ to organisational change caused by either contextual or technical issues should be addressed for successful IS/IT implementation. Yet, the original BDN framework does not emphasize on these inhibitors or how to address such issues (Coombs, 2015).

In the extended BDN by Coombs (2015), ‘inhibitors’ construct is added between ‘business change’ and ‘business benefits’ which would be a starting point for a workaround process to occur. This is based on the assumption that a workaround may be utilized once the inhibitors to business change emerge.

![Workarounds for Benefits Realisation](image)

Alter (2014) describes the process of workarounds including several steps presented in italic. First, the context, in which the workaround occurs, comprises of both the *intentions, goals, and interests* of each individual in a work system and the *structure*
which includes the architecture and characteristics of the work system. ‘Work system’ refers to “a system in which human participants and/or machines perform work using information, technology, and other resources to produce products/services for internal or external customers” (Alter, 2014; p.34). These first two elements, individual goals and structure, are defining the context in which the workaround occurs, yet, an actual workaround will start when ‘perceiving the need for a workaround’ emerges (Alter, 2014). Thus, the first two steps are not included in the integrated framework. Next, perceived need for a workaround results from a combination of situational constraints, obstacles, anomalies and individual goals. This is followed by identification of possible workarounds taken into consideration their perceived costs, benefits, and risks in addition to other factors such as knowledge and ability for designing workarounds, and ethical considerations. Next step is the selection of a workaround to pursue based on the perceived costs, benefits, and risks of the alternatives. If no potential workarounds can be selected due to its cost, risks, long term consequences or ethical considerations, the process of workaround would stop. The following step is the development and execution of the selected workarounds. Finally, examining the consequences of workarounds is the last element of the process (Alter, 2014).

The framework assumes that if the consequences from workarounds were successful, then, they can be institutionalized and persistent (Koopman and Hoffman, 2003; Kobayashi et al., 2005; Azad and King, 2012; Malaret and Avison, 2015), if otherwise, the process will start again to find alternative workarounds as a typical problem-solving process. This assumption is reflected by the two arrows emerging from the ‘consequences’ square.

As mentioned earlier, this combined approach of benefits management and workarounds has not been examined empirically in the literature and this study aims to address this gap. The framework is expected to be further improved by the completion of this ongoing study due to the application of western theory of workarounds in the context of middle eastern culture, SA in this instance, which forms a potential contribution of the research (Whetten, 1989; Davison and Martinsons, 2016).
4.0 Research Approach and Methods

This ongoing research is carried out using two critical realist case studies (Easton, 2010; Wynn and Williams, 2012). The approach basically seeks to provide “empirically supported statements about causation, specifically how and why phenomenon occurred” (Wynn and Williams, 2012: 789). This is consistent with the research questions that seek to understand how system workarounds can help to achieve business benefits from ERP implementation across net of SA SMEs. Adopting a case study strategy allows for an in-depth exploration of socio-technical phenomenon in relatively clearly bounded, but complex, context such as organisations or nets of connected organisations (Easton, 2010; Wynn and Williams, 2012).

Yin (2013) has identified three conditions for selecting a case study strategy. First, the type of research question; when the question is aimed at explaining ‘how’ or ‘why’, case study research will be relevant. Second, the level of control that the researcher has over the relevant behaviors of events. Third, the degree to which the research focuses on a contemporary issue. In this study, the research question satisfies these three conditions in that a) the research aims to answer the question of how workarounds can contribute to benefits realisation in SA SMEs, b) the relevant behaviors of phenomenon under investigation cannot be manipulated as the researcher has no control over the behaviour of SMEs, c) the study is aimed at exploring a contemporary issue associated with the implementation of ERPs across net of connected organisations, which satisfies the third condition.

4.1 Research Context

Two case studies are selected according to key criteria that reflect the unique organisational structure and business practice in SA context. First, the selected organisations are described as family-owned businesses run by different family members and have additional business partners. Both groups of organisations operate in a shared services environment where they share the same business units including IT, finance and HR departments with their sister companies and adopt shared IT investments. Shared technologies includes multi-company ERP, on-location ICTs infrastructure and services such the internet access, servers, devices, software and IT staff and supports. Further, both groups operate in gender-segregated environments where the female employees are working in a separated workplace. In addition, the
The majority of the workforce in both groups are expatriates which reflect high cultural diversity in the workplaces. The selected cases can provide a viable setting for answering the research questions because they reflect a typical SA SMEs characteristic which means the result of the two cases can be of use to other SA firms. The two case studies are envisaged to enable in-depth understanding of how, in practice, SA SMEs try to fit with off-the-shelf systems, such as ERP, and find out what sorts of social and technical workarounds have been developed to achieve business benefits.

4.2 Data Collection Strategy

During the ongoing case studies, the data is collected in several stages. First phase of data collection comprises of 11 semi-structured interviews with different people across the organisational structure in both female and male departments. Interviews lasted between 45 and 90 minutes. This was combined with direct observation of the social and environmental conditions of the workplace and working practices. The aim of this exploratory phase is to identify the contextual issues associated with the local conditions of SA organisations which might influence the outcomes of ERP implementation. Data emerged from this phase was important to inform the research due to the lack of sufficient literature about DCs context in general and SA SMEs in particular (Alyahya and Suhaimi, 2013). The collected data was then transcribed and thematically analysed (Braun and Clarke, 2006) and combined with the literature to develop the research framework and relevant lines of research questions (Yin, 2013).

The second phase of data collection consists of two in-depth case studies to further investigate how workarounds can help SA SMEs to overcome the contextual misfits. Further interviews with a range of management positions and employees will be conducted along with retrospective review of organisational documents including business process, project initiation document, project plan progress reports and notes from the firms’ IS development team meetings. The second phase is expected to reveal further insights into how social and technical workarounds have been developed and implemented during the system implementation to address contextual issues, as well as the impact of different workarounds on benefits achievement.
5.0 Anticipated Contributions of the Study

This ongoing research is anticipated to make a contribution to a growing body of IS literature on workarounds. Up to date, there is a lack of theoretically grounded and empirically tested understanding on the causes of workarounds and their impact on the implementation outcomes (Yang et al., 2012; Alter, 2014; Li et al., 2017). The study investigates how, in practice, workarounds can contribute to the benefits realisation in SA context which has witnessed a high failure rate of IT projects due to the gap between IS design and SA actual conditions. The research is expected to contribute to the theory of workarounds by investigating its application to developing countries context. The theory of workarounds and its process has been developed based on the practice of western organisations. Applying the theory to different conditions, in this instance middle eastern culture, may reveal new insights that help to improve the theory (Whetten, 1989; Tsui, 2006; Welch et al., 2011; Davison and Martinsons, 2016).

This ongoing research also contributes to benefits realisation literature. The study draws attention to the specific challenges encounter DCs organisations due to their contextual incompatibility with imported technologies. Current BR approach has not given particular focus to address contextual misfits. This study will further improve BR practice by integrating the concept of workarounds to support DCs firms to achieve IS benefits despite perceived contextual misalignment.

Finally, there is a lack of empirical investigation of IS implementation in SA SMEs (Alyahya and Suhaimi, 2013; Ebad, 2016). This study will add to our current understanding of the determinants of systems failure in SA SMEs and how they can be addressed to improve IT investment outcomes.
References


SOCIAL MEDIA? WHAT SOCIAL MEDIA?

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Abstract
This developmental paper is flagging up the issue of insufficiently clear definition of two contemporary concepts: social media and enterprise social media. Drawing on the findings from empirical case studies, differences in users’ perceptions of what is and is not social media are highlighted. These are juxtaposed with extant definitions from IS literature. The concept of “in-house” or “enterprise” social media is introduced from the literature and its clarity and necessity is challenged based on the data from the case studies. The aim of this early research paper is to evaluate whether a re-definition of “social media”, for example through performative lens is meaningful, necessary and helpful.

Keywords: Social Media, Enterprise social media, Definitions, Literature Review

1 Introduction
The field of information systems (IS) is concerned with the investigation of Information Technologies (IT) impacts on individual, organisational and societal levels (Lucas Jr, Agarwal, Clemons, El Sawy, & Weber, 2013). One of the recent most impactful IT phenomena is the emergence and spread of a sub-set of IT technologies referred to as social media (Kane, Alavi, Labianca, & Borgatti, 2014; Kapoor et al., 2017). (Kapoor et al., 2017) list top one hundred IS research topics on social media which range from foreign languages, politics to machine learning and even smoking related issues, touching virtually every aspect of people’s personal and professional lives.
Interpersonal web-based communication technologies have long been investigated by IS researchers (Kent & Taylor, 1998). Social media are, however, qualitatively different from traditional media and on-line communication systems.

Social media have been defined in a variety of ways. The definition of social media as a “platform to create profiles, make explicit and traverse relationships” by (Boyd & Ellison, 2008) has been cited over 13,000 times according to google scholar. Other definitions, identifying social media by the set of functionalities or “building blocks” (Kietzmann, Hermkens, McCarthy, & Silvestre, 2011), has 3,000 citations. A taxonomy of “social media” splitting the field into 6 distinctive categories (Blogs, Social Networking Sites, Collaboration Projects, Content Communities, Virtual Social Worlds, and Virtual Game Worlds) introduced by (Kaplan & Haenlein, 2010), too finds resonance with 11,000 citations on google scholar. The trend of creating new and updating old definitions continues, as does the development, use and adoption of social media (Kapoor et al., 2017).

This paper is raising two definitions which stem from an empirical qualitative comparative case study on social media use in organisations and juxtaposes them with current definitions in the literature. The first question is “what is social media and how do academically accepted definitions resonate with the definitions in the field”? The second question is based on research in “enterprise social media” and the highlighted importance of research in this field (Hauptmann & Steger, 2013; Kapoor et al., 2017; Leonardi, Huysman, & Steinfeld, 2013; Maruping & Magni, 2015): “what makes a social media platform an ‘in-house’ or ‘enterprise social media’”?

The paper starts with the introduction of possible definitions of “social media” from recent literature. This is followed by a brief introduction of the research project. The question of how to define social media and how to define enterprise social media are then discussed followed by conclusions and summary.

2 Discussion

To be considered “impactful”, academic research needs to be communicated and applied outside academia (Lucas Jr et al., 2013). One of barriers to communication is the language and definitions used in academia and in practice. There is no clear definition of what social media is, which means that research findings are often not comparable or transferable. In the case of social media, researchers have focused on one specific platform or application, albeit in a different context, e.g. use of twitter (Delery & Roumpi, 2017), Facebook (Brown & Vaughn, 2011; Gilbert & Karahalios,
Lacking a clear definition, it is uncertain and disputable whether e.g. findings from a “twitter-study” would apply to a “WhatsApp-study” etc. The definitions of social media in the literature, while disagreeing on many points, have some common properties.

### 2.1 Social Media Definitions – common denominators

Social Media has been defined as websites which allow profile creation and visibility of relationships between users (Boyd & Ellison, 2008); web-based applications which provide functionality for sharing, relationships, group, conversation and profiles (Kietzmann et al., 2011). Social media has been referred to as “social media sites” (Diga & Kelleher, 2009), or a set of information technologies which facilitate interactions and networking (Kapoor et al., 2017; Oestreicher-Singer & Zalmanson, 2013). However, there appears to be a broad agreement that Web2.0 technologies played a significant role in the development and adoption of social media.

Another definition of social media refers to “Internet-based applications built on Web 2.0, while Web 2.0 refers to a concept as well as a platform for harnessing collective intelligence” (Huang & Benyoucef, 2013 p. 246). Social media, such as Facebook, Twitter, and LinkedIn, provide people with a pervasive network connectivity (Asur & Huberman, 2010).

The term “Web 2.0” refers to the set of technologies and ideologies that enable and drive media rich content creation on the internet (Kaplan & Haenlein, 2010). Web 2.0 is rooted in the open source ideology, whereby users collaborate freely using free tools and sharing their work and information with each other. Technological advances in Web 2.0 and open ideology supported the emergence of User Generated Content (UGC). The UGC – the ability to create and share content free of censorship and at low cost, contributed to the proliferation of social media (DesAutels, 2011).

As an Information System, social media is built upon a set of (available) Internet, communication and computing technologies, as well as a set of ideological beliefs about how information should be created, accessed and distributed (Figure 1).
All definitions of social media agree that social media implies use of online or internet technologies. Following the transparency, sharing and integration ideology of Web 2.0, many of the applications (websites, mobile applications, online systems) are allowing programmatic integration with other Web 2.0 applications. Notable is the definition and proliferation of standard integration protocols which allowed the integration of several systems to be implemented in an easier and quicker manner, as the integration interfaces would follow pre-defined standards (for example Simple Object Access Protocol (SOAP) 1.1 in 2000, 1.2 in 2007, and Open Data Protocol (OData) for Representational State Transfer (REST) services initiated in 2007). Arguably, a definition of social media should include the technological (internet and mobility), the ideological (transparency, sharing and integration) as well as functional component.

### 2.1.1 Social Media Functionalities

One of the approaches to identify “social media” is to describe the functionalities of a given platform and application in terms of essential “social” properties. (Kietzmann et al., 2011) specify seven functional building blocks of Social Media which are present to greater or lesser extent any social media application and which can be substituted and enhanced through integration of several applications (Figure 2).
Identity refers to the representation of the user in the virtual world. It could be as descriptive and personal as a profile on Facebook, listing birthday, hobbies, family relationships etc., or could be as vague as an imaginary pseudonym.

Conversations allows users to interact with each other in a broadcast or dialogue manner synchronously in real time or asynchronously with time lapse between statements.

Sharing refers to activities through which existing content is spread (and possibly enhanced) through the social graph. Hereby the social connections might not be necessary be made explicit, for example publicly sharing on Facebook or posting on Twitter does not rely on existing connections: on the contrary in the example of Twitter “sharing” often precedes connections (expressed through “following”).

Presence allows users to know where other community members are (on/off-line and actual/virtual location).

Relationships allows community members to visualize their networks in many ways ranging from “likes” and “followers-followed” to virtual representation of real-life relationships. These social-graph abstractions can be uni- and bi-directional and allow strong and weak ties. For example, “following” on Twitter is not necessarily reciprocal, whereas a connection on LinkedIn requires both parties to accept the connection and both to indicate the nature of their relationship (e.g. colleagues).
*Groups* refers both to membership groups where users can articulate their affiliations with, or interest in, a specific subject and groups utilized by users to manage their relationships.

*Reputation* allows users to qualify the content provided by another user and establish trust-levels between community members. These trust-levels can be made explicit, for example through a scoring or ranking system (LinkedIn “influencer” status, StackOverflow points system), or remain implicit (Twitter number of followers).

Many of the platforms provide users with the ability to integrate other applications. Through the integration of two or more platforms the building blocks, the affordances of one system can be greatly enhanced, but also jeopardised. For example, by enabling the integration of Twitter and Facebook whereby a “tweet” also appears in the personal thread in Facebook, the “identity” of a (fairly anonymous) Twitter-account becomes much more personal on Facebook. Vice versa, a Facebook post, visible inside that platform only, could reach much wider (unintended) audiences when simultaneously (and automatically) posted on Twitter.

The inherent integrative nature of Web 2.0 applications makes the assessment of the functional blocks in a single application/platform difficult at the least, and meaningless at most. Integrated social media *systems* combine their capabilities and thus could be assessed as a system and not as individual applications. However, this poses another challenge: specific applications and technologies can be combined by the end-user to meet their individual needs, so that a “social media system” of one user is not necessarily the same or comparable to the “social media system” of another user. Arguably, definitions of “social media” as “landscapes” or “groups” would address this challenge.

### 2.1.2 Social Media Definitions

A technocratic definition of social media reads: “a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content” (Kaplan & Haenlein, 2010). This definition is suited for defining “media” – generation of content, internet based set of technologies. However, the “social” part of the definition is made only implicitly through references to “Web 2.0” and “Unser Generated Content”. (Boyd & Ellison, 2008, p. 211) take a less technical approach and define “social network sites as web-based services that allow individuals to (1) construct a public or
semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system”. (Kane et al., 2014) extend this definition by adding that users should also be able to create and access digital content. These definitions enhance the technical definition of Kaplan and Haenlein by adding the “connection” element (list of interconnected users) and a “human” element (profiles). However, the boundlessness of these systems: the ability of users to integrate and combine applications and features into a new unique system is explicitly excluded in this definition. Also, the “interactive” nature of social media: the ability of users to establish and maintain social contact is not made clear.

(Oestreicher-Singer & Zalmanson, 2013) employ the term “social computing” as a placeholder for online IT technologies which enable and facilitate social interactions and are deeply embedded in day-to-day human interactions. The focus on “any technology which supports relationships and collaboration” is also supported by (Kapoor et al., 2017). These definitions highlight the “social” nature of social media and focus on interpersonal communication and information exchange independent of technological platforms involved. These views lean towards the performative view, concentrating on what the platforms are used for rather then what the technology was intended to support.

2.1.3 Social Media – definition discrepancies

Despite a plethora of definitions and view-points being available many of the applications, websites, platforms which we “naturally” perceive as social media are not covered by these definitions. These applications are

- Accessible through apps and not (only) through websites – e.g. WhatsApp, or Facebook, which makes the “social media site” term too narrow;
- Always online through notifications in desktop applications and on mobiles, which is not mentioned in either definition and is not covered by the “presence” building block by (Kietzmann et al., 2011), as they become “intrusive”;
- Integrated and Media Rich, which goes beyond simple “interactions” (otherwise “pine” – the email client released in 1992 would be “social media”);
• Support “passive sharing” of content when information is pushed towards users without the creator actively doing that, which extends the “relationships” beyond explicitly made connections.

The difficulty of positively identifying social media became obvious in this study, a multiple case study performed in 2013-2017 which focuses on the impact of social media use on intra-organisational communication process. The researcher’s understanding of “social media” was different from that of the case study participants, and the participants did not agree on one single definition. The following section presents the study and the resultant questions for the need of a different (better, narrower, wider?) definition of social media.

2.2 Case Study
Social Media use in the context of Human Resource Management (HRM) was investigated in a comparative case study conducted in three large organisations in the UK. Traditionally, HR communications were one-way top-down communications with limited feedback mechanisms. In the case organisations employee feedback would be sought and collected through (bi-) annual employee surveys, without any means for the employees to provide immediate feedback on HR initiatives, activities and policy. This flow has been challenged by the emergence of social media, when social media platforms which are open and freely accessible by employees became part of communication resources (Huang, Baptista, & Galliers, 2013). The introduction of social media in the case organisations lead to enhanced ability of management to seek timely employee feedback on one hand, and to diminished ability of the management to control and censor this feedback.

The research involved three qualitative case studies in organisations which used social media for different purposes, with different intensity and with different outcomes. The three organisations UKBank, UKConsulting, and UKOutsourcing represented different industry sectors, however, they also shared many commonalities with regards to the geographical markets they operate in, location of headquarters, workforce size, composition and education level. The differences in social media use in each organisation are partially explained by the regulatory framework constraining the use (for example, UKBank, as a financial services provider, is subject to different regulations than UKConsulting – a technology consultancy, and UKOutsourcing, that provides services to private and public entities). Further, some differences are explained by the physical location and access to computers and internet (UKBank employees are
not officially permitted to use personal devices at work, or work-computers for personal use (such as visiting social media sites); UKConsulting employees are allowed to use their own devices and to access social media from within the office; Many of UKOutsourcing employees are not office-based and sometimes do not have access to internal network and/or corporate computers). Finally, the factors dictating, framing and enabling social media use in these organisations were the management’s involvement, strategy and policy. These internal factors were the focus of the research. The data collection was performed in a series interviews with informants from a range of hierarchical levels from associates (shop-floor employees), middle-managers, to higher-level managers who are (partially) responsible for setting and executing firm-wide policy and strategy. To protect the informant’s anonymity, whenever a proprietary in-house developed software was used, the name of that product has been changed by the authors to avoid the identification of the case organisations.

During the data collection and analysis stages of the research two issues became obvious: first, the differentiation between public and “in-house” social media was consistently being made by interviewees. Second, the conceptualisation of “social media” differed from interviewee to interviewee. The following sections discuss the observed differences and address the need for a re-definition of “social media” in IS research.

2.2.1 What is social media?

The three organisations use a variety of tools – in-house built applications, on-premise applications and web-bases tool, to communicate, share information and connect employees and managers. Some of the applications were used in all organisations, others were organisation specific (Table 1).

<table>
<thead>
<tr>
<th>Platform</th>
<th>Description</th>
<th>UK Bank</th>
<th>UK Consulting</th>
<th>UK Outsourcing</th>
</tr>
</thead>
<tbody>
<tr>
<td>LinkedIn</td>
<td>Public Professional Networking Website</td>
<td>pw</td>
<td>pw</td>
<td>pw</td>
</tr>
<tr>
<td>Facebook</td>
<td>Personal Networking Website</td>
<td>p</td>
<td>p</td>
<td>p</td>
</tr>
<tr>
<td>Avature</td>
<td>Web-based Semi-private community (invitation only)</td>
<td>w</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yammer</td>
<td>Web-based private community</td>
<td></td>
<td></td>
<td>pw</td>
</tr>
<tr>
<td>Sharepoint</td>
<td>On-Premise private document sharing platform</td>
<td>w</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email</td>
<td>asynchronous communication</td>
<td>pw</td>
<td>pw</td>
<td>pw</td>
</tr>
<tr>
<td>Whatsapp/Skype</td>
<td>Public communication applications</td>
<td>x</td>
<td>pw</td>
<td></td>
</tr>
<tr>
<td>BankTalk*</td>
<td>Web-based private community</td>
<td>pw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gratitude*</td>
<td>In-house private community</td>
<td>w</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Networking*</td>
<td>In-house public community</td>
<td>w</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend
- p = for personal purpose
- w = for work purpose
- x = unsanctioned work purpose
- * = name changed for anonymity

Table 1. Social Media use in case organisations
Two organisations (UK Bank and UKOutsourcing) used a similar application for internal communications. Both applications provided similar functionalities: users had profiles, groups can be created by users and by administrators (e.g. employees could create a group of people interested in a subject, or all employees from a department could be placed into a group), messages and media could be shared individually or within the group in asynchronous manner.

One of the interviewees in UKBank described the “BankTalk” in-house tool which allowed employees to have direct and group conversations with each other a “nothing but a messenger tool”. The statement dismissed the tool as “not social media”. Simultaneously, “Yammer” – an online, private communication platform which had very similar functionalities, was described as a “collaboration tool as well as being social”. The participants in UKOutsourcing were excited about the “relational” value of the tool: it acted as a “shrinker”: blurring departmental divisions and bringing geographically separated employees closer together. This platform was so much “social”, that UKOutsourcing reported struggles with middle management not permitting employees to use the communication platform: “they want to block it because it is ‘social media’”.

In the third organisation: UKConsulting, the use of Microsoft SharePoint was considered “social media” by one interviewee and not by another. While one interviewee considered SharePoint as a work-tool, others considered it as a part of a wider “social ecosystem”: one application which, integrated with other platforms (in this case an internal communication and sharing platform “Networking”), provided “social media” functionality for internal collaboration and communication.

Looking at these anecdotal examples, the question of definition of social media through the use of the application, rather than through its functionalities might appear appropriate. Would a performative lens provide a better and more “crisp” definition?

2.2.2 What is “in-house” social media?

Some interviewees in each of the organisations made explicit differentiation of using social media platforms for private and professional purposes. Some of the platforms were stated to be used internally, others only externally, however the boundaries of some platforms were blurred. This realization in parts supports findings from other research which call for a focus on in-house social media use (Leonardi et al., 2013). However, “Enterprise Social Media” – a concept coined by Leonardi et al., deviates
from the “perceptions” of the interviewees in our studies. The first defining property of an Enterprise Social Medium is the ability to “communicate messages with specific co-workers or broadcast messages to everyone in the organization” (ibid., p2). The participating organisations were using public social media platforms (notably LinkedIn) for internal communications and exchange, which, inevitably, resulted in those exchanges becoming public. For example, UKOutsourcing employees in the recruitment area would share each other’s roles on LinkedIn to attract candidates, or tag the hiring managers in their job postings. On the other hand, UKConsulting employees would use an internal social media platform for collaboration with external audiences (partners and customers).

The clarification of what “in-house” means is essential here. Is an “in-house” system a system which is developed “in-house” (like the “Networking”-platform in UKConsulting), or one which is used for internal communications only (like “Yammer” in UKOutsourcing), or one which has both these properties: internally developed and used for intra-company communication (for example “BankTalk” in UKBank)?

Further, the way in which the platform use was sanctioned by management and in which the employees used these platforms also varies. In all organisations employees reported deviant use of social media platforms. This actual use: mis-use, not-use, other-use defies a rigid definition of “in-house” social media. For example, the recruiters in UKBank were instructed to use LinkedIn to attract candidates and arrange interviews, instead they migrated to Skype and WhatsApp to talk to potential candidates. Employees in UKConsulting were encouraged to use “Networking” to share project documentation with clients, instead they used SharePoint and emails to collaborate. In UKOutsourcing the employees are asked to use the (private) Yammer platform to share and consume information about the organisation, but instead ten times more employees are participating in LinkedIn groups than in similar groups on Yammer.

These, again anecdotal, observations pose the question of whether a differentiation between in-house and public social media is possible or even meaningful?

Further, the perceptions of what constitutes “organisational” use of social media also differs. One of the UKBank employees suggested that creating connections and profiles on LinkedIn is a “personal matter”, which was contradicted by another employee who claimed that having an up-to-date LinkedIn profile would benefit the organisation by improving internal mobility. Referring to collaboration on internal social media in UKOutsourcing one interviewee said that it was great to be “just having fun”. Whereas
one of the UK Consulting employees stated that they did not want to use their “personal” LinkedIn account for work related activities. The borderline between personal and professional use, between in-house and public tools appears blurred.

2.2.3 Blurring of boundaries

There is an emerging networked competitive landscape (Merali, Papadopoulos, & Nadkarni, 2012) where ubiquitous IT is an integral part of organizational strategy that spans inside and outside organizational boundaries (Nolan, 2012). Informal networks are critical to knowledge creation and sharing (Huysman & De Wit, 2004). Collaborative technologies enable informal networks to interact across geographic and temporal boundaries (Sims, 2016). The term ‘on-line community’ encompasses a wide range of Internet fora including markets and auction sites, bulletin boards, listservers, social networking sites, blogs, gaming and shared interest sites (Miller, Fabian, & Lin, 2009). On-line communities enable asynchronous, immediate, interactive, low cost communication and weblogs offer asymmetric communication (Silva, Goel, & Mousavidin, 2008). Online and offline social networks allow content to spread further, e.g. the “Youth Movement for Egyptian Opposition” group on Facebook in 2007 had 300 users who were invited via email, within three days the awareness grew and the number of group members reached 3000 (Lim, 2012). The content spread along the social graph, crossing virtual platform borders, political and geographical boundaries and the boundaries between virtual and real worlds (Wolf, Sims, & Yang, 2015). Huang et al (2013) noted that organisations lose control over their rhetorical resources, with boundaries between the rhetor and the audience becoming blurred. Social media enables the creation of online communities of practice, which exist within and outside organizations, span organisational boundaries, as well as spanning domains of specialist practice and knowledge (Sims, 2016). In the case of Social Media-use in HR, new audiences (Alumni and Candidates) are entering the space of corporate communications (Wolf, Sims, & Yang, 2017). Simultaneously, organisations are also able to penetrate the “in-house” boundaries and enter the personal space. Managers and leaders can extend their personal influence to promote their organisations (Billington & Billington, 2012). Selection activities on Facebook, checking potential employee’s profiles are not uncommon and clearly remove the professional/personal divide on social media (Weathington & Bechtel, 2012). Individuals are prepared to give up their privacy and lower their guard in order to promote themselves professionally (Van Dijck, 2013).
The case organisations in this research report deliberate and unintended breaches of the “in-house” barriers. UKBank’s initiative to introduce Avature – an online community to engage with potential candidates shows the organisation’s desire to reach beyond the organisational borders. UKConsulting’s employees actively participate in online Groups on public websites which are dedicated to either UKConsulting’s products or to areas related to individual employee’s work (e.g. HR or Project Management). They do this in order to learn more about the products and services offered by the organisation: seeking “in-house”-relevant information on public spaces. UKOutsourcing employees, too, engage on public social networks. They overstep organisational and geographical boundaries by re-posting job adverts from other locations, by tagging hiring managers in job posts on LinkedIn. The cases of UKConsulting and UKOutsourcing are examples of social media use across organisational boundaries which is not sanctioned or supported by the respective organisation. The democratisation of communication within and without of organisations is an outcome of social media and user-generated-content; defining any tool as “in-house” social media appears to undermine the trans-organisational reach that social media enables.

2.2.4 Social Presence

Social presence is a key part of social media (Kietzmann et al., 2011). Social presence is the sense of “warmth” and sociability within a website (Gefen & Straub, 2003). Social presence is defined as “the extent to which a medium allows users to experience others as psychologically present” (Hassanein & Head, 2005). Presence is the “illusion of being there or an experience of being in an environment while physically situated in another location” (Li, Daugherty, & Biocca, 2002). Short et al (Short, Williams, & Christie, 1976) suggest that intimacy and immediacy enhance the warmth of the media and presence is higher for interpersonal and synchronous communications than mediated and asynchronous (Kaplan & Haenlein, 2010). A media is perceived as warm if it enables human interactions, sociability, and sensitivity (Hassanein & Head, 2005). Information seeking increases the perception of social presence (Hajli, Sims, Zadeh, & Richard, 2017) and Cheung, Chiu, and Lee (2011) find that social presence enhances users’ continued use of social media.

The empirical data from the case studies underlines the participant’s understanding of social media as one which builds relationships and community. UKBank interviewees
suggested that productive social media use includes “just keeping in touch” and knowing what one’s colleagues “are up to”. One of the UKConsulting interviewees explained that they find it easier to work with someone if they have previously read their colleague’s blog or “liked” any of their posts, as this would create a “relationship” between them prior to and independent of any common task. UKOutsourcing interviewees gave examples of developing a sense of “belonging” and “affiliation” developed through group-membership on social media. Any definition of social media should somehow capture the experience of social presence and warmth engendered by belonging to a community: even communities of practice, which are essentially work related, bring about a sense of social presence.
3 Summary
Comparing definitions and focus of current IS literature on social media with the perceptions and definitions of social media and personal/professional use of these IT there are possible questions which deserve academic attention. One question is whether our current (set of) definition(s) for what is “social media” allows us to adequately identify social media. When academics are collecting data from the field – are they and their informants using the same language and concepts? A common terminology between “the field” and academia would make our research more transferable and allow for a greater practical impact. One of the difficulties discussed in this paper is the ambiguity of social media definitions in the society. Informants in our study used different definitions of social media and different interviewees described the same (or very similar) platforms as social media and as not-social media.
Another question is whether it is possible and meaningful to distinguish between personal and professional social media use, and between public and private social networks? One of the properties of social media (despite the lack of a universally agreed definition) is the boundlessness of individual applications, sites, and platforms. Social media is built around connections and relationships – these interpersonal interactions are not necessarily contained within organisational borders (“in-house” social media), and are not necessarily kept personal (“private” social media-relationships becoming part of organisational life).
Data from empirical study suggest that there might be discrepancies in what the academic world defines as social media, social media use and what the praxis world understands when interrogated about it. The data and literature further suggest that a clear-cut distinction between “in-house” and “public” social media may neither be possible nor desirable.

4 References


DIGITAL LITERACY AND EXCLUSION IN THE SOCIAL MEDIA AGE

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Abstract

Digital Technologies are changing societal, personal and organisational lives. Access to some technologies becomes essential to fully participate in social interactions. Lack of access to necessary Information Technologies (Digital Divide) results in social exclusion. With the continuous evolvement of Information Technologies, the skills and capabilities required for digital participation are also changing. This paper aims at identification of current necessary and essential skills, capabilities and access to technologies from the viewpoint of service-dominant approach. An empirical investigation into ICT skills necessary for employment in different industry sectors is proposed to identify sets of necessary and transferable digital skills. The identification of these sets will not only enhance our theoretical understanding of how the digital divide changes over time, but will also allow policy and training efforts to be focused on (new) skills needed to reduce the gap.

Keywords: e-exclusion, digital exclusion, digital divide, digital literacy

1 Introduction

Digital exclusion can come from of a lack of individual access to technology, or a lack of skills or capabilities to use technology, leading to social exclusion or lack of access to jobs. Our early understanding of digital exclusion and the digital divide, focussed on access to a computer and having the skill to use it. This moved on to include many other limiting factors. As our understanding of digital literacy and digital exclusion has evolved over time the discussion has moved from a focus on access to computers, to acquisition of skills and capabilities, to an understanding that limited access to the Internet is one aspect of digital exclusion that can lead to social exclusion (Bunyan & Collins, 2013; Cushman, McLean, & Klecun, 2008; Deursen & van Dijk, 2010; Helsper, 2011a; Helsper, 2011b; van Deursen & van Dijk, 2011; Van Dijk, 2013; Warren, 2007). There is evidence that the different skills of “Digital natives” and “Digital Immigrants” leads to differing degrees of digital inclusion or
Inappropriate technology design and organizational structures can also interact to ostracise some users, alternatively technology can be perceived as an empowering tool for organisations that not only supports communities of practice, but also develops and transforms practice (Adams, Stubbs, & Woods, 2005; Sims, 2016).

The digital economy affects organisations of all sizes, every industry sector and public service, it deeply affects the daily lives of the majority of people across the world (Ward & Peppard, 2016). Digital innovation has redefined industries in many sectors, as well as creating completely new industries such as global auction sites and market places, and disintermediated services such as Uber and Airbnb.

Access to broadband Internet is becoming a necessity for obtaining information and resources about healthcare, education, and employment. However, the broadband global digital divide continues to inhibit and limit individuals' access within and among nations, measures of social justice and individual capability are positively associated with affordable broadband access across countries (Weiss, Yates, & Gulati, 2016)

Information and Communication Technologies (ICTs) have changed the way information is stored, disseminated and processed. Information is central for participation in social, economic and political activities. Even though the Internet has brought about freedom, productivity and communication, its uneven distribution and access has led to the Digital Divide (Weiss et al., 2016): the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of other activities.

The nature and extent of the digital divide is changing over time (Sims, Vidgen, & Powell, 2008). A study from 2000 showed only one-third of households in Wales had access to computers at home, while thirteen percent had access to the Internet at home (Godard, Selwyn, & Williams, 2000). By 2003 research into the use of learning technology in secondary education found a significant minority of students’ homes lacked computers and access to the Internet (Lewin, Mavers, & Somekh, 2003). Access to, and use of, the Internet at home was divided along socio-economic lines (Computer-Weekly, 2003), back in 2003, 52% of the UK population were regular
Internet users and growth of use in low income groups was low. Of those regularly using the Internet in the UK, 82% were high earners, while only 10% low earners. Access to the Internet was limited by a number of factors besides hardware and access to telecommunications service: many websites for example were not designed to be used with adaptive technologies such as audio screen readers or Braille keyboards, leaving the visually-impaired excluded from full participation. By 2015 83% of households in the EU28 had access to the Internet, 80% had access to broadband and 53% ordered goods or services over the internet for private use (Eurostat, 2016).

There are many barriers to the adoption of ICT in the home: changing technology, high cost and acquisition of the necessary skills. A study by the European Commission (2005) points to some causes of digital exclusion:

“.. the non-availability of a PC at home, combined with lack of access at work or at Public Access Points; the high cost of PC ownership and Internet connection; the complexity of the technology and the lack of basic skills account for the main identified barriers: income and education related factors emerge again as major determinants of digital exclusion. Lack of awareness, lack of time, language barriers and unavailability of useful content are identified as other important obstacles to ICT use.” (pp10-11)

An early study showed that adopters were driven by the utilitarian outcomes, hedonic outcomes (i.e., fun), and social outcomes (i.e., status) of adoption (Venkatesh, 2001). Non-adopters on the other hand were influenced primarily by rapid changes in technology and the consequent fear of obsolescence. Demographic factors, age and education, are still found to be significant predictors of Internet adoption (Choudrie, Vyas, Voros, & Tsitsianis, 2013; Laukkanen, 2016). Most Internet users access the Internet using mobile devices: 57% of all American adults are cell internet users (Duggan & Smith, 2013).

Attitudes to the use of technology affect the choice of educational course. The culture of ICT was generally young, white, middle class and male, not working class, older, female or ethnic minority (Godard et al., 2000), this leads to a view that in the short- to medium-term, access to the Internet will be delineated along the lines of socio-economic, gender, and ethnic group, and traditional patterns of exclusion will remain. In the past, lack of skills and access to hardware was stopping low income groups
from accessing the Internet, and the cost of equipment and access to the internet deterred poorer groups. However, ownership costs for computers and mobile devices have dropped and more recent evidence finds the gender gap is narrowing (Choudrie et al., 2013; European Commission, 2005) and is a temporary phenomenon, having been almost or completely overcome in newer EU member states such as Ireland.

The European Commission (European Commission, 2005) concluded that effective public intervention was needed if Europe was to become “a more cohesive knowledge society”. As such, social inclusion and e-inclusion are linked. This linkage points to a need to widen participation in education and the potential role for e-learning in enabling that widening of participation to those excluded groups.

2 Goods-dominant vs service-dominant approach to the digital divide

The digital divide is usually conceptualized through a goods-dominant logic, where bridging the divide entails providing digital goods to disadvantaged segments of the population, but Srivastava & Shainesh (2015) argue an alternative service-dominant logic and view the divide from a service perspective viewing the divide across societal segments in accessing basic services such as healthcare and education. The differences in the level of services consumed by different population segments (service divide) is a key aspect of the current digital divide. This research argues that access to employment is also a critical service aspect of digital inclusion, exclusion and an important aspect of the digital divide.

For well over a decade a circular pattern of exclusion has been observed: income and education are the major determinants of digital exclusion (Choudrie et al., 2013; Laukkanen, 2016; Sims et al., 2008; Venkatesh, 2001), yet education and digital inclusion are determinants of higher levels of social inclusion and higher income. In households with low income and low terminal education there will be low e-inclusion. In households with high terminal education and high e-inclusion there will be higher social inclusion and income.

Srivastava & Shainesh (2015) suggest that information and communication technologies (ICTs) can be leveraged to bridge the service divide to enhance the capabilities of service-disadvantaged segments of society. But such service delivery requires an innovative assembly of both ICT and non-ICT resources.
3 Study approach and methodology

To address the problem of digital divide by assessing individuals’ access to education, training and jobs, the study proposes to analyse the necessary digital skills to get into employment. The aim of the first stage of the analysis would be to identify what ICT skills are explicitly and implicitly required to apply for, notwithstanding to secure, the job. This would enhance our understanding of what training is necessary to breach the divide, what type of access to ICT (hardware, software, infrastructure) is necessary to enhance an individual’s ability to secure employment, and what factors limit individual ability to acquire work.

The base data consists of 210 job adverts collected on digital job advertising platforms. The data covers three industry sectors which are commonly associated with low(er) incomes such as tourism, hospitality and charity.

Because the data was collected from digital adverts, it implicitly suggests that a potential employee requires some ICT skills and capabilities in order to see the advert: a device with which to access the advertising platform, a network infrastructure, ability to use the browser and to navigate websites.

The data analysis should provide a multitude of insights and suggestions for further research. First, is there a set of “common” skills, necessary for all (a majority) of jobs in each sector? Second, is there a “common skillset” across the sectors? Third, is there a skill set associated with higher-paying/higher positioned (e.g. management, supervision) jobs in each sector? Fourth, is there a skill set associated with higher-paying jobs across sectors? Fifth, are there “unnecessary” ICT skills, which are not required in a certain sector or at certain positions/income levels?

The raw data requires manipulation and cleansing before it can be analysed. Each job-advert will be associated with (1) industry, (2) qualification/job type, (3) level, (4) income, (5) required education level, (6) age. The job types and levels will be normalised to allow comparison. The salaries, specified in annual, monthly or per-hour values will be re-calculated to annual salaries based on 220 working days at 8 hours, to allow comparison. Initially, an association of jobs and gender was considered, however, none of the adverts under analysis were gender specific so that this association will be dropped from further analysis.

At this very early stage of the research, some skills appear to be implicitly needed for almost every job across the sectors (Table 1). Out of 70 jobs analysed in each sector,
the numbers in the table refer to the number of job adverts in which a skill was required.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Microsoft Word</th>
<th>Internet</th>
<th>E-mail</th>
<th>Mobile</th>
</tr>
</thead>
<tbody>
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<td>Hospitality</td>
<td>70</td>
<td>70</td>
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<tr>
<td>Tourism</td>
<td>63</td>
<td>61</td>
<td>65</td>
<td>49</td>
</tr>
<tr>
<td>Charity</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

Table 1 Requested Skills per Sector

Already at this early stage of the investigation some patterns emerge to suggest that specific skills and capabilities are transferable across hierarchies and industries. Further analysis would enable identification of skills and capabilities to reduce the digital divide.

4 Summary

Digital exclusion is a persistent inter- and intra-societal phenomenon. The findings from this research would allow research to guide the steps to breach the digital divide by focussing on the “universal” skills and capabilities, to provide a better access to education and technologies for yet excluded groups. The research will have theoretical, policy and practical impact. It will manifest and enhance our understanding of the ICT skills and access required today in order to reduce discrepancies in education and income. It will further assist in focussing the policy on necessary, transferable ICT skills for those who are affected by e-exclusion. Finally, it will indicate practical steps to improve access to necessary ICT and education both to employers and employees by highlighting the required skills to the employees, increasing their mobility, and thus by providing the employers with a population of potential employees with the right skills.

5 References


INTERVENTION EVOLUTION ENGINE - AN INTELLIGENT EHEALTH SERVICE DELIVERY PLATFORM

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Abstract
The rising global population and longevity of individuals place ever-greater demands on healthcare. Increasing choice and complexity of modern treatments make it difficult for clinicians to know and offer the best choices to patients and monitor outcomes to optimise and individualise care. Patients in turn, struggle to adhere to complex treatments offering better outcomes. Information Communication Technologies could improve decision-making by automating aspects of delivery as well as collecting and analysing outcome data that can drive optimisation. We propose an intelligent eHealth-based platform for primary care. The core technology is an Intervention Evolution Engine (IEE) that continuously optimises discreet interventions by comparing two or more versions and replacing the least effective intervention with a new alternative, based on patient feedback. The ultimate aim of this work is to offer a sustainable and exploitable solution for improving and preserving the health and well-being of individuals.

Keywords: Decision Support System, eHealth, Expert System, Information Communication Technology, Machine Learning, Service Delivery

1.0 Introduction
Globally people are living longer and increasing the cost and demand of healthcare. Meeting the demand to maintain the health and life quality of senior citizens will require increasingly effective and efficient treatments (WHO, 2013). Hence, the growing interest in the field of eHealth, defined by the WHO (2016) as the “use of information and communication technologies in support of health services”. Interest in eHealth has mainly focussed on the progressive integration of ICT into “paperless” health systems/services, where most growth has been seen since the millennium (WHO, 2016). Improving healthcare is complicated by considerable variability in clinical decision-making, treatment delivery and outcome monitoring (PHE, 2016). On the one hand, this is driven by increasing medical knowledge and complexity in the healthcare environment, and on the other, the limitations of prevailing clinical
decision-making that depends heavily on clinician experience rather than data analytics (NIB, 2014).

As a result, the typical Healthcare Service Delivery (HSD) model wastes valuable opportunities to benefit from continuously collecting feedback data from both patients and clinicians to rapidly improve the efficiency and effectiveness of interventions (Picker Institute Europe, 2009). Integrating eHealth into the HSD process therefore remains promising but elusive. In approaching this goal, the question guiding our approach is, “What is the single most effective implementation of eHealth that will perpetually maximise the benefits to patients and healthcare services as well as facilitate ubiquitous adoption?” The proposed solution is the Intervention Evolution Engine (IEE), an ICT based HSD system deploying Machine Learning algorithms that utilise the health status and behavioural data of patients to optimise individual treatment and rapidly evolve interventions via a continuous feedback mechanism. To maximise the impact of the system on population health the IEE will prioritise interventions when considering the decision-making algorithms.

2.0 Problem Statement

Despite widespread availability of eHealth technologies and worldwide practice of HSD, a large integration gap remains that makes it difficult to automate more advanced ICT to optimise the HSD process (NHS Digital, 2017). This provides an opportunity to closely integrate an eHealth-based solution to meet healthcare demands. ICT has advanced to a point where it is now possible to build systems that:

- Facilitate the collection and utilisation of data to,
- inform and individualise clinical decision making about interventions via
- an Expert Decision Support System that combines clinician experience (expert aspect) with Machine Learning (decision support aspect).

ICT can also facilitate better standardisation of intervention delivery through clinical workflow management that improves reliability, repeatability, and patient adherence. This can in turn, improve data collection via a continuous feedback mechanism that proceeds from baseline data collection to intervention delivery and outcome measurement to the selection of the most effective interventions.

By bridging the gap between ICT and HSD, the anticipated result is to create a platform where clinicians can select and deliver the most effective and efficient individualised prevention and treatment interventions to patients. The key innovation of the IEE will see interventions automatically evolve in subsequent iterations to
facilitate maximum clinical benefit. The system will implement the Stepped Care model, where patients are first allocated to the most efficient and likely effective form of treatment, before proceeding with the next most effective form of treatment if the previous step is deemed unsuccessful (Franx et al., 2012). Intervention selection will be personalised based on health status, personal preferences, and individual requirements. We also plan a comprehensive benchmark and trend analysis of existing eHealth systems and services to form the foundation of developing the IEE as well as address any identified gaps therein.

3.0 Purpose Statement

The purpose is to design and implement the IEE (Figure 1) into routine clinical practice in primary care settings. The core architecture of the IEE will drive the Stepped Care model via Machine Learning algorithms (providing predictive analyses) with ongoing outcome measurement i.e. a continuous feedback mechanism. A core principle of the system is that patients will be randomly allocated to one of two or more available interventions, as in a Randomised Controlled Trial (RCT), where one option will be the current “gold standard” and the alternatives are either variations or novel interventions. Alternative interventions will contain a new attribute that will be compared against the current version and at the end of each iteration; the best performing intervention will proceed on to the next iteration where it will be tested against a new alternative. This will form the basis of the A/B Testing procedure (Kohavi and Longbotham, 2016).

The aims of this solution are to:

- Provide end-users with successful User Experience (UX) by following best practices on gathering and organising major business, user, and system requirements at the beginning of each prototype development iteration, emphasising both functional and non-functional system requirements.
- Design a user-friendly and user-centric User Interface (UI) that will collect baseline and outcome data from patients (i.e. patient feedback) at set intervals, which will allow the system to learn and adapt in an iterative manner.
- Develop Machine Learning algorithms with the high predictive ability to calculate the best point of entry into the Stepped Care model as well as a selection of optimal interventions for specific conditions to save time and maximise cost-effectiveness.
- Operationalise randomised A/B Testing of specified attributes in each care module of each step of the Stepped Care model, to speed up the evolution of interventions.
4.0 Research Question(s)

The question to answer here is, if eHealth can revolutionise the HSD process, *what is the single most effective implementation of eHealth that will perpetually maximise the benefits to patients and healthcare services as well as facilitate ubiquitous adoption?*

In answering this question, it is essential to propose several sub-questions that will ultimately lead to answering this main research question. These sub-questions will also help to guide the study through the Research and Development (R&D) process by breaking down the study and providing us with key objectives to work towards. These additional questions will centre on the Systems Development Life Cycle (SDLC) of the IEE system with emphasis on the design and implementation phases where the study places more focus. Regarding the System Development Methodology (SDM), we propose a novel approach further expanded on in the Conceptual Framework section of this report.

The sub-questions of this study are:

- How can we use eHealth to help automate and manage the healthcare service delivery process applied routinely by healthcare professionals, to eliminate or at least reduce the risk and consequences of conditions such as Type 2 Diabetes Mellitus?
- How can we design and study an eHealth-based system that can effectively deliver diabetes risk detection and reduce these risks by data-driven suggestions as well as optimisation of personalised lifestyle and medical interventions?
- How can we embed eHealth in routine clinical practice to automate use and outcome data collection to regularly assess and enhance the effectiveness of the treatments and therapies administered to patients?
5.0 Conceptual Framework

Using Type 2 Diabetes as a case study, this research will focus on administering interventions related to two key priority areas of Diabetes management (NICE, 2015):

- Patient Education - Offer structured education to adults with Diabetes at and around the time of diagnosis.
- Lifestyle Advice - Integrate dietary advice with a personalised diabetes management plan, including other aspects of lifestyle modification, such as increasing physical activity.

We will identify current best practices, advised by the National Health Service (NHS) and National Institute for Health and Care Excellence (NICE) guidelines, in biological, psychological, and social data collection by collating data collection measures (surveys and questionnaires) that either contribute to risk calculations or guide interventions. In terms of software and algorithm development, we will benchmark, source, and reuse or adapt existing code where available. However, unique functionalities of the IEE system will be coded from scratch.

The IEE will be developed using a novel System Development Methodology (SDM), conceived by adapting the Cross-Industry Process for Data Mining (CRISP-DM) methodology and combining it with Eric Ries’s The Lean Startup approach along with Tim Brown’s process of Design Thinking (Figure 2).

- CRISP-DM is considered the leading methodology for data mining and predictive analytics projects, covering the typical phases of an analytical project (IBM, 2011).
- The Lean Startup approach guides fast, efficient solution development and delivery by focussing time and capital into iteratively building solutions to meet the needs of customers, thereby reducing their product development life cycles (Ries, 2011).
- The Design Thinking process allows decisions to be made based on what future customers want instead of relying only on historical data or making risky assumptions based on instinct rather than evidence (Brown, 2009).

This novel methodology was designed to optimise software as a service development.
6.0 Rationale and Significance

The IEE in concise will aim to reliably deliver proven prevention interventions in a Stepped Care model approach, possess functionality that routinely measures outcomes to continuously evaluate and improve the effectiveness of interventions as well as facilitate randomised A/B Testing to speed up the evolution of these interventions for subsequent application. Using primary and secondary prevention methods to aid in targeting a few common serious health conditions that carry risk to healthy ageing and have high morbidity (such as those associated with Type 2 Diabetes) can have vast potential benefits for all patients and the public. This project can consequently assist researchers and HCPs by helping them to identify and understand the correlations and dependencies between patient preference and adherence, their health conditions, and its associated treatments. This could at the right time help add to our understanding of the causative and contributory factors of these disorders.

The IEE would prove to be a very valuable tool serving many of its stakeholders. Not only will it help patients to tackle problems early on before the need and involvement of significant and costly interventions it would also help researchers and HCP’s collate vital information that would essentially help them to pinpoint the best form of treatment to treat a health condition. This work is aimed at contributing to the
realisation of a sustainable and exploitable solution for improving and preserving the well-being of individuals. The significance of our work will be determined by our success in uniting the necessary technologies and managing related HSD processes into a valuable automated eHealth-based platform. Further developments and advances to the platform (beyond this study) can form the core of an Artificially Intelligent (AI) technology used to treat other types of health conditions and disorders.

References


EXPLORING THE COLLABORATIVE ACTIVITIES OF HOME-BASED BUSINESSES IN OECD COUNTRIES

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Abstract  
Collaboration is frequently cited as a driver for sustainable success, and yet despite over half of all small businesses in OECD countries being run from the home, within the existing literature little attention is paid to how these businesses work with others. This article therefore presents a quantitative study into the collaborative behaviours exhibited by home-based businesses located within OECD countries. Based on a large, cross sectional data set collected by the Global Entrepreneurship Monitor, this exploratory study outlines the extent of collaboration among home-based businesses, the nature of their collaborative activities and the relationships which exist between the different behaviours that are exhibited.

The study finds that collaboration is a widespread occurrence among home-based businesses, with over 75% of home-based businesses collaborating in some way. Furthermore, home-based business collaboration is diverse in its nature and is present across all industries. Moreover, it is found that collaboration among home-based businesses is distinct enough from the current findings of collaboration among SMEs that it warrants further investigation.

Keywords: Home-based business, business collaboration, Global Entrepreneurship Monitor, OECD countries

1.0 Introduction

1.1 Background to the Research  
In order to facilitate expansion and to attain competitiveness in a market, small businesses frequently develop cooperative and collaborative relationships with other organizations (Casals, 2011). The benefits offered by such relationships are numerous,
extending from a reduction in transaction costs through to the acquisition of hitherto unavailable resources and the sharing of knowledge between businesses (Camarinha-Matos & Abreu, 2007). One particular sector - home-based businesses - is able to gain considerable benefits from these forms of collaborative relationships owing to the scarcity of available financial, physical and knowledge based resources. By utilizing data analytics techniques this study will offer insight into the extent of these collaborations, the form which the take and the patterns in which they occur.

A home-based business (HBB), while often included as a form of small to medium enterprise (SME) can be more specifically defined as “any business entity engaged in selling products or services...operated by a self-employed person...that uses residential property as a base from which the operation is run” (Mason, Carter & Tagg, 2011, p.12). In this study, the term HBB is inclusive of mobile businesses and businesses based from but not operated at the home, in line with the definition used in contemporaneous research (Clark & Douglas, 2014). Further to this, collaboration in the domain of SMEs and HBBs does not always rely upon formalized agreements and may instead involve word of mouth agreements and tacit commitments (Johannisson, 1987). Thus the term “collaboration”, when used in this study, is inclusive of all working relationships between organizations as indicated within the data.

In the UK, over 50% of SMEs are also HBBs, a sector with an annual turnover of over £300bn, and which contributes around £40bn per year to local economies (Enterprise Nation, 2014). Moreover, this trend is not exclusive to the UK, with studies indicating that over 50% of small businesses are based from the home across most OECD countries (Mason, 2010). Despite this, in many countries there is a lack of policy level support for HBBs, with some in the literature arguing that research into the “real world” of HBBs – including the extent of their collaborative activities – is required for them to be perceived as important economic actors engaged in joint enterprise, and to engender positive action among policy makers (Mason, Carter & Tagg, 2011; Mason, 2010). Moreover, existing findings within the literature suggest that most small businesses are reluctant to engage in collaborative activities (Casals, 2011). This study is concerned with collaborative propensity among home-based businesses, and will adopt a quantitative, data driven approach to providing evidence which is able to
support or deny this claim, providing evidence showing the extent of collaboration among HBBs.

1.2 Aims of the Research

The aims of this study are as follows:

- **A1**: To determine the extent of collaboration among HBBs.
- **A2**: To determine the differences in collaborative behaviours across industry sectors.
- **A3**: To explore patterns of common associations between collaborative behaviours exhibited by HBBs.

Collectively the insight provided via the above aims will provide an overview of the current collaborative environment in which HBBs inhabit, in addition to illustrating the areas in which collaboration is most required, thus providing direction for future work.

2.0 Methodology

2.1 Research Structure

The study utilized a number of methods to assess the collaborative behaviours of HBBs, presented as follows in the sequence which they were performed. Firstly, summary statistics by frequency were used to develop an understanding of the degree of collaboration exhibited by HBBs. Next, individual analysis was performed by industry sector, using descriptive statistics to outline collaborative trends across a range of industries. Lastly, association analysis was performed to detect trends and frequent associations between the collaborative behaviours.

2.2 Data Overview

The data used for this research was provided by the Global Entrepreneurship Monitor (Global Entrepreneurship Monitor, 2016), henceforth referred to as GEM. The 2012 release of the data was used due to the presence of year-specific questions concerning the collaborative activities of the surveyed businesses, not found in prior or subsequent releases of the dataset. The rationale behind the choice of using the GEM dataset was twofold: firstly, the unique composition (among publically available
repositories) of the dataset which allows for the concurrent study of individual, organizational and environmental variables, and secondly, as it provides access to standard, consistent data relating to businesses from almost all OECD countries, thus increasing the applicability of the findings produced.

2.3 Data Preparation

To identify usable cases for the study the original dataset was condensed on the basis of three main conditions: firstly, the presence of values indicating that the business was home-based. Secondly, the presence of data indicating the collaborative activities of the business, and thirdly, the location of the business indicated as being within OECD country, so that relative parity in terms of national economic conditions could be assured. The total number of cases post data reduction was 3891, from a total of 20 countries (further detail can be found in Appendix A).

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Represented behaviour(s)</th>
<th>Possible value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CollabProduce</td>
<td>Production of goods or services with other businesses or organizations</td>
<td>$1 = Yes, 0 = No$</td>
</tr>
<tr>
<td>CollabProcure</td>
<td>Procurement of goods or materials with other businesses or organizations</td>
<td>$1 = Yes, 0 = No$</td>
</tr>
<tr>
<td>CollabSellMarket</td>
<td>Selling and/or marketing of goods or services with other businesses or organizations</td>
<td>$1 = Yes, 0 = No$</td>
</tr>
<tr>
<td>CollabCreate</td>
<td>Creating new goods or services with other businesses or organizations</td>
<td>$1 = Yes, 0 = No$</td>
</tr>
<tr>
<td>CollabEffective</td>
<td>Working with other businesses or organizations to make the business more effective</td>
<td>$1 = Yes, 0 = No$</td>
</tr>
</tbody>
</table>

Table 1. Variables present in the GEM 2012 dataset representing collaborative behaviour.

The dataset includes data on five different forms of collaborative activity, indicated through the values contained in five variables, as shown in Table 1. The data in each is represented by a Boolean value denoting a business’s participation in an activity. While the behaviours identified within the data are not exhaustive, the scope of this study is defined by the boundaries of the dataset, and is deemed satisfactory for the
purpose of identifying the general disposition towards collaboration demonstrated by HBBs.

In the original dataset collaborative activities were split over ten variables, with each behaviour represented by two variables – one for start-up businesses and another for established businesses. As each pair of variables includes only one value, each pair were consolidated into a single variable for analysis. An example of the data structure and the associated interpretation of the variables can be seen in Table 2.

<table>
<thead>
<tr>
<th>CollabProduce</th>
<th>CollabProcure</th>
<th>CollabSellMarket</th>
<th>CollabCreate</th>
<th>CollabEffective</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>No collaborative activity indicated</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Some collaborative activity indicated</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>All collaborative activities indicated</td>
</tr>
</tbody>
</table>

Table 2. Example of variables within the GEM 2012 dataset.

Post data reduction there still remained a small quantity of missing values in the collaboration variables (<5% for each). Imputation was therefore required to best preserve the size of the dataset, with the use of the expectation-maximization (EM) algorithm being chosen as the method best suited to the task, due to the ability of algorithm to preserve the relationships between variables (Schaffer, 1997).

3.0 Findings and Discussion
3.1 Extent of Collaboration Among HBBs
To assess the extent of collaborative behaviours among HBBs, basic summary statistics were produced, as seen in Table 3. The most prominent finding from the summary statistics is the overall engagement in any collaborative behaviour by HBBs, with over 75% of businesses (75.6%, shown in Table 3) collaborating in some way. This is in contrast to the previous studies which indicated that the majority of HBBs
are indisposed to collaboration, due to the barriers impeding successful inter-firm cooperation such as a lack of suitable partners, a lack of the required investment or the fear of knowledge over-sharing (Casals, 2011).

<table>
<thead>
<tr>
<th>Collaborative activity</th>
<th>Percentage of HBBs engaged in activity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any collaborative activity</td>
<td>75.6</td>
</tr>
<tr>
<td>Production</td>
<td>49.8</td>
</tr>
<tr>
<td>Procurement</td>
<td>42.1</td>
</tr>
<tr>
<td>Selling/Marketing</td>
<td>43.6</td>
</tr>
<tr>
<td>Creation</td>
<td>26.7</td>
</tr>
<tr>
<td>Making business more effective</td>
<td>38.0</td>
</tr>
</tbody>
</table>

Table 3. Summary statistics of collaborative behaviours among HBBs.

Regarding the forms of collaboration engaged in, it can be seen that the most common is working with others to produce goods or services, and the least common is working with others to create new goods or services (as given in Table 3). This indicates that collaboration among HBBs is primarily of a practical nature – utilizing it as a tool to access resources not held internally or to derive transaction cost benefits via resource pooling – as opposed to joint initiatives and ground-up collaborative product development.

3.2 Analysis of Collaborative Propensity by Industry

An industry based analysis was performed in order to explore the nature of collaborative activities among HBBs operating within various sectors. A double digit International Standard Industrial Classification (ISIC) code (United Nations, 2014) recorded within the GEM data was used as the industry identifier, with a range of twelve industries being identified within the data, as seen in Table 4. Across each industry two tests were performed: a breakdown of collaborative propensity by percentage of industry total, and a collaborative activity breakdown illustrating the ratios of industry members exhibiting or not-exhibiting each behaviour. A summary of the results can be seen in Table 4.
<table>
<thead>
<tr>
<th>Industry</th>
<th>% of businesses showing no collaborative behaviours</th>
<th>% of businesses showing one or more collaborative behaviours</th>
<th>% Deviation from aggregated industry mean*</th>
<th>Most common collaborative behaviour (% engaged)</th>
<th>Least common collaborative behaviour (% engaged)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Forestry, Fishing</td>
<td>22.8</td>
<td>77.2</td>
<td>1.6</td>
<td>Procurement (49.9)</td>
<td>Creation (20.9)</td>
</tr>
<tr>
<td>Mining, Construction</td>
<td>18.0</td>
<td>82</td>
<td>6.4</td>
<td>Procurement (56.8)</td>
<td>Creation (26.0)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>19.0</td>
<td>81</td>
<td>5.4</td>
<td>Procurement (53.8)</td>
<td>Creation (27.8)</td>
</tr>
<tr>
<td>Utilization, Transport</td>
<td>30.2</td>
<td>69.8</td>
<td>-5.8</td>
<td>Production (51.2)</td>
<td>Creation (21.8)</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>20.1</td>
<td>79.9</td>
<td>4.3</td>
<td>Procurement (54.3)</td>
<td>Creation (26.7)</td>
</tr>
<tr>
<td>Retail trade, Hotels, Restaurants</td>
<td>24.6</td>
<td>75.4</td>
<td>-0.2</td>
<td>Procurement (51.4)</td>
<td>Creation (24.1)</td>
</tr>
<tr>
<td>Information, Communication</td>
<td>22.8</td>
<td>77.2</td>
<td>1.6</td>
<td>Production (55.4)</td>
<td>Procurement (35.3)</td>
</tr>
<tr>
<td>Financial intermediation, Real Estate</td>
<td>25.7</td>
<td>74.3</td>
<td>-1.3</td>
<td>Selling/Marketing (55.8)</td>
<td>Procurement (25.7)</td>
</tr>
<tr>
<td>Professional services</td>
<td>25.7</td>
<td>74.3</td>
<td>-1.3</td>
<td>Production (56.3)</td>
<td>Procurement (31.8)</td>
</tr>
<tr>
<td>Administrative services</td>
<td>34.9</td>
<td>65.1</td>
<td>-10.5</td>
<td>Production (42.1)</td>
<td>Creation (27.2)</td>
</tr>
<tr>
<td>Government, Health, Education, Social services</td>
<td>24.7</td>
<td>75.3</td>
<td>-0.3</td>
<td>Production (47.1)</td>
<td>Creation (27.8)</td>
</tr>
<tr>
<td>Personal/Consumer service</td>
<td>24.4</td>
<td>75.6</td>
<td>0</td>
<td>Production (57.3)</td>
<td>Creation (31.7)</td>
</tr>
</tbody>
</table>

Table 4. Summary of collaborative behaviours across industries. (*Non-weighted mean of the percentage of collaborative businesses across industries)
Across all industries, at least 65% of HBBS engaged in at least some form of collaboration (65.1% being the lowest value, shown in Table 4) with the mean across industries being 75.6%, calculated from the data shown in Table 4. The most common form of collaboration (by frequency) across all industries is working with other businesses to produce goods or services. The least common form of collaboration (by frequency) is working with other businesses to create new goods or services. While the majority of industries achieve similar collaborative propensities relative to the mean, those outside of the standard deviation from the mean (which is calculated to be 4.5) include “Mining, Construction” and “Manufacturing” – both of which show a higher than average inclination toward collaborative activity, in addition to “Utilization, Transport” and “Administrative Services”, both of which demonstrate a lower than average inclination toward collaborative activity.

Of note is the lack of focus on collaborative creation of new goods or services, which runs as a counterpoint to the theory that working together to achieve innovation and generate new products is the primary purpose of collaborative activity among SMEs. (Casals, 2011; Narula, 2004).

3.3 Association Pattern Analysis
To explore the relationships which exist between the multiple forms of collaboration, two key areas were investigated; the associations between the varying activities and the likelihood of their common occurrences. To achieve an understanding of the regularity of certain combinations of collaborative behaviours, a frequency pattern (FP) tree was compiled, a method commonly used for the identification of frequently occurring itemsets within a dataset (Han & Kamber, 2006). Illustrating the number of incidences of behaviours one to five (as shown in Table 1) occurring together, up to a total of three concurrent behaviours. The minimum support cost was set at one fifth of the number of cases, 778. Table 5 details the frequently grouped item sets which achieved that threshold.

The measures of support and confidence were utilized as a method of identifying the most prominent relationships within a dataset. Support can be seen as measure of frequency, indicating the proportion of cases exhibiting a particular combination of behaviours. Confidence designates the amount of times a statement of association can
be seen to be correct. From the data it can therefore be seen that the activities of “Production” and “Selling/Marketing” jointly occur in 35% of all cases, yet based on the presence of one of these activities it can be predicted with a 61.2% confidence that the other will also be present in a given case.

<table>
<thead>
<tr>
<th>Combination</th>
<th>Support</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production, Selling/Marketing</td>
<td>0.35</td>
<td>61.2%</td>
</tr>
<tr>
<td>Production, Procurement</td>
<td>0.28</td>
<td>55.8%</td>
</tr>
<tr>
<td>Production, Making business more effective</td>
<td>0.26</td>
<td>52.8%</td>
</tr>
<tr>
<td>Selling/Marketing, Making business more effective</td>
<td>0.26</td>
<td>58.7%</td>
</tr>
<tr>
<td>Procurement, Selling/Marketing</td>
<td>0.24</td>
<td>57.6%</td>
</tr>
<tr>
<td>Selling/Marketing, Creation</td>
<td>0.22</td>
<td>50.9%</td>
</tr>
<tr>
<td>Procurement, Making business more effective</td>
<td>0.22</td>
<td>52.0%</td>
</tr>
<tr>
<td>Production, Creation</td>
<td>0.22</td>
<td>43.8%</td>
</tr>
</tbody>
</table>

Table 5. The most numerous collaborative combinations ranked by support.

The association analysis identified that in addition to “Production” being the most prevalent form of collaboration among HBBs when taken in isolation, it is additionally the behaviour most likely to occur in combination with others. The overall spread of behaviours however is diverse, with only four behavioural combinations occurring in over 25% of cases. The following phase involved determining the probabilities of a behaviour occurring based on the presence of one or more other behaviours. Table 6 displays the behaviours most likely to occur in conjunction with others.
Behaviours (Dependent | Independent(s)) | Conditional Probability
--- | ---
Making business more effective | (Selling/Marketing & Creation) | 0.74
Making business more effective | (Production & Creation) | 0.73
Making business more effective | Creation | 0.69
Selling / Marketing | (Production & Procurement) | 0.67
Making business more effective | (Procurement & Selling/Marketing) | 0.66
Making business more effective | (Production & Selling/Marketing) | 0.64
Selling/Marketing | Production | 0.61
Creation | (Production & Selling/Marketing) | 0.61

Table 6. Most probable incidences of behaviours occurring in combination.

The figures shown in Table 6 help to illustrate a number of trends shown in the data. One combination of behaviours which is of interest is “Making business more effective” and “Creation”, which in isolation are the two behaviours least likely to occur (see Table 3) but possess a high probability (0.69) of occurring in tandem.

Another key trend revealed via the probability analysis is the prominence of “Making business more effective”, with 5 of the 8 most probable behavioural combinations including this behaviour, which when compared with the base rate of occurrence 38% (shown in Table 3) indicates the increased likelihood of this behaviour to occur in conjunction with other behaviours as opposed to in isolation. One explanatory hypothesis for this phenomenon is that HBBs with existing willingness to collaborate in areas such as joint purchasing and outsourced production of goods are more also more open to receiving outside assistance in improving their internal business processes.

4.0 Conclusions

The study has shown that collaboration among HBBs is widespread, with over 75% exhibiting one or more collaborative behaviours, with collaborative production, procurement and selling/marketing being the most frequent forms of collaboration among HBBs. Equally, this study has shown that the collaborative behaviours of HBBs vary considerably, with even the least frequently occurring behaviour – collaborative creation – being exhibited by over 26% of HBBs.
Furthermore, collaboration is a practice not limited to a small selection of industries and is instead commonplace across all industry sectors, with all industry’s possessing at least a 65% rate of collaboration. The most collaboratively inclined industries were shown to be the mining/construction and manufacturing industries, both of which possessed collaboration rate in excess of 80%. Additionally, this study has provided insights into the nature of collaboration in HBBs, illustrating which behaviours are likely to occur in combination with others. This analysis has highlighted a number of trends within the data, including the increased likelihood of collaboration to make a business more effective occurring in conjunction with other behaviours, and the close relationship displayed between the behaviours of collaborative production and collaborative selling/marketing.

Of particular note is that a number of the findings generated by this study - concerning both the extent of and the nature of HBB collaboration - are far enough removed from those existing in the current literature on SME collaboration to reinforce the theory that HBBs operate in a different manner to SMEs and must therefore be considered as a separate entity (Clark & Douglas, 2014). By addressing the subject of HBB collaboration from a data analytics perspective, the findings illustrate the reliance shown by HBBs on collaborative activities, and are able to clearly demonstrate that HBBs located within OECD countries are actors heavily engaged in joint enterprise and inter-organizational cooperation.

5.0 Further research
The future research will comprise a more involved analysis of the areas covered in this study, including studying HBB collaboration on the basis of intensity and business maturity. Following this, classification of businesses into like groups on the basis of their collaborative activity will be performed by means of cluster analysis, with the aim of using the identified clusters to develop an understanding of common factors which exist between collaboratively inclined HBBs.
Appendix A

Table 7 displays a breakdown of the composition of businesses utilized in the study by country of origin. Businesses from a total of 20 OECD countries were used in the study, a number limited by valid cases in dataset post data reduction, as detailed in section 2.3.

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of valid cases</th>
<th>Percentage of total cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>997</td>
<td>25.6</td>
</tr>
<tr>
<td>Netherlands</td>
<td>383</td>
<td>9.8</td>
</tr>
<tr>
<td>Poland</td>
<td>211</td>
<td>5.4</td>
</tr>
<tr>
<td>Estonia</td>
<td>209</td>
<td>5.4</td>
</tr>
<tr>
<td>Austria</td>
<td>202</td>
<td>5.2</td>
</tr>
<tr>
<td>Latvia</td>
<td>197</td>
<td>5.1</td>
</tr>
<tr>
<td>Hungary</td>
<td>175</td>
<td>4.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>174</td>
<td>4.5</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>171</td>
<td>4.4</td>
</tr>
<tr>
<td>Germany</td>
<td>171</td>
<td>4.4</td>
</tr>
<tr>
<td>Finland</td>
<td>171</td>
<td>4.4</td>
</tr>
<tr>
<td>Ireland</td>
<td>169</td>
<td>4.3</td>
</tr>
<tr>
<td>Slovakia</td>
<td>137</td>
<td>3.5</td>
</tr>
<tr>
<td>Slovenia</td>
<td>118</td>
<td>3</td>
</tr>
<tr>
<td>Denmark</td>
<td>98</td>
<td>2.5</td>
</tr>
<tr>
<td>Belgium</td>
<td>94</td>
<td>2.4</td>
</tr>
<tr>
<td>Israel</td>
<td>74</td>
<td>1.9</td>
</tr>
<tr>
<td>Italy</td>
<td>68</td>
<td>1.7</td>
</tr>
<tr>
<td>Greece</td>
<td>46</td>
<td>1.2</td>
</tr>
<tr>
<td>Portugal</td>
<td>26</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Table 7. Breakdown of valid cases by country
References


COMMUNICATION-DRIVEN USEFULNESS HYPOTHESIS FOR ONLINE HEALTHCARE APPLICATIONS

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Abstract
Healthcare insurance is a complex financial product with many variables involved. What drives perceived ease of use (PEOU) and perceived usefulness (PU) of healthcare insurance applications (HIAs), be they websites and mobile apps? We propose a communication-driven usefulness hypothesis, which posits three aspects of communication with healthcare insurer providers determining PEOU and PU. Those aspects are: information quality (IQ), interaction ease, and provider competence. The results from 333 survey questionnaires from current healthcare insurance customers support our hypothesis. Thus, future studies should examine further the driving factors of PEOU and PU of the apps involving complex products and services besides healthcare insurance.

Keywords: Healthcare Insurance Applications (HIAs), Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Communication-Driven Usefulness Hypothesis

1.0 Introduction

Access to healthcare insurance information is critical for the welfare of both health and financial needs. Fortunately, about three-quarters of Americans now own a smartphone, and 88% of them access to the internet in 2017 according to Pew Research (Smith, 2017). A 2017 survey shows that 64% of patients use mobile devices including mobile application (apps) to manage their health (McCarthy, 2017). Therefore, our focus should be directed not so much as to whether health insurance customers could access insurance information online but as to how insurance providers improve the ease and usefulness of their online apps and websites.

The technology acceptance model (TAM) has been widely used to explain how users accept new technologies and applications (Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003). In it, perceived ease of use (PEOU) and perceived usefulness (PU) are two key variables that directly impact the attitudes towards usage and the intentions to use them. PEOU is defined as “the degree to which a person believes that using a particular system would be free of effort” whereas PU is “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989). Mortenson and Vidgen (2016) identified 3,386 studies using TAM. However, there are a few understudied aspects. Most TAM studies do not focus on health
insurance apps and websites. More importantly, PEOU and PU are treated as independent variables (IVs) in many cases.

In today’s environment, many consumers do regularly use websites and mobile applications to obtain healthcare insurance information. However, healthcare insurance service is not a simple form of service delivery. Healthcare insurance involves complex sets of rules, regulations, contracts, and medical circumstances. Thus, what improves PEOU and PU is more pressing and important than what increases use intention of websites and mobile applications. In this study, we focused on factors impacting PEOU and PU of healthcare insurance apps (HIAs) including websites. Our communication-driven usefulness hypothesis for HIAs posits (1) PEOU is driven by information quality and communication complexity, and (2) PU is, in turn, determined by PEOU and customer service competence of insurance provider.

2.0 Background and Hypotheses

A TAM literature review between 1986 and 2013 by Marangunić and Granić (2015) notes a number of factors that possibly influence PEOU and PU including: system characteristics, user training, user participation design, the nature of the implementation process, personality traits, demographic characteristics, computer self-efficacy, technology anxiety, and prior usage and experience. In the design and development phase, consumer healthcare apps should certainly follow the guidelines well-known in the human–computer interaction community; that is, providers develop right “use cases” and identify relevant functional and content and features (Schnall et al., 2016).

Once HIAs are developed and released, however, what drives PEOU is primarily the quality of information (IQ). The Information Systems (IS) Success Model (DeLone & McLean, 1992; DeLone & McLean, 2003) posits that three key drivers of IS success are IQ, system quality, and service quality. Health insurance is a complex financial product that requires consumers to manage intricate tradeoffs over a range of variables (Nadash & Day, 2014). Consumers often grapple with “complex contracts and hard-to-decipher benefits designs” (Kingsdale, 2014). That is, such factors as IQ, interaction ease with the insurance provider, and provider competence likely play critical roles for HIAs, if we treat the quality of HIAs as a constant. This is the basis for our communication-driven usefulness hypothesis for HIAs.

For instance, the positive impact of IQ on PEOU is found for using online retailing websites (Ahn, Ryu, & Han, 2007), where consumers search and compare multiple purchase options. IQ also influence PEOU of community municipal portals that facilitate the delivery of information, services, and resources (Detlor, Hupfer, Ruhi, & Zhao, 2013). Finally, Kuo and Lee (2009) report that IQ significantly impact PEOU in the context of knowledge management systems (KMS), where complexity of task knowledge may often be involved. Thus, we hypothesize:

H1: The higher the IQ, the higher the PEOU.

In using HIAs, consumers navigate, search and comprehend their healthcare coverage and expenses for each medical situation. They engage often in multiple iterations of communication and interaction with the provider through HIAs to resolve any issues beyond information
obtainable from HIAs. For instance, providers often “do not completely reimburse the expenses despite their contractual obligations” (Khademolqorani & Hamadani, 2015). On one hand, such difficulty is comparable to obfuscation where consumers experience cognitive limitations due to the interaction complexity associated with price structure and presented information during their search efforts (Choi, Kwon, & Shin, 2017). Obfuscation could be eased by superior HIA designs. On the other hand, the difficulty is also rooted in the underlying communication protocols between consumers and providers. Thus, we posit:

**H2:** The greater the interaction ease, the higher the PEOU.

A literature review (Legris, Ingham, & Collerette, 2003) find 21 studies supporting the relation between PEOU and PU whereas only 5 do not see a significant relation between them. Thus, we propose:

**H3:** The higher PEOU, the higher the PU.

Service provider competency significantly relates to positive and negative sentiments towards service encounters (Price, Arnould, & Deibler, 1995). We postulate provider competence leads higher PU, which in turn increases positive sentiment. This is consistent with the findings of a study (Featherman, Miyazaki, & Sprott, 2010) that reports a significant positive influence of e-service provider trust worthiness and expertise over PU.

**H4:** The higher the provider competence, the higher the PU.

Our research model is shown in Figure 1.

3.0 Method

This empirical study analyzed data collected from Amazon Mechanical Turk\(^1\) using an online survey in 2017. Partial least squares (PLS) modeling was used to analyze the data and to identify

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\(^1\) [https://www.mturk.com/mturk/welcome](https://www.mturk.com/mturk/welcome)
factors that lead to dependent variables, PEOU and PU, among consumers of health insurance companies. The survey also consisted of latent independent variables that included information quality, complexity, and provider competence. Each item was measured on a five-point Likert scale anchored by 1 = strongly disagree and 5 = strongly agree (Table 1).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Construct</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived ease of use</td>
<td>I find that my insurance company’s technology is easy to use. I find that my insurance company’s technology is easy to learn. Interacting with my insurance company’s technology does not require a lot of mental effort.</td>
<td>Davis (1989)</td>
</tr>
<tr>
<td>Perceived usefulness</td>
<td>I find that my insurance company’s technology is useful. Using my insurance company’s technology increases my productivity. Using my insurance company’s technology is convenient. Using my insurance company’s technology saves me time.</td>
<td>Davis (1989)</td>
</tr>
<tr>
<td>Information Quality</td>
<td>Generally, I can find the information that I want from my health insurance company. My health insurance company provides relevant information. My health insurance company provides accurate information. My health insurance company provides timely information. My health insurance company provides up-to-date information.</td>
<td>DeLone and McLean (2003)</td>
</tr>
<tr>
<td>Interaction ease</td>
<td>My health insurance company is easy to work with. Dealing with my health insurance company is hassle free. It is simple to work with my insurance company. Interactions with my health insurance company are not complex.</td>
<td>Parasuraman, Zeithaml, and Malhotra (2005)</td>
</tr>
<tr>
<td>Provider Competence</td>
<td>The employees at my health insurance company have the required knowledge to solve problems. The employees at my health insurance company are highly skilled at their jobs. The employees at my health insurance company carry out their tasks competently. I believe the insurance company employees have the ability to answer all questions accurately. The behavior of employees at my health insurance company instills confidence in customers.</td>
<td>Dagger, Sweeney, and Johnson (2007)</td>
</tr>
</tbody>
</table>

Table 1. Construct of variables

Survey respondents were offered $1.25 to complete the survey. Responses were screened for completion, duplicates, and location. Only responses submitted from the United States were included in the study. Five hundred twenty-two responses were collected. Duplicates, unfinished surveys and broker responses were omitted. Further, 104 did not use health insurance company technology. Therefore, a net of 333 respondents were included in the study.

4.0 Results

SmartPLS 3 (Ringle, Wende, & Becker, 2015) was used to test our model. Loadings for the variables are all significant ($p < 0.001$). Table 1 shows that all constructs’ Cronbach’s alpha
values exceed 0.7 and have a high reliability (Petter, Straub, & Rai, 2007). In addition, we conducted convergent and discriminant validity tests based on the average variance extracted (AVE) value for each construct reported (Yoo & Alavi, 2001). Table 2 shows that the square root of these AVEs on the diagonal are larger than the correlations with other constructs. This test result indicates that all questions used to measure constructs in the model have high discriminant and convergent validities.

<table>
<thead>
<tr>
<th></th>
<th>Cronbach’s α</th>
<th>Composite Reliability</th>
<th>Competence</th>
<th>Complexity</th>
<th>IQ</th>
<th>PEOU</th>
<th>PU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence</td>
<td>0.960</td>
<td>0.969</td>
<td>0.928</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complexity</td>
<td>0.948</td>
<td>0.963</td>
<td>0.823</td>
<td>0.931</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IQ</td>
<td>0.936</td>
<td>0.951</td>
<td>0.725</td>
<td>0.703</td>
<td>0.892</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU</td>
<td>0.916</td>
<td>0.947</td>
<td>0.499</td>
<td>0.530</td>
<td>0.602</td>
<td>0.925</td>
<td></td>
</tr>
<tr>
<td>PU</td>
<td>0.903</td>
<td>0.932</td>
<td>0.567</td>
<td>0.579</td>
<td>0.600</td>
<td>0.786</td>
<td>0.881</td>
</tr>
</tbody>
</table>

Table 2. Variable reliability and correlations

The PLS model (Figure 2) confirms the basic dynamics for PEOU and PU as our four hypotheses postulate. Concerning the two factors for PEOU, H1 (IQ impact) and H2 (interaction ease) are supported with $\beta = 0.455$ (p = 0.000) and $\beta = 0.210$ (p = 0.001), respectively. As predicted, PEOU strongly influence PU ($\beta = 0.669$, p = 0.000). This confirms H3. Finally, provider competence significantly impacts PU ($\beta = 0.234$, p = 0.000), affirming H4.

![Diagram](Figure 2. PLS results)

**. p < 0.05  ***: p < 0.001

5.0 Implications and Conclusion

This study focused on the understudied aspect of TAM and health insurance apps and websites by focusing on factors impacting PEOU and PU involving complex products and services. Health insurance providers should focus on (a) improvement of insurance information quality, and (b) increase interaction
ease with their customers, in order to increase PEOU of their online tools. In turn, improved PEOU increase customers’ perceived usefulness of those tools while further improving customer service competence. In a bigger picture, the results are consistent with what the IS Success Model (DeLone & McLean, 1992; DeLone & McLean, 2003) posits. That is, the success of HIAs starts with information quality and service quality, provided the design quality of HIAs is adequate.

References


THEORY CHOICE IN CRITICAL REALIST INFORMATION SYSTEMS RESEARCH

Abstract

There has recently been calls for Information Systems (IS) researchers to revisit the dominant mode of theorizing in IS research practice, a process often reduced to “shopping” around for an appropriate theory among a diversity of competing theories. To answer this call, this paper examines the process of theory choice from a critical realist perspective, and in so doing develops guidelines for middle-range theorizing in critical realist IS research. Three steps are identified in this process, these being to (1) understand the background theories relevant to the phenomenon under investigation, (2) contrast and combine these background theories, and (3) situately integrate the background theories. The process is illustrated by demonstrating its use in a case study of the emergent usage of adaptive IS.

Keywords: Critical realism, Theory choice, Middle-range theorizing, Background theories

1.0 Introduction

Recently concerns have been raised about the practice of theorising in Information Systems (IS) research (Avison and Malaurent 2014; Grover and Lyytinen 2015). Of particular concern is the scripted manner of most IS research whereby researchers identify a problem, “shop around” for a theory, typically from reference disciplines, and then adapt it to the IS context with minor modification and extension before testing it (Grover and Lyytinen 2015). Grover and Lyytinen (2015) classify this script as mid-range theorizing, that produces theories that are lacking in innovation. Suggestions for improvement have included alternatives to the mid-range script, such as data-driven research, blue-ocean theorizing (Grover and Lyytinen 2015) or “theory light” approaches (Avison and Malaurent 2014). Another alternative for yielding improvement is not to abandon the script all together, but to revisit the process by which borrowed theories are chosen. Rather than “shopping” for a theory, theories can be strategically chosen in relation to the empirical situation. The latter approach to theorizing is known as middle-range theorizing (Hassan and Lowry 2015; Merton 1968) and it constitutes the focus of this paper.

Theories are undergirded by implicit or explicit philosophical assumptions (Archer 1995; Byron and Thatcher 2016). For example, Lee, Briggs and Dennis (2014) proffer requirements that ought to be satisfied when developing a theory of explanation in positivist research. Similarly, Lee and
Hovorka (2015) identify requirements for interpretive theory to satisfy. Critical realism has been demonstrated as appropriate for investigating IS phenomenon, and revealing new insight (Mingers et al. 2013). Views of theory and theory choice in critical realist research are less well-known in the IS discipline. The purpose of this paper is to articulate from a critical realist perspective an overview of what theory is, its implications and contributions. Specifically, the paper focuses on the issue of theory choice in critical realist middle-range theorizing. The paper illustrates how theories were chosen in a critical realist study of emergent usage of adaptive IS. To focus the paper, we ask the following questions:

(1) What is the general view of theories and their implications in critical realist research?
(2) How can scholars select and integrate theories in critical realist middle-range theorizing?

The rest of this paper is organized as follows: Section 2 consists of a brief overview of critical realism; Section 3 gives a general overview of theories and their implications in critical realist IS research. Section 4 presents how scholars can select and integrate theories in critical realist research and Section 5 illustrates an example of theory choice in a critical realist case study of emergent usage of adaptive IS.

2.0 Critical Realism – An Overview

Critical realism subscribes to the notion of an objective reality that is independent of our descriptions and knowledge (Mingers et al. 2013). While our ideas about the reality may change over time, reality itself does not change with our changing thoughts and is stratified into three domains - the real, the actual and the empirical (Bhaskar 2008). The domain of the real contains structures, their relations and generative mechanisms all in a constant state of flux (Mingers 2010). When such mechanisms are triggered, events may or may not be actualized. When actualized they may or may not be observed at the level of the actual. They may be observed in the form of their effects that carry traces of their causes at the empirical domain (Bhaskar 2008). Mechanisms have causal powers and enduring properties that when triggered under specific conditions produce different outcomes (Smith and Johnston 2014). Therefore, the same mechanisms are prone to produce different social phenomena under different conditions within a historical context. Knowledge of such reality is also stratified, transformative and can be conceived of as a social product (Bhaskar 2008; Souza 2014). Thus, critical realism takes an epistemologically relativist stance that acknowledges the social construction of knowledge about the mind-independent reality.
(Bhaskar 2008). It also acknowledges the fallibility of all knowledge. Thus, knowledge is historically temporal, and it acquires meaningfulness and value relative to space, time and the social-practice position of the knower (Arvanitidis 2006; Souza 2014). Such knowledge is also situated in a historical and cultural discourse that favours certain knowledge claims over others via a process of judgmental rationality (Bhaskar 2008; Souza 2014).

Judgmental rationality captures the shared reference points for making rational choices between alternative theories (Isaksen 2016). Ignoring judgmental rationality “renders problematic the idea of a rational choice between ‘incommensurable’ theories and to encourage (superidealistic) skepticism about the existence of a theory-independent world” (Bhaskar 1998, p. x-xi) Alternative theories are not just different in their suppositions as suggested by Walsham (1993), but are incommensurable theories about the same world (Bhaskar 1998). Thus, they are understood to compete and conflict in their claims to advance upon established explanations about the reality in question (Bhaskar 1998).

Critical realism subscribes to open systems where temporal, non-universal and invariant patterns of regularities exist as demi-regularities (Lawson 1997). Within the open systems, micro entities interact to form a variety of social objects that possess emergent powers (Ononiwu and Brown 2013). Equally, there is an integration of micro-level and macro level dynamics to connect the real with the empirical domains in the open system. By this, emphasizes shifts to unobservable causal mechanisms at the real domain rather than deterministic causality at the level of the observed events. A critical realist explanation thus involves a gradual transition from the observed events through reasons (actors’ accounts) to rules and thence to structures based on retroductive mode of reasoning (Mingers et al. 2013; Sayer 1992).

Structures are real with causal powers but may not be actualized and they manifest in the form of material, ideals, artifacts and social objects (Fleetwood 2005). Social structures do not exist independently of an agents’ conception of their effects (Fleetwood 2005). That is, social structures manifest through the activities they govern and, as such, cannot be directly observed (Fleetwood 2005). They have an intransitive dimension (the presupposition of the real in the form of enduring structures and mechanisms) and as a result function independently of their appropriate
conceptualization (Arvanitidis 2006). Being regarded as the ever-present condition and also the outcome of human agency, social structures at any moment in time are pre-given for individuals who do not create them, but merely reproduce or transform them in their substantive activities (Archer 1995). Thus, we do not make social structures: they pre-date us having properties and powers that have emerged as a result of actions taken by our predecessors (Archer 1995). Thus, in a transcendental and causal manner, social structures become the necessary condition for human behavior and action. By the causal powers of social structures, we proclaim their reality and also by their pre-existence, we establish their relative autonomy as distinct objects of scientific investigation (Arvanitidis 2006). Consequently, the ontological and methodological separability of social structures and human agencies is recognized with distinct emergent properties and causal powers (Archer 1995; Arvanitidis 2006).

Since, critical realism assumes that “a cause is whatever is responsible for producing change” (Sayer 2000, p. 94), causal explanatory theories become the goal of realist researches. Such theories ought to capture the mechanisms and their interaction that cause the event. Thus, constant conjunction of events is neither a sufficient nor a necessary condition for a causal explanation. Rather, it can at best support the identification of events in the empirical domain (Ononiwu and Brown 2013). Causal explanation focuses on “finding or imagining plausible generative mechanisms for the patterns amongst events” (Harré 1972, p. 125), leading to “the postulation of a possible mechanism. Thence, we can attempt to collect evidence for or against its existence, and the elimination of possible alternatives” (Outhwaite 1987, p. 58). From a critical realist perspective, to understand the real domain is the reason for science (Bhaskar 2008). Theorization then becomes the means to explain why an event occurs via a retroductive-based transcendental process (Bhaskar 2008). Such a process occurs when we use the observed event as a symptomatic clue to fallibly infer the type of mechanisms that lies beyond the observed events (Mingers et al. 2013).

3.0 Theories and their Implications – A Critical Realist Perspective

There is a lack of consensus as to what constitutes a theory. Consensus exists that theories are made up of ideas called concepts and propositions that describe, explain or predict phenomena (Gregor 2006). Consensus also exists that theories vary in levels of abstraction- grand theories are
more abstract than middle-range theories (Gregor 2006). In critical realist IS research, theories are seen to be models that specify “the tendencies of transfactually active mechanisms, which co-determine particular concrete events or phenomena” (Bhaskar and Danermark 2006, p. 283). Such a definition presupposes that theories are causal models that are historically context-specific. It emphasizes a shift in focus from deterministic explanations of the observed events to explanations of the enabling conditions and generative mechanisms (Rogers 2015). “Generalization, in this view, is not legitimated by the empiricist’s collection of positive instances of correlations but through the development and elaboration of theories of causal mechanisms and models” (Rogers 2015, p. 228). Mechanisms rather than variables become the building blocks of theory leading to the development of domain-specific ontological theories (Cruickshank 2003; George and Bennett 2005).

The implication is that theory now provides a causal understanding that enables researchers and indeed practitioners to understand the situated meaning of actions, rather than the cataloguing of behavioral measures that describe such actions (Rogers 2015). To develop such theories within the realm of IS, pre-existing theories may be subjected to immanent critiques (i.e., critique of theories using their own standpoint) probing into the question of whether the pre-existing theories at hand offer adequate and consistent accounts of the reality they purport to explain in the IS phenomenon studied. Theories therefore, become tools ready to be used, and also as constructions in a state of flux (Bhaskar 2008). The tool view of theory (background theory) captures the background functionalities of theories as pre-existing social products used to produce knowledge about why/how things happen in a vague phenomenon (Bhaskar 2008; Mason and Waywood 1996). Bhaskar classified such a background theory as ‘produced means of production’ (Bhaskar 2008, p. xvi). The under-construction view of theory (foreground theory) captures the foreground functionalities of theories as local theories in-view, undergoing development processes in order to answer a specific research question (Mason and Waywood 1996).

On one hand background theories allow researchers investigate facts and phenomena by providing the tools for design, and the language to observe, understand, describe and explain phenomena. The underlying dualist view of background theories positions us to account for theories as a means to explain complex situations as well as a system of concepts that affect how we see the
phenomenon studied. Thus, background theories help us to understand what are taken to be the things that can be questioned and what counts as an answer to that questioning (Mason and Waywood 1996). Since research aims, questions, objects and methods of investigation are theory-laden, background theories help us to commit to specific kinds of aims, questions and methods of investigation. There are ontological gaps between the intransitive dimension and the transitive dimension (knowledge domain of conceptual elaborations) (Bhaskar 2008). Thus, background theories are used to fill such gaps and constitute the tools used to mediate into the intransitive dimension we do not have immediate access to in a practical sense. Therefore, background theories mediate between the real world and our empirical experiences of it. By doing so, they become our provisional method for making our way into the real world, resulting in their transformation into a deeper knowledge of the real world (Ononiwu and Brown 2013). Dissecting the nature of the background theory helps us to account for the theory’s ontological affinity with the realist paradigm the researcher brings into the research given the theoretical account of the phenomenon studied (Pozzebon 2004). Considering the theory’s upholding of ontological affinity assists in answering the question: Does this background theory fits with the critical realist assumptions the researcher is bringing into the research? It is highly uncertain that “researchers will be able to make effective use of theory unless they feel an affinity for the vision or worldview embedded in that theory” (Anderson et al. 2005, p. 515).

On the other hand, foreground theory can be seen as an ontological “product-in-process” embedded in the practical work of researchers (Bhaskar 2008). Such a theory is domain-specific, cognitive, transient and the socio-historical material of a scientific practice. It is a product of a particular, ongoing and open-historical research endeavor (Bhaskar 2008). A foreground theory developed along these lines comes with some notable merits and implications in IS research. Being elaborated in accordance with the critical realist tenets, theories will incorporate the interplay between artifactual structures of IS and social structures, including processes of reproduction and transformation of such structures. Thus, the knowledge of both background and foreground theories and their implications amplify the fact that theories have dialectic roles of not just guiding research practices within the confine of their embedded philosophical underpinnings- they are also influenced by research practices as well as being the products or the aims of research practices (Prediger et al. 2008).
4.0 Theory Choice in Critical Realist Middle-Range Theorizing

There are challenges of theory choice when a diversity of background theories is to be used during a research endeavor. Such challenges are associated with: (1) the difficulties of understanding different theoretical frameworks in-depth because of their different backgrounds, languages and implicit assumptions, (2) the difficulties of integrating the empirical results that emanate from different theoretical perspectives, and lastly, (3) the difficulties of improving the scientific progress by building upon empirical research that emanates from different theoretical frameworks that are sometimes incompatible and which even produce contradictory results (Prediger et al. 2008). Despite these challenges, some critical realists advocate for a diversity of theories to be used (Bhaskar 2013; Isaksen 2016). Other critical realists argue for the use of a single theory (Dobson 1999) while recognizing that a single theory both illuminates and conceals. As such, it is helpful to apply a diversity of theories to empirical evidence. As a multi-disciplinary field IS research routinely uses insights from psychology, sociology, economics and many other disciplines to develop explanations that help us understand specific IS issues. There is growing interest in using multiple theories in discrete IS investigations to address this multidisciplinarity holistically. Re-contextualizing IS phenomena using different background theories can provide novel insights. Besides, the complexity of IS phenomena are increasing, due to the entwinement of technology into everyday life, organizations and society (Yoo 2010). Because “we are prisoners in the cave of our theories” (Bhaskar 2008, p. xii), a single background theory is often insufficient to explain the multifaceted digital reality as it becomes ever more woven into our ways of doing (Yoo 2010).

Use of diverse background theories allows for gaining deep, complex and varied insights into the empirical and conceptualized phenomena. It sharpens theory development through: (1) building new concepts, (2) posing new questions, and (3) making explicit commonalities, while keeping the theories’ specific identities. It also provides a wider scope to compare and contrast data from different versions of the same reality when guiding data analysis. However, deploying a diversity of theories comes at a cost of selecting the most appropriate theories. Walsham (1993) suggests that there is no need for theory choice among a diversity of background theories since no one theory is “better” for use in an empirical situation. This is because of the belief that all theories are equal and ‘reality’ is what people say it is. This belief stems from a constructionist notion of
judgmental relativity and the rejection of the possibilities of knowing a non-subjective, non-discursive reality (O’mahoney and Vincent 2014). In contrast, critical realism advocates for better theories judged on the basis of their explanatory powers by invoking the concept of judgmental rationality as a reasoned discrimination between competing theories in their context of use (Lopez and Potter 2001; Peacock 2000). As pointed out by Lopez and Potter (2001) “[w]e can (and do!) rationally judge [or choose] between competing theories on the basis of their intrinsic merits as explanations of reality” (p. 9). However, critical realist IS literature does not make clear how to “go about” selecting appropriate background theories among competing ones. We therefore propose a model as shown in Figure 1 to guide researchers in making fallible and contextual theory choices to overcome performative contradictions associated with the mismatch between theory and empirical evidence (Smith 2006).
The process shown in Figure 1 represents a background theory selection process. It draws from an abductive mode of reasoning as a means of creative insight to engage with the given phenomenon studied (Ononiwu and Brown 2013). It first starts by using disconfirming preliminary empirical evidence of the observed phenomena to constantly compare with the assertions of the background theories (Van de Ven 2007). Given the theory-laden nature of observations, constant comparison with reflexivity is done to capture theoretical fitness with the data (Van de Ven 2007). Thus, from the observed properties, we reason our way toward theories with the hindsight that the observed empirical evidence represents symptomatic signs of the underlying mechanisms in interactions to form empirical traces (Bhaskar 2008). Such traces are context-dependent, subjective, theoretically laden and capture the different versions of the events that arise due to the underlying mechanisms.
in interactions (Smith and Johnston 2014). The cycle continues by bringing in other background theories until the preliminary empirical evidence is exhausted and the theories that have the most significant explanatory powers in the context are selected. To connect multiple competing background theories for matching with the series of the initial empirical data three phases are considered namely: (1) understanding the theories, (2) contrasting and combining theories and (3) integrating theories in the empirical situation. Each phase will be discussed in turn.

4.1 Understanding Theories

All attempts to select theories must start with the understanding of the background theories. As Figure 1 attests, being the first phase, the theory’s assertions and concepts should first be well understood for us to use it for problem conceptualization. Using background theories as a means of problem conceptualization is when we prescribe a particular way of forming ideas and notions about the phenomena studied, which makes it possible to consult theories that align with the empirical investigation (Ochara 2013). By drawing from literature of what we know about the background theories, an immanent critique is brought to bear to understand their strengths and weaknesses (Isaksen 2016). As we continue to adopt an immanent critique process we will understand the core and empirical components of the theory and its application areas. The core components of the theory include its basic foundations, assumptions and norms which are sometimes taken for granted. The empirical component consists of concepts in relations. As in the case of some grand social theories, due to their unbounded and encompassing abstraction of concepts, there may not be relations (Hassan and Lowry 2015). The empirical components determine the theory’s content and its usefulness through its application in research (Prediger et al. 2008). For example, actor network theory (ANT) having stemmed from a social constructivist foundation (Elder-Vass 2015) does not permit any researcher to subject it to statistical or variable-centered type of theorizing when investigating a new IS innovation. Rather, such a researcher adopts an interpretive methodological perspective to pay attention to ANT’s call to follow the key-actors’ interactions, i.e., to follow the IT artifact as it is rolled out through ANT’s concepts of inscription, enrollment and translation. Besides, ANT’s core components of generalized symmetry, where human and material actors are viewed as on the same plane, prioritizing the trace of the social actors’ connections at the expenses of the causal role of such social interactions makes ANT incommensurable to critical realist assumptions (Elder-Vass 2008). Based on such
incommensurability, it is generally advised not to use ANT in critical realist IS research. Thus, understanding background theories on the basis of their core and empirical components is a precondition for selecting them, and at the same time, a successively deeper understanding is also a requisite aim of selection attempts (Prediger et al. 2008).

4.2 Contrasting and Combining Theories

As more and more preliminary empirical evidence is added, background theories continue to be compared with respect to: (1) their general approach to the research objectives within the limit of their functions, (2) the role of their core and empirical components, (3) their enactment in the analysis of the empirical evidence, and (4) generally, their articulation on the practice of empirical research they are applied to (Prediger et al. 2008). Thus, multiple viable explanations for empirical evidence begins to emerge. Judgmental rationality is then used to weigh the adequacy of the competing theories and arrive at the one that most likely leads to a valid and useful explanation. Contrasting strategy is used to discover the individual theories’ differences and the nexus of their combination with regards to the empirical evidence. Thus, specificity of each theory and their possible connections can be made more visible through contrasting. Theories are then combined through juxtaposition or triangulation based on their similarities and their differences since they each have their limitations in understanding any empirical phenomena (Prediger et al. 2008). Depending on the research objective, theories with compatible core and complementary or non-complementary empirical components are selected to reflect the different elements of the empirical phenomenon. Careful analysis of their mutual relationship is carried out with the view of integrating the chosen theories.

4.3 Integrating Theories in The Empirical Situation

The chosen background theories are not just juxtaposed to offer different perspectives of the phenomenon (Walsham 1995), but they are integrated (Danermark et al. 2002; Dobson 2001). They constitute the analytical frames and are synthesized and integrated through the process of theoretical redescription (Downward et al. 2002). Theoretical redescription is the use of selected background theories to re-contextualize the phenomenon studied into a new context (Downward et al. 2002). By re-describing the phenomenon, we can discover the operative mechanisms and evaluate the explanatory power of such mechanisms at stake in the light of the empirical evidence
and compared them with those postulated by the selected theories (Danermark et al. 2002). By doing so, the embryonic research model that explains the phenomenon emerge subject to further refinement with more and more observations in the investigative context (Pawson and Tilley 1977).

It is useful for analytic purposes to separate out the three phases of connecting theories, but their activation in practice can vary and often all of them are used at the same time. As illustrated in Figure 1, the process continues in an iterative and reflexive fashion until the researcher exhausts the preliminary empirical evidence reflecting the IS phenomenon being studied.

5.0 Illustrated Example of Theory Choice Process

To make our view less abstract, we provide an example of how background theories are selected using the process shown in Figure 1. The illustration is from a critical realist case study that investigated emergent usage of adaptive IS. Our ultimate goal and contribution is in offering theoretical guidance on how to select theories with significant explanatory powers to investigate IS phenomena, while aligning to critical realism tenets. As per the model of Figure 1 we start by delineating the research problem.

5.1 Research Problem

Adaptive IS are systems that change in the face of perturbations (e.g. user requirement changes in task accomplishments) so as to maintain some kind of invariant state by altering system behaviors or modifying the system environment (Arkin 1998). They are highly interactive systems suited to support user engagement and service consumption experience. Their effective functioning mainly depends on user-system interactions that involve tweaking, modification, appropriation, and embodiment of the system while-in-use in an aesthetically-enriched environment. While such kind of usage occurs, the system evolves with new structures to support user requirement changes (Fischer and Herrmann 2011). Such usage is classified as emergent and is defined as a post-adoptive behavior in which users modify IS in their context-of-use based on their direct engagement and experience, to meet personal relevance in ways that were not planned by designers. The IS emergent use epitomizes the capacity of users to alter a software artifact and its meanings through diverse practices, interactions, and dynamic interpretations in the form of
adaptation (a change in the meaning of the artifact and the ways in which it is used) and/or reinvention (a transformation of the meaning, the use, and the structure of the artifact) (Siles and Boczkowski 2012; Straub and del Giudice 2012). The pervasiveness of emergent IS use is not in doubt. What is of interest is why emergent usage occurs with adaptive IS? or what generative mechanisms must exist for such emergent usage to be possible?

The latter research question infers that the goal of the research is causal explanation. Causal explanation is a goal for certain types of theoretical studies (Gregor 2006). Causal explanation is rarely discussed in-depth in IS literature (Hovorka et al. 2008), especially when it takes the form of mechanism-based explanations involving causal detail of why an IS phenomenon has happened (Avgerou 2013; Markus 2014). Therefore, a causal mechanism-based explanation of why emergent use of adaptive IS occurs is the aim of the research.

5.2 The Preliminary Empirical Evidence and Literature Review

A case study approach was used to conduct the investigation. A web-based adaptive financial system developed and deployed by a financial service provider for public use was the investigative context. Emergent usage of this system constitutes the observable IS event at the empirical domain (or the demi-regularities) in the investigation (Lawson 1997). Since the emergent usage of the adaptive IS cannot occur without the original design supporting the notion of new purposes of use, the design activities were also included in the investigation.

The case (i.e., emergent usage of adaptive IS for e-financial services) was the primary unit of analysis within this single case; however, attention was also given to the social actors’ experiences, perceptions, apperceptions, and actions in the system as sub-units (Miles and Huberman 1994; Paré 2004). The social actors’ experiences, perceptions, apperceptions, and actions provided cues of what seems to have caused the emergent usage of the system to occur over a period of time. The social actors were the managers and software designers in the case organization, as well as officers of banks, grocery shops, other financial institutions (insurance companies) and ‘prosumers’ or active users outside the organizational context (Tapscott and Williams 2006). In their respective constituencies, these actors made up the interdependent elements that created the emergent IS usage event, by reason of their interactions (Fischer and Herrmann 2011). The unit of analysis also set the operational boundaries of the theory that was to be developed and it clearly and directly associated with the research question (Paré 2004; Yin 2009).
In the light of the data that we collected and analyzed, we went to literature and identified for review about 150 papers related to the phenomenon, including papers in the grey literature and practitioner publications. Thematic analysis was used to abstract, and group concepts based on perspectives of how the phenomenon has been covered in IS or other related fields. Thus, the article search was extended beyond IS to include related disciplines such as human-computer interaction and organizational science.

Based on critical realist guidelines for synthesizing literature (Okoli 2012; Rycroft-Malone et al. 2012), we developed a critical realist conceptual framework related to emergent usage of adaptive IS. The high-level categories of the framework were: enabling structures, dynamic mechanisms, control mechanisms, and enabling causal conditions. Concepts arising from the literature review were incorporated into each of these categories where relevant. The identified concepts under enabling structures were: embeddedness and under-design (Fischer and Herrmann 2011; Volkoff et al. 2012), information asymmetrical structures of financial institutions (Barbaroux 2014; Kau et al. 2012) and organizational structure (Alaa 2009; Patel 2012). Dynamics mechanisms were: misfit and workarounds (Alter 2014; le Roux 2014), technological cognizance (Nambisan et al. 1999), technology mediation (Verbeek 2006; Zhu et al. 2010), system affordances (Markus and Silver 2008), and trust-distrust dialectics (Alaa 2009; Benamati et al. 2003; Kupreychenko 2013), while the enabling conditions were: personal innovativeness in IT (PIIT) (Agarwal and Prasad 1998), situational abnormality and suspicion (Moody et al. 2014; Pavlou et al. 2007). The control mechanisms were: critiquing, reflection and learning (Fischer and Herrmann 2011; Giaccardi and Fischer 2008). The identified concepts and their interactions summarized a set of patterns that suggested the outcome - emergent usage of adaptive IS. They do not guarantee that such an outcome will occur in our context, but they tend to explain it as corroborated by the initial empirical evidence, when applied retrospectively to data using abductive reasoning. Thus, we used the concepts identified from literature to offer novel explanations of the phenomenon, and theoretical relationships which had hitherto been unexplained.

5.3 Theory Choice

At this stage there is need for a background theory or theories that could help us to infer the casual relationships, clarify the meaning of the unobserved mechanisms and delineate the IS phenomenon. Such theories should provide a posteriori plausibility for the retroductive
hypothesizing of the causal relationships in the investigative context. That is, theories we can draw from to retroductively hypothesize that the identified structures, mechanisms, enabling conditions and their interactions exist and they are what produced the emergent IS usage in the context. Retroductive hypothesizing or theorization is a process of developing hypotheses by the use of “theories that seek to provide causal explanation of what has not necessarily been empirically deduced or induced, but has been synthesized and inferred from available empirical data and related concepts” (Kempster and Parry 2014, p. 91).

In our retroductive theorization of the IS phenomenon under investigation we considered three theories: (1) sociomateriality (Orlikowski and Scott 2008) (2) complex adaptive systems (CAS) theory (Merali 2006; Nan 2011) and (3) meta-design (Fischer and Herrmann 2011; Giaccardi and Fischer 2008). The choice of these theories is because they: (1) possess potential coherence with the concepts seen as structures and mechanisms from the synthesized literature, when placed in the light of the initial empirical evidence of the research, (2) offer explanations that recognize the socio-materiality of the technology when explaining how or why people use IS in emergent ways, and (3) delineate the micro-interactions of structures, mechanisms and agency (both IT agent and human) for emergent order to occur.

5.4 Understanding the Candidate Theories

We rendered an immanent critique of the selected background theories (Bhaskar and Hartwig 2010), and in so doing identified the strengths and weaknesses of each theory in the light of the empirical evidence. In the end, sociomateriality theory was seen to be less suitable, while CAS and meta-design were found to be compatible and better suited as candidate background theories. The reasons are presented next by firstly discussing sociomateriality in relation to the empirical situation, then CAS and meta-design.

Sociomateriality

By particularizing the theory in the initial empirical analysis, it was found that:

(1) the theory does not take into account the causal efficacy of material agency and the embeddedness of social structures into software artifacts (Al Lily 2013; Leonardi 2013). When sociomateriality theory is extended to emergent IS use, it only captures IS use as performativity in practice and as such the causal essence of the pre-existed artifactual structures evident in the context will not be accounted for (Cuellar 2010; Jones 2014). Material agency includes the tangible technical objects,
intangible stuff, such as data and algorithms as well as the inscribed digital artifacts (Kallinikos et al. 2013; Leonardi 2012).

(2) the concept of structure exists as material-cum-social in an interpenetrative realm of inseparability. Thus, the theory will not reflect how artifactual structures of the technology or IS structures in socio-technical format are positioned in the investigative context. IS structures are seen as material and/or ideations (media content) with their own casual powers which exist in relation to the social (Leonardi 2012; Mutch 2013).

(3) there is an absence of temporality in sociomateriality theory (Jones 2014; Leonardi 2013; Mutch 2013). This made it difficult to understand how emergent IS usage was sustained and evolved over time.

(4) the linkage of individual micro-level action and macro-level institutional processes has received little attention in the sociomaterial literature (Jones 2014). Thus, researchers could be “misled into overlooking the important interactions of the IT artifact with its internal and external environment” (Tiwana et al. 2010, p. 677).

Theories of CAS and Meta-design

Theories of CAS and meta-design have common underlying assumptions in their cores and thus, we considered them together here. Both theories share conceptual proximity with the IS phenomenon (Okhuysen and Bonardi 2011). By means of immanent critique (Bhaskar and Hartwig 2010), theories of CAS and meta-design suggest a fit with the initial empirical evidence based on:

(1) the support for causal efficacy in material agency and the embeddedness of social structures into software artifacts as IT agents (Fischer and Herrmann 2011; Nan 2011). Both theories conceptualize emergence as a process that accounts for qualitative novelty (Fischer and Herrmann 2011; Nan 2011). Based on this, it empowers the researcher to look at the system’s emergent usage as an innovative or reinvention process with unpredictable outcomes. The theories also empower the researcher to consider emergent IS usage as a set of dynamic and adaptive interactions. Emergent interactions among autonomous entities (i.e., individual, organization, environment, software artifact) and their self-reinforcing mechanisms are accounted for by both theories (Fischer and Herrmann 2011; Nan 2011). Consequently, such usage can be theorized at the individual level, without ignoring the organizational and environmental impacts associated with the technology’s situatedness.

(2) From the initial empirical evidence, it was seen that to theorize emergent usage of the technology demands an understanding of the designers’ activities, the interaction of the users as secondary designers, the software artifact, the service contents, and the context, as they altogether evolve (Fischer and Herrmann 2011; Hovorka and Germonprez 2008). Theories of CAS and meta-design suggest each of these latter components can be viewed as agents in interactions (Hovorka and Germonprez 2008).

(3) Both theories of CAS and meta-design have a high degree of commonality in that their tenets originated from socio-technical systems thinking (Fischer and Herrmann 2011; Mingers 2014). They resonate well with the phenomenon of interest. They share the same semantic commensurability in ascribing causal powers to structures and mechanisms. Both theories support sociomateriality ontology, but treat “materiality as existing in the realm of structure and social action as existing in the realm of action and both can relate with one another” (Leonardi 2013, p. 66). Because of such relations, we can understand that artifactual structure and human agency are both emergent strata of social reality with sui generis properties and powers in a specific and open context where the technology is situated (Archer 1995; Mutch 2010). Technology in this view is not static, but exercises a great deal of flexibility. It emerges in practice by reason of the interactions
between people, materiality of IT, and institutional environment at certain points in time (Fischer and Herrmann 2011; Leonardi 2011; Nan 2011).

5.5 Contrasting and Combining Theories

The core and empirical components of the three theories in relation to the initial empirical evidence and critical realist presuppositions were examined. The sociomateriality concept is embodied in the core of all three theories (Fischer and Herrmann 2011; Jones 2014; Nan 2011), but may not in some cases share the same ontological assumptions. Sociomateriality (Orlikowski and Scott 2008) shares a relational ontology with CAS, but there are subtle and distinct nuances that compel both theories not to be used in the same research. The relational ontology of sociomateriality stems from inseparable entwinement of humans and technologies while ignoring their inherent properties. The properties are acquired by emergent entanglement through performativity. Thus, reality is not given but performed through relations in practice and emergence arises through agential intra-actions (Barad 2003; Orlikowski 2010). Through such intra-actions material-discursive practices form relations to enact their particular properties without first not being self-essential entities in interaction (Cecez-Kecmanovic et al. 2014; Jones 2014).

Theories of CAS and meta-design share a relational ontology with sociomateriality theory (Fischer and Herrmann 2011; Hassan 2014; Nan 2011). However, their relational ontology arises through autonomous and self-essential entities in interaction (Giaccardi and Fischer 2008; Mingers 2014), in contrast to agential intra-actions as in sociomateriality (Jones 2014; Orlikowski 2010). CAS recognizes the pre-existing self-essential entities (human and technologies) that sociomateriality theory denies (Byrne 1998; Cecez-Kecmanovic et al. 2014). Such entities involve themselves in dynamic and synergistic interactions to form emergent order in a self-organized fashion (Curseu 2006; Fischer and Herrmann 2011; Merali 2006). Meta-design theory, being a substantive theory that is crafted from socio-technical systems thinking endorses an objective reality similar to CAS (Fischer and Giaccardi 2006; Merali 2006). The reality exists by emergence with powers and sui generis properties irreducible to the constituent parts that interact to form it in a specific and open context. Thus, relations that produce social objects or phenomena in CAS and meta-design’s view arise from the interweaving of human and material agencies in interactions (Nan 2011), in contrast to the intra-action concept of sociomateriality (Barad 2003; Orlikowski 2010). To CAS emergent behavior is unknown in advance, but is observable at the macro-level in the form of regularities.
(Antoniou and Pitsillides 2007; Nan 2011). To explain interactive relations in a relatively enduring motion of change over time, theories of CAS and meta-design introduce the concept of reciprocal causal mechanisms. In CAS theory it is called feedback systems (Alaa 2009; Merali 2006), while in meta-design theory it is called critiquing systems (Giaccardi and Fischer 2008).

CAS and meta-design while being compatible, each have a few distinct perspectives which when combined yield insights that each perspective alone cannot provide. For instance, CAS theory in its pure form does not cover emergent behavior that pertains to IS use or explain the coevolution of behavior and technology (Sedera and Zakaria 2008). Another major critique of CAS theory is that it has abstract and broader concepts that do not explicitly capture context-specific mechanisms despite being manifested within different relationships of mechanisms that also influence its evolution (Nan 2011). Thus, CAS theory is adapted in this research context and further fortified by incorporating meta-design theory that has concepts that specifically cater for emergent IS usage and the adaptive nature of systems (Fischer and Herrmann 2011).

The empirical components of sociomateriality theory and its application area suggest a posthumanist view where reality is created by performativity or discursive effects (Cecez-Kecmanovic et al. 2014). Agency is neither in humans nor in technologies, but in enactments of iterative changes to particular practices through the dynamics of intra-activities of humans and technologies (Barad 2003; Orlikowski 2010). Thus, there is composite assemblages of humans and technologies only by ontologically inseparable components in intra-activities (Barad 2003; Orlikowski 2010). Consequently, the theory is suitable for descriptive studies rather than explanatory since it precludes an examination of ‘becoming’ (Jones 2014; Leonardi 2013). Sociomateriality shifts its focus to what ‘is’ (Jones 2014; Leonardi 2013) since “relations and boundaries between humans and technologies are not pre-given or fixed, but enacted in practice” (Orlikowski and Scott 2008, p. 462).

In contrast the empirical components of theories of CAS and meta-design hold assumptions that are consistent with an objective reality independent of knowledge, similar to critical realism (Fischer 2007; Mingers 2014). Such empirical components empower the researcher to embrace emergence, self-organization, diversity, historicity and contingency of actors’ experiences with the
technology. Data is collected to unveil webs of causation, rather than relying on simple linear relationships that epitomize the traditional reductionist framework (Tredinnick 2009). Data collection and analysis along these lines are plausible, because actors and users of technology do not perceive technologies and humans (social) as interpenetrated entities that can only be perceived by instantiations (Leonardi 2013). By virtue of steering a course between induction and deduction, theories of CAS and meta-design support the critical realist multi-pluralistic retroductive method and the theoretical sense required to answer the research question (Byrne 1998).

5.6 Integrating Theories in the Empirical Situation

Theories of CAS and meta-design are selected and combined based on their explanatory powers in the initial empirical evidence, the commensurability of their core and empirical components, and their concordance with critical realism tenets. In this phase, they are integrated with the conceptual framework synthesized from literature in the light of the initial empirical evidence through theoretical redescription (Danermark et al. 2002). From the theoretical redescription, we abstract an embryonic theoretical model of emergent IS usage as a kind of working hypothesis (Pawson and Tilley 1977). To refine the model, it is compared with images which are constructed from empirical observations via an explanatory case study (Easton 2010; Miller and Tsang 2010). The data analysis plan utilizes codes based on the embryonic theoretical model by using counterfactual reasoning to argue towards transfactual concepts behind the data, differentiating between constitutive concepts and accidental circumstances (Meyer and Lunnay 2013). Counterfactual reasoning makes use of previous knowledge and direct empirical observations or experience in the phenomenon to explore the motives behind the data, by questioning: “how would this be if not . . .?” “Could one imagine what must have prompted the analytic themes in the data?” (Danermark et al. 2002, p. 101). This ultimately leads to the development of a new foreground theory that is equally aligned with the empirical data, as well as generalizable analytically (Tsang 2013). The newly developed foreground theory offers a fallible mechanism-based explanation of why emergent IS usage occurs in the investigative context. Therefore, the use of theories is not limited to problem formulation and the literature review—they also guide the study throughout the research all the way through to development of a theory that is a contribution to knowledge concerning the phenomenon under investigation.
6.0 Conclusion
The paper has provided a general overview of theory and its implications from a critical realist perspective. It has also demonstrated the process of critical realist middle-range theorizing in IS. The model developed to guide theory choice provides for selection of background theories that have appropriate fit with the methodological plan in critical realist IS research. It also allows for development of theory as an outcome of analytical engagement with data, leading to foreground theories. The model empowers the researcher to select background theories based on their explanatory powers in order to build an argument, establish the context of the problem, and explain findings. Such theories provide for a theoretical contribution by way of using background theories to justify the research questions, conceptualize the problem, and determine the research design and the data analysis plan to make sense of the phenomenon. Thus, rather than inappropriate overemphasis on theories that can constrain the accumulation of knowledge, our model provides for a process of critical engagement with theories in the light of the empirical evidence, subject to the specific research questions to be addressed.

The model offers a contribution to critical realist research in IS, a philosophy which has only recently been introduced to the discipline. It illustrates the abductive and retroductive approach to theorizing in critical realist research, which is different from the more well-understood deductive, inductive or solely abductive modes of inference. The model offers guidelines as to how to select appropriate background theories through the critical realist notion of engaging in an immanent critique of theories.

References


Knowledge Diffusion Via Specialist Best Practice

Abstract
Enterprises have been turning to explicit- and even conceptualizing on tacit- Knowledge Management to elaborate a systematic approach to develop and sustain the intellectual capital needed to succeed. To be able to do that, you must be able to visualize your organization as consisting of nothing but knowledge and knowledge flows. Hence, creating the ability of further actively classifying existing organizational content evolving from and within data feeds, in an algorithmic manner, potentially giving insightful schemes and dynamics by which organizational know-how is visualized. In this paper, we discuss an empirical research study that was conducted previously to try and explore knowledge diffusion in a specialist knowledge domain.

Keywords: Knowledge Management, Knowledge Repository, Knowledge Diffusion

1 Knowledge Diffusion

The literature revealed a rapidly increasing body of knowledge relating to knowledge management, which cross level and cross-link many different disciplines and areas of interest to academics and organizational practitioners, especially knowledge is considered a common factor or input, on a parity with labour, capital and so on.

While definitions of any subject matter can be helpful regarding clarifying the scope and depth of the subject under consideration, they can also be notoriously difficult to articulate.
Definitions can often result in unwarranted simplistic reductionist arguments. When the subject that is being considered is in the management domain, the difficulty is compounded even further due to the subjective and diverse nature of the field. Such types of models categorize knowledge into discrete elements. For instance, Nonaka’s model is an attempt at giving a conceptual representation of knowledge management and essentially considers it as a knowledge creation process. Figure 1 shows Nonaka’s knowledge management model reflecting knowledge conversion and dissemination modes.

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Figure 1 Nonaka and Takeuchi’s Knowledge Management model (Nonaka et al, 1995)

As can be observed from the figure above, knowledge would be composed of two constituents, Tacit and Explicit. Tacit Knowledge is defined as non-verbalized, intuitive, and unarticulated. Explicit or articulated knowledge is specified as being formally structured in writing or some pre-defined form.

Figure 2 Three-Tier Knowledge Lifecycle

In accordance to diagram above, we believe that knowledge creation undergoes a nested set of computerized processes [explicit] and accompanying practices [tacit], allowing as well for its inter-linkages and cross levelling to diverse specialist areas of expertise and to those it would
tend to restrain, as knowledge would be considered as highest level available for awareness on the object of concern. Hence, aim is rather to acquire automatically, represent visually, and reason collectively on textual content contained. This research empirically investigated the creation of new technical knowledge, and how it diffuses (flow in addition to adaptation), text being the chosen currency (symbol of exchange) for communicating descriptions of such specialist knowledge. It extends Nonaka et al’s (1995) organisational knowledge creation theories (knowledge conversion model) into the area of research and development ventures, within satellite engineering, that may be requiring a cooperative, computer mediated environment.

2 Research Study Framework for the Diffusion of Knowledge

One can distinguish to a certain extent the highlights of the research and experimental phases in research documents, and that of consolidation and utilization in commercial documents. The transformation of ideas from science onto business applications is a complex and at times an enduring process. The articulation of ideas and knowledge throughout such process be represented by the specialist terminology, that created and evolving within the domain. The figure below represents a possible spectrum of documents within the domain investigated and field project. Such can be referred to as formulating the basis of a knowledge repository that is in turn formed of sets of text repositories. For the purposes of this research study, the regions covered by research and commercial documents in the spectrum below are assumed to be overlapping at times. As research documents are thought to feed into commercial documents for the case of this field project, representative of knowledge diffusion (i.e. flow and adaptation also referred to as acquisition and conversion). The use of terminology by scientists reporting within the collection of documents was identified to be differing. Though within the same domain, it tended to relate to distinct phases of a knowledge lifecycle - from conception to
utilization, thus containing traces of the domain knowledge at differing levels of an organization and consideration by domain experts.

The methods and systems used for enunciating ideas and their realizations in a given language tend to enable a shared set of protocols for communicating either knowledge of science or the business application. Scientists report in their natural and/or specialist language, and throughout the evolution of their research. Terminology used gets adapted, hence created at times, to the novelty of their work. Thus, at times new terms are coined. Such has been used as a communication instrument to report research and intent behind any other type of research reporting to permit for the knowledge to flow and adapt amid knowledge workers.

This research was about understanding and identifying how scientific knowledge is converted into the knowledge of a business application. We have used a model for the conversion of scientific research into a business enterprise, thus the flow and adaptation (together leading to the diffusion) of specialist knowledge from research documents onto commercial documents. We focused only on such conversion of research documents to commercial documents. A field project (for the PhD research 2003 – 2007) within the context of a spin off enterprise (SME, Small to Medium Enterprise) was conducted. Our hypothesis was to attempt and identify through comparative and diachronic studies how research documents (science: theories, assumptions, fundamental knowledge: i.e. higher education institution) feed onto commercial (business: models, practices, applied knowledge: i.e. spin-off of higher education institution) documents. Whilst covering the organizational structures supporting the flow of knowledge
and its adaptation within the same domain of application (s) of science, through the observational study. Collectively and in general, we considered to what extent an SME is to create dynamics of innovation, by expanding on Nonaka et al’s (1995) *knowledge conversion model*. Considering the diffusion of knowledge as a parameter based on evidence in terms of attempts to manage knowledge, in contrast to the creation of knowledge, per se. We have selected a specialist domain of investigation for our research and as our pool of text-based data, that on satellite technology, though for which knowledge is continuously evolving due to the undiscovered nature of space environment, as of yet. Such is narrowed to LEO (Low Earth Orbit) satellites manufacturing organization, alike those developed and managed by SSTL, Surrey Satellite Technology, in which a field project was conducted. Hence, we have carried an introspective study using *Case Methodology* (Yin 1993, 1994) and guided at times by *Grounded Theory* principles (Glaser, 1978). The latter being a positivist approach towards creation of knowledge, as it is believed that knowledge is created from experiences, because reality or truth are argued to be knowable. Accompanied by use of methods for corpus linguistics being focused on the specialist language in use, and guided by the generally agreed statement, that frequency of lexis is a correlate of its acceptability (Quirk et al, 1985). To assess our corpus-based approach for studying the flow and adaptation of knowledge we had equally pursued a case study. To be able to investigate the gap in knowledge diffusion within SSTL, we did an observational study, and a study of language used in satellite engineering in general. Both studies have an empirical basis. Diffusion of knowledge within organizations, may take different forms and mediums. In this research, knowledge diffusion is regarded as a two-tier process. Involving the flow of knowledge (displacement of belief) and its adaptation (replacement of belief), we looked at:

- Employee to employee knowledge diffusion (online, synchronous feedback): Through the questionnaire survey (and face to face interviews).
Employee to organization knowledge diffusion (offline, asynchronous feedback): Partial coverage through the questionnaire survey, but analysis of knowledge diffusion is mainly driven by results from the lexical analysis (single words and compound terms) of the collated sets of documents. Those are of research (i.e. higher education institution, specialist research groups) and commercial (i.e. spin-offs of higher education institution, domain specific enterprise) nature and source.

A bimodal research method was followed. Inclusive of:

- Observational study: questionnaire and interview based
- Historical study: analysis of text repositories. Involving extraction and modelling of specialist terminology collated from: public domain publications (i.e. NASA, BSI, and BMP), specialist domain publications (i.e. Surrey Space Centre and SSTL).

3 Contributions and Primary Conclusions

Through such research studies the following contributions were made,

- We had developed a method for a systematic study of knowledge management within a small to medium enterprise. Especially those focused in high technology ventures.
- The method developed includes questionnaire surveys, face-to-face meetings, and corpus-based analysis.
- Attempt was made to see whether documents could facilitate diffusion of knowledge (i.e. research to commercial teams). Such that these documents are accessible by different members of the knowledge creating crew (ranging from researchers to marketing people, and from administration to engineers; for instance).
- We had expanded Nonaka’s et al (1995) knowledge conversion model (largely based on intuition and for knowledge creation), to a model on knowledge diffusion based on empirical evidence (for flow and adaptation of knowledge).
The observational study helped us deduce that text-based knowledge diffusion may be the solution to alleviating knowledge bottlenecks as a hypothesis. Thus, it led us to conduct the historical (due to diachronic nature of text) type of study. We looked at written text in the form of both research-driven papers and commercially-driven papers. We attempted to show a connection between the two forms of reporting scientific research and commercial research per se, thus diffusion of knowledge. Suggesting that research papers have an effect on applications driven papers, by having attempted to demonstrate that there is a cohesion where commercial interests are existent, and, indeed, a distinction at the level of choosing and adapting a set of lexis by the knowledge workers of the domain, on a par with the practice followed within an organization. Such choice is representative of the knowledge of the technology within the domain of the application. However, being grounded to intent behind such commercial activity, once the transition from research type of documents to commercial type of documents is compromised. This is related to the terminology of the domain that is diffused and utilized by knowledge workers of specialist domains. The choice of lexis may as well be analyzed through cross-citation of authors contributing to a specific domain of a technology, which could be compounded further if the domain is multidisciplinary. Though such may provide the basic framework by which knowledge diffuses, for instance from research documents to commercial documents. Whereas appearance of specialist terminology in patent documents may be looked upon as an intermediate stage in the transfer of knowledge from research labs and centres to commercial organizations and ventures. The observational study has paved the way for us to model and investigate how knowledge may flow, including supporting technologies and organizational structures (i.e. management, practices, rules and so forth), alike the development of knowledge maps for such specialist domain.
References
Different Languages, Different Questions: Language Versioning in Q&A

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Question and Answering (Q&A) communities have become effective forums for humans to collaborate and build accurate domain-specific archives of information. Stack Overflow is a prime example of a system which has effectively leveraged Q&A to build a strong archive of computer programming information. However, English is the dominant language in size and scope. To reach a wider audience, Stack Overflow has started language-specific sites. In this paper, we seek to understand how these language version sites are used, and whether they form unique Q&A structures or mirror the English version. The results indicate that each site is structured differently, and that users of different languages have different question asking patterns. The contributions from this work are useful in informing designers of systems attempting to conduct language versioning and provide an argument for developing sites within languages, rather than only providing translated versions.

Keywords: Collaborative Computing Systems; Language Versioning, CSCW

1.0 Introduction

Large distributed knowledge-sharing platforms, such as Wikipedia, often have a desire to expand their services and repositories into other languages (Bao et al., 2012). This desire can serve multiple complementary purposes including expanding the reach of the system to a diverse number of languages, creating more traffic to generate potential income, and supporting egalitarian aims, such as the spread of knowledge to information poor communities. However, language versioning is not an easy task to undertake. The auxiliary sites are often significantly smaller than the parent site and may suffer from lower participation rates and inferior or limited content (Bao et al.,
Different Languages, Different Questions: Language Versioning in Q&A

2012). This is an important problem since individuals may rely on these distributed knowledge-sharing communities for personal and professional growth. Information aggregating and sharing systems must decide whether to expend energy on supporting full-fledged systems in different languages or rely on improving machine translation.

In this paper we look at a large scale technical Q&A system that is attempting to create language versions of its system to benefit non-English speakers. In specific, we study three language sites including Russian, Portuguese, and Japanese. These are operated by the highly successful English-base site Stack Overflow (SO). SO is a popular and important question-answer (Q&A) community for computer programming that was established in 2008. As of December 2017, SO averages 8.3 million visits per day and has a community of over 6.6 million users who have asked 13 million questions and have given 21 million answers. The community also successfully resolves 72% of all questions.

One issue for the SO community is that it has been a monolingual English site since its inception in 2008. There are significant challenges for non-native English speakers in using SO, such as issues with terminology and comfort levels with engaging in the community (C. Treude, Prolo, & Filho, 2015; Xu et al., 2016). Because of this, participation rates among countries in SO are affected by culture and English proficiency (Oliveira, Andrade, & Reinecke, 2016). SO started beta versions of language specific sites to alleviate these issues.

An important concern is how the sites create their archives in relation to each other. SO aims to create a highly accurate and complete archive of computer programming questions, and this archive is expected to be duplicated across all language sites (Hanlon, 2014). A stated concern from community members is that the different language versions could result with different language communities talking about different topics and technologies (Maciel, 2014). This is an issue for users who believe in having a universal authority for computer programming Q&A. Instead of having all question topics being centralized in English SO, there would instead be areas of conversation that are focused in different languages.
For a Q&A system Stack Overflow, is it realistic to assume that different languages result in similarly structured question archives? If the answer is “yes”, then translating the archives may make sense given the lack of scale for most languages. If the answer is “no”, then steps may be needed to make sure that basic concepts are covered in each language corpus. In this manuscript, we present an analysis of questions across four question sets taken from a two-year period. By investigating the questions through user-generated tags, we find that the question archives are all significantly different from each other. The research questions and contributions can be summed up as follows:

- **Do the language versions of Stack Overflow ask different questions?** The content of questions can be determined via Stack Overflow’s universal tagging system. After translating and normalizing tags, we used the log-likelihood (LL) to determine similarity between popular tags in the corpora. Adjusted alpha results from both group and pairwise tests show that the corpora have different tags from each other.

- **Do the language versions of Stack Overflow present different related tag structures for universally popular tags?** Even if the structure of a popular tag is different for each site, the structure for tags that are popular across all sites could be similar. We chose “Javascript”, a tag in the top 3 for each language version, and mapped the co-related tags. The results show that central tags are different for each version. This indicates that there is a unique question-asking paradigm for each language.

Our paper investigates the impact language versioning has on domain-specific Q&A. To do this, we present the framework for the quantitative study by presenting an overview of the language versioning process and its users before presenting the results. We also present a discussion of the importance of the results in informing translation efforts as well as providing a justification for language versioning efforts in collaborative information gathering communities.

**2.0 Background**
In this section, we provide an overview of previous studies on language versioning. We then provide background on Stack Overflow’s reasoning and process behind conducting language versioning. We also provide a brief case study of the Japanese site that provides background on the motivations of the users of a language versioned site. Finally, we present our research questions based on the presentation of the background.

2.1 Language Versioning

We might first assume that languages share similar information across boundaries, but this is shown to be false in social networks, where there are vast differences in content and production (Hong, Convertino, & Chi, 2011). This makes intuitive sense if we consider that different cultures will have different norms and ways of communication. Peer production communities exhibit these differences, including differences in what would seem to be universal fact-based information, such as that found in an online encyclopaedia. Hecht (Hecht & Gergle, 2010) and Bao (Bao et al., 2012) found that the differences between language versions of Wikipedia are significant. Cultural viewpoints seem to greatly affect the way that information is conceived and reported. However, whether this applies to a Q&A site like Stack Overflow (SO) and Japanese Stack Overflow (JSO) is unknown. We do know from previous research that the vast number of questions in sites like SO are those which have concrete answers (Anderson, Huttenlocher, Kleinberg, & Leskovec, 2012; Christoph Treude, Barzilay, & Storey, 2011). Would computer programmers, who are attempting to navigate real world programming issues (Christoph Treude et al., 2011), ask materially different questions? This question has not been studied in detail in previous research.

2.2 Stack Overflow’s Process of Language Versioning

SO is a large popular Q&A community that is focused solely on computer programming. Much of its success has been attributed to its incentive system which allows users to vote on each other’s content and thus give and take away reputation points (Mamykina, Manoim, Mittal, Hripcsak, & Hartmann, 2011). These reputation points have been shown to be a strong incentive for participation (Tausczik & Pennebaker, 2012) and have been exported to all of SO’s related sites. Another reason for its success has been its ability to command and maintain a site with user curated
Different Languages, Different Questions: Language Versioning in Q&A

material based on clear rules (Correa & Sureka, 2013; Li, Zhu, Lu, Ding, & Gu, 2015; Mamykina et al., 2011).

One of these rules is the mandate that all questions must be in English and must be clear and understandable. This, of course, creates a significant barrier for those who do not read and write English at a level which facilitates contributing. One of the founders of SO argued that programming essentially requires the use of English as a lingua franca (“The Ugly American Programmer”, 2009). However, as time progressed, there was a move towards language versioning.

In 2014, SO decided to develop other language versions in-house. An independently created version of SO had been developed in Russian in 2012. The site, finally integrated with Stack Exchange in 2015, boasted over 55,000 questions, 29,000 users, and 31,000 visits per day. This provided evidence that a non-English site-programming community could work.

The justification for language versioning is to reach more users. For instance, the introductory post for the Portuguese language site argues that 10% of the world’s programmers are in China, but only 4.8% of visits come from China, Japan, and Korea combined (Hanlon, 2014). These numbers, the SO administration argues, have been because of language constraints. The administrators stated when the first beta language version in Portuguese was launched they expected to maintain centralization due to the critical mass of the English site and they expected almost every question that was asked on the language version site to also be asked and answered on the English site (Hanlon, 2014).

<table>
<thead>
<tr>
<th>Site</th>
<th>Questions</th>
<th>Users</th>
<th>Age in Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>14M</td>
<td>7.1M</td>
<td>106</td>
</tr>
<tr>
<td>Russian</td>
<td>147K</td>
<td>74K</td>
<td>50</td>
</tr>
<tr>
<td>Portuguese</td>
<td>70K</td>
<td>50K</td>
<td>32</td>
</tr>
<tr>
<td>Japanese</td>
<td>12K</td>
<td>12K</td>
<td>26</td>
</tr>
</tbody>
</table>

Table 1. List of Stack Overflow Language Versions at the Beginning of 2017
Japanese was considered a good candidate due to the strength of its programming community. Japanese Stack Overflow (JSO) went public in October 2014, and the site was announced on the SO official blog on December 15, 2014. The announcement was a topic of discussion on the SO blog; 100 comments were posted by 49 unique users, many of whom addressed the pros and cons of launching the site. In order to better understand the arguments of the community, the first and second authors conducted a Grounded Theory session (Glaser & Strauss, 2009). The open coding session found 13 codes which coalesced into 5 themes:

- **Splintering**: The community will be split, will cover different technologies, and will decrease the amount of participation from Japanese members.
- **English is a necessity for advanced programming**: Japanese usage will stunt the growth of novice programmers.
- **Reduction of Poor English Questions on SO**: Fewer limited English speakers will contribute bad questions.
- **Gateway to SO**: Users will use JSO and other language sites and move to the main SO site.
- **Will Broaden Knowledge**: JSO will discuss uncommon problems which will make their way to SO.

The first and fifth themes were influential in informing this study. First, they contradict the official narrative SO had put forth themselves with the launch of the language sites. These commenters do not assume the language versions will be mirror copies of the main site, but rather that specific topics and technologies may be discussed instead. In addition, the first theme contained a sub-theme which argued for translating the main SO site, rather than creating separate Q&A communities.

### 2.3 Motivation for Using a Language Specific Site: Case Study of Japanese Stack Overflow

Why would a user choose to participate in a language specific site rather than the larger and more active English site? For some users the answer is obvious; they lack the necessary proficiency to ask and answer questions on the English site. However, we can see from Japanese Stack Overflow (JSO), that many of the early contributing users
were active contributors on English Stack Overflow (ESO). In the first 6 months of JSO, 265 users were active on ESO as well. This is in comparison to 1,078 users who were only active on JSO. In addition, users who were in the top 5% of all ESO users were also the most active in asking questions and providing answers. Table 2 shows the cumulative averages for the two categories of JSO contributors.

The data in Table 2 shows us that the formation of JSO is connected to the ESO community beyond name and site infrastructure. To understand the nature of this connections, we conducted interviews with JSO users.

<table>
<thead>
<tr>
<th>Category</th>
<th>Users</th>
<th>Answers</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>JSO Only</td>
<td>938</td>
<td>M=1.8</td>
<td>M=1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD=6.51</td>
<td>SD=3.49</td>
</tr>
<tr>
<td>ESO Top 1%</td>
<td>39</td>
<td>M=7.3</td>
<td>M=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD=11.6</td>
<td>SD=6.2</td>
</tr>
</tbody>
</table>

Table 2. Japanese Stack Overflow Users

We obtained the email addresses of all 74 users who listed their address in their public profiles, whom we then asked for interviews. We were able to gather ten participants. Interviews were conducted over email. The first and third authors conducted semi-structured interviews over a two-week period. The interviewers could ask more specific questions when they felt it was appropriate. In total, 186 questions and responses were logged. Eight of the interviewees had accounts on SO as well as JSO, while two only had accounts on JSO.

The interview questions had themes including: 1) Programming history and language abilities, 2) the motivation for participation on JSO, 3) the relationship between JSO and ESO, 4) the value of reputation on the sites. We used a Grounded Theory method (Glaser & Strauss, 2009) to analyse the data. Special care was taken to represent the Japanese responses as best as possible. Analysis of the interviews identified several major themes as shown in Table 3.

Overall, the results of the interview study indicate that the connected users between ESO and JSO see the new language site as a gateway for beginner programmers, and not as a replacement for ESO. From the interviews, we would expect that questions on
Different Languages, Different Questions: Language Versioning in Q&A

JSO would be more basic or fundamental computer programming questions compared to ESO. It is interesting, since it does indicate that while ESO’s question archive was developed as a natural progression of supply and demand, JSO has a more directed path.

This case study is useful for framing how one site, JSO, came into existence. We can see how the early stages of the site were born out of a movement from the dominant site. It is important to consider that the origins of each site may affect how each community acts and what questions they ask. Portuguese Stack Overflow (PSO) has a very similar background to JSO, having been developed by ESO site users (Hanlon, 2014). Russian Stack Overflow (RSO) has a much different background from JSO and PSO, having been started outside the community.

These are important distinctions to make. Should we consider that PSO and JSO will be more similar due to their shared origins, or should we consider that RSO and ESO will be similar due to their independence of development? It is difficult to measure the impact of origin directly, but it is a variable that must be considered when discussing results.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supporting Japanese IT</td>
<td>“(I joined) to support the framework for beginner programmers.” (User5 in Japanese)</td>
</tr>
<tr>
<td></td>
<td>“As a native Japanese speaking developer, I’d like to contribute to the Japanese IT industry.” (User 7 in English)</td>
</tr>
<tr>
<td>ESO is used for problem-solving</td>
<td>“I do not use the Japanese version to resolve problems as much as the English version.” (User 4 in Japanese)</td>
</tr>
<tr>
<td></td>
<td>“I answer on both sites, but there is a difference in content. In the English version, I answered specific questions. In the Japanese version, I answer the more common questions.” (User 3 in Japanese)</td>
</tr>
<tr>
<td>Reputation points are not important on JSO</td>
<td>“Reputation is more valuable on the main site because it is global.” (User 1 in Japanese)</td>
</tr>
<tr>
<td></td>
<td>“I don’t care at all about the reputation points on the Japanese site” (User 6 in English)</td>
</tr>
</tbody>
</table>

Table 3: Examples of Responses from Interviews
2.4 Discussion
On one hand, it seems likely that the different languages will ask similar questions to each other due to the limited domain. Unlike Wikipedia, where culture greatly determines what or who is important (Bao et al., 2012), computer programming Q&A is focused on solving the problems of people searching for real and practical solutions (Anderson et al., 2012; Christoph Treude et al., 2011). On the other hand, our interview study showed that there was significant influence from the primary language site, which may affect the questions asked.

Even if the ratio of question topics asked in each site is different (or similar), are the related topics similar? Very few questions have one user-generated tag to describe it. A universally popular tag could have similar related tags across languages. That would indicate that the questioning process across languages are similar. The opposite would indicate that the different language sets are asking different types of questions.

3. Question Data
In this section, we describe the data that is used to analyse the question corpora of English Stack Overflow (ESO), Portuguese Stack Overflow (PSO), Russian Stack Overflow (RSO), and Japanese Stack Overflow (JSO). We then discuss the appropriateness of using tags as a data point to compare question corpora. Finally, we explain the process of normalization for the tags.

3.1 Question Tags
A challenge in comparing questions asked in different language corpora is determining the data for comparison. Ideally, entire questions and their content could be analysed and compared on exact terms. However, this is not only difficult given large data sets, but also may obfuscate similarities. That is, language used to describe a question may be different, but the content is not. To gain an overview of similarity between the question corpora, we use question tags which describe the main topics of the questions.

In all Stack Overflow sites there is a system for tagging questions. The purpose of this system is to describe the topic accurately, allow experts to quickly identify questions, and to allow for useful indexing of questions (“What are tags, and how should I use
Different Languages, Different Questions: Language Versioning in Q&A

They can choose up to five tags to describe their question, and they are required to use at least one tag. Tags are not ordered by importance, rather they must all be relevant to the question. They are, however, ordered by popularity (“What are tags, and how should I use them?”). Tags are then displayed at the bottom of the question body, as shown in Figure 1.

The example in Figure 1 shows the wide range of options that are available in tagging. Tags can be very specific or broad and allow users and the community to appropriately choose. As such, the number of tags depends on the size of the community. For example, in ESO there are 43,085 tags that have been used at least once.

Too many tags and variations would make taxonomy via tags unmanageable. In order to combat this, the administration started the process of creating a tag master list in which synonyms are merged together (“What are tag synonyms and merged tags?,”). For example, if a user were asking a question about PageRank Algorithm, it would be logical to tag the question either “Algorithm”, “Algorithms” or both. The tag master list avoids these redundancies by merging synonyms into the master tag. Figure 2 shows an example of a master and synonym relationship. This system has been replicated across all languages.

A concern with using tags for analysis is a reliance on their accuracy. Can users be trusted to accurately tag their questions? Editing of questions by qualified members of
Different Languages, Different Questions: Language Versioning in Q&A

the community helps assure that tags are accurate (Li et al., 2015). The communities are encouraged to search out inaccurate tags and change them to conform to community standards, and they do so actively (Correa & Sureka, 2014; Li et al., 2015; Vargo & Matsubara, 2016).

3.2 Tag Normalization
An obvious issue that hinders analysis is the difference in language between the four sites. As Figure 3 shows, most tags in each language site are in English. However, some tags are presented in the site language. In Figure 3, we see the tag “アルゴリズム” which translates directly into “Algorithm”. A corpora comparison without translation would be useless.

Using the master synonym list, we translated tags in Portuguese, Russian, and Japanese into English. The results of translations were checked against machine translation to ensure accuracy.

4. Analysis of Question Corpora
4.1 Data Sets
We performed two analyses on four corpora from English Stack Overflow (ESO), Portuguese Stack Overflow (PSO), Russian Stack Overflow (RSO), and Japanese Stack Overflow (JSO). All questions asked in a 24-month period between the beginning of November 2014 and the end of October 2016 were obtained from the Stack Exchange data explorer. The number of questions and tags in each site is shown in Table 4.
The data sets are different in size, with ESO 40 times larger than the other languages combined. In addition, we can see that there are discrepancies between the ratio of tags per question, with ESO providing an average of 3 tags per question compared to 2 tags per question on JSO. Any test on the data sets require normalization in analysis.

<table>
<thead>
<tr>
<th>Site</th>
<th>Questions</th>
<th>Tags</th>
<th>Tags per Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>English (ESO)</td>
<td>4,608,931</td>
<td>13,875,878</td>
<td>3.01</td>
</tr>
<tr>
<td>Portuguese (PSO)</td>
<td>42,164</td>
<td>108,033</td>
<td>2.56</td>
</tr>
<tr>
<td>Russian (RSO)</td>
<td>64,125</td>
<td>155,496</td>
<td>2.42</td>
</tr>
<tr>
<td>Japanese (JSO)</td>
<td>9,208</td>
<td>18,488</td>
<td>2.01</td>
</tr>
</tbody>
</table>

Table 4. Language Sites and Number of Tags and Questions

4.2 Do the language versions of Stack Overflow ask different questions?
The null hypothesis is that the languages are not significantly different from each other. Specifically, we assume that the most popular tags in each language version are similarly distributed across the various languages. To test this, we took the top 25 tags across each site and compared their normalized frequencies. The top 25 tags in each language version provides coverage of almost every question asked in the 24-month period. All four sites had at least 99% of all their questions containing at least one of the top 25 tags. In total, there are 43 tags that are in at least one of the top 25 tags for all four language sets.

To compare expected frequencies across the data set we used the Log-Likelihood (LL) test, which can compare keywords amongst corpora of different sizes (Rayson & Garside, 2000). LL is a contingency test with a statistic similar to Chi-Squared (Rayson, 2008). LL normalizes by comparing relative expected frequencies based on the entire population of the corpus (Rayson, 2008; Rayson & Garside, 2000), thus it is a useful tool for identifying structural differences between corpora of different sizes.

We conducted both groupwise and pairwise tests with a total of 301 comparisons. Therefore, we consider all tests to have an adjusted alpha p<0.05 to be p<0.00016 using Bonferroni Correction. For the groupwise test, we consider a LL score (G-test) of greater than 24 to be significant, and for the pairwise, a result greater than 15.5. In
addition, we measure Bayes-Factor, which shows strength of difference. A score of greater than 10 indicates strong differences.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Log Likelihood</th>
<th>Bayes BIC</th>
<th>Tag</th>
<th>Log Likelihood</th>
<th>Bayes BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>.net</td>
<td>843.4302618*</td>
<td>797.3254906</td>
<td>monaca</td>
<td>5568.539653*</td>
<td>5522.434882</td>
</tr>
<tr>
<td>ajax</td>
<td>665.3195587*</td>
<td>619.2147875</td>
<td>mysql</td>
<td>1752.798235*</td>
<td>1706.693464</td>
</tr>
<tr>
<td>algorithm</td>
<td>515.2795249*</td>
<td>469.1747538</td>
<td>node.js</td>
<td>640.6765277*</td>
<td>594.5717565</td>
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<td>821.1311931*</td>
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</table>

Table 5. Groupwise Log-Likelihood Results *p<0.05

As Table 5 shows, all groupwise comparisons have significant results. This shows that no tag is distributed evenly among the four languages. What this indicates at first is that computer programming is not as limited in its domain as the system designers thought. However, the groupwise test does not conclusively prove that all the sites are different.
Different Languages, Different Questions: Language Versioning in Q&A

from each other, as one site could prove to be skewing most of the results. To account for this, we conducted six pairwise tests as shown in Table 6. The results clearly show that most pairs are significantly different.

None of the corpora have similar distributions of their most popular tags. We can reject the null hypothesis for R1 and conclude that the different language sites do choose different distributions of topics.

None of the corpora have similar distributions of their most popular tags. We can reject the null hypothesis for R1 and conclude that the different language sites do choose different distributions of topics.

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Significant</th>
<th>Not Significant</th>
</tr>
</thead>
<tbody>
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<td>ESO vs PSO</td>
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<td>9</td>
</tr>
<tr>
<td>ESO vs RSO</td>
<td>39</td>
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<td>ESO vs JSO</td>
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<td>6</td>
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<tr>
<td>PSO vs RSO</td>
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<tr>
<td>PSO vs JSO</td>
<td>36</td>
<td>6</td>
</tr>
<tr>
<td>RSO vs JSO</td>
<td>33</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 6. Summary of Pairwise Tests

4.3 Do the language versions of Stack Overflow present different tag structures for universally popular tags?

The fact that the distribution of tags is different for each of the languages does not mean that there is a fundamentally different way of asking questions regarding similar tags. To examine this, we chose a universally popular tag “Javascript”, which ranked No. 1 on ESO, No. 2 on PSO, No. 3 on RSO, and No. 1 on JSO. We then sought to understand the related tags that are included when a “Javascript” tagged question is asked.

A potentially useful tool would be to use Normalized Mutual Information (NMI) to compare tag hierarchies (Tibély, Pollner, Vicsek, & Palla, 2013). The problem with NMI, however, is that there needs to be a hierarchy of tags. Popularity of the tag does not indicate the hierarchy of the question. In some cases, such as Figure 1, it is relatively
easy to designate the node as being “Git” and the subsequent tags as modules. However, many questions are not the same. For example, a question tagged “iOS” and “Android” might be equally important.

To provide an analysis of shared information around the tag “Javascript”, we chose a modified version of Sankey Diagrams which are based on force-directed graphs. In these graphs, the left-most tags represent the most central tags, while size of a bar indicates the relevant frequency to all the questions that were also tagged with “Javascript”. Graphs were created with a normalized link-strength of 3.

There are some notable differences in the centrality of related tags. JSO, for one, includes a technology (Monaca and Onsen-UI) which fails to even make the other charts. It is central to many of the “Javascript” questions that are asked on the site. RSO is dominated by a centrality of “Jquery” which is a tag which is present in almost all of the “Javascript” questions. PSO has “Ajax” and “AngularJS” as its most central tags, and ESO has “HTML” as its most central tag.

Figure 4. ESO Sankey Diagram
This does not mean that there are not similarities. “Jquery” is a large part of each question set. However, the results still show that the different language versions associate different topics around a popular tag like “Javascript”, and the result is a question set which has a different shape. This indicates that language or locality is
important to how and what questions are asked. Even the shared topic areas are visually different.

5. Discussion

The results of the analysis show that the questions asked between the four corpora are significantly different. This adds to the research indicating that culture and language impacts the type of information that is produced and curated by a community (Bao et al., 2012). The results extend the previous work by showing that even in a closed technical domain this impact can be seen.

This result is important for three reasons. First, we can consider that only naïve designers will expect language versioning to result in similar corpora. We should expect that language versioning will result in splintering effect where content is not replicated across sites. This includes situations in which the initial contributors come from the parent site, like Japanese Stack Overflow (JSO).

The second reason these results are important is that they can inform directed translation efforts. Wikipedia is a venue where much effort has gone into creating effective methods for translation of material (Hautasaari, 2013; Ishida, 2011). Lessons from these efforts indicate that it is difficult to locate the gaps in knowledge a priori. In a situation like the Stack Overflow system (SO), we might assume that the most basic and common questions are asked first, because they are the most basic questions. However, in JSO we see that country specific questions, like “Monaca” tagged questions show up as a central tag. A possibility is that users are already translating basic questions by themselves instead of investing time into asking basic questions. This might explain the different shapes of the communities.

The differences can be used to inform translation efforts by showing site administrators where gaps in knowledge exist. If the goal of the community is to provide the most access to knowledge, then there is ample opportunity to find places where translation efforts will have the greatest effect.
Most significant, however, is that the results show the importance of not just translating versions of a site into another language. As our results show, it is incorrect to assume that the structure and content of the dominant language site will be replicated (even on a smaller scale). Instead, we see that sites in different languages have different approaches to topics and include technologies that are largely absent from the dominant site.

Without language-specific sites, these discussions might be lost to the all communities. If the sites were mere replicas of each other, then translation-only efforts would make sense. With these results, however, the lack of language specific sites would result in a loss of information. With this in mind, site administrators of dominant language communities might consider including translation versioned sites to their own.

6. Conclusion
This study aimed to determine whether language versions of a technical community result in similar or different question archives. We used a statistical method, Log-Likelihood, and a visual method, Sankey Diagrams, to explore the user-generated question tags as they describe the archives. We found that between four languages the tags were significantly different in distribution. We also found that the related tags around a universally popular tag were different in amount and centrality.

The results from this study are important for informing designers of collaborative information gathering communities interested in language versioning. In addition, we argue that the results are important for both informing translation efforts and justifying the existence of language versioned communities.

Acknowledgements
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References


Different Languages, Different Questions: Language Versioning in Q&A


AN INVESTIGATION OF THE FACTORS AFFECTING THE COLLABORATIVE PROPENSITY OF HOME-BASED BUSINESSES: AN OUTLINE OF THE INITIAL STUDY

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Business collaboration is frequently used as a method for small businesses to maximise their chances of success in competitive markets, allowing as it does for a reduction in transaction costs and access to resources held by other businesses. Home-based businesses in particular stand to benefit from collaborative arrangements, owing to the typical scarcity of resources available to them. Despite the relative prevalence of collaborative behaviours exhibited by such businesses, very little research has been performed to study the factors which impact a home-based businesses propensity for collaboration. This positional paper presents an investigation into those factor using a “pre-collaborative” approach, using quantitative methods applied to the Global Entrepreneurship Monitor (GEM) data to discern commonalities present within the organisational, technological and environmental conditions of home-based businesses which display a collaborative inclination, to determine the underlying factors which predispose these businesses to the formation of collaborative relationships.
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Abstract

Business collaboration is frequently used as a method for small businesses to maximise their chances of success in competitive markets, allowing as it does for a reduction in transaction costs and access to resources held by other businesses. Home-based businesses in particular stand to benefit from collaborative arrangements, owing to the typical scarcity of resources available to them. Despite the relative prevalence of collaborative behaviours exhibited by such businesses, very little research has been performed to study the factors which impact a home-based businesses propensity for collaboration. This positional paper presents an investigation into those factors using a “pre-collaborative” approach, using quantitative methods applied to the Global Entrepreneurship Monitor (GEM) data to discern commonalities present within the organisational, technological and environmental conditions of home-based businesses which display a collaborative inclination, to determine the underlying factors which predispose these businesses to the formation of collaborative relationships.

Keywords: Home-based business, business collaboration, collaboration factors

1.0 Background to the study

A home-based business (HBB), while certainly a form of small-to-medium enterprise (SME) can more accurately be defined as “any business entity...operated by a self-employed person...that uses residential property as a base from which the operation is run” (Mason, Carter & Tagg, 2011, p.12). In line with the stance adopted by Clark & Douglas (2014), this broad definition extends to business based both ‘at’ and ‘from’ the home, including mobile businesses and those with no fixed premises. Within the OECD countries, over half of all small businesses are run either from or at the home
(Mason, 2010). Despite this, they remain an understudied sector, particularly with regard to their interactions with other firms. While the area of small-to-medium enterprise (SME) collaboration is well studied, little work has been performed on the topic of the collaborative behaviours of HBBs.

Given the challenging market conditions often facing small firms, a common step taken by such businesses is to combine their resources and working efforts (Knop, 2007) and as such these firms are seeking collaborative opportunities outside the boundaries of their organisation (Hudnurkar et al., 2014; Casals, 2011). While Hoffman & Schlosser (2001) reported that small firms were pointedly less likely to engage in collaborative behaviours, this is disputed by Robson & Bennett (2001) who argued that larger businesses are more likely to shun alliances while smaller businesses are more inclined to use alliances as a way of enhancing their resource holdings and market position. While figures on the exact proportion of SMEs engaging in collaborative activities are somewhat disputed, empirical findings show that the exhibition of collaborative behaviours is in fact common. Knop (2007) indicated that over 50% of European SMEs work collaboratively with others, while findings by Brunetto & Farr-Wharton (2007) provide a more specific figure, with results stating that 68.4% of surveyed SMEs participated in collaborative activities of some form.

Antonelli & Taurino (2011) highlighted three main strata of collaborative relationship among small firms. Firstly, ad-hoc, where the collaboration remains at the level of a conventional customer-supplier relationship; secondly, defined and linked, whereby collaboration occurs at an operational level and comprised of activities such as forecasting and procurement, and thirdly, integrated and extended, where the collaboration extends to coordinated strategies and assimilated enterprise activities. While collaboration is a frequent occurrence among small firms, these collaborative arrangements are most often located within the two former strata, and commonly arise from informal and unplanned relationships - stemming from geographic or market proximity - with few collaborative arrangements found to be structured or long-term in nature (Carneiro et al., 2013; Antonelli & Taurino, 2011). Further to this, Brunetto & Farr-Wharton (2007) divided collaborative relationships into just two categories: hard relationships, which involve interdependent firms participating in joint production and marketing ventures, and soft relationships, describing those
arrangements which consist solely of cost cutting measures such as the sharing of resources. For the purpose of this study, all forms of collaboration are treated as equal, regardless of their permanence or arrangement.

This paper describes the background and rationale to an exploratory, quantitative study based on Global Entrepreneurship Monitor (GEM) data which will investigate the factors affecting the inclination towards collaboration among HBBs located within OECD countries. This paper seeks to understand which conditions are required to establish a ‘breeding environment’ for collaborative relationships, and to explore the underlying structure of factors likely to indicate a propensity for collaboration.

2.0 The Associated Benefits of Small Business Collaboration

Engaging in collaborative activities with other businesses and building collaborative relationships has become an increasingly effective way for small businesses to meet the increasing performance requirements placed upon them (Carneiro et al., 2013, Casals, 2011). Due to this, business collaboration is frequently cited as a primary driver for sustainable success in the small business sector, from which businesses are able to derive numerous benefits. The existing literature describes a number of main areas from which these benefits can be derived via businesses’ participation in collaborative activities: a reduction in transaction costs; access to new or larger markets; the ability to take on larger projects than would otherwise be feasible (via either production chain integration or improved production capacity) and access to resources currently outside the boundaries of the business.

According to Knop (2007), the primary rationale behind SME cooperation is access to new markets and the ability to supply to larger markets, in addition to improving their competitive position within such markets. In the majority of cases however, the primary driver of collaboration is the opportunity to leverage the hitherto unavailable resources held by another firm (Hudnukar et al., 2014). The most notable amongst these resources is knowledge, which through collaborative efforts can be both shared and created, to the mutual benefit of all parties involved (Carneiro et al., 2013; Antonelli & Taurino, 2011; Knop, 2007).
Fundamentally, through collaboration and the diffusion of knowledge, businesses are able to achieve a level of competitive advantage which would otherwise be unattainable (Crook et al., 2008; Brunetto & Farr-Wharton, 2007). Findings produced by Pouly et al. (2005), demonstrated that in business terms, collaboration is an overwhelmingly positive force, with the majority SMEs involved in collaborative activities being more successful than those which were not. Of those questioned, 82% responded that collaborative involvement had increased their competitive strength.

3.0 Research Design

3.1 Justification of the Study

The main research question motivating this study is what organisational, technological and environmental conditions possess the greatest impact on the collaboration inclination of HBBs? In addition, the study aims to identify and define the conditions favourable for the development of collaborative behaviours. To attain this understanding, the proposed research will undertake a data driven examination of the factors shared by OECD based HBBs which demonstrate collaborative inclination, to discover the common factors that exist between them. Confidence in the findings produced can be drawn from the diversity of the businesses used in the study, both in terms of geographic location and industry alignment.

3.2 Differentiation from Existing Studies

This study aims to differentiate itself from the existing research in the field on a number of levels. Firstly, through the explicit focus on HBBs: while there are a number of qualitative studies which have performed an investigation of the collaborative practices of SMEs, findings within the literature dealing solely with HBB collaboration are scarce at best.

Secondly, the majority of existing studies which focus on the collaborative activities of SMEs or HBBs concentrate on the performance factors which are found to contribute to successful collaboration. Carneiro et al. (2013), Brunetto & Farr-
Wharton (2007), Hoffman & Schlosser and Robson & Bennett (2001) detailed factors which emerge from collaborative relationships, and are thus based upon a ‘post-collaborative’ approach, in which collaborative arrangements are retrospectively analysed. The primary differentiator between this study and others is the adoption of a ‘pre-collaborative’ approach, in which the factors identified are intrinsic to those businesses which appear to display a predisposition to collaborative behaviour. Therefore this study aims to answer the ‘why’ question associated with collaboration, through the identification of characteristics common in collaborating HBBs, so that insight may be gained into which attributes and conditions produce an underlying propensity for collaboration.

Thirdly, unlike the majority of other examples found within the literature, this study utilises data from HBBs based in a number of countries, as opposed to using only data relating to businesses based in a single nation. In addition, this study uses a high dimensional dataset with records of approximately 3000 businesses from 20 OECD countries (Global Entrepreneurship Monitor, 2016). The resulting geographical diversity data richness and will allow for the findings to benefit from increased generalisability.

### 3.3 Overview of the Data

The study will be performed using data collected by the Global Entrepreneurship Monitor (GEM), a cross sectional repository of data on entrepreneurial businesses from across the globe, collected via a standardised survey. The study will utilise the 2012 release of the GEM dataset, due to the presence of year-specific questions relating to the collaborative practices of the businesses surveyed, not found in prior or subsequent versions of the dataset.

Knop (2007) stated that successful collaboration is dependent upon the environment in which it occurs. To this end, a number of environmental variables (shown in Table 1) will be used in this study. Moreover, the success of a collaborative relationship hinges on strategic, structural and cultural factors. The richness of the GEM data is therefore well suited to a study of HBB collaboration, as variables are present which represent all of these domains. The choice of using only those HBBs located within
OECD countries is intended to ensure relative parity in the economic environments of the businesses studied (OECD, 2008).

3.4 Identification of Variables

For the experimental phase of the study, a number of variables found within the GEM dataset will be used, describing both the organisational and environmental attributes of the businesses being studied, in addition to a selection of variables describing the personal attributes of the business owners. Within the literature however there is little research into the factors which result in a disposition for collaboration. Therefore this study will adopt an approach of utilising variables used in somewhat similar studies to establish an underpinning of continuity to previous work, allowing for comparisons to be made from the findings produced. Table 1 outlines variables used within prior studies which hold equivalents within the GEM dataset, and are therefore eligible for use within this study.

<table>
<thead>
<tr>
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<th>Study found in</th>
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<td>Industry sector</td>
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</tr>
<tr>
<td>Market</td>
<td>Hudnukar et al. (2014)</td>
<td>Identified as variable affecting the transfer of information and knowledge between businesses</td>
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<td>Competitive environment</td>
<td>Hudnukar et al. (2014)</td>
<td>Identified as variable affecting the transfer of information and knowledge between businesses</td>
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<tr>
<td>National culture</td>
<td>Hudnukar et al. (2014)</td>
<td>Identified as variable affecting the transfer of information and knowledge between businesses</td>
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<tr>
<td>Business size</td>
<td>Hudnukar et al. (2014)</td>
<td>Identified as variable affecting the transfer of information and knowledge between businesses</td>
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<tr>
<td>Technology level</td>
<td>Antonelli &amp; Taurino (2011)</td>
<td>Used a variable to describe businesses in collaborative networks</td>
</tr>
<tr>
<td>Number of employees</td>
<td>Antonelli &amp; Taurino (2011)</td>
<td>Used a variable to describe businesses in collaborative networks</td>
</tr>
<tr>
<td>Export percentage</td>
<td>Antonelli &amp; Taurino (2011)</td>
<td>Used a variable to describe businesses in collaborative networks</td>
</tr>
<tr>
<td>Innovation effort</td>
<td>Casals (2011)</td>
<td>Identified as part of a systematic review as a reason for collaboration</td>
</tr>
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</table>

Table 1. Variables used in other studies concerning collaboration which correspond to variables found within the GEM 2012 dataset.
Owing to the study being exploratory in nature the scope has been widened to include variables not commonly used in within the existing literature. This approach allows for factors not previously considered to be related to collaborative propensity to be included, thus allowing for a more expansive range of underlying trends and patterns to be identified through data mining techniques. This is made possible due to the richness of the data available through the use of the GEM dataset, therefore in addition to the variables shown in Table 1, a range of other variables found within the data will also be incorporated into the experimental phase of the study, bringing the total amount of variables to be used to 37. A full breakdown of the variables used can be found in Appendix A.

4.0 Future Work

The experimental phase of this study possesses the primary purpose of identifying which factors occur most often with HBBs which are known to exhibit collaborative behaviours. The study will utilise a data mining technique known as association rule mining, sometimes termed market basket analysis, to find commonalities within the data when the presence of previous or ongoing collaborative activities is used as a control variable. Figure 1 shows the stages involved in the usage of the algorithm.
The key purpose of association rule mining is to determine frequent itemsets within the data (Hipp et al., 2000) thus detecting key trends and patterns which exist among the various attributes of HBBs which are engaged in collaborative activities. The primary method which will be applied is the apriori algorithm, a widely used and influential means of determining common relationships among variables in a dataset, known as rules. Hahsler et al. (2005) outlined the three key principals of the apriori algorithm: support, confidence and lift. Support can be defined as the proportion of transactions (in this study, rows of data) within a dataset which contain a particular itemset (i.e. concurrent occurrences of the certain values). Confidence can be thought of as the likelihood of a rule being found to be true, while lift is a measure of variable interdependency. An example of the output generated via this process can be found in Appendix B. Together these four elements allow for the identification of the most prominent rules within a given dataset.
Through the use of this method, answers will be provided to the primary research question of identifying the factors, or combination of factors, with the greatest impact on the collaborative propensity of HBBs within OECD countries. These factors will later be used to develop a model to ascertain the optimum conditions HBB collaboration to occur.
Appendix A

Table 2 details the variables used within the study. All are binary variables, so as to allow their use in with the apriori algorithm. All variables names and descriptions are taken directly from the GEM 2012 dataset.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>knowent</td>
<td>Do you know someone personally who started a business in the past 2 years?</td>
</tr>
<tr>
<td>suskill</td>
<td>Do you have the knowledge, skill and experience required to start a new business?</td>
</tr>
<tr>
<td>fearfail</td>
<td>Would fear of failure prevent you from starting a business?</td>
</tr>
<tr>
<td>TechSector</td>
<td>Technology Sector</td>
</tr>
<tr>
<td>BUSyyJOB</td>
<td>Expected job growth &gt;= 10 persons and &gt;= 50 percent</td>
</tr>
<tr>
<td>BUSyyEMP</td>
<td>Any jobs now or in 5 years</td>
</tr>
<tr>
<td>BUSyyHJG</td>
<td>Expects more than 19 jobs in 5 years</td>
</tr>
<tr>
<td>busang</td>
<td>Have you, in the past three years, personally provided funds for a new business started by someone else?</td>
</tr>
<tr>
<td>occufull</td>
<td>Employed by others in full-time work</td>
</tr>
<tr>
<td>occupart</td>
<td>Employed by others in part-time work</td>
</tr>
<tr>
<td>occuself</td>
<td>Self-employed</td>
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<tr>
<td>occuseek</td>
<td>Seeking employment</td>
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<td>occurd</td>
<td>Not working because I am retired or disabled</td>
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<td>occuhome</td>
<td>Full-time home-maker</td>
</tr>
<tr>
<td>SUB</td>
<td>Reports new start-up effort (independent or job)</td>
</tr>
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<td>SUBA</td>
<td>Actively involved in start-up effort</td>
</tr>
<tr>
<td>SUBO</td>
<td>Owner in start-up effort</td>
</tr>
<tr>
<td>SUBOA</td>
<td>Actively involved in start-up effort and owner</td>
</tr>
<tr>
<td>SUBOANW</td>
<td>Actively involved in start-up effort, owner, no wages yet</td>
</tr>
<tr>
<td>OMBABYX</td>
<td>Involvement in start-up, reclassified into own/managed young business</td>
</tr>
<tr>
<td>OMESTBX</td>
<td>Involvement in start-up, reclassified into own/managed est. business</td>
</tr>
<tr>
<td>BABYBUSOM</td>
<td>Manages/owns a business that is up to 42 months old</td>
</tr>
<tr>
<td>ESTBBUSM</td>
<td>Manages a business that is older than 42 months</td>
</tr>
<tr>
<td>ESTBBUSO</td>
<td>Manages and owns a business that is older than 42 months</td>
</tr>
<tr>
<td>SUBOANWC</td>
<td>Owning-managing business reclassified into setting up business</td>
</tr>
<tr>
<td>BUSOWN</td>
<td>Business owner of running business (not nascent)</td>
</tr>
<tr>
<td>TEAyyANY</td>
<td>Involved in TEA</td>
</tr>
<tr>
<td>TEAyyOP</td>
<td>Involved in TEA, opportunity</td>
</tr>
<tr>
<td>TEAyyNE</td>
<td>Involved in TEA, necessity</td>
</tr>
<tr>
<td>NEANYyy</td>
<td>Nascent entrepreneur Y/N</td>
</tr>
<tr>
<td>SUBOPPyy</td>
<td>Nascent entrepreneur, opportunity</td>
</tr>
<tr>
<td>SUBNECyy</td>
<td>Nascent entrepreneur, necessity</td>
</tr>
<tr>
<td>IntrapreneurYN</td>
<td>Active as an intrapreneur</td>
</tr>
<tr>
<td>IntrapreneurLDYN</td>
<td>Active and Leading as an intrapreneur</td>
</tr>
<tr>
<td>CollabIntense</td>
<td>Indicates intense collaborative activity</td>
</tr>
<tr>
<td>Collab</td>
<td>Takes part in any collaborative activities</td>
</tr>
</tbody>
</table>

Table 2. Variables from the GEM 2012 data used in the study
Appendix B

Table 3 displays an example output generated by application of the apriori algorithm on the GEM 2012 dataset. This preliminary test was performed as a proof of concept, and was limited to the use of just 5 variables, with a fixed dependent - or right hand side (RHS) - variable of “Collab”, denoting the participation in collaborative activities. Variable labels can be found in Appendix A.

<table>
<thead>
<tr>
<th>Left Hand Side</th>
<th>Right Hand Side</th>
<th>Support</th>
<th>Confidence</th>
<th>Lift</th>
<th>Count</th>
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<tbody>
<tr>
<td>Suskill, occuself, ESTBBUSM, BUSOWN</td>
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<td>0.36</td>
<td>1.00</td>
<td>&gt;1.00</td>
<td>1049</td>
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<td>Occuself, ESTBBUSM, ESTBBUSO, BUSOWN</td>
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<td>0.42</td>
<td>1.00</td>
<td>&gt;1.00</td>
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<tr>
<td>SUBA, SUBO, SUBOA, SUBOANW</td>
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<td>0.25</td>
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<td>Collab</td>
<td>0.27</td>
<td>1.00</td>
<td>&gt;1.00</td>
<td>807</td>
</tr>
</tbody>
</table>
References


Transformation of Big Data for Health in the European Union

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Abstract
Modern healthcare is increasingly dependent on good data, and effective information systems, for care delivery, and to develop and evaluate health policy. The context of big data differs in significant ways from traditional types of health data, while the use of big data for epidemiology and public health is becoming more common, the use of these tools for health service planning and health policy making lags behind. A large EU funded project (titled MIDAS) that focuses on merging, analysing and visualising data from heterogeneous sources to support health policy makers work in using and accessing health data across EU countries is underway. This paper briefly describes the key challenges that must be met to access, use and make sense of this big data in healthcare, focusing on legal, governance and ethical issues. Unless these issues are dealt with, the promise of Big Data for health, will never be fulfilled.

Keywords: Data Analytics, Epidemiology, Public Health

1.0 Introduction
Digital epidemiology is motivated by the same objectives as traditional epidemiology, but focuses on electronic data sources that emerged with the advent of information technology (Hay et al., 2013). It draws on developments such as the online growth of sharing platforms, which constantly generate vast amounts of data containing health related information (Vayena et al., 2015). Utilizing available global real-time data accelerated disease outbreak detection is feasible. Reports of emerging outbreaks have been detected through digital surveillance channels in advance of official reports e.g. Ebola virus outbreak, West Africa (Anema et al., 2014), assessment of health behaviour and attitudes (Salathe & Khandelwal 2011) and pharmacovigilance (White et al., 2013).

Big Data technology and services are expected to grow worldwide at a compound annual growth rate of 40% (Vessat, 2012). The European Commission adopted the communication on the data-driven economy, focusing on the digital economy, innovation and services as drivers for growth and jobs and called for EU action to provide the right framework conditions for a single market for Big Data and cloud computing (Com, 2014, 442). They are also bringing in a new general EU legal framework on the protection of personal data. The General Data Protection Regulation aims at eliminating fragmentation and providing consistency and coherence for the whole Union (Com, 2012, 11). This is critical for the wider reuse of personal data in Europe.

The European Commission Directorate-general for Health and Consumers Protection (DG SANCO) are committed to capturing the potential of Big Data in public health policy and research to produce policy recommendations to member states according to the logic improvement of healthcare systems and in light of the Directive 2011/24/EU on Patients’ Rights in Cross-Border Healthcare (Union, E.P.a.C.o.t.E., DIRECTIVE 2011/24/EU on the application of patients’ rights in cross-border healthcare, 2011). In this context, they have funded the MIDAS project, which seeks to develop tools for accessing analysing and interpreting heterogeneous data sources, oriented towards health policy makers (Rankin et al. 2017).
2.0 Big Data and Public Health

Big data cannot be readily grouped into clearly demarcated functional categories. Depending on how they are queried and combined with other datasets, a given dataset can traverse categories in unpredictable ways (Vayena et al., 2015). New data analytics constantly change the kinds of outcomes that become possible.

They go beyond early identification, and detection of disease patterns to include predictions of the event’s trajectory or likelihood of recurrence (Thomas, 2014; Brockmann & Helbing, 2014). These possibilities render good data governance, which is essential for ethical use. The last two decades have seen an explosion in big data throughout the healthcare value chains, as well as the advent of new platforms, tools, and methodologies in storing, structuring, and analysing big data (Bernstein, 2014).

Numerous questions can be addressed with big data analytics. Clinical outcomes may be predicted and/or estimated based on vast amounts of historical data, such as length of stay; patients who will choose elective surgery; patients at risk of surgical complications; risk for sepsis, MRSA, C. difficile, or other hospital acquired illness (Manyika et al., 2011).

Within public health applications included analysis of disease patterns and tracking disease outbreaks and transmission to improve surveillance and speed response (Raghupathi and Raghupathi, 2014). Faster development of more accurately targeted vaccines, e.g., choosing the annual influenza strains; and, turning large amounts of data into actionable information that can be used to identify needs, provide services, predict and prevent crises for the benefit of populations (Manyika et al., 2011). Optimisation of pharmaceutical outcomes utilising a variety of statistical techniques ranging from predictive modelling to machine learning, data mining is another area of rapid development. (Hernandez and Zhang, 2017).

The MIDAS project, data analytics and operations research applications will inform practitioners and policy makers solving healthcare problems. Supporting the development of sustainable long-term solutions across disease management, service delivery, and health policies, in part by optimizing the performance of system elements and analysing interactions (Capan et al., 2017)

3.0 Big Data Challenges

The big data dynamic environment generates challenges that relate not only to the value of health systems, individual rights and other moral requirements (Vayena et al., 2015). The distinct features are the methods by which data are generated, collected and stored. The kind of information that is inferred by their analysis, and eventually how that information is translated into practice (Neff, 2013). Data analytics technology can derive value in ways that were previously impossible, the technical capabilities have reached a level of sophistication and pervasiveness that demands careful consideration and presents several challenges.

3.1 Governance

Public health surveillance and public health research are governed by national and international legislation and guidelines. Many of these norms were developed in response to technologies that have now been superseded (Fairchild & Bayer, 2004). Such mechanisms may not be appropriate or effective in addressing the new ethical challenge posed nor the questions that will be raised if big data is effectively integrated into standard public health systems. Health research utilizing social media data and other online datasets have already exerted pressure on existing research governance procedures (Vayena et al., 2012).
As the amount of health related data and global digital information grows, so does the number of actors accessing and using this information. Assurances must be given that personal data related to health will be used appropriately, in the context of the intended uses and according to relevant laws. There is public scepticism about “where my data goes”, “by whom it is used” and “for what purpose” in the fragmented and complex legal environment of the EU (EU Report, Use of Big Data in Public Health Policy Research, 2014).

A strong governance model and adaptation of best practices of new technologies are essential for the deployment of big data for large-scale data production, coupled with interoperable data storage, data integration, and data analytics solutions (Meldolesi et al., 2016). Further, evaluation of data needs to be assessed and interpreted in a timely manner (Hood et al., 2014; Raghupathi et al., 2014) to improve the efficiency, effectiveness, prediction and prevention strategies of public health services and policy (Rumsfeld et al., 2016; Monteith et al., 2016).

3.2 Confidentiality & Security

An important condition for the access to patient related information is the protection of personal data. Data protection rules as transposed into national laws in Europe do not yet establish full-harmonized conditions for health data processing, although this will improve as the General Data Protection Regulation (GDPR) is adopted (Maldoff, 2016).

Existing computational infrastructures can readily cope with the storage of big data, but the specific challenge for the EU is the lack of a suitable large-scale European infrastructure and methods of secure data distribution in a cross-border setting (Georgatos et al., 2013).

It is crucial to ensure the infrastructures that exist and evolve are coordinated and sustainable. There are significant differences of culture and practice within and across Europe for data access and data sharing polices (DLA Piper, 2016). Recently a code of practice on the secondary use of medical data in European research has been developed (Bahr et al., 2015) and deployed in the IMI-funded project eTRIKS https://www.etriks.org.

A common and reasonable concern for patients is the risk of the misappropriation of their health information, particularly of genetic data (Fallik, 2014; Millier, 1998; Riba, 2007) that may adversely affect personal circumstances, including insurance coverage and employment. (Feldman et al., 2012). Data access and confidentiality risks are directly correlated (Kum & Ahalt, 2013). In specifically excluding personal medical data from general principles making public data open-by-default, the EC’s Open Data policy appears to reflect these concerns. The EC has planned to address patient confidentiality concerns through amendments to existing data protection directives (Directive 95/46/EC; EU COM/2012/11. 2012) following EU constitutional revisions that strengthened personal data protection rights (Treaty of Lisbon, 2008).

The Directive on patients’ rights (Article 14) addresses legal policy cooperation on eHealth. The eHealth Network Multi-Annual Work Plan 2015-2018 defines concrete actions to be taken in the domains of interoperability and standardisation; exchange of knowledge; assessment of implementation; and global cooperation and positioning cross the European Union (Multi-Annual Work Plan 2015-2018). The adoption of guidelines on the electronic exchange of patient summaries, (November 2013) is one example of the development of electronic exchange to meet the requirements of the Cross-Border Directive (2011/21/EU. 2013: Brussels). These legislative changes unify EU initiatives on confidentiality and data security, provide a flexible legal framework that can rapidly adapt to changing technologies. Data protection reforms have arguably been few and limited to enhancing transparency and confidentiality in lawful data processing (Salas-Vega et al., 2015), but this is set to change as the GDPR comes into force in 2018 (Maldoff, 2016).
3.3 Standards & Interoperability

There are still standardization problems in the healthcare sector, as data is often stored inconsistently, or stored in systems that produce and consume incompatible formats (Roney, 2012). Research, clinical activities, hospital services, education, and administrative services are siloed, and, in many organizations. Each silo maintains its own separate organizational (and sometimes duplicated) data and information infrastructure. The lack of coordination between systems, health care providers and countries, supports the call for standards to facilitate interoperability among the components of the big data value chain (EU Report - Use of Big Data in Public Health Policy Research, 2014).

3.4 Technical Issues

Robust scientific and data processing methodologies involve the validation of algorithms, filtering systems for noisy data, managing biases, and the selection of appropriate data streams. Methodological robustness is an ethical, not just a scientific requirement. Limited resources are wasted based on defective results and incomplete analyses, but also because trust in health care systems and professionals can be undermined by the use of misleading or inaccurate results (Vayena et al., 2015).

4.0 Conclusions & Future Implications

Health care delivery is a major challenge for all EU member states. The growth of big data in this sector, and the wider use of data analytics platforms offer a promise of more effective and efficient delivery of health care in the future. The MIDAS study is being undertaken to develop data forecasting, dashboards and visualisation technology to provide sustainable solutions in four European countries relating to diabetes, obesity, children in care and mental health services. Part of the work is a systematic approach to addressing the problems of governance, confidentiality, security as well as the complex technical issues involved in working with heterogeneous data sources. The aim is to support the development of new tools for health policy development and monitoring, and ultimately new policies for health service delivery. Unless these issues can be addressed in a way which meets the legitimate concerns of health service users, and the increasingly strict legal requirements, the immense promise of Big Data for health care will remain just that, a promise.
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eTRIKS: European Translational Research Information and Knowledge Management Services. https://www.etriks.org


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Transformation of Big Data for Health in the European Union


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Transformation of Big Data for Health in the European Union


Union, E.Pa.C.o.t.E., DIRECTIVE 2011/12/EU on the application of patients’ rights in cross border healthcare.


Abstract
This study aims to identify the implications of I4.0 to both Supply Chain Management (SCM) and Human Resources Management (HRM) by finding out the topics that take place at the intersection of them. Another objective is helping the readers to realize the expected changes in these two areas due to I4.0 in order to take the necessary steps in advance and make recommendations to catch up the latest trends. The topics covered in the developments of I4.0, such as digitization, Internet of Things, big data, cloud usage etc. are highly related to Information Systems. As found in the literature, this study is the first to combine the I4.0, SCM and HRM and urges to lead future works by finding out the intersections of those three areas. The findings of the study have visualized and the intersections of those topics are explained in order to see what are the future expectations and important developments in those areas.

Keywords: Human Resources Management, Industry 4.0, Information Systems, Supply Chain Management

1.0 Introduction
Industry 4.0 is the fourth industrial revolution introduced by Germany in 2011. It basically means more technology, more automation, and more flexible production. According to PwC survey, I4.0 does not only represent a “future trend” anymore, it has already moved from talk to action. Beyond that, it has become the core of the company strategies. I4.0 offers numerous benefits for firms such as generating additional revenue from digitising products and services, offering big data analytics as services; or lower the cost and have greater efficiency from real-time inline quality control based on Big Data Analytics, horizontal integration, as well as track-and-trace of products for better inventory performance and reduced logistics (PwC Survey 2016).

The main objective of this study is to identify the implications of I4.0 to both SCM and HRM by finding out the topics that take place at the intersection of them. Another objective is helping the readers to realize the expected changes in these two areas due
to I4.0 in order to take the necessary steps in advance and make recommendations to catch up the latest trends.

### 2.0 Intersections of Concepts

As it is known, the main objective of a supply chain is maximizing the overall value created in the chain. This goal can be achieved by using the resources more efficiently. In the same way, the developments in technology carry out the same goal. Besides that, HRM aims to use the human capital more efficiently. This common aim brings these three concepts together and lets us work on them as a whole.

A successful HRM is a critical issue in the management of an organization. It doesn’t matter how advanced technology is used or the management is very successful in an organization, without the necessary HRM practices it is very hard to enhance operational performance (Ahmad & Schroeder, 2003). The technological developments are expected to create changes in the HRM practices and the labour force characteristics. Currently, the organizations are getting knowledge intensive. Therefore, I4.0 requires highly educated people instead of blue-collar workers. This might create changes in the HRM practices since educated employees’ demands and expectations from the organization are different from the low-skilled employees. Besides the new skill requirements, the number of workers is expected to decrease due to increased automatization in the processes. The machines will take the automated task over low-skilled employees and there will be less need to them. This decrease might make the management of human capital easier in the future.

Only 5 years ago, Supply Chain Forum an International Journal stated that working on both HRM and SCM had not attracted enough attention. Even though both of these topics have an important role in achieving competitive advantage, human capital management in the supply chain has not realized enough (Claes & Lakshman, 2012).

In order to fill this gap in the literature, they published a special issue called “Managing the Human Resources in Supply Chain”. One of the papers in that issue states that Supply Chain Managers may make the best planning and set the best strategies for their organizations. However, an insufficient human performance can damage these plans. Basically, if the human fails, the supply chain fails, too (Swart et al., 2012). Moreover, as it is widely accepted, the failure of supply chain means the
failure of the organization. That’s why following the changes in human resource management in supply chains has essential importance for the future success of the organizations. New requisite skills of employees caused by technological developments will affect the whole company performance.

Menezes et al. worked on the integration of Operations Management (OM) and HRM by including supply chain in OM. They found out that there is a positive relationship between integrated usage of OM and HRM and firm performance. Also stated that this integration creates a competitive advantage by enabling the firms to achieve multiple goals that result in improved firm performance (Menezes, Wood, & Gelade, 2010).

2.1 The Venn Diagram of I4.0, HRM and SCM

The Venn diagram below summarizes the relationship between I4.0, HRM and SCM. The non-intersection parts are left empty because this study aims to focus on the mutual topics in these three areas.

Firstly, the logistics professionals in the intersection of Human Resources (HM) and Supply chain (SC) (area 2) mean that the employees who specialized in logistics in order to manage and operate the supply chains. Hiring these educated people or training the workers to become a logistic professional is the Human Resources Managers’ responsibility. As stated above, finding the right employees is an essential task of HR. These “right employees” will make managing the company easier and help to cope with complexity in the organization. Another critical point in that intersection is that HR and SCM should operate in a coordination to achieve the common goals. Their coordination will improve the overall firm performance.

Secondly, there are three items in HR and I4.0 intersection (area 1). I4.0 is mainly considered as technological developments in this Venn diagram. HR has been significantly impacted by technology in the recruiting area. Technology brought a variety of new ways to reach people and inform them about the open job positions. In addition, searching and determining the right job candidates has become easier with Big Data. Since there is a pool of related information about potential employees, HR managers can simply surf in that data and decide whom to offer a job position. This helps them to save time and other resources like money or paper works. Another benefit of collected data is knowing what the employees know. This means that being aware of the employee’s abilities and training them according to their insufficiencies.
It prevents organizations from giving unnecessary training to employees and wasting money and time. Lastly, keeping the employee working data in a pool enables managers to evaluate easily the performance of the employees. HR tools can track the employees’ daily working activities and report the results to the managers.

Thirdly, supply chain and I4.0 have six topics in common (area 3). The most popular one in here is Digital Supply Chain (DSC) topic. With advancing technology supply chains have started to become digital. One of the main requirements of DSC is the digitization of the data in the chain. Once the data is digitized, it allows monitoring of data in real time and creates end-to-end visibility. Visibility is important because it can result in improved operational performance of an SC (Barratt & Oke, 2007). Another research that has done on humanitarian organizations shows that improved visibility across supply chain partners improve the performance as well (Maghsoudi & Pazirandeh, 2016). Everybody in the organization can access the needed data within the used system and this improves transparency of the data. Monitoring the data in real time and saving them in storage help managers to make better decisions. Not only by using the past data, using the fresh data provided improved forecasting because real-time data makes it easier to detect the changes in the demand. More accurate forecasting means that need for lower inventory. Finally, keeping lower inventory results with cost saving.
The figure below visualizes the cause and effect in the above paragraph;

Figure 1: I4.0-HR-SC Venn Diagram

Thomas Group’s combined application of Total Cycle Time (TCT) methodology and real-time inventory control is a real-life industry example of the benefits of real-time data monitoring. After they started applying these systems, warehousing and distribution parts of the business are affected the most by the change. Real-time inventory control and higher data accuracy in the chain resulted in the inventory reduction of $16.5 million. In addition, the net effect of the change was to increase the value of the company to the shareholders by over $200 million (Williams, 1997).

Another benefit of the DSC is enabling the personalized production. Currently, personalizing is getting more important in production. Collected real-time data let
manufacturers realize what the customers want rapidly and like in the forecasting case, finding out the changes rapidly in the demand. This speedup helps organizations to gain a competitive advantage by reacting to the changes and satisfying the customer needs faster with more personalized products. Personalization may seem costly for producers but the automation in production makes it possible for them. For instance, robots those have several parts to produce different products in the same machine is a good example of that issue.

Improving the product reliability is another advantage of real-time data collection. For instance, collecting cars data while the customers are using them may provide essential insights to manufacturers. If any problem occurs in the car, detecting it and sending help to the customer may improve the customer satisfaction. In addition, the problems can be prevented in the future before they happened by detecting the common problems in the cars before the production process by using the collected data from users. Avoiding the problems before they take place will improve the product reliability for customers.

Finally, the intersection of all components (area 4) shows that they have many in common. Most of the subjects in this intersection actually explained in the previous paragraphs that explain the bilateral relationships (area 1, 2, and 3). However, since they are related to all three concepts they have been written in the middle intersection. For instance, how Big Data usage affects SC and HR is in separate intersections but since it is common in all three concepts, they have been placed in the middle intersection.

Since the production processes are getting more automatized, the need of low-skilled people has shifted to need of highly skilled people. While fewer people are needed in the production, need of educated people has risen. This need occurred due to I4.0 and affected both HRM and SCM. To manage the digitalized supply chains HR must recruit the highly skilled employees who can handle the technological complexity of the processes. This change in the needs creates new job positions, for instance in the past there was no need for CIO, but today it's one of the musts in the organizations. Like this example, new needs are occurring especially in the software and computer-related areas. Lack of Information Technology (IT) experts creates trouble to organizations since there won’t be any people to integrate to the newest technological developments (Big Data Analytics) (Kache, & Seuring, 2017). For that reason, exploring the need for new skills is an essential issue.
When HR left the paperwork and use Big Data or newly developed IT tools to operate its activities they start to lower their cost in time. As explained in detail before, using less time and other resources result in save on cost. On the other side, as it can be seen from the Figure 2 above, technology helps SC to lower the costs, too. Not just the cost, also like in the HR, using technology helps SC to operate faster and save time. Addition to savings, the Figure 2 also explains how the decision-making in SC improves with I4.0. In HR, using the reports that the systems created about potential employees might be an example for the improved decision-making process.

Digitization is an important component of I4.0. All the data that is going to be used as system input should be in a digital form. HRM and SCM managers should be aware of these and provide the required data to the systems are in true forms.

Another important component of I4.0 is IoT and Big Data usage. Most of the explanations that have been made above are dependent on data collection. This huge amount of data collection means using Big Data and in I4.0 most of the data is collected via IoT. Sensors and chips on the products bring the information to the manufacturers. To keep all these data cloud technologies has started to be used. Cloud is preferred because of its significant advantages over the physical warehouses. These advantages are: no requirement for up-front investments, lowering operating cost, high scalability, easy access, and reduced business risk and maintenance expense (Zhang, Cheng, & Boutaba, 2010).

Kache et al. identified the opportunities for Big Data Analytics usage in corporate and SC level. Some of them are: “operations efficiency and maintenance, optimized servicing, SC visibility and transparency, optimized talent management and HR, enhanced employee education, improved product traceability, SC inventory optimization, consumer data collection, increased competitive advantage through new business models” (Kache et al., 2017). This proves that most of the components in the Venn diagram are related with Big Data Analytics.

In order to benefit from Big Data, HR managers should hire the skilled employees who can understand what Big Data is and have the ability to apply it through the organization. These employees must know about the data related topics such as collection of the data, securing the data, organizing the data etc. Unfortunately, due to its novelty, companies facing difficulties in finding this “data scientists”. (Kache et al., 2017). In addition to that, even in the matured areas like SCM the required job skills have not been separated from the logistics yet. The difference in the skill set for
an SCM and a logistics manager is still an issue for the organizations (Zinn & Goldsby, 2014). Therefore, HR managers should follow the changes in the needs and specify the required skills. In the heart of all these changes and development explained above, there is the desire for earning a higher profit. It is the main reason for all advancements, that is why it should be at the intersection of all.

2.0 Conclusion

This paper aims to identify the implications of I4.0 to both SCM and HRM by finding out the topics that take place at the intersection of them. Identifying these common concepts helps the readers to realize the expected changes in these two areas due to I4.0 in order to take the necessary steps in advance and make recommendations to catch up the latest trends. The topics covered in the developments of I4.0, such as digitization, IoT, big data, cloud usage etc. cannot be separated from Information Systems discipline. These topics should be discussed by academics from different fields in order to see the big picture. As found in the literature, this study is the first to combine the I4.0, SCM and HRM and urges to lead future works by finding out the intersections of those three areas. One of the main findings of this research is that a change in the labour force qualifications is expected with the advancements in the technology. The need of workers with a higher level of skills will directly affect the HRM in a way of recruiting and managing those people. Another main finding is the advancements in the technology will change the place of production. The supply chains are expected to be influenced by that change. The findings of the study have visualized and the intersections of those topics are explained in order to see what are the future expectations and important developments in those areas.

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ANALYSIS OF ELECTRONIC VOTING SCHEMES IN THE REAL WORLD

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Abstract

Voting is at the heart of a country’s democracy. Assurance in the integrity of the electoral process is pivotal for voters to have any trust in the system. Often, electronic voting schemes proposed in the literature, or even implemented in real world elections do not always consider all issues that may exist in the environment in which they might be deployed.

In this paper, we identify some real-world issues and threats to electronic voting schemes. We then use the threats we have identified to present an analysis of schemes recently used in Australia and Estonia and present recommendations to mitigate threats to such schemes when deployed in an untrustworthy environment.

Keywords: Insider Threat, Authentication, Cyber Threat, Electoral Fraud, Privacy, Trust

1 Introduction

As democracies continue to grow, citizens of a lot of nations, more so in the developing countries, are beginning to clamour for the introduction of electronic voting because they believe the traditional paper based systems are often marred by wide scale electoral fraud

One common issue with e-voting schemes is that the environment assumed during design may not fully consider the threats that exist in real world deployment. Thus, when these schemes are deployed some vulnerabilities may appear that were not considered in the initial threat model.

The voting environment and how voting schemes relate to other parts of the voting process goes a long way in determining which security requirements are necessary and which requirements may be satisfied by default. For example, a remote voting scheme and a supervised in-person voting scheme are two different voting environments and provide different levels of security by default. A supervised voting scheme can provide coercion resistance by being supervised but remote voting schemes do not give such guarantees by
default. Consequently, remote voting schemes need to rely on technical security provided by cryptography.

With electronic voting, voter authentication is an open issue; it can be quite complicated authenticating the voter if done remotely. For example, a spouse may vote on behalf of her partner and there is no way the system can tell the difference. Some e-voting schemes have tried to address this threat by using smartcards (Abandah, Darabkh, Ammari, & Qunsul, 2014; Springall, et al., 2014) as an instance of the voter. If the smartcard is authenticated as done in the Internet voting scheme used in Estonia (Springall, et al., 2014) then the voter is assumed to have been authenticated correctly.

Many voting schemes might work in one environment but might not work in another because of socio-economic factors (such as religion, poverty). These factors may determine how effective the voting schemes would be in such environments. For example, in a world where no one wants to cheat the system, we wouldn’t have to worry about voters being coerced or ballot stuffing.

It is well known that a system is only as secure as the weakest component. In a remote voting environment, while the network and servers are secure, there is no assurance that voter’s computers are secure. In the Estonian I-voting scheme, voter’s computers were assumed to be secure. Subsequently, in a mock election (Springall, et al., 2014), a group of researchers were able to attack voters’ computers and change votes to their choice. So, to have assurance that the entire voting scheme is secure, the voter’s computer needs to be secure as well.

Another common assumption made, is the trust placed on electoral officials. In precinct voting schemes, we trust electoral officials to correctly authenticate voters and prevent double voting (Culnane, Ryan, Steve, & Vanessa, 2015). However, this is not always the case in real world elections where the electoral officials may be part of the fraud (Asunka, Brierley, Golden, Kramon, & Ofosu, 2013).

Hence, to build a secure e-voting scheme, security must be considered at the outset and designed into the system. Security of all software and hardware should be analysed and proved secure if possible, however the level of security also depends on the environment where it is deployed.

In this paper, we identify the security requirements for an e-voting scheme in section 2 and in section 3 we analyse threats that exist in the real world. In section 4 we review two well known voting schemes, the I-voting scheme used in Estonia and the prêt-a-voter scheme used
in Australia, presenting a security analysis of each. We discuss the analysis in section 5 and present our conclusions in section 6.

2 Security Requirements of an Electronic Voting Scheme

Electronic voting is more complicated than other electronic transactions such as e-commerce. Many of the security requirements required for an electronic voting scheme are not necessarily needed in other electronic transactions. Moreover, electronic voting has conflicting security requirements which are difficult to resolve, for example verifiability and receipt-freeness (Chevallier-Mames, Fouque P, Pointcheval, Stern, & Traoré, 2010)

Most security requirements for e-voting also apply to traditional paper based voting. However, universal verifiability is not satisfied in traditional paper based schemes. Based on an analysis of the literature (Schoenmakers, 1999; Delaune, Kremer, & Ryan, 2006; Jan, Chen, & Lin, 2001; Karr & Wang, 1999; Fujioka, Okamoto, & Ohta, 1993; Benaloh & Tuinstra, 1994; Cramer, Franklin, Schoenmakers, & Yung, 1996; Anane, Freeland, & Theodoropoulos, 2007; Burmester & Magkos, 2003) the following describes what we believe should be the main security requirements an electronic voting scheme.

- **Coercion Resistance**: a coercion resistant scheme prevents a coercer from forcing voters to reveal their ballot.

- **Receipt freeness**: this property ensures that a voter doesn’t get any information that could be used to prove to anyone how he voted. This requirement helps to check vote buying and selling.

- **Individual verifiability**: this property implies that a voter is able to confirm that their vote was cast as intended.

- **Universal Verifiability**: in a universal verifiable scheme, anyone can confirm that votes have been recorded as cast and counted as cast.

- **Privacy**: This requires that the identity of the voter is not revealed. Thus, from a vote cast, it should be impossible to identify the voter. This is closely linked with, but different from, anonymity which is the unlinkability between the voter’s identity and the vote cast. This requirement gives e-voting the ballot secrecy achieved using ballot boxes in traditional paper based elections.
ANALYSIS OF ELECTRONIC VOTING SCHEMES IN THE REAL WORLD

- **Democracy**: An electronic voting scheme should ensure only eligible voters can vote and they cannot cast multiple votes.
- **Robustness**: A robust scheme should be resilient to external attacks such as denial of service attacks; should prevent inclusion of votes by corrupt parties for abstained voters; and should be able to recover from any faulty behavior due to collusion by malicious parties.

2.1 Types of Electronic Voting

Electronic voting is the communication of votes by electronic means using electronic devices. Voting can either be done remotely via the Internet (Internet Voting) or by using a voting machine at a precinct which is usually referred to as supervised voting scheme. Supervised e-voting schemes are like traditional voting schemes because they make use of voting kiosks and are supervised by polling officials. If voting is done remotely or in a voting kiosk, it could determine the security requirements satisfied by default. In a supervised environment, polling officers are meant to prevent coercion of voters. In a remote setup, schemes try to provide coercion resistance by allowing re-voting as seen in the I-voting in Estonia (Springall, et al., 2014). This allows voters to vote manually which supersedes an electronic vote (Springall, et al., 2014) and overrides the use of credentials/votes used by a coercer (Clarkson, Chong, & Myers, 2008).

3 Threat Analysis in Real World Voting Schemes

In this section, we consider issues that may affect the integrity of elections in real world implementations if not included during the design phase of e-voting schemes.

3.1 Socio-economic Issues

It has been documented that vote buying and vote selling is very prevalent in real world electronic voting. In Mexico, voters were so suspicious about the integrity of elections because of the electoral fraud committed by parties (Domínguez & James, 1998). Such fraud relied on many techniques including ballot stuffing by both voters and electoral officials; stealing of ballot boxes between the polling units and collation centres; intimidation of voters, observers and party officials; and manipulating voter’s registration lists (Ferree, Gibson, &
ANALYSIS OF ELECTRONIC VOTING SCHEMES IN THE REAL WORLD


Vote buying, selling and coercion is common practice in elections. In an analysis done in Taiwan (Nichter S., 2014) as little as $10 was paid to voters to sell their votes. This is not surprising because of the economic situation in many countries, and vote buyers usually target poor voters. In the USA five Democratic Party Operatives were convicted in a federal court in 2004 for offering poor people cigarettes, medicine, beer and $5 to $10 dollars for their votes (Nichter S., 2008).

In other cases, electoral officials are part of this electoral fraud. A report about the 2012 elections in Ghana recorded issues like double voting, under age voting, over voting and voting by ineligible individuals (Asunka, Brierley, Golden, Kramon, & Ofosu, 2013). This was possible because the poll-site officials were trusted to prevent this. These issues are difficult to address solely by human supervision because the trusted polling officials are sometimes part of the fraud, usually for financial gain.

Voting schemes cannot prevent all forms of electoral fraud since there is always a financial incentive to cheat the system due to socio-economic challenges. However, design of voting schemes should take these threats into account and leverage on technical security wherever possible to ensure that any deliberate attempt to circumvent the technology is detected.

3.2 Insider Threat

According to (Schneier, 2009) “Insiders are especially pernicious attackers because they're trusted. They have access because they're supposed to have access. They have opportunity, and an understanding of the system, because they use it or they designed, built, or installed it. They're already inside the security system, making them much harder to defend against.” The UK Cyber strategy also notes that “Computer systems, networks and applications all rely upon people for their development, delivery, operation and protection and the likely success of an attack is increased when a so-called ‘insider’ is involved” (Cabinet Office, 2009).

The insider threat is a well-documented issue and one of the biggest threats to organizations. About 53% of attacks on organization have been deliberate actions or negligence by staff. 54% of IT staff feel it is difficult to detect insider threats while 33% of organization have no formal response plan (Cole, 2014).
Attackers have realized that it is difficult to attack secure networks, so they find easier routes, like targeting individuals that work in organizations. An example is the 2011 attack on RSA secureID where phishing emails with an attachment that contained malware was sent to a group of unsuspecting employees who downloaded the files allowing the attackers to gain access to the network\(^1\).

In e-voting literature, the insider threat and how it could mar an election is not often considered. Instead some schemes assume electoral officials can be trusted to carry out vital functions such as authentication (Springall, et al., 2014) of voters or transfer of sensitive information from one entity (i.e. a server) to another (Culnane, Ryan, Steve, & Vanessa, 2015). This could have been done more securely by technology. This trust in human procedures and processes over technology is an assumption in the I-voting scheme and prêt-a-voter.

In an analysis of the electoral process in Estonia (Springall, et al., 2014), researchers recorded various lapses in procedures which introduced vulnerabilities that could be exploited. The financial benefits for malicious insiders is enough incentive for them to either aid an attack or look the other way when this happens.

With vulnerable electoral officials, it is important to ensure that the technical security employed in voting schemes should reduce threats posed by insiders. Hence, auditability of the process and verifiability of votes cast should be satisfied for a voting scheme to be credible.

In section 4 we do an analysis of the vVote: a verifiable voting scheme (Prêt-a-voter) and I-voting scheme to shed more light on this issue.

3.3 Cyberthreat and Foreign Government Influence

Cyber threat and cyber warfare has become a serious issue that organizations and governments are dealing with. There have been various reported cases of state sponsored attacks like the alleged North Korean attack on Sony\(^2\) or alleged United States attack on Iranian nuclear enrichment plant (Langner, 2001). Increasingly we continue to see allegations of foreign government influence in the democratic processes of other nations.

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\(^1\) http://www.eweek.com/c/a/Security/RSAs-SecurID-Breach-Started-with-Phishing-Email-318649

\(^2\) http://www.ft.com/cms/s/0/287beee4-96a2-11e4-a83c-00144feabd0c.html#axzz3h4p5qypf
In addition to the current controversy surrounding recent elections in the USA, it has been alleged that Russia carried out a state sponsored Distributed Denial of Service (DDoS) attack on Estonia in 2007. In Hong Kong, the largest and most sophisticated ever DDoS attack hit an online democracy poll that canvassed opinions for future elections in the country. Also, in Ukraine a virus that was meant to delete votes during the presidential elections hit their Central Election Authority.

In Washington DC, an Internet voting system was designed to allow overseas absentee voters cast their votes, this was a pilot project and it was tested as a mock election in 2010. Some researchers (Wolchok, Wustrow, Isabel, & Halderman, 2012) attacked this system and gained full access within 48 hours, changing every vote and revealing almost all secret ballots.

These Cyber-attacks have created a completely different threat environment that did not exist before, and now that nations are pushing for e-voting this should be considered when designing e-voting schemes.

In the literature, many schemes don’t consider the threat of a cyber-attack. In the I-voting scheme used in Estonia, lapses were shown in the electoral process and architecture that could create avenue for a cyber-attack (Springall, et al., 2014). The implicit trust placed on voters’ computers in some Internet voting schemes clearly shows that cyber threat was not considered in their design.

### 3.4 Threat Model

Based on the review in the previous section and sections 4.3 and 4.4 we present a threat model in Table 1 and make some assumptions about the attacker. We do not consider all the threats that exist in e-voting, only threats we believe are most important.

<table>
<thead>
<tr>
<th>Threat</th>
<th>Vulnerability</th>
<th>Impact</th>
<th>Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poll-site</td>
<td>Trust placed on poll-site officials to authenticate</td>
<td>Votes are cast for abstained voters without being</td>
<td>Pret-a-voter</td>
</tr>
<tr>
<td>officials</td>
<td>officials to authenticate voters using traditional</td>
<td>detected by the</td>
<td></td>
</tr>
</tbody>
</table>

---

4. [http://www.theregister.co.uk/2014/06/23/most_sophisticated_ddos_strikes_hk_democracy_poll/](http://www.theregister.co.uk/2014/06/23/most_sophisticated_ddos_strikes_hk_democracy_poll/)
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Vandalization Effect</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vote on behalf of abstained voters.</td>
<td>System and could change the outcome of the election.</td>
<td></td>
</tr>
<tr>
<td>An attacker can stuff the ballot without being detected.</td>
<td>Double voting by legitimate voters. Ballot stuffing by poll-site officials without being detected and could change the election outcome.</td>
<td>Pret-a-voter</td>
</tr>
<tr>
<td>Poll-site officials can allow ineligible voting</td>
<td>Ineligible people can cast ballots undetected by the system, compromising election integrity</td>
<td>Pret-a-voter</td>
</tr>
<tr>
<td>An attacker can install a vote altering or data stealing malware in election servers and voter’s computers.</td>
<td>Attacker alters votes to that of his choosing without being detected. Spyware monitors how voters voted, breaking ballot secrecy and could enforce voter coercion.</td>
<td>I-Voting</td>
</tr>
<tr>
<td>Vote selling to coercers by voters.</td>
<td>Voter can leave poll-site with candidate list and show a third party there by breaking privacy, receipt-freeness and coercion resistance.</td>
<td>Pret-a-voter</td>
</tr>
</tbody>
</table>
3.4.1 Capability of the Attacker

In this section, we make some assumptions about the attacker based on our threat model:

- An attacker can either be an insider or an outsider.
- An attacker may be motivated by financial incentives to cheat the electoral process.
- A voter may be motivated by financial incentives to cheat the electoral process.
- We assume that an attacker has the following capabilities:
  1. An attacker can stuff the ballot box without being detected.
  2. An attacker can vote on behalf of an abstained voter or allow ineligible voting.
  3. An attacker has adequate resources to carry out a DDoS attack.
  4. An attacker can tell the link between a voter’s id and the cast ballot.
  5. An attacker can install vote altering, or data stealing malware in election servers and voters’ computers.

4 Electronic Voting Scheme

In the previous section we identified threats to e-voting schemes in the real world. In this section, we now review two electronic voting schemes in the light of the threats and requirements discussed earlier.

4.1 vVote: A Voter Verifiable Voting Scheme (Prêt-a-voter)

The prêt-a-voter voting scheme is an end-to-end verifiable scheme that provides privacy. It uses a candidate list which is printed on demand before voting. This candidate list has the names of candidates arranged in a random order. The voter can audit this candidate list to confirm that it has the correct encryption of the random arrangement of the candidates. If this audit is done, the candidate list is decrypted and hence cannot be used to cast a vote to maintain the secrecy of the ballot (Burton, Culnane, & Schneider, 2015). A QR code of the candidate list is scanned into a tablet and this launches the vote capture application. The voter...
fills the ballot using the tablet. After completing the ballot, a preference receipt (PR) is printed. The voter can compare the candidate list with the preference receipt to confirm that they are both arranged in the same order, this gives the voter assurance that his vote has been cast as intended. The candidate list is expected to be destroyed after confirmation, to maintain ballot secrecy while the preference receipt is kept by the voter. At the end of the elections, a voter uses the preference receipt to confirm that his vote has been published on a Web bulletin board at the final tally. This gives voters assurance that their votes have been recorded as cast (Burton, Culnane, & Schneider, 2015). Further details could be found in the draft report (Culnane, Ryan, Steve, & Vanessa, 2015).

4.2 Estonia Internet Voting System (I-voting)

Over 30% of votes cast in elections done in Estonia today are done electronically this makes Estonia one of the front runners in the use of electronic voting for elections and the first country to use Internet voting nationally (Springall, et al., 2014). Estonia has a national ID card which has cryptographic keys issued by the government which are used to authenticate voters during election. The scheme attempts to replicate the double envelope process used in postal voting. A digital signature is generated with the voter’s signing key and this is used to provide the voter’s identity (outer envelope). The system’s public encryption key is used to encrypt the ballot to provide secrecy (the inner envelope). The signature is stripped from the ballot leaving a set of anonymous encrypted votes once the eligibility of all voters has been established. These anonymous votes are then transferred to a physically separate vote counting server connected to a hardware security module for decryption.

The Estonian voting system uses a vote forwarding server which is the only publicly accessible server. This server communicates with the client software and forwards vote to a vote storage server. Votes are copied using DVDs to the vote counting server by electoral officials. The vote counting server is not connected to any server. The Estonian Internet voting system is not end-to-end verifiable and much of security it provides relies on human procedures rather than technical means thereby placing lot of trust on electoral officials. Further details about how this voting scheme really works can be found in (Heiberg & Willemsen, 2014, Springall, et al., 2014).
4.3 Security Analysis of vVote: A Verifiable Voting Scheme (Prêt-a-voter)

Prêt-a-voter, used in Australia, relies on traditional means to validate eligibility (Democracy see section 2). If this scheme is to be adopted in other environments, this may not work since part of the reason why nations clamour for electronic voting is the inadequacies of traditional means of authenticating voters. As stated in our threat model, relying on poll-site officials to authenticate voters could leave the system vulnerable to ineligible voting. This risk could be mitigated using Photo ID but cannot be eliminated by this approach alone especially if the polling officials are untrustworthy.

This scheme expects voters to destroy the human readable candidate’s list after casting their votes, this puts a huge level of trust on voters to do this. Privacy is an important requirement of e-voting as well as receipt freeness which helps to mitigate vote buying, vote selling and voter coercion. If voters fail to destroy this human readable part, which isn’t unthinkable considering the socio-economic challenges (Section 3.1), then this scheme would not provide privacy. Because with this candidate list you can make a link between the candidates and vote cast published on the bulletin board as highlighted in our threat model is section 3.4.

Furthermore, with the candidate list, voters have proof to show a vote buyer or a coercer. Thus, this scheme would fail to provide coercion resistance (section 2) and gives voters the opportunity to sell their votes to vote buyers.

Ballot stuffing, double voting and voting in place of abstained voters could go a long way in determining who wins an election and has been reported in several elections, an example is the 2012 national elections held in Ghana (Asunka, Brierley, Golden, Kramon, & Ofosu, 2013).

The prêt-a-voter scheme is as vulnerable to corrupt official as traditional schemes and this needs to be mitigated using technical means. A corrupt official could vote for an abstaining voter and this wouldn’t be detected by the system because of unlinkability between voter and the ballot cast; and lack of technical means for authentication. Schemes like the I-voting in Estonia solve this problem by using a smartcard which is an instance of the voter. This link prevents corrupt officials from voting for abstained voters without physically having their smartcards. Prêt-a-voter system is meant to be end-to-end verifiable but the attacks mentioned cannot be detected by the system and represent a big risk to take in certain environments. Hence, considering insider threats and socio-economic issues like poverty, prêt-a-voter may not offer any better security than traditional schemes.
However, prêt-a-voter would improve efficiency and minimize human errors in the vote counting process and if we could guarantee that the electoral officials and voters are trustworthy then it may well satisfy its security claims but this is easier said than done in the real world.

In conclusion, prêt-a-voter is vulnerable to breach of privacy, vote buying and selling since achieving receipt-freeness relies on voters being trustworthy, ballot stuffing, ineligible voting is possible if trust assumptions are broken.

4.4 Analysis of Estonian Internet Voting Scheme

A group of researchers observed the Estonian elections and produced a report which showed lapses in the electoral process that could undermine the integrity of the election. One of the issues raised was the use of procedural means over more technical means to provide security. A high degree of trust, as seen in prêt-a-voter system, was placed on electoral officials, making security critical aspects of the system rely on, sometimes, a single individual. Trust was also placed on the integrity of voters’ computers as well as the various servers used. We will consider some of these lapses to support our argument but a full report on this election can be found in (Springall, et al., 2014).

Contrary to security best practices electoral officials logged on to servers using root access. This is a major lapse because the system cannot tell which official accessed it. This creates an opportunity for a malicious insider to carry out attacks such as installing malware that could alter votes between decryption and tabulation, or stealing information that could compromise vote privacy as highlighted in our threat model in section 3.4.

It was also observed that the vote storage server reported an error suggesting that the drive configuration had changed when it was booting during the tabulation phase. Instead of the officials investigating this error, it was simply bypassed in this critical phase of the election where encrypted votes are exported. In other instances, servers were simply rebooted to clear error messages rather than troubleshooting. If these errors were caused by malware, the officials would not have noticed. And since the system is not end-to-end verifiable, voters and auditors cannot tell if votes are counted as cast in the final tally.

It was also documented that officials downloaded client software using an unsecure http connection. This makes the system vulnerable to a network man-in-the-middle attack which could compromise the election. Unclean laptops that had links to gambling sites and bit
torrents installed were used to prepare client software distributed to the public, this could introduce malware into voter’s computers (section 3.4) on a large scale. Most attacks on organizations are carried out because unsuspecting insiders are targets of cyber attackers. So even if the electoral officials are not genuinely part of the electoral fraud, their actions as have just been highlighted leaves the electoral process vulnerable to attacks.

In the Estonian system, a voter can verify with an application (Springall, et al., 2014) that their vote was cast as intended. However, with the increasing interaction between smart phones and computers it is not difficult to imagine that both devices can be corrupted making it difficult for the voter to notice that their votes have been altered.

In the tabulation phase, it was also reported that a technical glitch occurred and an official’s personal flash drive, that contained other personal files, was used to copy unencrypted votes to a laptop connected to the internet where the official result was signed. If this USB contained malware, this would mean the votes could have been altered without detection. Furthermore, the flash drive could have introduced malware to the counting server, this malware could be a spyware which could have the ability to monitor the decryption process and hence know the relationship between a voter and a ballot- breaching voter’s privacy. These possibilities were identified in our threat model in section 3.4.

From the published portions of the I-voting server software the researchers found out that the log server, which logs information from the vote forwarding and vote storage servers, saved any unexpected data to disk. If this storage gets exhausted voting would stop allowing a denial of service attack Such an attack is well within the means of the state sponsored attacker or even a modest attacker with adequate resources (section 3.4) depending on the size of the disk. Furthermore, storing of unexpected data means the system is vulnerable to other attacks.

In conclusion, we can see that this scheme is vulnerable to many attacks such as DDoS, breach of privacy, and vote alteration. Some of these attacks are possible because the scheme is not universally verifiable (section 2) and trust was placed on human procedures and processes rather than technical security.

5 Discussion

It is clear that while existing e-voting schemes may be secure in benign environments, their adoption for use in untrustworthy environments presents a number of risks. In section 3, we
ANALYSIS OF ELECTRONIC VOTING SCHEMES IN THE REAL WORLD

identified the threats to e-voting schemes and how these could impact security. In this section, we do a further analysis on the schemes considered in section 4, highlighting the motivation for the attacker, vulnerabilities that could be exploited and some ways to mitigate the threats.

**Authentication:** In the prêt-a-voter scheme, we have shown that trust placed on electoral officials may allow ineligible voters vote, over voting and voting on behalf of abstained voters. These vulnerabilities could be prevented by the introduction of a tamper-resistant token, such as a smartcard which is difficult to clone. With smartcards voters can be authenticated correctly preventing ineligible voters from voting. Such a device could also sign ballots ensuring linkability between the voter’s id and cast ballot. Linkability would ensure officials cannot vote for absent voters without the smartcard in their possession, preventing ballot stuffing.

However, the use of smartcards comes at an extra cost and the added advantage of introducing a smartcard may not be justified. The Estonian National ID card which has cryptographic keys for both authentication and digital signature adequately addresses the issue of ballot stuffing and voter’s authentication. There also exist other electronic voting schemes that use smartcards for authentication of voters (Langner, 2001), prevention of double voting and impersonation of abstained voters (Abandah, Darabkh, Ammari, & Qunsul, 2014).

**Incentives:** In the prêt-a-voter scheme, the trust placed on voters creates an opportunity for vote buying, vote selling and coercion because of the possibility of voters carrying the human readable candidate list out of the polling booths. This means receipt-freeness, which underpins privacy and coercion-resistance, relies on voters who may not always be trustworthy. We have shown that considering the socio-economic issues in societies, there is an incentive for voters and electoral officials to partake in corrupt electoral practices. In many environments, a voting system cannot rely solely on trustworthy voters or electoral officials but should rather rely on technical measures for security sensitive processes.

In the I-voting scheme, the procedural lapses highlighted in section 4.4 creates an avenue for a malicious insider to infect voter’s computers on a large scale. Personal devices should not
be used to prepare client software sent to voters. Special purpose laptops or PCs dedicated to this task should be used. Moreover, the integrity of any software should be checked at intervals to ensure that the client software has not been tampered with.

**Verifiability:** The I-voting scheme places trust on the voter’s client machine. Malware can be introduced to the system by taking advantage of procedural lapses highlighted in section 4.4 above. This kind of attack would go unnoticed by voters and auditors because the scheme is not end-to-end verifiable (verifiability section 2). Trust was placed on the voter’s client machine, human process and procedures to prevent this. Our argument is that such trust is misplaced, thus verifiability is difficult to guarantee.

Further attacks on the I-voting system were carried out on both the client side and server side affecting ballot secrecy and voter’s privacy (Springall, et al., 2014). The prêt-a-voter scheme, however, is end-to-end verifiable from vote casting to the final count and tallying of results. Any vote alteration would be detected both by voters and third parties because this scheme relies on sound security practices to provide verifiability rather than relying on human processes and procedures.

**Cyber Attacks:** We have shown that Cyber-attacks by well-resourced attackers or state sponsored attackers are a threat to electronic voting which did not exist in traditional paper based schemes. The DoS attack that could stop voting in the I-voting scheme by exploiting data logging (see section 4.4) can be prevented by ensuring proper validation of input data. Furthermore, the use of unclean laptops to prepare client software sent out to voters creates an avenue for wide scale malware infection of voters’ computers. This kind of vulnerability could leave the entire e-voting process vulnerable to a full scale cyber-attack. In the prêt-a-voter scheme the voting is done in a more controlled environment since elections are done in a precinct and all the equipment used are under the control of the electoral authorities.

**Technical Security vs Human Procedures and Processes:** Many technical solutions to ID verification rely on PINs or passwords. These may be stolen, or shared. Alternatively, a physical token could be issued that generates temporary passwords or PINs. This gives an extra level of security because even if PINs have been compromised an attacker would still require a physical token to make use of that information. We argue that the cost of issuing
such tokens may be justified depending on the environment where the e-voting scheme is deployed.

We have shown from both schemes analysed, that the part of the scheme where technical means are used to provide security and the kind of trust assumptions made could determine which security requirements would be satisfied. In the prêt-a-voter scheme, from vote casting to the final vote tallying is end-to-end verifiable but the Estonian Internet Voting scheme is not.

This gap in technical verifiability between authentication and vote casting in prêt-a-voter, and in the I-voting scheme between vote casting and vote tallying, introduces weakness which could be exploited by an attacker as discussed in sections 4.3 and 4.4.

In the prêt-a-voter scheme authentication was undertaken by traditional means since it is a supervised scheme, this is a sharp contrast from the I-voting scheme which used a smartcard to authenticate voters. The lack of technical authentication in pret-a-voter creates the opportunity for electoral officials to cheat the system as discussed in section 4.3 without being detected.

On the other hand, the trust placed on voters to destroy the human readable part of the prêt-a-voter ballot form used to verify votes are cast as intended, creates another vulnerability that could be exploited by voters to break ballot secrecy and sell votes. In the I-voting scheme, a verification app on a smart phone is used to check that votes have been cast as intended. However, in this scheme, a coercer can watch a voter while voting. This could be mitigated by a re-voting option to override any coerced vote. In cases where the voter is corrupt, no technology can prevent the voter from selling votes or allowing someone vote in his stead because this scheme is not supervised.

In conclusion, both e-voting schemes reviewed have advantages and disadvantages in terms of meeting the requirements for a secure e-voting scheme. However, neither scheme is able to meet all requirements. In particular, we have identified two issues that need to be addressed if e-voting schemes are to be used in untrustworthy environments. Firstly, methods to mitigate
threats posed by insiders are required; and secondly robust methods to authenticate the voter needs to be addressed. These issues need to be considered in any practical implementation of voting schemes if they are to be widely deployed.

6 Conclusion

Electronic voting systems are beginning to move from the lab to be deployed in the real world. Such systems have many potential benefits, however, at this stage there are some impediments that may leave the systems vulnerable in an untrustworthy environment.

In section 2 we presented a set of requirements that, if met, will overcome these impediments. We used these requirements to analyse two e-voting schemes that have recently been used in real elections and to consider how they would fare in an untrustworthy environment. Based on our analysis these schemes we saw the difficulty in preventing coercion resistance, vote buying and vote selling in the remote voting scheme – since a voter can be monitored whilst voting, or voted on behalf of. And with supervised voting schemes, we cannot always rely on traditional means and electoral officials to adequately authenticate voters.

We argue that in order to be deployed in less benign environments, e-voting schemes should be end-to-end verifiable right from authentication of voters to the tallying of votes. Fewer trust assumptions need to be made and less trust placed on voters, electoral officials and observers.

We appreciate that it is highly unlikely that voting schemes would completely eliminate human procedures and processes since security cannot be achieved by technology alone. However, we argue that where security could be provided by technological means, then this should be leveraged wherever possible in the electoral process.

We are currently investigating the use of smartcards and biometrics for authentication in supervised electronic voting schemes and the cost implications. We are also looking at end-to-end verifiable schemes using mix-networks to provide anonymity. We will also be investigating a means of providing individual verifiability whilst still satisfying receipt-freeness.
References


TITLE: FACTORS THAT AFFECT THE ACCEPTANCE OF NEW TECHNOLOGIES IN THE WORKPLACE: A CROSS CASE ANALYSIS BETWEEN UK AND HONG KONG

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Abstract
The introduction of a new IT application within an organisation represents change, and the acceptance of such change starts with the individual end users since they are the ones that often resist the newly introduced IT. This research identifies the factors that affect the acceptance of new technologies in the workplace in order to understand better how end-users can influence the successful introduction of IT in academic institutions. We use one Higher Education Institution (HEI) in Hong Kong and one HEI in the UK in order to gather our data and cross analyse the differences between the two countries. Our research shows that the staff at both universities have a high Behavioral Intention (BI) to use new technologies. However, there is no significant difference between the two universities, which means that although there is a general difference in the Hofstede’s cultural dimension scores between the two populations, these dimensions have no effect on the staff who works at these universities.

Keywords: technology acceptance, workplace, cross case analysis

1.0 Introduction
The introduction of new technology in an organisation provides a number of benefits such as sustainable competitive advantage, lower production and labour costs. This in turn adds value to products and services, and generally improves the business processes (Nguyen, Newby and Macaulay 2013). Technological changes are often driven by either an emphasis on improving
efficiency and business expansion, or a pressure to meet certain requirements from customers and industry standards (Nguyen, 2009). Nguyen et al (2013) referred to these drivers as part of an innovation decision process, where management and organisations assess the advantages and disadvantages of adopting the new technology.

According to Arasteh, et al. (2011), Information Technology (IT) on the one hand facilitates fast communication in organisations and on the other it automates business processes. They also state that technology reduces user’s task through computerisation processes and allows the users to do their task differently. However, introducing new technologies in companies is not a straightforward task and companies often face a lot of resistance during the adoption of new systems. These challenges in the usage of IT in organisations have led to the investigation of how different individuals interact with the new technology in their work environment. This research will look into the factors that influence the acceptance of IT in academic institutions.

As Aubert et al (2008) argue the benefits from a new technology are not gained if organisations experience low utilisation by the intended users. Research (Lippert and Davis 2006; Sharma, 2013; Kim and Kankanhalli, 2009) suggests that when introducing new technologies, the acceptance of change starts within the individuals and this can be affected by the way they perceive how the new applications would affect their job performance. Also, Hidayanto and Ekawati (2010) concluded that the success of implementation would depend on user acceptance and use of the technology in an organisation. A major aspect of this research is to identify the various factors that affect the acceptance of new technologies in order to understand better how end-users can influence the successful introduction of IT in academic institutions.

Therefore, the main aim of this research is to investigate the factors that affect the acceptance of new technologies in a workplace by individual users. We are planning to use one Higher Education Institution (HEI) in Hong Kong and one HEI in the UK in order to gather our data. The main objectives of our research are:

- Examine the factors that influence IT acceptance in organisations
- Investigate an individual’s attitude to IT

The paper is structured as follows. The literature discusses IT acceptance factors with a focus on aspects related to the role of individuals in technological change. The theoretical model and the hypothesis are also presented. The methodology section explains the methodology
that this study employs. Then the findings and discussion are discussed while the conclusion part summarises the main aspects of this research.

2.0 Literature

The introduction of a new IT application within an organisation represents change, and the acceptance of such change starts with the individual end users because they are the ones that may resist the newly introduced IT, due to fear of uncertainty or the complexity of the technology (Jiang, Muhanna and Klein, 2000; Davis, 1993). This may be as a result of fear of losing their job(s), and the fear that the new application may be difficult to learn. Resistance to new IT applications is viewed as the opposition of individuals to change, which is associated with the new technology implementation (Sharma, 2013; Kim and Kankanhalli, 2009). Therefore user acceptance is an important factor to consider in IT adoption, implementation and usage within the organisation because its usage will be determined by the level of user acceptance of the newly introduced IT (Lippert and Davis, 2006; Agarwal and Karahanna, 2000).

IT acceptance research has been built on theories, such as the Theory of Planned Behavior (TPB) (Taylor and Todd, 1995; Ajzen, 1985) and the Technology Acceptance Model (TAM) (Davis, 1989; Davis, Bangozi and Warshaw, 1989) in an effort to capture the individual acceptance and use of information technology in organisations. The common features among these models are the individual beliefs or perceptions towards the new technology, which influences their actual usage behavior (Agarwal and Karahanna, 2000).

In particular, the TAM model was designed to predict the acceptance of technology usage and also to examine individual user’s reaction towards a new application (Davis, 1993; Davis, Bangozi and Warshaw, 1989). More specifically, TAM predicts two factors, which affect individual usage behaviour, namely the perceived usefulness (PU) and the perceived ease of use (PEOU). PU refers to the situation where using a particular system enhances individual job performance whilst the PEOU represents when using a particular system by an individual is free of effort (Davis 1989; Davis, Bangozi and Warshaw, 1989). Individual beliefs influence attitudes towards the behavior, and the behavioral intention in turn influences the actual behavior to use the new technology within the organisation (Davis, Bangozi and Warshaw, 1989).

Though the TAM model is widely used in the IT literature, it has also been widely criticised by researchers. There are claims that the TAM theory lacks predictive power and lacks practical values (Chuttur, 2009). The TAM model was also criticised because it lacks the
adaptive nature in an IT changing environment and ignores the social influence in the IT implementation process (Bagozzi, 2007).

According to Burton-Jones and Hubona’s (2005) study the original TAM belief construct such as PU and PEOU remains an important predictor in capturing individual system users acceptance. However, they claim that the two constructs remain incomplete predictors of systems usage behavior because they suggest self-identity and habits to impact individual intentions. Burton-Jones and Hubona (2005) point out that self-identity represents an important driver of behavior and therefore refers to it as individual conception of the self, which determines whether his behavior is consistent. While habits represent a consistent behavior and state that individuals behaviors are habitual in nature, their findings therefore suggested that individual acceptance and usage of technology can only be predicted with individual difference variables and these include staff seniority, age and education level.

Similarly, Bagozzi (2007) claimed that the TAM model failed to consider the importance of group, social and cultural aspects of technology acceptance. He emphasized that people do not act in isolation; rather they live in social environment where they relate with other peers, parents, members and other group. The group norms are also important aspect in technology acceptance as well as the individual differences between cultures. He further highlights that individuals from different cultures would react differently towards technology in terms of their individual emotions, motivations and cognitive (self-awareness of group membership) processes. He considers group, culture and social aspects of technology to be integrated in explaining individual decisions towards new technology.

This research takes into consideration the cultural and social aspects by looking into the differences between Hong Kong and UK by using Hofstede’s cultural dimensions. According to Hofstede and Hofstede (2011), the culture of a country can be measured in five dimensions, namely, Power Distance, Individualism, Masculinity, Uncertainty Avoidance, and Long-Term Orientation. The difference between Hong Kong and the UK are the biggest in the Power Distance and Individualism dimensions.

In the Power Distance dimension, the scores for Hong Kong and the UK are 68 and 35 respectively (Itim International, 2017). Power Distance refers to the extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally (Hofstede and Hofstede, 2011). The much higher score means that people in Hong Kong believe that inequalities are acceptable and that individuals are influenced by formal authority, in contrast with the people in the UK. In terms of technology
acceptance, it means it is possible that if an employee in Hong Kong sees that their supervisors use a new technology, they are more likely to accept the same new technology.

In the Individualism dimension, the scores for Hong Kong and the UK are 25 and 89 respectively (Itim International, 2017). The low score of 25 for Hong Kong means it has a collectivist culture in which people prefer to maintain a harmonious relationship in a group and avoid conflicts. This can be described as personal relationships prevailing over tasks and company. In terms of technology acceptance, it means it is possible that if an employee in Hong Kong will not adopt a technology that may upset the relationship with their colleagues, even if that employee may consider the technology as better for the task. These differences may play an important role in the adoption of technology in the respective societies. Therefore, there is a need to investigate the role of cross-cultural differences in adoption of new technologies and this research will cross analyse the findings in HK and the UK.

Furthermore, in order to overcome some of the shortcomings of TAM, Venkatesh et al. (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT) model and identified various determinants such as behavioral intention to use IT (social influence, performance expectancy and effort expectancy), technology use (facilitating conditions and behavioral intention), and the contingencies (age, gender, voluntariness and experience). The study suggests behavioral intention determined by performance expectancy and the effect of behavioral intention to vary across individual characteristics such as age and gender. Effort expectancy on the other hand expected behavioral intention to vary across individual characteristics such as age and gender and to exact effect on different individual experience. Social influence was found to influence behavioral intention. This was contingent on individual characteristics such as age, gender, voluntariness and experience. The facilitating condition, such as the technical and organisation support to influence the behavioral intention on technology use, was also moderated by age and experience (Venkatesh and Zhang, 2010; Wong et al. 2013).

Venkatesh and Zhang (2010) examined technology adoption in two different cultures and integrated the UTAUT model to capture the employees’ similarities and differences between U.S and China. Findings revealed that culture plays an important role in IT adoption between the two countries. This finding was due to the role of social influence, which varies across the two countries. We will further investigate the differences between UK and HK.

As a result of the importance of the acceptance of IT in organisations by individual end users, this research will further examine the factors that affect the successful IT acceptance in
academic institutions. The acceptance of IT remains a critical factor to any organisation’s effort to initiate change because technology has the attributes to facilitate organisational change, which is driven by changes to implement new IT capabilities in an organisational setting.

The research framework is composed of five hypotheses, presented in Figure 1.

![Research Framework Diagram]

**Figure 1: Research Framework**

**Hypothesis 1:** Performance expectancy has a positive association with the Behavioral Intention to adopt new technologies in workplace.

**Hypothesis 2:** Effort expectancy has a positive association with the Behavioral Intention to adopt new technologies in workplace.

**Hypothesis 3:** Social influence has a positive association with the Behavioral Intention to adopt new technologies in workplace.

**Hypothesis 4:** Facilitating conditions has a positive association with the Behavioral Intention to adopt new technologies in workplace.

**Hypothesis 5:** The intention to adopt new technologies in workplace positively affects the actual adoption of new technologies in workplace.

### 3.0 Methodology

#### 3.1 Measurement instruments

A set of measurement items in respect of technology adoption, workplace technology and the UTAUT model were adapted to the specific context of this study on the acceptance of new technologies in the workplace (Escobar-Rodríguez and Carvajal-Trujillo, 2014; Kijsanayotin, Pannarunothai and Speedie, 2009; Oye, Iahad and Rahim, 2014; Raman et al., 2014; Williams, Rana and Dwivedi, 2015; Yueh, Lu and Lin, 2016). As exhibited in the previous
section, there are in total six constructs, namely Performance Expectancy (4 items), Effort Expectancy (4 items), Social Influence (4 items), Facilitating Conditions (4 items), Behavioral Intention (3 items) and Use behavior. Also, a part was designed to collect the demographic details of respondents. Except Use Behavior, each item was measured by a 5-point Likert scale, anchored by 1 (strongly disagree) and 5 (strongly agree). Aligned with prior studies (Behrend, Wiebe, London and Johnson, 2011; Im, Hong and Kang, 2011), Use Behavior was measured by a 9-point Likert scale (have not used, once a year, once in six months, once in three months, once a month, once a week, once in 4–5 days, once in 2–3 days, almost every day). A pilot study was conducted to test the validity of the questionnaire.

3.2 Sampling and data collection
This study aims at providing insights on the acceptance of new technologies between two regions. Therefore, two universities (one from United Kingdom and one from Hong Kong, China) were invited to participate in this survey. The finalized questionnaire was published in an online survey platform and a QR code was prepared for respondents. An introduction email, together with the QR code, were sent to both academics and administrative staff in these two institutions. A friendly reminder email was sent one week after to remind the potential respondents. In total, there are 187 valid responses were used in the data analysis. Among the usable returns from this survey, 117 (63.9%) were collected from United Kingdom while 66 (36.1%) were completed by staff in Hong Kong. Other demographics details were tabulated in Table 1: Demographics Profile of Respondents.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Categories</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>M</td>
<td>38.92</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>35.14</td>
</tr>
<tr>
<td></td>
<td>Other / Transgender</td>
<td>0.54</td>
</tr>
<tr>
<td>Highest Education Level</td>
<td>Primary</td>
<td>1.08</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>2.70</td>
</tr>
<tr>
<td></td>
<td>Bachelor</td>
<td>9.73</td>
</tr>
<tr>
<td></td>
<td>Master</td>
<td>19.46</td>
</tr>
<tr>
<td></td>
<td>Doctor</td>
<td>41.62</td>
</tr>
<tr>
<td>Age Group</td>
<td>Below 25</td>
<td>2.16</td>
</tr>
<tr>
<td></td>
<td>25 – 34</td>
<td>15.14</td>
</tr>
<tr>
<td></td>
<td>35 – 44</td>
<td>24.32</td>
</tr>
<tr>
<td></td>
<td>45 – 54</td>
<td>19.46</td>
</tr>
<tr>
<td></td>
<td>55 or above</td>
<td>13.51</td>
</tr>
</tbody>
</table>

3.3 Data Analysis
In this study, SPSS V23.0 and SmartPLS 3.0 were used to analyse the data collected from two regions. Descriptive statistics was obtained through the use of SPSS V23.0 package. To
analyse the relationship of multiple independent and multiple dependent variables in the research model, Structural Equation Modelling (SEM) was utilized. With the use of SmartPLS 3.0, the measurement model evaluation and structural model evaluation results are presented. First, Table 2: Descriptive Statistics of Measurement Items presents the description and descriptive statistics of each of the items and the constructs that they are intended to measure. The average of each measurement item ranges from 3.19 (SI3) to 3.96 (PE1). Moreover, the reliabilities of all constructs are greater than the minimum acceptable Cronbach's alpha level of 0.70, indicating internal consistency.

Table 2: Descriptive Statistics of Measurement Items

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Items</th>
<th>Descriptions</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Cronbach's alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Expectancy</td>
<td>PE1</td>
<td>I would find the new technologies useful in my job.</td>
<td>3.96</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>Performance Expectancy</td>
<td>PE2</td>
<td>Using the new technologies enable me to accomplish tasks more quickly.</td>
<td>3.67</td>
<td>0.97</td>
<td>0.875</td>
</tr>
<tr>
<td>Performance Expectancy</td>
<td>PE3</td>
<td>Using the new technologies increases my productivity.</td>
<td>3.64</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Performance Expectancy</td>
<td>PE4</td>
<td>If I use the new technologies, I will increase my chances of getting a better performance review rating.</td>
<td>3.34</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>Effort Expectancy</td>
<td>EE1</td>
<td>It would be easy for me to become skillful at using the new technologies.</td>
<td>3.58</td>
<td>0.96</td>
<td>0.885</td>
</tr>
<tr>
<td>Effort Expectancy</td>
<td>EE2</td>
<td>I would find the new technologies easy to use.</td>
<td>3.35</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>Effort Expectancy</td>
<td>EE3</td>
<td>Learning to use the new technologies is easy for me.</td>
<td>3.47</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>Effort Expectancy</td>
<td>EE4</td>
<td>My interaction with the new technologies would be clear and understandable.</td>
<td>3.48</td>
<td>0.89</td>
<td></td>
</tr>
<tr>
<td>Social Influence</td>
<td>SI1</td>
<td>People who influence my behavior think that I should use the new technologies.</td>
<td>3.50</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>Social Influence</td>
<td>SI2</td>
<td>People who are important to me think that I should use the new technologies.</td>
<td>3.35</td>
<td>0.81</td>
<td>0.713</td>
</tr>
<tr>
<td>Social Influence</td>
<td>SI3</td>
<td>The senior management of my school has been helpful in the use of the new technologies.</td>
<td>3.19</td>
<td>0.94</td>
<td></td>
</tr>
<tr>
<td>Social Influence</td>
<td>SI4</td>
<td>In general, my school has supported the use of the new technologies.</td>
<td>3.82</td>
<td>0.91</td>
<td></td>
</tr>
<tr>
<td>Facilitating Conditions</td>
<td>FC1</td>
<td>I have the resources necessary to use the new technologies.</td>
<td>3.59</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>Facilitating Conditions</td>
<td>FC2</td>
<td>I have the knowledge necessary to use the new technologies.</td>
<td>3.49</td>
<td>0.88</td>
<td>0.712</td>
</tr>
<tr>
<td>Facilitating Conditions</td>
<td>FC3</td>
<td>Technical colleagues in my organization are available for assistance with system difficulty.</td>
<td>3.71</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>Facilitating Conditions</td>
<td>FC4</td>
<td>I think that the new technologies fits well with the way I like to work.</td>
<td>3.50</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td>Behavioral Intention</td>
<td>BI1</td>
<td>I intend to use the new technologies in the next 6 months.</td>
<td>3.95</td>
<td>0.71</td>
<td>0.943</td>
</tr>
</tbody>
</table>
Based on the SmartPLS 3.0 result, the items’ outer loadings, average variance extracted (AVE) and composite reliabilities (CR) were presented in Table 3: Assessment of the measurement model. First, the CR values obtained in this study ranged from 0.816 to 1.000 and these values are over the minimum acceptable limit of 0.70 (Gefen et al. 2011, Gefen, et al. 2000; Nunnally and Bernstein, 1994). Together with the result of Cronbach’s alpha, the internal consistency reliability was considered as acceptable in this research. Second, the items’ outer loadings and AVE values are used to examine the convergent validity. Hair, Ringle, and Sarstedt (2011) suggested that any items with loading below 0.4 should be removed. According to the result, all outer loadings are above 0.5. Third, the AVE values are between 0.816 (Facilitating Conditions) to 0.963 (Behavioral Intention) which are above the acceptable AVE value (0.5) (Fornell and Larcker, 1981). To sum up, convergent validity was exhibited in this study.

Table 3: Assessment of the measurement model

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Items</th>
<th>Loadings</th>
<th>AVE</th>
<th>CR</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE</td>
<td>PE1</td>
<td>0.856</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PE2</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PE3</td>
<td>0.912</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PE4</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE</td>
<td>EE1</td>
<td>0.844</td>
<td>0.916</td>
<td>0.732</td>
</tr>
<tr>
<td></td>
<td>EE2</td>
<td>0.868</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EE3</td>
<td>0.866</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EE4</td>
<td>0.868</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI</td>
<td>SI1</td>
<td>0.683</td>
<td>0.820</td>
<td>0.533</td>
</tr>
<tr>
<td></td>
<td>SI2</td>
<td>0.757</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SI3</td>
<td>0.723</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SI4</td>
<td>0.754</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC</td>
<td>FC1</td>
<td>0.712</td>
<td>0.816</td>
<td>0.529</td>
</tr>
<tr>
<td></td>
<td>FC2</td>
<td>0.778</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FC3</td>
<td>0.588</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FC4</td>
<td>0.812</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>BI1</td>
<td>0.948</td>
<td>0.963</td>
<td>0.897</td>
</tr>
<tr>
<td></td>
<td>BI2</td>
<td>0.944</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BI3</td>
<td>0.949</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UB</td>
<td>UB</td>
<td>1.00</td>
<td>1.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Remarks: Cut-off values for: (1) CR: 0.7; (2) AVE: 0.5

Apart from convergent validity, this paper also reviewed the discriminant validity. Table 4: Discriminant Validity using Fornell-Larcker Criterion presents the results about the
discriminant validity of six constructs. The bolded numbers in the matrix diagonals refer to the square roots of the AVEs and these values are greater in all cases than the off-diagonal numbers in their corresponding row and column. As a result, this study exhibited discriminant validity.

Table 4: Discriminant Validity using Fornell-Larcker Criterion

<table>
<thead>
<tr>
<th>Constructs</th>
<th>BI</th>
<th>EE</th>
<th>FC</th>
<th>PE</th>
<th>SI</th>
<th>UB</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI</td>
<td>0.947</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE</td>
<td>0.391</td>
<td>0.862</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC</td>
<td>0.401</td>
<td>0.653</td>
<td>0.728</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE</td>
<td>0.458</td>
<td>0.640</td>
<td>0.587</td>
<td>0.856</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI</td>
<td>0.325</td>
<td>0.343</td>
<td>0.508</td>
<td>0.462</td>
<td>0.730</td>
<td></td>
</tr>
<tr>
<td>UB</td>
<td>0.251</td>
<td>0.036</td>
<td>0.061</td>
<td>0.097</td>
<td>-0.010</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Notes: Boldface numbers on the diagonal are the square root of AVE values

3.5 Structural model evaluation

The structural model was presented in Figure 2: Structural modelling results. Performance Expectancy showed a positive influence on Behavioral Intention (H1: $\beta=0.276; p < 0.05$), H1 is supported. Secondly, a positive association between Behavioral Intention and Use Behavior was proven (H5: $\beta=0.251; p < 0.05$). Thus, H5 is supported. However, the impact of Effort Expectancy, Facilitating Conditions and Social Influence on Behavioral Intention are insignificant, H2, H3 and H4 are not supported. Table 5 summarizes the evaluation result of the structural mode.
Figure 2: Results of structural model
Table 5: Structural modelling results

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Path Coefficient</th>
<th>t-value</th>
<th>p-value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Performance Expectancy -&gt; Behavioral Intention</td>
<td>0.276</td>
<td>2.718</td>
<td>0.007*</td>
<td>Supported</td>
</tr>
<tr>
<td>H2: Effort Expectancy -&gt; Behavioral Intention</td>
<td>0.100</td>
<td>1.040</td>
<td>0.298</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H3: Social Influence -&gt; Behavioral Intention</td>
<td>0.101</td>
<td>1.294</td>
<td>0.196</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H4: Facilitating Conditions -&gt; Behavioral Intention</td>
<td>0.122</td>
<td>1.215</td>
<td>0.224</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H5: Behavioral Intention -&gt; Use Behavior</td>
<td>0.251</td>
<td>2.907</td>
<td>0.004*</td>
<td>Supported</td>
</tr>
</tbody>
</table>

Notes: * Significant at the 0.05 level (2-tailed).

Table 6: The Difference of Use Behavior between Two Universities

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Significance (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>11.246a</td>
<td>8</td>
<td>0.188</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>12.290</td>
<td>8</td>
<td>0.139</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>5.007</td>
<td>1</td>
<td>0.025</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>130</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A Chi-squared test was conducted to test whether there is any significance between Use Behavior and university. As shown in Table 6, the p-value is 0.188 (which is greater than 0.05), hence there is no significance between the Use Behavior and the university at 5% level of significance.

4.0 Findings and Discussion

The data analysis section shows that only hypotheses H1 and H5 are supported. It also shows that the staff at both universities have a high Behavioral Intention (BI) to use new technologies. This section will review the constructs in the hypotheses and will discuss the possible explanations of the findings.

Since there is no significant difference between the two universities, this means that although there is a general difference in the Hofstede's cultural dimension scores between the two populations (Itim International, 2017), these dimensions have no effect on the staff who work at these universities. One possible explanation is that both universities have policies and the telecommunications infrastructure that encourage their staff to make frequent contacts with the international academic society. This in turn has created a culture that is unique to universities, but different from the general population within which the universities operate. There is a need to confirm this by measuring the scores in the cultural dimensions in the university context.

Since H1 is supported, it means that in both the UK university and HK university, the staff have a higher Behavioral Intention to use new technologies in the workplace if there is a higher performance expectancy (PE) associated with those new technologies. An interesting
observation is that among the four items that made up PE, item PE1 “I would find the new technologies useful in my job” has the highest score and smallest standard deviation. In contrast, PE4 “…I will increase my chances of getting a better performance review rating” has the lowest score and a higher standard deviation. This means that the staff in the universities are intrinsically motivated to use the new technologies that they think are useful to them.

Since H5 is supported, it means that in both the UK university and HK university, the staff have a higher Behavioral Intention to use new technologies in the workplace within 6 months. In fact, the BI construct has the highest average score, and the lowest standard deviation among all the constructs. This means the staff at these two universities do have the intention to use the new technologies, but only the PE construct contributes to the high BI in this study.

The hypotheses H2, H3 and H4 are not supported. This means that in both the UK university and HK university, the staff’s Behavioral Intention to adopt new technologies is not positively associated with effort expectancy (EE), social influence (SI) and facilitating conditions (FC). This is despite the fact that all the items in these three constructs each have mean scores higher than “3”, which means “neutral” in our 5-point Likert scale, in which “5” means “Strongly Agree” and “1” means “Strongly Disagree”. A possible explanation is that the staff at these universities have high self-efficacy. With a high self-efficacy, they have a strong belief in their abilities to use new technologies successfully despite the extra effort in learning and becoming skilful with the new technologies. Furthermore, universities have a tradition of encourage independent and freethinking among its staff. Therefore, the staff are less likely to be influenced by other people. It is noted that SI3 “The senior management of my school has been helpful in the use of the new technologies” has the lowest score of 3.19 among all items in the questionnaire. This means that the senior management must not only support the use of new technologies, but also make their support clearly felt by the staff. This re-iterates the importance of senior management in the successful implementation of new technologies in organisations.

5.0 Conclusions – Next Steps

Organisations nowadays invest huge amounts of money on new technologies in an effort to become more efficient, more competitive and most importantly more profitable. However, a factor that often hinders the introduction and adoption of new technologies in the workplace is the resistance and attitude of the end users and the various employees who are supposed to use the new technologies. Often companies spend a lot of time, money and effort on new
technologies only to realise that their employees either do not use them. Although there is research that examines the factors that affect employees’ behaviour towards new technologies however, companies are still struggling with the successful introduction of IT while there is a lack of cross cultural studies that investigate whether certain countries are more or less successful in introducing new technologies. Therefore, this research is making a significant contribution in examining the factors that affect the acceptance of new technologies in the workplace through a cross case analysis between UK and Hong Kong HEIs. Therefore, the main objectives of our research were to:

- Examine the factors that influence IT acceptance in organisations
- Investigate an individual’s attitude to IT

Our study found that the staff have a higher Behavioral Intention to use new technologies in the workplace if they feel that the new technology will help them perform better in their jobs. In order to realise the importance and relevance of new technologies staff need to be appropriately educated of any new systems while senior management must be seen by their staff as supporting the use of new technologies. Also, we found that there is no significant difference between the two universities possibly because academic staff have frequent contacts with the international academic society. This might be the case because, although university staff might treat new technologies differently than in other sectors universities have a similar culture unique to the sector. However, this needs to be further investigated in future research in order to measure the scores in the cultural dimensions in the university context.

In addition, hypotheses H2, H3 and H4 are not supported in this research. This means that in both the UK university and HK university, the staffs’ Behavioral Intention to adopt new technologies is not positively associated with effort expectancy (EE), social influence (SI) and facilitating conditions (FC). We believe that this might be the case due to the unique environment that universities operate in. HE institutions have a tradition of encouraging independent and freethinking among its staff. Therefore, the staff are less likely to be influence by their social environment. However, future research can further explore these factors by focusing on a more specific technology e.g. enterprise cloud computing.

Our research contributes in theory as well as in practice. From a theoretical perspective we are building on existing literature that has utilised the UTAUT model and we are providing a further understanding of the factors that can affect the acceptance of new technologies in organisations. From a practical perspective we believe that our findings can enable managers
and practitioners in organisations, especially in HE institutions, to be better equipped regarding the introduction of new technologies by allowing them to address those factors that could potentially hinder any new technology investment and therefore increase the acceptance and smooth adoption of IT.

6.0 References


THE SERVITIZATION OF THE IT FUNCTION: IMPLICATIONS FOR THE IT PROFESSIONAL (Development Paper)

Abstract

This development paper notes that IT work has been increasingly subjected to processes associated with 'servitization' through managerial frameworks that espouse working practices managed according to principles of scientific rationalisation (specifically but not exclusively, ITIL). This has been (re-)shaping the experience of working as an IT technical professional, and thereby has implications for professional identity. In the following short paper, some of the literature in relation to this matter is discussed (as the basis for a future research project). This paper suggests how managerialism is embedded within the IT servitization discourse and this has implications for de-skilling and loss of professional autonomy.

Keywords: IT Service Management, IT Profession, IT Servitization, Identity, Job Quality.

1.0 The Servitization of the IT Function

In the early stages of the development of organizationally-situated computer/IT work, the focus of the work was primarily on the technological design and development of IT systems. Management of such work was typically technology-oriented (Winniford et al., 2009) and practiced by experienced technical professionals. Relatedly, the academic literature that has developed on the practices of the IT profession has mainly focused upon IT developers/programmers (e.g. Marks and Scholarios, 2007; Bergvall-Kåreborn and Howcroft, 2013) whose work is primarily performed before IT systems ‘go live’ to be used by other workers. Traditionally, the IT professional employed as a developer/programmer was required to follow the rules of the coding language(s) being used but otherwise was typically and necessarily able to work independently until they completed the programming task. To a large extent this remains the case: the programming task is still typically performed over an extended period, and as such programmers have a need to be afforded a high degree of autonomy. However, as programming languages have become easier to master with greater inscribed support for problem solving within the coding task (e.g. quicker compilation and more helpful feedback from compilation), there has opened up a greater opportunity for managerial surveillance of the programming labour process, with Suddaby et al (2017, p.290)
recently asserting that ‘the average… computer programmer is as subject to the same
deskilling impacts of scientific management as is the typical assembly line worker’.
As IT systems have established themselves as being ubiquitous across organisations of all
sizes, such that they are ‘an intrinsic part of… business practices and government activities
and service provision’ (Greenhill, 2011, p.v), so most organisations have shifted their primary
concern from systems development (the domain of programmers) to the maintenance and
support of the ‘live’ IT services they rely upon to trade/function. The term ‘servitizing IT’
was coined in the academic literature by Conger (2010) to denote this trend towards
emphasising customer-oriented service in the delivery of business IT solutions. The nascent
and still scant academic literature on organisational IT provision following this ‘service turn’
(Iden and Eikebrokk, 2013) essentially responds to ideas that had already taken hold amongst
an IT service management (ITSM) practitioner community, having been diffused via
discursive practice and practitioner literature (e.g. Bartlett et al., 2001; Stroud, 2011). Of
particular importance in this regard are the techniques described in the ITIL (formerly,
Information Technology Infrastructure Library) ‘best practice’ literature (e.g. Bartlett et al.,
2001; Steinberg, 2011), which remains the predominant framework for ITSM (Rae, 2017).
ITIL has evolved from being a set of IT management guidelines for UK civil servants in the
late 1980s to being an internationally-diffused managerial model for conceiving IT systems
as services and managing them accordingly (Iden and Langeland, 2010). Specifically, under
ITIL, IT functions are reconfigured to prioritize managerial concerns, and in doing so
implicitly contaminate the professional values of IT technicians with those managerial
concerns (Faulconbridge and Muzio, 2008).
While there are alternative models of ITSM ‘best practice’ (e.g. DevOps and COBIT), ITIL
dominates as the global ‘gold standard’ framework for IT managers to use (Dorfman, 2008;
Rae, 2017) and carries endorsements across the technology business landscape: from iconic
US organizations such as IBM and NASA (So and Bolloju, 2005; ITIL news, undated) to the
leading Indian IT service providing companies such as TCS Computer Services (2017) and
Wipro (2017). In part the rise to prominence of ITIL, and its related international standard of
ISO/IEC 20000 (van Bon et al, 2008), responds to the increasing complexity of
organizational IT systems (Pollard and Cater-Steel, 2009). And in part it reflects
contemporary neo-Taylorist management approaches, including ‘Total Quality Management’
(e.g. Feigenbaum, 1986) and ‘Lean’ (e.g. George, 2003), applying them to the provision of IT
services (Levitt, 1972; Conger, 2010). Management control is asserted via the
implementation of multiple rationalised and standardised processes that interact within a system designed to fulfil defined customer needs (Steinberg, 2011).

2.0 The Servitization of the IT Professional

In contrast to the IT professional in the traditional IT function, the IT professional employed in the servitized IT function to maintain and support live systems is more likely to be working on a succession of monitored tasks during each working day, working within management-defined and imposed processes (notably: Incident Management; Change Management and Problem Management) (Trusson, 2013). As such, they are more prone to managerial surveillance and control. As with other workers who work in such a way (i.e. taking a task from a queue, completing it and moving on to the next task), ICTs might usefully be employed to assert such control. Within this new servitized working environment the IT professional is expected to take on the role of servant to the defined ‘customer’ who is mythically assigned sovereignty over the IT professional (Korczynski, 2002) within the rational framework. This customer:servant relationship is presented to workers as being sacrosanct within a creedal service level agreement (SLA) that is negotiated and agreed at a rational business-to-business level between the management of the service provider and the management of the service recipient. The SLA, as a feature of rationalized service level management (Sturm et al., 2000), sets out the performance levels to be met by the employees of the service provider (i.e. here the IT service professionals) and is thereby central to the servitization of the IT function. It determines the worker performance data that ICTs need to capture so that IT service managers can provide an assurance that agreed service levels are being met. As such it is a mechanism for asserting greater pressure/control over the IT professionals who are tasked with providing the ‘expert’ service for the service provider.

ITIL promotes the commodification of IT professionals as ‘people assets’, such that their ‘productive capacity’ might be measured ‘in units of cost, time and effort’ (Cannon, 2011, p.382). Similarly, it commodifies the capabilities of IT professionals as ‘knowledge assets’, defined as ‘accumulations of awareness, experience, information, insight and intellectual property’ such that they ‘can be highly leveraged’ (Rance, 2011, p.67). It is this commodification that has facilitated the ‘outsourcing’ and ‘offshoring’ of corporate IT work. For large Western companies, this work has often gone to specialist IT service providers in
India (Standing, 2011), with the objective being to create greater shareholder value (Davis, 2009), often by exploiting ‘national differences of wages’ (Marx, [1867], 2009). The ITIL framework also advocates the management imposition of role-specific and process-related integrated applications software. This software is designed to support the servitization of the IT function by standardising the ‘[performance of] specific tasks and information processing activities’ (Turban et al., 2001, p. 129).

Significantly, the academic literature has yet to adequately explore the effects upon the nature of IT professional practice resulting from IT servitization. Any acknowledgement of the nature of IT professional work having changed through the diffusion of ITSM ‘best practices’ is only implicitly acknowledged (e.g. Cater-Steel, 2009) but not discussed to any great extent. Despite the widespread servitization of IT functions, organizations remain reliant on the technical skills of IT professionals albeit that that there may be a lesser expectation of skills competency today than in previous eras (Hawk et al., 2012). While technical information systems work has long been attributed professional status (Evetts, 2003), by adopting a trait-based perspective on professions (Muzio et al, 2013), IT service professionals (conceived of as those workers who develop and support ICTs used by others) retain multiple traits associated with organizationally-situated professional workers. Firstly, their work is socially significant (Brock et al, 2014). Secondly, they are required to exercise ‘superior’ technological expertise (Larson, 1977, p.185) underpinned by a body of theoretical knowledge (Fincham, 2006). Thirdly, they exercise an ‘ability to grasp new events quickly and to respond effectively’ (Broadbent et al, 1997, p.51) using professional inference (Abbot, 1988) or creativity (Cohen et al, 2005). Fourthly, their technical expertise affords them both diagnostic authority (Johnson, 1972) and the trust and obedience of those who benefit from their expertise (Starr, 1982). And fifthly, they ‘[solve] core problems for their employers’ (Muzio et al, 2013, p.710).

However, in opposition to these traits attributing professional status to IT workers, the shift towards a servitized IT function, points in the opposite direction towards IT work becoming more akin to ‘info-service work’ (Russell, 2009). Whereas the academic literature has tended towards painting a picture of IT work as a prestigious domain of experts, most notably in Barley and Kunda’s (2004) classic ethnography of ‘gurus’ and ‘hired guns’, this may not reflect the experience of most IT professionals following IT servitization. The work might perhaps more usefully be presented as one of commodified labour practicing within management-defined work processes that entail the mandatory use of management-imposed ICTs.
3.0 Concluding Comment: The Complicity of the IT Profession in the Servitization of the IT Professional

ITIL, as a mechanism of IT servitization within an organization, is enthusiastically promoted by the UK’s leading IT professional body, ‘BCS, the Chartered Institute for IT’ (formerly the British Computer Society, and hereafter BCS). By implicitly accommodating the managerialist values inscribed within ITIL, the BCS opens itself up to accusations of complicity in degrading the quality of jobs within the IT profession. There is a clear suggestion of self-alienation (Blauner, 1964) and/or self-exploitation in advocating the commodification of IT professionals within the systems model and the imposition of ICT artefacts (produced by other IT professionals) upon them to facilitate ‘commercial business growth’ (BCS, 2009). The overriding proposition here is that the shift towards the servitization of organizational IT functions has had a significant influence upon the IT professional discourse. It has brought to the fore a managerial logic that has overlapped with, and to some extent usurped, the technical-professional logic that was foundational to the IT profession (Olakivi and Niska, 2016).

4.0 Developing the Research

A key reason for bringing this development paper to UKAIS would be to have the opportunity to discuss how the issues raised by this paper might be subjected to empirical research. For my PhD research (completed in 2013 under the supervision of Neil Doherty), that conceptualised the IT service support worker, I conducted qualitative research across five case study IT functions that had been subjected to servitization via implementation of ITIL managerial practices. This entailed collecting and analysing observation and interview data. While some of this data will be pertinent to this research, the positioning of this research argues that an historical shift has taken place within the IT profession, affecting job quality and professional identity, that has not been adequately acknowledged in the literature, and for which I have only limited data to support. I would welcome the opportunity to discuss how historical and contemporary perspectives might be addressed through data collection and analysis. For example, might identifying and then interviewing IT professionals who have
witnessed changes associated with the servitization agenda be a fruitful line of enquiry? I am sure that the UKAIS community would be helpful to me at this developmental stage.

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Trusson


THE IMPACT OF ROBO-ADVICE ON FINANCIAL ADVISERS: A QUALITATIVE CASE STUDY

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Abstract
One of the most significant recent technological developments concerns the application of robotics and Artificial Intelligence (AI) to skill-intensive, knowledge-based jobs. The financial adviser is a role that has been identified as being under threat from automated robo-advice services. However, there are conflicting views on the future of human financial advisers. It has been argued that human financial advisers will soon become obsolete because robo-advisers are lower cost and make fewer mistakes. Conversely, it has been argued that financial investment is an emotional process that requires empathy and reassurance that cannot be provided by automated robo-advisers. In this exploratory study we use service encounter theory to explore the key elements of the financial adviser job role, identifying where human interaction with the client was considered to be valuable. Our findings suggest that robo-advisers are likely to augment rather than substitute human financial advisers.

Keywords: Robo-Adviser, Financial Advice, Automation, Augmentation, Qualitative, United Kingdom.

Introduction
One of the most significant recent technological developments concerns the application of robotics and Artificial Intelligence (AI) to jobs that up to now have been considered safe from automation. Described as the second machine age, analysts and commentators have forecast mass unemployment from the robotisation of a wide range of predictable, repetitive job roles (Brynjolfsson & McAfee 2016). What sets this change apart from previous technological revolutions, such as the automation of factory work in the 19th century, is the potential of robotisation to affect dramatic changes to the demand for skill-intensive, knowledge-based workers (Loebbecke & Picot 2015). The role of the financial adviser is one such role that has been identified as being under threat from automated robo-advice services (Davenport & Kirby 2016).

Professional financial advisers gather detailed information about a client’s circumstances, goals and attitudes to risk. Based on this information the adviser will then identify and recommend different financial product portfolios that are suitable for
the client. By contrast, robo-adviser services provide financial advice with minimal human intervention. In general, robo-adviser services use simple surveys, often of only 10-15 questions, to profile clients and to assess their needs. This data is used to create a range of proposed asset allocation portfolio’s that vary in their volatility. The client’s chosen asset allocation portfolio is adjusted and implemented and portfolios are monitored, rebalanced and reported for the duration of the relationship. Randy Cass, founder of Net Wealth, a digital wealth platform, suggested at the European Investment Conference 2017 that financial advisers would become obsolete unless value can be added beyond simply providing portfolio maintenance. Cass (2017) describes a vision of the future where it could be impossible to determine if a client was working with a machine or a human due to the level of personalisation a robo-advice system could provide. However, several commentators have argued that there will still be a need for human financial advisers. For example, in a market downturn, robo-advice will offer no reassurance or human comfort (Economist, 2015). This sentiment is shared by Scott Smith from Cerlulli (Beilfuss 2017), who says the ongoing service provided by human advisers and what clients appear to want is simple human interaction.

The interaction between a financial adviser and their client can be considered as a series of service encounters. Larivièrè et al. (2017) argue that technology has transformed many service encounters and may either augment the role of service employees, or provide a substitute for service employees. Voorhees et al.’s (2017) conceptual model of service encounters provides a useful structure to frame the client service experience without prescribing how the service encounter interactions may occur. Therefore, guided by service research theory, the research question this study addressed was how might robo-advisers impact on the role of human financial advisers?

The paper is organised in five sections. The following section reviews the relevant literature regarding the nature of the automation debate, the recent developments in robo-adviser services and the theoretical foundation of the study. The method adopted for this study is then explained. The findings of the study are presented in four parts: initial contact and first meeting; establishing client needs and servicing; implementing investment decisions and; financial adviser views on robo-advice. These findings are
then discussed in the following section. In the final section of the paper, the main conclusions from the study are presented as well as the limitations and avenues for future research.

**Literature Review**

In this section, we review and synthesize (1) the current debates regarding the automation of service work (2) robo-advice and the future of financial advisers and (3) how service research provides the theoretical foundation of the study.

**Automation of service work**

Throughout history there have been many warnings of developments in technology wiping out ordinary jobs, for example, the Luddites in the early 19th century. A more recent example is the ‘automation jobless’, a trend towards bigger production with a smaller workforce (TIME 1961). Brynjolfsson and McAfee (2016) claim rapid digitisation is likely to lead to a loss of jobs in the first instance as it leads to economic disruption. There will be less need for some types of workers as technology progresses and can replicate these jobs. Autor (2015) argues in the future improved computing power and artificial intelligence will increase the chance of replacing labour on a scale and in a way that has not been seen before.

Autor (2015) discusses why labour has not been wiped out. Autor argues that automation is a substitute for certain types of labour but also a complement to others and raises output in a way that leads to a higher demand for labour. For example, the introduction of ATM machines replaced Bank Tellers in branches during 1990s in America. The number of ATM machines grew from 100,000 to 400,000 from 1995 to 2010. During this time period the number of Bank Tellers employed also increased. The falling costs created by using ATMs allowed more branches to open and the time saved allowed Bank Tellers to undertake different tasks and become involved in ‘relationship banking’. Autor concludes that though automation reduces the labour requirements per unit of output, automation does not necessarily reduce aggregate employment levels.
Autor (2015) identified three main factors that can influence the impact of process automation on employment: 1) is the job a substitute or a complement to automation? If it is a substitute it is more likely that employment will fall for that job; 2) the elasticity and supply of labour can mitigate wage gains. For example, as demand increases for a job that is a complement to automation, if the labour supply is greater than the demand, wage gains will be reduced; 3) the output elasticity of demand combined with income elasticity of demand can either dampen or amplify the gains from automation.

Historically, computerisation has been restricted to manual and cognitive routines that followed explicitly defined rules (Autor & Dorn 2013; Goos et al., 2009). As a result, the jobs most susceptible to computerisation were those that followed well-defined routine tasks that could easily be performed by sophisticated algorithms (Frey & Osborne 2017). Frey and Osbourne claim that recent technological breakthroughs are, in large part, due to efforts to turn non-routine tasks into well-defined problems. Defining such problems is helped by the provision of relevant data. i.e. Big Data. As predicted by Autor & Dorn (2013) and Goos et al. (2009), more tasks that are non-routine are becoming automated. One example of a job that has been previously considered non-routine and safe from automation is the financial adviser.

**Robo-Advice and the Future of Financial Advisers**

Robo-advisers are defined as automated computer systems that provide financial planning services with little or no human intervention and typically at a lower cost compared to traditional financial advisers (Blenman, 2017). Cass (2017) argues that what robo-advisers offer is not new or different than wealth managers but it is delivered in a more convenient format.

In a report by on robo-advice, Accenture (2015) claim robo-advisers currently only control a small share of assets under management (AUM) but can offer cost savings of up to 70%, resulting in rapid and accelerating growth. Accenture claims most interest in robo-advice comes from the mass-affluent, delegator market segment, which is essentially wealthy people who want someone else to manage their money, a segment which has traditionally been underserved. Full service advisers are looking at robo-advice to serve smaller accounts and increase adviser productivity.
Robo-advice sits between traditional investment advice and discretionary management. Jane Warren (2016), chief executive of Investec’s online arm, says robots will give people with less money the chance to invest, providing them with ‘lower costs, more convenience and lower minimum investment values’. Robo-advice may also reduce the mistakes made by human investors when dealing with money (Economist, 2015). Lisa Kramer (Professor of Finance at the University of Toronto and a member of the board of advisers for Justwealth, a newly launched robo-advisery firm in Canada) suggests robo-advisers are likely to outperform humans because they are less susceptible to making mistakes (WSJ 2016). Scott Smith from Cerlulli adds that human advisers may also provide the wrong advice, but that this may also be evident in robo-advisers as they are designed by humans and therefore susceptible to poor design (Beilfuss 2017).

However, there are also strong arguments to suggest that the human aspect of financial advice will remain an important factor. The emotional element to financial planning is highlighted by Carla Dearing, CEO of SUM180, an online financial planning service who said ‘money is emotional and there are always intangibles to consider in deciding what to do next, which cannot be captured by robots’ (Metinko 2017). Individual client needs vary considerably so while new or simple needs may be met with robo-advice, more complex financial planning may best sit with human financial advisers (Economist 2015). Thus, robo-advice may be a complement to add to existing wealth management services (Accenture 2015). For example, Cicero Research (2016) investigated how technology could be used to support parts of the financial advice process and found the first point of contact and initial engagement with a client required human interaction to establish the client’s needs. However, once this rapport and understanding had been achieved the execution of the business and ongoing servicing required less human input and could be led by technology. Similarly, Scott Smith (WSJ 2017) found in his research clients most often cited the reasons for using a human adviser was ‘their willingness to take the time to understand my needs and goals’ and ‘to look at my entire financial picture’. He also states that investors begin by using online tools to get a basic understanding of their needs but then look to talk to a human to discuss them.
Theoretical Foundation

Service research provides a useful lens to conceptualise the interaction between financial advisers and clients. Voorhees et al. (2017) argues that the relationship between a customer and a firm is based on a series of encounters, and it is these encounters that determine the customers’ perception of the quality of the firm and the likelihood of continuing the relationship. Voorhees et al. argue that a service experience can be considered as three distinct periods: (1) pre-core service encounter, (2) core service encounter, and (3) post-core service encounter (see Figure 1). The pre-core service encounter is the time period that customers begin reviewing information about the firm and make initial contact. The core service encounter is the period when the primary service is delivered to the customer for example, receiving advice and recommendations for a client’s investment portfolio. The post-core service encounter is the period when the customer reflects on and assesses their experiences in the previous two time periods. These assessments may involve providing feedback through surveys or completing reviews and includes any actions by the firm to maintain the relationship, such as scheduling future investment portfolio reviews. Voorhees et al. argue that if these actions are effective then they are likely to trigger future pre-core service encounters for a further iteration of the service experience loop.

![Figure 1. Voorhees et al. (2017) Conceptual model of service encounters through the service experience](image-url)
Larivière et al. (2017) observe that the service encounter is fundamentally changing due to advances in technology. For example, pre-core service encounters such as information searches are often undertaken via the internet, the customer drawing on online recommendations and initiating contact via email or online forms. Core interactions may often be supported through email exchange and investment decisions monitored through software dashboards provided by financial investment firms such as Fidelity. Post-core encounters may involve online reviews or social media contact. Larivière et al. add that the service interface is also evolving becoming increasingly dominated by technology, in some cases the human being removed from the interaction. For example, a smartwatch interacting automatically with a service provider (e.g. Fitbit) for further data analysis. This growth in the role of technology may lead to either the augmentation of service employees with technology complementing and assisting employees, or the substitution of service employees (e.g. Amazon Go retail stores).

There are limited academic papers regarding technology in wealth management. There are many trade papers on technology and robo-advice that are useful in explaining theoretic capabilities of robo-advice but limited examples of actual use in businesses. Many sources agree that robo-advice will provide investment guidance at a lower cost compared to traditional financial advisers and that it can be more successful as it removes the emotional element from finances (WSJ 2016; Metinko 2017). Counter to this, many sources state the emotional element is important in understanding a client’s needs. Humans are much more adept at building a relationship and offering real advice to support clients. Robo-advice was seen as less able in identifying and understanding client’s wants and needs (WSJ 2017; Dearing 2017). This study investigates how human face-to-face interaction between financial advisers and their clients’ influences the financial planning process. Our research uses Voorhees et al.’s (2017) Conceptual Model of Service Encounters to interpret and understand how the financial adviser-client relationship may change through technology and robo-advice. It was envisaged that in so doing the study would provide greater understanding regarding how robo-advice may be appropriated in the wealth management sector.
Method
As the study was exploratory in nature a qualitative case study approach was adopted. Case studies are particularly suitable when attempting to answer the “how” and “why” questions of a research phenomenon (Yin 2009). The study was interpretive as it sought to gather in-depth understanding of the views of participants on the financial adviser-client relationship and how robo-advice may impact on that interaction. Consequently, semi-structured interviews were the most appropriate research method for data collection. Semi-structured interviews provided the best balance between structure and freedom for the participant to answer. It allowed the interviewer to ask specific questions whilst allowing the conversation to flow, probing for more detail and examples as required (Saunders et al. 2016).

Site selection
Our research focus guided the selection of the case study site. We chose an organization that was reviewing the use of new technologies to support and improve the financial adviser-client relationship. This provided an opportunity to study the aspects of human interaction that were considered most important by advisers when interacting with clients. The single-case study enabled us to make sense of our data without the risk of oversimplifying and to provide a rich description of the investigated phenomenon (Sigglekow 2007).

The organization studied is a wealth management firm (WealthCo) located in the United Kingdom (UK). WealthCo provides a network of financial advisers to provide financial advice to individuals and businesses across the UK. WealthCo advisers will support their clients for a range of services including insurance, mortgages as advising on more complicated areas such as inheritance tax, retirement planning or investment for growth.

Data collection
The profile of financial advisers varied at WealthCo with some operating as sole traders, some comprising of medium size businesses and a small number of large businesses. Therefore, we targeted all three groups when selecting participants for the interviews. Data collection took place between April 2017 and June 2017. An email
was sent to participants in advance to explain the interview process. The interviews were arranged at the convenience of the participant and the majority of interviews were undertaken in a private meeting room to ensure confidentiality.

Five interviews were conducted with a financial adviser from a range of different business sizes (see Table 1). The rationale for interviewing a range of advisers was twofold. First, it provided representativeness in the advisers’ descriptions of their experiences interacting with clients. Second, it allowed triangulation of data through comparisons of the views of advisers.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Role</th>
<th>Scale of Business</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant A</td>
<td>Financial Adviser</td>
<td>Single Person</td>
</tr>
<tr>
<td>Participant B</td>
<td>Financial Adviser</td>
<td>Single Person</td>
</tr>
<tr>
<td>Participant C</td>
<td>Financial Adviser</td>
<td>Medium</td>
</tr>
<tr>
<td>Participant D</td>
<td>Financial Adviser</td>
<td>Medium</td>
</tr>
<tr>
<td>Participant E</td>
<td>Financial Adviser</td>
<td>Large</td>
</tr>
</tbody>
</table>

Table 1. Summary of interviews and participants (April 2017–June 2017).

The interview questions centred on each adviser’s background and his/her experiences of engaging and working with clients. The interview questions addressed how the advisers perceived the process of initial contact and attracting new clients, servicing and maintaining the relationship with the client and understanding routine information gathering tasks. All interviews were recorded and transcribed. Handwritten notes were also taken to record additional details not captured in the audio recording, such as body language and non-verbal communication. All participants were informed that they had the right to withdraw at any time, to request a copy of the transcript and to withdraw their data. A summary of the interview guide is provided in Table 2.

The interview transcripts were coded using a combination of a priori and in vivo codes. The frequency of the application of the codes was then used to develop a series of matrix displays to create a thematic analysis. The following section presents a summary of the findings from the thematic analysis.
### Interview Schedule

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do the first interactions with a client occur?</td>
<td></td>
</tr>
<tr>
<td>In what format does you usually communicate with clients?</td>
<td></td>
</tr>
<tr>
<td>When is the first face-to-face meeting?</td>
<td></td>
</tr>
<tr>
<td>Does any contact occur leading up to the meeting? What format? How frequent? From who?</td>
<td></td>
</tr>
<tr>
<td>What follow up communication to the client is there?</td>
<td></td>
</tr>
<tr>
<td>How do you build a relationship with your clients?</td>
<td></td>
</tr>
<tr>
<td>What are the most important actions in building this relationship?</td>
<td></td>
</tr>
<tr>
<td>Are there any points where this relationship is essential to doing business?</td>
<td></td>
</tr>
<tr>
<td>Are your meetings and questions structured or is there an informal or varied format?</td>
<td></td>
</tr>
<tr>
<td>Is there a repetitive element to the meetings or a topic that is covered in every meeting?</td>
<td></td>
</tr>
<tr>
<td>How do you capture the information from a client meeting and what is done with it?</td>
<td></td>
</tr>
<tr>
<td>What part of you interacting with the client could be improved?</td>
<td></td>
</tr>
<tr>
<td>Are there any dull or repetitive tasks that you or your support staff have to do?</td>
<td></td>
</tr>
<tr>
<td>What do you think of the current technology available to support you in your role?</td>
<td></td>
</tr>
<tr>
<td>Have you heard of and what are your thoughts on robo-advice?</td>
<td></td>
</tr>
<tr>
<td>Do you think robo-advice would ever be adopted by WealthCo?</td>
<td></td>
</tr>
<tr>
<td>If there was a platform to assist partners in providing advice – how would that make you feel?</td>
<td></td>
</tr>
</tbody>
</table>

| Table 2. Interview Guide for Financial Adviser Semi-Structured Interviews |

### Findings

In this section, we describe the interaction between financial advisers and clients and the aspects that financial advisers perceived to be the most important for creating a successful client service experience.

**Initial contact and first meeting (Pre-Core Service Encounter)**

Several advisers commented that during the early stages of initial contact with a customer they believed face-to-face interaction to be the most influential form of communicating. The advisers explained that the face-to-face interaction allowed them to build a relationship with the client by establishing rapport and responding to social
cues. It also provided an effective way for the advisers to judge customer attitudes and preferences allowing them to physically see and comprehend how their words and body language were being perceived by the client. The advisers believed that face-to-face contact was more effective because alternative forms of communication such as email or telephone conversations provided fewer opportunities to judge customer responses. The advisers explained:

‘My perception is that they can see me, look at me, interact with me... it's about the soft issues of how that person comes over and whether you can trust that person [the adviser].’

‘It's all about trust and relationship and that's easiest to generate face-to-face.’

‘We could send as a letter but actually speaking to somebody [face-to-face] is by far the best way of first communicating.’

In particular, the advisers felt that this personal interaction was valuable as it enabled them to demonstrate empathy with the client, in terms of understanding and appreciating the client’s personal situation and their corresponding needs. The most common method to gain this understanding was through identifying common ground between the client and the adviser, such as identifying shared views, interests or preferences. Demonstrating this empathy and understanding was considered to be critical for establishing sufficient trust from the client in the adviser’s advice and recommendations. The advisers explained that trust was a significant part in identifying a client’s needs. The adviser needs to build up a sufficient level of trust for the client to be willing to share their personal financial details with the adviser. These personal financial details are necessary to ensure that the adviser is providing the appropriate advice to the client. Advisers made the following comments:

‘One of the main things is empathy. If you can find something in common with them or something are really interested in it doesn't take much to build rapport. And once you've got rapport you've got trust.’
‘I think that relationships build upon time spent and share stories and finding things that are commonalities of interest.’

‘Adding in all those elements build up that trust also if you can have some empathy and engagement, it gives you a connection.’

In summary, the main pre-service encounter activities described by the advisers were to arrange a face-to-face meeting and to demonstrate empathy and establish trust with the client. All the advisers recognised this to be a critical stage in the service experience as it normally the first point of contact between the two parties and first impressions were considered very important in setting expectations. In some respects the primary aim of the initial meeting was not to do business but to provide the foundation to build a long lasting relationship to enable repeat business with the client. The on boarding client experience was considered to be a key stage in building a relationship between the adviser and the client, a relationship that the advisers valued.

**Establishing client needs and servicing (Core Service Encounter)**

Having completed an initial meeting and establishing an agreement to undertake a more structured follow up meeting, normally also face-to-face, the advisers explained the next stage was to establish the client’s needs. The advisers described particular questioning styles that they employed to elicit key information about the client’s attitudes to risk, preferences for particular types of investment, and general knowledge and understanding of finance. A key feature of this activity described by the advisers was the ability to probe and respond to client answers so the adviser could gain a deep understanding of the client. The advisers felt this was more effective than the clients simply answering without any prompts or clarifications, such as through an online form. The adviser could also help the client reflect on their own situation before answering, to give a more accurate representation of their views. However, the advisers acknowledged that this required skilful questioning to avoid leading the client to particular answers. For example, advisers frequently mentioned using ‘triggers’ or clients needing triggers to uncover their true needs. The advisers explained:
‘The question will take [the client] back into that state when they were interested [in receiving financial advice].’

‘Questioning identifies other needs they [the client] didn’t know they had previously.’

‘The majority of people are apathetic [towards financial decision making] and won’t do it for themselves, they need someone to ask and prompt them.’

Having established the client’s needs the advisers explained that they aimed to provide an ongoing service throughout the time the client holds funds with the adviser. This ongoing advice is important as there are frequent changes in legislation or interest rates that may influence investment decisions as well as changing client circumstances. Consequently, the advice needs of the client are likely to evolve. Having an ongoing relationship with an adviser can provide a qualified expert with which to discuss these changing circumstances, and also to reflect on whether the most appropriate decisions are being or have been made. The advisers explained that they often provided reassurance and advice to clients, built on their strong understanding and empathy with the client’s needs and circumstances, adding value to the relationship that they believed would be difficult to achieve through a robo-adviser service.

‘Clients need that reassurance and human contact and robo-advice won’t give you that!’

‘Computers lack context or emotion and that is so important when dealing with people’s money.’

‘If we’re charging a fee then we have to be giving advice. We can’t ask the client what do you want to choose, we have to give advice.’

‘Anything could come up and [clients] are free to contact me. This emphasizes and reinforces the service element of WealthCo.’
Several advisers added that they felt the action of setting up a face to face meeting was important to act as a catalyst for the client to focus on addressing their investment needs, as otherwise the activity was easy to continually defer. As client circumstances change so frequently financial arrangements need to be reviewed to make sure they are still suitable. The majority of advisers felt that for many of their clients, although aware of the need for advice, were unlikely to pursue that need and obtain advice. They added that many clients were even less motivated to research the advice for themselves. For example, an adviser stated:

‘A lot of clients even now will think, “I need to do XYZ” but it doesn’t get done and it takes a conversation with somebody to say, “let’s do it then”’ to get them to actually do it.’

The advisers also highlighted client contact as an important aspect of their business model. Each touch point with the client is an opportunity to provide a good client experience. This experience was important as it contributed the client’s perception of the adviser and helped develop into the business relationship with the client. The advisers explained that they would also take into account client preferences for the method and style of communications. In some cases the adviser would specifically ask the clients preferred communication medium, whereas others would respond using the same method that the client had used to instigate the communication. The advisers commented:

‘I make a point now to ask in meetings [what communication clients want].’

‘It’s a balance, but I find it [communication preferences] develops naturally. I don’t specifically ask.’

‘Every client is different, even in the same household the husband might want an email and the wife likes to receive letters.’

The main core-service encounter activities described by the advisers highlighted the need for skilful questioning and probing to encourage the client to reflect on their own circumstances and situation, often in a face-to-face meeting. They also highlighted the
ongoing need to provide reassurance and advice as the client’s circumstances changed over time that was built upon empathy and trust that was established at the start of the relationship. The action of setting up a face to face meeting also appears important as this action forces the client to devote time to reviewing and discussing their investment needs, often with the adviser implementing the investment decision outcomes. Finally, the advisers try and demonstrate that they provide a tailored service to their clients, and this is illustrated through attention to their communication methods and client contact preferences.

**Implementing investment decisions (Post-core service encounter)**

Having established the client’s needs and confirmed their investment choices and decisions the advisers proceed to action those decisions on their client’s behalf. These actions may involve registering the client with investment companies, pension funds and software platforms for financial services. These activities would generate a considerable amount of correspondence and the advisers believed that it was important for this communication to be tailored to specific clients preferences to reflect their relationship with the adviser. Advisers commented:

‘It [communication] should be bespoke by client, or certainly appear more bespoke.’

‘It’s very much a bespoke [communication] process for me but it all depends on the clients.’

‘It [communication] is personalised for each person.”

The advisers also identified a number of situations that involved recording information from clients. The advisers considered capturing and processing this information to be inefficient and an area that benefit from further automation. They commented:

‘It's down to how you capture the information and then how you are able to recall the information. At the moment, it feels quite labour-intensive.’
'At each meeting notes are taken in various forms. For my office typing these up is the most time consuming element of client meetings.'

'We need to do more to have repeatable processes and repeatable good experiences.'

The advisers stated that in every meeting with the client, there is a need to capture information. This information is captured in various ways and the process differs between each adviser. For some advisers it may be using pen and paper, for others they dictate using smart phones or enter the information directly into forms using hand held technology, such as iPads. Most advisers saw using and manipulating this data and other data within WealthCo as an area for improvement.

Reflecting on their interactions with clients all of the advisers emphasised the importance of the overall client experience. The advisers believed that this experience was shaped by the nature of all interactions with a client and that these interactions were important, influencing the client’s perception of the advisers business. The overall client experience was believed to contribute to the ongoing relationship and reinforce feelings of trust that were essential to conduct business. Advisers commented:

'it's an all-round experience from the building to everyone else who has an interaction with the client and the carpets are clean. Everything adds up everything has an impact.'

'Each point of contact with a client adds to their experience and builds on their perception of my practice.'

'All this [interactions] has a massive impact on the client journey and the client experience.'

In summary, the post-core service encounter activities described by the advisers mainly comprised of processing information recorded from the client, generating bespoke client communications and ensuring that the cumulative interaction points between the adviser and the client contributed to a high quality client experience. The
advisers believed that these information capturing and processing tasks could be more efficient through greater use of technology, so long as the service was sufficiently tailored to account for client preferences and appear personal in style. It was interesting to note that the advisers tended to refer to technology for improving information processing tasks, a transition that is well-known and well established for business process improvement.

**Financial advisers’ views on robo-advice**

The advisers had varying degrees of knowledge of robo-advice. The majority of advisers did not believe it was a threat to their business. The most common reason the advisers gave for their perspective was that they thought robo-advice would be unable to deliver the high quality and personal relationship necessary for providing financial advice. The advisers highlighted that a robo-adviser service would be unlikely to be able to replicate the catalyst of a face-to-face meeting that many clients require to enable them to devote specific time to personal financial planning. The advisers also argued that a robo-adviser service would be unable to capture a sufficiently detailed understanding of client needs, as it would not be able to discuss and probe the client’s personal and financial situation and set that in context. The advisers believed that there was a significant difference between a human asking questions and probing for answers compared to a person just answering questions online, as would typically be done for robo-adviser services. The advisers felt strongly that there was a need for human interaction to capture the full needs of the client. They also believed that the financial investment environment was highly complex and that the complexity was continually increasing, which robo-adviser services would struggle to reflect in their investment advice. The advisers made the following comments.

‘Someone told me at least 10 years again that financial advisers would be dead because everybody would do things online. I said not they won’t because nobody wakes up and thinks I really must plan how much I should pay into my pension.’

‘I think that much of financial services advice and interaction is based upon relationships and there is a very small percentage of the population who don't need that.’
‘They’re [clients] not going to get that online [personal relationship] and they need the human interaction to do it.’

‘I would say it's essential [the need for human interaction]. There is a lot of talk of robo-advice, there is so much complexity in financial services and the government only makes things worse by adding more layers, there's always going to be a need for advice and it's only going to get worse.’

However, several advisers held the view that they would benefit from greater access to more information regarding investment options and client information and viewed technology as a means to provide these improvements. For example, some advisers suggested that if a robo-adviser system could be used to support their processes and that there were benefits to the adviser and the client then such systems would be welcomed. An adviser explained:

‘If we can use technology that's available to make things more efficient then great. If that results in a letter going to a client two days earlier then great.’

Overall, the advisers believed that there were sufficient differentiating factors between their service offerings compared to robo-adviser services that would ensure that robo-advisers did not pose a significant threat to their business for the foreseeable future. These views were mainly founded on their experiences of clients not being pro-active in addressing their investment planning needs without the triggering action of engaging a human financial adviser. The advisers also believed that the personal relationship between the adviser and the client, built on strong understanding, empathy and trust, was a critical aspect of the financial adviser service experience that would be extremely difficult to replicate using only an automated computer technology.

Discussion

Accenture (2015) suggest robo-advice will have a significant effect on the business model for wealth management. Where robo-advice provides an effective, low cost alternative, people will not be willing to pay the higher premiums of face to face
advice unless wealth managers can provide demonstrably better performance or provide value-added services. Davenport and Kirby (2016) argue that one way a human worker can insulate themselves from the threats presented by automation is through focusing on the skills that robots and artificial intelligence find difficult. These skills are often considered ‘softer skills’ such as demonstrating empathy with other people, being creative, responding to social cues, and undertaking sophisticated social interactions.

Our findings show there are several encounters during financial service client experience that draw on these softer skills as shown in Figure 2. For example, during the pre-core financial service encounter the advisers in our study spoke at length about the importance of demonstrating empathy and establishing rapport with clients to generate a sense of trust between the adviser and the client. During the core financial service encounter advisers spoke of the need to use sophisticated questioning techniques and gentle probing to get to the heart of the client’s personal financial needs. They also highlighted the importance of providing reassurance and empathy, particularly when changes occurred either in the environment or in the client’s personal circumstances.

At present, the robo-advice capabilities offered by online firms are basic (Accenture 2015) While the reduced costs of robo-advice are a key attractions (WSJ 2017; Metinko 2017) with many offering fees of under 1% they do not provide a detailed understanding client needs or the ability to developing longer term financial plans. At present robo-advice services are generally not sufficiently sophisticated to provide complex financial advice (Economist 2015). Thus, continuing to highlight and demonstrate the added value of the human aspects of the financial service experience may help protect financial advisers from competition from robo-advice services.
However, there were several service encounter activities that may well be suitable for future automation. These activities include providing bespoke communications to clients, faster information processing and providing advisers with more investment information from which to derive their advice. Many of these activities could support the financial adviser through removing routine and mundane tasks that are still important in maintaining a high quality client experience. Thus, while human financial advisers are likely to remain important for wealth management firms, new technologies such as robo-advice services will offer new capabilities that wealth management firms may need to embrace. For example, there are an emerging number of firms that offer hybrid services pairing computerized services with hand-holding from human advisers. In these firms, the computers are used to capture and analyse data and derive market analysis to allow the human financial adviser to focus on the interaction with the client, the overall goal of the financial investment and the design of the portfolio (WSJ 2016). These observations suggest that while some automation of some tasks formerly performed by human financial advisers is likely, there remain a significant number of high order soft skills that favour human workers. The findings of this study suggest the role of the human financial adviser is more likely to be augmented by new technology, rather than substituted by the new technology (Larivièere et al. 2017).
Conclusions

Wealth management firms need to think strategically about how they wish to design the service encounter with their clients. With the emergence of new powerful technologies such as artificial intelligence and robotics managers need to decide on the balance between human and technological inputs. These options may range from full technology-driven service encounters to full human driven encounters (Larivière et al. 2017). Managers need to carefully analyse the critical value adding features of the financial advice service encounter and whether these features are easily codified or not. This analysis will need to consider the client, the type of financial service and the stage of the customer journey (DeKeyser et al. 2015). The preferred combination of technology–human capabilities is likely to evolve over time as technology becomes more sophisticated and some commentators believe that focusing on softer cognitive tasks will only protect human workers for a relatively short time. However, as Frey & Osborne (2017) observe, it may be that technology may not always be the preferred option because of its creative and social limits.

While this exploratory study has provided a number of new insights into the potential impacts of robo-advice in financial services it is subject to several limitations. The sample size is small and only comprises of wealth managers from a single firm in the UK. Although the advisers that were interviewed were drawn from a range of different sizes of business, and from different regions in the UK, it is acknowledged that studies with a greater number of participants or in different national contexts would be beneficial. It is also acknowledged that the client perspective is not captured in this study. Thus, the next stage of this study will involve collecting data from client experiences of using financial advisers and robo-adviser services to provide a fuller understanding of the potential impacts of robo-advice.

Acknowledgements

We would like to thank the financial advisers at WealthCo that gave up their time to participate in this study.
References


Tourist Expectations and Behaviour towards Sport Tourism in Thailand

Abstract

Tourism business has been growing every year which has led to the creation of a business growth that effect on many countries. Sport tourism is one of the most popular tourist destinations that has a positive impact on the economies of each countries. This research investigates tourist expectations and behaviour towards sport tourism in Thailand. The Nine 9’s of marketing mixes, Theory of Planned behavior, and Social Cognitive Theory has been used as the main theoretical background for this study. This research will be conducted using quantitative and qualitative methods. The exploratory part of the study involves a survey which will be used to collect preliminary data, via online and paper-based questionnaire. A qualitative approach followed, based on focus group discussion. This increases the depth of understanding of the cases and situations studied. The expected outcome of this research study will be value not only for understanding tourist perspectives, but also for the design of the most effective strategy of sport tourism of Thailand for the future work.

Keywords: Sport tourism, Tourism expectation, Tourist, Tourism in Thailand

Introduction

Many several years ago, Tourism business has been growing every year. According to the World Tourism Organization (WTO), current tourist arrivals are up 4% from January 2016 to June 2016 when compared to the same period last year. Taleb Rifai, Secretary-General of the World Tourism Organization, stated in an article of the Tourism Organization in 2016 that tourism is a very important industry for the world economy. Tourism has led to the creation of a business growth that has had a profound effect on many countries (World Tourism Organization, 2016). Nowadays, there are various types of tourism; for example education tourism, work tourism, leisure, and sport tourism (Anca, 2008)
**Sport Tourism**

Sport tourism is one of the most popular tourist destinations in the world. Sports tourism has a different meanings. However, the overall meaning is similar, it is a leisure travel outside of residential areas in order to participate in physical or sightseeing activities, or to visit places of interest related to physical activity or sports (Hinch and Higham, 2011). Several researchers found that sport tourism has a positive impact on the economies of each countries (Gammon and Robinson, 2003; Weed and Bull, 2004; Weed, 2006). World Trade Organization (2016) reports that global travelers grow by more than 4.4 percent by 2015, resulting in more than 1,184 million tourism revenue by the end of year. Gratton, Shibli, and Coleman. (2006) found that increased tourism revenue came from sports tourism. Similar to the study of Weed (2006), He found that tourism in general will grow by 5 percents per year until 2020, and predict that sport tourism will grow up to 10 percents per year.

The United Kingdom is regarded as an outstanding country for sport tourism. The UK news agency reported that in 2011 more than 1.3 million tourists arrived in the UK to visit the football stadium. The most popular stadiums are Old Trafford, Anfield Emirates Stadium and Stamford Bridge respectively which earn revenue from tourism more than 1.1 billion pounds. This information is similar to the report of academic tourism Statistics 2015 that the tourism make a huge income for the country (Tourism Alliance, 2015)

**Tourism strategy in Thailand**

In case of Thailand’s tourism, it found that tourism industry is one of the main revenue for Thai government. Year 2014, tourism revenue reach 1.7 trillion baht calculated as 14.2 percents of Thailand overall revenue which is resulted in direct and indirect from tourism activities and services (Nakorntup, 2015). Arguably, tourism is a vital part for strengthening a country’s competitiveness. Thai government perceived the benefit of tourism and has put tremendous effort into and budgets to support Thai tourism. Tourism was announced as one of a national agenda in 2015. The ministry of tourism and sports is the main agency who is responsible for promoting and supporting entire tourism in Thailand. There are various Thai National Plans concerning tourism support and development. For example:

- Strategy of the Office of the Permanent Secretary: Ministry of Tourism and Sports 2011-2016
- Strategy of Ministry of Tourism and Sports 2012-2016
- Reforms of Thailand Tourism Strategy 2015-2017
Thai National Tourism Development Plan 2017-2021
ICT master plan for Ministry of Tourism and Sports 2014-2019
Tourism Strategy of each provinces

Although, much evidence can be found from official documentary that Thai government has developed many strategies and put much support on tourism, there is no evident that sport tourism strategy of Thailand has been existed. Therefore, this research focus on what should sport tourism strategy of Thailand be like? For an exploratory phase, researcher will focus on tourist expectations and behaviour towards sport tourism in Thailand. The outcome of this research study will be value not only for understanding tourist perspectives, but also for develop and design of effective strategy of sport tourism of Thailand for the future work.

Theoretical background

For customer or tourist focus, this study draws on several major theoretical paradigms; namely The Nine 9’s of Marketing, Theory of Planned Behaviour (TPB), and Social Cognitive Theory (SCT)

The Nine 9’s of Marketing
One of the most popular theories of understanding tourist expectation and demands of customer is The Nine 9’s or 9P’s of Marketing. Anna Antczak-Barzan (2014) has given the meaning of tourism marketing as to put an effort on the growth of the local tourism, organisational tourism, national and international tourism, There are nine elements of 9P’s Marketing Mixes, namely product or service, price, place, promotion, process, people, physical environment, presentation, and passion. Marketing mixes have been used for studies and research in various fields, including tourism. The marketing mix theory is the concept of Philip Kotler. Philippe Cottle started his career as an economist. He explained that the most important of marketing is customer whether in demand or supply, or even in services or mechanisms. These will bring the product to the point of development and create a good image for the product and service. It means customer is the center of marketing (Mahajan, 2013).

Theory of Planned Behaviour
This model determines behavioural intention by measuring subjective norms and perceived behavioural control (Ajzen, 1991). The key determinant of an individual’s behaviour is defined by the relationship between attitudes toward the behaviour, subjective norms, and also
perceived behavioural control. Ajzen (2002) indicated that attitude toward behaviour has a direct effect on behaviour intention, while attitude toward an object has an indirect effect. In the context of technology usage, to investigate people’s subjective norms on what they care about, will affect the behaviour.

Social Cognitive Theory
This theory is conceptualized by Bandura (1986) as a “theoretical framework for analysing human motivation, thought, and action”. A key concept of SCT is perceived self-efficacy which refers to the belief an individual has in his/her ability to perform certain behaviour.

Research Methodology
This research is conducted using quantitative and qualitative methods as shown in figure 1. The study involved a survey (Collis, 2003), which was used to collect preliminary data, via online and paper-based questionnaire.

The exploratory questionnaire was developed based on the theories mentioned previously. A qualitative approach followed, based on focus group discussion (Collis, 2003). Zikmund (2000) described the focus group as an unstructured, free-flowing
interview with a small group of people. It is not a rigidly constructed question-and-answer session, but a flexible formation that encourages discussion of, say, a labour issue, a new service, or a new-product concept. Copper and Schindler (2008) argued that the topical objective of a focus group is often a new product or product concept. The output of the session is a list of ideas and behavioural observations with recommendations of the moderator. This increases the depth of understanding of the cases and situations studied (Patton, 2002; Collis, 2003). According to King (2004) the strength of a qualitative method is to gain descriptions of the life-world of the interviewee with interpretation of the meaning of the described phenomena, and to understand how and why they come to have this particular perspective. According to Bryant (2009), the fundamental characteristic of qualitative research is to express commitment to the perspective of people who are being studied.

Research in progress

- Data Collection Methods

The data collection methods employed in this study are survey and focus group interview. The data was collected in Thailand. The exploratory survey collected preliminary data via online and paper-based questionnaire. Lewis and Thornhill (2009) states that questionnaire is one of the most widely methods used for collecting preliminary data - both quantitative data and qualitative data. It is an effective way of collecting responses from a large sample (Collis, 2003; Saunders, Lewis and Thornhill, 2009) and can be administered to many people at distant sites (Gray, 2004). Gable (1994) argues that although the survey approach can provide general statements about the object of study, it provides only a snapshot of the situation at a certain point. Zikmund (2010) describes the focus group as an unstructured, free-flowing interview with a small group of people. It is not a rigidly constructed question-and-answer session, but a flexible formation that encourages discussion of the research issue.

This survey was followed by focus groups with eight various persons from different occupations such as secretary, office administrator, lawyer, researcher, strategy management planner etc. The focus group discussions will tape recorded, with the
participants’ permission, and consent forms were signed. These increased the depth of understanding of the cases and situations studied.

- **Data Analysis**
  - Questionnaire survey

  Numerical data responses from the closed questions was analysed by computer (using Microsoft Excel or SPSS), while text from open-ended questions was analysed by carefully reading and summarising into categories manually. In the process of questionnaire development, a coding scheme were established which was incorporated into the closed-questions. Saunders, Lewis and Thornhill (2009) suggest that this method is useful and enables comparisons with other data sets.
  - Focus group discussion

  The audio recordings of focus groups and interview will fully transcribed word for word. Data analysis was undertaken manually using colour highlight pens. Once data has been categorised and coded, descriptive statements are formed to explain what the participants said. Results were presented using the descriptive text and incorporating comments from the participants.

**References**


Smart Classroom - New Dimension of Learning:
the case study of Suan Dusit University Thailand

The scientific and technological advancement results in the present day's environment which is surrounded by computerized technologies. It is common that educational institutions in general invest their budgets in the procurement of modern equipment and technology in their classrooms. However, introducing technology into education efficiently and effectively cannot be achieved by merely designing a modern classrooms and introducing various new modern tools and equipment therein. The important and challenging thing for an organization is the confrontation with the changes which occur when new thing is introduced. The change from the traditional style of learning to the active learning or the so called Smart Classroom is the creation of a new dimension of learning because teachers will not merely have the skill and potential in appending the new tool to the teaching, but must also change their paradigm, insight, and idea on method of teaching and transferring of knowledge. This must be done in order to truly take the organization to a new educational culture and society.

Keywords: Educational Technology, ICTs in higher education, Smart Classroom, Thai Higher Education

Learning Process and Smart Classroom

Most of the traditional classrooms have the teaching format in which the teachers pass on the knowledge to students by explaining by words, actions, textbooks or other books. This format passes on only 10% of the knowledge which the teachers intend to transmit (Center for Research on Learning and Teaching, 2017). Therefore, the new format of the learning processes have been developed to conform to the adjusted context in order to increase the efficiency and effectiveness, such as the Active Learning or the Interactive Learning.

Active Learning is a learning process which promotes the participation of learners in thinking and synthesis (Center for Research on Learning and Teaching, 2017). The knowledge which learners will receive from this format of learning will emphasize on the actual participation procedure, problem solving, and synthesize and understand the context by the learners themselves. This is different from the traditional learning in which learners listening to teacher or reading from text alone. Education and Culture DG (2010) indicates that learning through the Active Learning method achieves higher learning result than through the traditional method. Learning through actual participation creates better understanding and longer memory of the content and information. Besides, this format of learning is more fun and enjoyable than the traditional method. As for the Interactive Learning, it is the format which emphasizes on learning through the interaction either between teacher and learner or between learners, either in a classroom or on an online network. Under this format, teachers who used to have the duty in the one-way transmitting of knowledge will have to adjust and change their role to be advisors who participate in the learning process (Education and Culture DG, 2010). Therefore, an appropriate environment must be provided for learning of either a small or large group in such a way that will make both teachers and learners interest in the activities and promote the connection in the knowledge and
thoughts between them. This will result in achieving the specified objectives and goals (Lunsden, Lumsden, and Wiethoff, 2010; Zosh et al., 2016)

Smart Classroom is an integration of technology and the traditional learning format to reinforce the experience by various information technologies (Pahey, 2014) which can well support the Active Learning and the Interactive Learning processes. From the study and research, it is discovered that the introduction of Smart Classroom into the normal learning and teaching process helps the collective learning in various subjects such as health and medical field or linguistic. As a result, learners can achieve a higher degree of learning (Huang, Yang, and Xiao, 2014; Pahey, 2014). However, the development of Smart Classroom needs to integrate various components to ensure that the objectives are achieved. The introduction of state-of-the-art information technology into an organization consists of various interconnected factors. Contextualism is the theory which helps in the analysis of the relationship between information. It is appropriate to be used in the analysis of relationships structure between various components as a foundation for educational technology development (Pettigrew, 1987, Smiths and Poel, 1996; Caldeira and Ward, 2011. Contextualism was founded in Warwick University in England in mid 1980's by a team of organizational strategy and change researchers. The study covered the components on the work of various developments of more than 100 small, medium, and large organizations. Every organization must confront changes which develop new things in it. This theory concludes that an initiative or new development in an organization should begin by studying the connection of three main components namely the context, the content, and the process, as shown in Figure1.

![Figure 1: Contextualism (Pettigrew, Mckee and Perlei, 1988)](image)

**Context:** According to Contextualism Theory, Pettigrew (1997) gave the meaning of context as the things that influences the thinking process, course and cause of change. The study of these things is to understand the context which occurs from either outer or inner factor, and affects the achievement of the specified objective or requirement. Organizational culture has an influence over the inner factor (Hill et al., 2012). Schein (2004) and can affect the people of that organization in doing or not doing this or that, as well as in the believing, the following, or the valuing.
**Content** means the characteristic, format, or boundary of the thing that is being studied which can be some products or equipment being introduced to be used in an organization (Pettigrew, 1997). If we are to talk about equipment or information technology system, Bouwman et al., 2005 points to the fact that the characteristic of the product is the main factor that affects the acceptability and the favorable attitude of the users for the development of the organization.

**Process** is the sequence of steps or activities which bring the change from one thing to another (Pettigrew, 1990) Kwon and Zmud (1987). There are six stages of information technology implementation in an organization, including: initiation, adoption, adaptation, acceptance, use and incorporation.

- **Initiation**: It includes scanning of organisation problems and gathering information regarding opportunities for IT solutions.
- **Adoption**: It is the stage when the decision to commit resources is made, to get organisation ready for the new technology implementation.
- **Adaptation**: It includes the IT installation, maintenance of new technology, and the development of new organisational procedures.
- **Acceptance**: It is the stage at which organizational members are induced to commit to using the new information technology.
- **Routinization**: It is the stage at which the new information technology is encouraged as a normal activity.
- **Incorporation**: It includes the integration of new information technology within the organisation's system to support higher levels of organisational work.

**Contextualism and Suan Dusit Smart Classroom**

Suan Dusit Smart Classroom utilizes Contextualism theory in the conceptual framework of management by connecting the three main components which are Context, Content, and Process.

- **Context** consists of both the outer factor and inner factor of the university as follows.
  - Outer factor emphasizes on the policy on the national level which affects organization in realizing the benefit and the need of technology. The university is a governmental sector which must manage according to the framework and policy of the government. According to the study, it was discovered that technology for education was clearly specified in the master plan and policy of the Ministry of Education such as in the National Education Act 1999 section 9 (http://moe.go.th/main2/plan/p-r-b4-01.htm) with the substance in promoting educational institution to append information technology into the learning and teaching or the Education Development Plan for Higher Education Edition No.11 (2012-2016) of the Office of the Higher Education Commission which emphasizes on the technological skill of teachers and learners in all levels of education (www.mua.go.th/users/bpp/developplan).
  - Inner factor emphasizes on the organizational level management policy; be it concrete objects such as building and equipment, or abstracts such as organizational culture and management. For this university, it is a public university which was first opened on May 17th, 1934. The main campus was built in Bangkok over 80 years ago. The University also has campuses throughout Thailand, with more than 2000 staff. The University now offer graduate degrees to doctoral level. For this university, if we were to think back on the past operation regarding information technology, we would discover that the university gave importance to it for many decades. It was
started in 1995 with the allocation of budget planning for information technology. In 1997, there was an investment on the fundamental structure and equipment. In 2000, a fully electronic library called the Virtual Library was established (Academic Resource Centre Handbook, 2016). This library provides educational facilities and resources such as Video on Demand, email network, online database, and automatic library system. In 2006, laptop computers were allocated to all new students as a learning tool. In 2007, Suan Dusit Internet Broadcasting (SDIB) was founded to produce and provide resource for educational broadcasting in digital format. Suan Dusit Rajabhat University is well-known for being a higher education institution with the most completed technological system in Thailand (Suan Dusit University, 2016). The educational development by introducing technology into the teaching and learning has been continuous and in 2014, the university introduced iPad as a learning tool under an educational cooperation project between the Department of Local Administration and Suan Dusit University in order to produce graduates in Early Childhood Education. And presently, the university still continuously develops the information technology. The evolution of the development of the information technology of Suan Dusit university is shown in Figure 1.

![Figure 1: The Development of Educational Technology of Suan Dusit University](image)

The above information is a testimony that the university truly and continuously realizes the importance of technology for education. The use of technology for management and in support of education is nothing new for the university. The working environment is complete with facilities to support the use of technology. If the university wanted to introduce innovation or new technology such as Smart Classroom into the organization, there would be no problem for the personnel and students in terms of the potential and attitude because the IT acceptability and familiarity are already existed here (Niamsorn, Wainwright and Graham, 2011).

- **Content** is the characteristic and format of various equipment used in an organization. For Suan Dusit Smart Classroom, different kinds of fundamental IT equipment are introduced into classrooms, which are divided into two types:

  Classroom Type 1 is a standard classroom where the fundamental IT equipments such as projector, 3D document camera, microphone and sound system, and the internet connection are installed.

  Classroom Type 2 is a smart classroom which has all the equipment of the Classroom Type 1 but with the addition of the Interactive Learning supported equipment.

- **Process** is the sequence of steps or activities of Suan Dusit Smart Classroom development which, according to the principle of Kwon and Zmud (1987), include 6 stages as Table 1.
Table 1: Procedure of Suan Dusit Smart Classroom according to Kwon and Zmud’s process

<table>
<thead>
<tr>
<th>Steps</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation</td>
<td>The administrators of the university realize and play an important role in introducing the information technology into the organization continuously.</td>
</tr>
<tr>
<td>Adoption</td>
<td>There is a support and allocation of budget for the procurement of necessary equipment in the management of Suan Dusit Smart Classroom.</td>
</tr>
<tr>
<td>Adaptation</td>
<td>Various sections are assigned with responsibilities and work connections between them are established in order that the Smart Classroom System can be installed as specified. This includes the maintenance plan, the operation plan, and the system usage training.</td>
</tr>
<tr>
<td>Acceptance</td>
<td>User Manual is produced. Training on necessary functions is provided. Introduction to digital database through multi-media or various forms of the university's publications are also available in the Smart Classroom as well as the teacher training on innovative and creativities in each field of study.</td>
</tr>
<tr>
<td>Routinisation</td>
<td>Support, promote, publicize, and stimulate the usage of information technology in teaching and learning.</td>
</tr>
<tr>
<td>Incorporation</td>
<td>The 'SDU Smart Community' was established on the social network as a center to give advice, support, and solve problem which may occur from the use of the system, both on the equipment and the classroom management. Besides being a communication channel between the people involved in the development and installation of the Smart Classroom and the teachers who use the system, it is also a channel for teachers to exchange knowledge and recommendation among themselves as well as a chance to utilize our educational technologies to its fullest capacity.</td>
</tr>
</tbody>
</table>

**Conclusion**

The development of Suan Dusit Smart Classroom is aimed to integrate the Active Learning and Interactive Learning among teachers and learners with the support from proper equipment. This learning format does not only develop the learners to be familiar with the learning through activities, thinking, and synthesis, but also changes the paradigm of teachers while motivates both teachers and learners to learn together. The learning through technologies results in the transition from traditional format to a new format. But the investment in modern technology alone cannot give the real answer to the question on how to develop the learning process. The realization on the connection between various contexts must be fulfilled. And in order to understand the connection between different contexts, the Contextualism Theory is thus used in the development of Suan Dusit Smart Classroom. It is anticipated that both the teachers and learners have sufficient skills and potential in the information technology so that they are ready for the new era of education in which the thinking, analysis, and exchange of knowledge are emphasized.
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Encountering camera surveillance and accountability at work – case study of the Swedish police

Research-in-progress

Abstract

Today’s mobile cameras mean that anyone may easily be filmed and exposed to a wider audience meanwhile conducting their daily work. Police officers belong to an occupation that most frequently have to encounter this development. As state representatives, entitled to make use of violence at work, they end up being held accountable by a variety of actors capturing police initiatives on film. Police authorities around the world therefore have started to use body-worn cameras, aiming to enhance trust and transparency, but also as a means to control their work environment. On the one hand, cameras are described as a tool ensuring legal security and public trust in the police, on the other hand cameras are also associated with concern for surveillance and integrity. We intend, in this recently started study, to investigate what consequences this technology have on individual officers organising their own practices, and on the management of patrols wearing these cameras. The study is guided by the following questions: 1) What opportunities and challenges do individual officers associate with the introduction of cameras in their practice? 2) In what way is the use of cameras managed by the organisation, what tensions do they have to address between the individual officer’s practice, the management and the public? 3) What opportunities and challenges do the police associate with citizens using cameras to document the police? Theoretically the analysis draws on research on accountability, technological affordances and surveillance. Empirical material is planned to be collected through interviews, focus groups and document studies.

Keywords: body-worn camera, mobile camera, affordance, accountability, surveillance, police, social media

1.0 Introduction

Today’s widespread use of camera-equipped smart phones has enabled the public to take photos or videos of current events and, through social media, immediately make these available to a very large audience. This is the result of the ubiquitous or pervasive spread of a new digital infrastructure, allowing everyone to document everything and easily share it (Sörensen, 2010). However, this development forces professionals in many parts of the public sector to face and reflect upon specific concerns. While exploring new digital opportunities to enhance transparency and
public trust, they have to tackle risks associated with acting in public. As improvements emerge, an increasing range of considerations associated with this new digital technology is also becoming an integrated part of their daily work. In this study, we set out to investigate police officers as one of the occupational groups that are exposed to this development.

In addition, the police themselves have in a number of countries started to carry cameras placed on their uniforms to be able to film their practice, so called body-worn cameras. The motivation for adopting this technology is more or less the same across all countries: (i) the need to make police more accountable to society; (ii) the need for individual police officers to protect themselves against false accusations, and; (iii) the expected pacifying effect on the interactions between police and citizens (Coudert et al., 2015).

We draw on the police in Sweden as a case allowing us to generate more knowledge about how the police as a profession have started to use body-worn cameras. In this case, the explicit idea has been to use technology to improve transparency in a way that strengthen public trust in the police authority. To make sure that citizens understand the circumstances, the cameras used are placed visible on the police officers’ uniform, with the screen turned towards anyone being filmed. It is the individual officer him/herself that have the power to take the decision to turn the camera on or off (Datainspektionen, 2017).

Even if this initiative is described as a way to strengthen legal practices and public trust in police professionalism, there are concerns expressed about extended surveillance and the risk of violating citizens integrity and rights (Lee et al., 2016). Most studies so far have focused on aspects of integrity, whereas we know little about how the individual officers’ work is shaped by new demands on considering how to apply their use of cameras. It is this latter topic that is in focus in this study. As implied above, the aim to implement the cameras is to improve transparency and trust. However, before drawing any conclusions it is crucial to investigate what consequences these cameras have on the individual police officers’ practice and the organisation of work hosting these practices. We also need more knowledge about how police management approaches the use of these cameras while governing the
officers and their work. In addition, to fully understand the police organisations’ perspective, this study will also take in consideration how the public make use of digital cameras to film the police. That is, we will acknowledge the police use of body-worn cameras as a measure within a broader digital context in which they have to consider the fact that citizens also engage in surveying them (with their smartphones etc) as representatives of an authority (Lippert & Newell, 2016; Sandhu, 2016); so-called sousveillance.

The police use of body-worn cameras are thus understood as a response to the ubiquitous potential allowing everyone to watch everyone. We focus on how this ever present potential, and the spread of digital technologies like smartphones provide both opportunities and constraints in officers’ work practices and how the police due to these potentials try to manage and organise their practices in a legitimate manner. Legitimacy and accountability in relation to both their own organisation and the citizens are then seen as components that are always relevant to public authorities. However, due to extensive demands on how to represent both their specific authority and societal democratic principles (with violence if necessary) such legitimacy concerns emerge as particularly evident in the case of the police (SOU, 2012:13).

It is because of such demands on legitimacy that police officers in many countries are encouraged to use body-worn cameras to document incidents and actions both among citizens and officers. There are extensive expectations that the use of these cameras will improve accountability as well as strengthen trust in the police (Lee et al., 2016). Body-worn cameras has emerged as a tool that may contribute in “civilising” the police as well as consolidating their legitimacy. However, concerns are also expressed about what effects the technology may have on the ability to monitor and whether there is a risk that they may violate citizens’ integrity (Lippert & Newell, 2016; Mateescu et al., 2016). The fact that these are concerns that to a high extent still awaits investigation, have not prevented authorities in many countries from introducing the technology (Mateescu et al., 2016). Amongst other things, it is both seen as a preventative measure as well as a way to reveal when officers violate their own public assignment, e.g. by using unjustified violence. By filming their own actions, the idea thus is that they improve their accountability, but officers are also said to learn how to adapt their behaviour to any situation where there is a risk of
being filmed. They tend to apply ‘camera friendly work’ (Sandhu, 2016), which take the shape of strategies aiming at controlling how they are perceived by different people and officers filming them or looking at the films.

These are all different expectations, implying that the consequences that these cameras have on officers’ work practices should be understood both on an individual and on an organisational level. In accordance, this study draws on empirical material that will reflect both how the police authority as an organisation and the individual officers tackle different challenges in police work related to the use of body-worn cameras. It is about different challenges to how they maintain public services recognised as accountable and appropriate. In other words, we investigate how legally appropriate and responsible practices for the use of body-worn cameras emerge within the police. In what way do the organisation and/or the individual officer in practice tackle different expectations on legitimacy in action and in relation to more general demands on a robust and legal system for managing big volumes of data.

1.1. Purpose and research questions

Thus, body-worn cameras have become more common in western countries, raising expectations on improved transparency and legitimacy. Nevertheless, a range of questions concerning policy, organisation of work, management of data and integrity remain to be investigated (Mateescu et al., 2016; Datainspektionen, 2017). Drawing on the initiative by the Swedish police to introduce body-worn cameras, this study investigates the consequences these cameras will have both for the individual officers’ daily work practices as well as for the police organisation and how it try to govern these work practices. By doing so we start filling the gap of empirical studies investigating how body-worn technology shapes police work and public trust in the police. The analysis will be guided by the following research questions: 1) How do individual officers tackle different risks and opportunities related to body-worn cameras in their work practice? 2) In what way are the use of body-worn cameras introduced in the police organisation, and to what extent does it foster tensions between work practice, police management and the public? 3) What are the opportunities, challenges and dilemmas that are fostered by the increased use of cameras by the public, documenting and distributing films showing different police actions?
2. Accountability, affordance & surveillance as theoretical perspectives

Organisational accountability, technological affordance, and surveillance are concepts that are central to the analysis to be conducted in this study. To begin with, investigated technology is conceptualised as a socially defined materiality (Orlikowski & Scott, 2008), holding certain features that promotes potential affordances (affordance, see Gibson, 1979). As a concept ”affordance” has been developed to understand how a certain technology or digital infrastructure –in this case body-worn cameras–interact with human actions. The aim is to explore how this interaction make technology actionable (Faraj & Azad, 2012; Majchrzak et al., 2013; Norman, 2011). In this study that would mean that we direct our interest towards how cameras enable and constrains a set of actions (Gibson, 1979; Norman, 2011), related to different forms of surveillance that in the context of any public authority foster various demands on accountability.

Thus, technological affordance may foster different types of accountability. The meaning of accountability may take different shapes depending on the interaction between human actions and the cameras. Thus, when police officers apply the camera and its ability to document and broadcast short cuts from real situations, they will organise their actions in relation to a set of other actors and their demands on surveillance and accountability. For instance, it may mean that filmed data is turned into evidence in courts, or raises demands that individual officers adhere to formal accountability. Likewise, the public’s use of smartphones may generate films that are spread via social media or to journalists (Bekkers & Moody, 2014), films that may also be used in courts.

In the analysis of the type of accountability that is associated with body-worn cameras, this study draws on the fact that the police is forced to consider that this is a technology that can be used everywhere and in very different ways (Sörensen, 2010). Demands for accountable digital work are not only evident in situations when the police officer sits down at his or her office to conduct computer based administration. Instead, they have to reflect upon how to apply a more ubiquitous technology in a
correct manner (Castells, 1998). To be in accordance with public directives, they have to acknowledge that this is a technology that Adam Greenfield (2006) has described as “everywares”, demanding awareness of the fact that they bring it with them into continuously new contexts. Hence, they have to reflect upon the fact that these cameras will be applied under different circumstances, where a variety of affordances and consequences are possible. By investigating how police officers relate to such circumstances, this study contributes with knowledge about how affordances associated with a mobile and pervasive digital technology for surveillance, shapes the form of digital accountability that will emerge as an organising principle within the police authority.

By analysing different forms of accountability we draw on an extensive international field of research. It is a field of research providing us with perspectives and ideas about how a variety of demands on accountable actions condition how organisations and practices of work emerge within the public sector (Mulgan, 2000; Millen & Stephens, 2012). Two different types of accountability is of specific interest to our analysis. To begin with we will therefore engage in identifying and scrutinising how police officers adjust themselves to demands on actions that meet certain norms and regulations (laws); i.e. normative accountability. Furthermore, we will bring attention to how to approach demands on accountability justified by goals and references to powerful or efficient applications of the technology; i.e. instrumental accountability (Roberts, 1991). In cases when the police watch or are being watched by citizens, they often have to consider how to manage complex combinations of these two different forms of accountability.

The study aims at examining how these two forms of accountability emerge as meaningful to police officers that constantly have to approach complex networks of digital relations with different implications for how they should approach public demands on accountable police work. By being an investigation into how digital technology enables different forms of surveillance, embedded and sometimes taken for granted in daily settings (Lyon, 2015), the study will then also bring attention to the field of studies that sometimes is referred to as research about panopticon (Foucault, 2003). More precise, the study recognises how surveillance, being distributed and organised, also can be explained by understanding the police as
modern center for societal power (Lyon, 2006). Within this theoretical context, instrumental and normative demands on accountability will be investigated as conditions shaping the way police organise their work practices while applying these new digital opportunities to strengthen their capacity to watch; for instance, by considering how to organise their use of cameras without violating citizens integrity (Lyon, 2015).

Our application of panopticon as a concept by which we may analyse potential top-down surveillance, can be useful to provide opportunities to identify and understand meaning of different surveillances systems pervasively embedded in our daily lives (Bauman & Lyon, 2013; Eneman, 2009: 2010). The fact that some researchers point out that this ubiquitous development counteract established power centers’ ability to control society, have meant that the study also draws on the concept of ‘synopticon’, referring to the distributed digital capacity in society to watch established authorities (Mathieson, 1997; Bauman & Lyon, 2013). By also scrutinising how citizens use digital technology to film and document how individual officers act, we will be aware of such situations. We will thus apply the concept of synopticon as a way to study how digital demands on police practices and accountability also may be associated with bottom-up surveillance.

2.1 Related research
Our focus to examine different types of affordance associated with different forms of demands of responsibility in exercise of public authority, could be seen as unique compared to the majority of research with a focus upon the technology within the growing areas of “ubiquitous computing” and “everywearables” (Sörensen, 2010). Our study will contribute with knowledge regarding how the interaction between digitalisation and other more organisational processes affect the ways to organise work within an authority as the police. With the use of body-worn cameras, the police now have access to new forms of powerful surveillance. Even though surveillance is not a new phenomenon in society, digitalisation has changed the surveillance capabilities radically. One of the most significant changes is that digital technology enables surveillance system to become more powerful, further automated and can be used for large-scale collection and storage of data. Additionally, surveillance systems are today often concealed and embedded in the environment (ubiquitous) and are thus
invisible (Lyon, 2015). A consequence of this is that individuals are not always aware of when being exposed to surveillance, which could be seen as a serious threat to individuals’ privacy (Bauman & Lyon, 2013). Murray (2016) argues that digital technology enables even more powerful surveillance and control of citizens than what George Orwell predicted in his dystopian classic “1984”. Despite that the concept of panopticon (Foucault, 2003) has been subject for certain critique for its limitations to adequately understand contemporary surveillance systems where many watches many, it is still central and valuable in the discourse regarding surveillance, since panopticon is such a multifaceted concept that could be used for interpretation in a number of ways and in different contexts (Lyon, 2006).

The use of body-worn cameras enables the individual police officer to monitor the surrounding of both citizens and colleagues (and at the same time being monitored by other colleagues), which could be understood by the concept of governmentality (Rieken, 2013) to capture aspects connected to that everyone can collect information and monitor and control their surrounding/environment. In addition, the individual police officers’ use of body-worn camera could be understood as a form of self-regulation since their own behaviour is monitored. By wearing a camera, regardless if it is on or off, the potential risk or possibility of control is visible and constitutes in itself a form of disciplinary power (Foucault, 2003). Another effect of the camera use is that large volume of information about individuals’ behaviour is collected, which means that material consisting of personal information must be managed and stored within the organisation. Joh (2016) argues that the use of body-worn cameras within the police must be regulated and that the regulation should focus both on the actual use of the cameras and the control of the data, for example during what circumstances data is allowed to be collected, how it should be analysed, stored and who should have access to the data.

A further dimension connected to surveillance is the public’s use of mobile surveillance technology, such as smartphones with built-in cameras, to document police officers in the field, which means that technology also enables for citizens to monitor and control the police’s government work and can be understood through the concept of counterveillance (Monahan, 2006) and sousveillance (Mann et al., 2003; Mann & Ferenbook, 2013). Sousveillance, surveillance of the observer, relates partly
to the network society and the possibilities to rapidly access many users and partly to
the expansion of mobile technology (Mann et al., 2003). Sousveillance is closely
connected to the development of mobile technology, and the convergence between
phones and cameras. Finally, It should be emphasised that powerful surveillance
systems cause/provoke active resistance where different strategies are developed by
individuals to avoid or disrupt the surveillance mechanisms (Eneman, 2009; Ball,
2006), which indicates that it is a mistake to believe that surveillance result in total
disciplinary power (Lyon, 2015). The project will also contribute to the established
research field regarding Surveillance, where our specific contribution problematises
surveillance (as both risk and possibility) in relation to work practices within the
context of public authorities.

3. Planned research design

3.1 The Police as a case

The project will be designed as a case study (Walsham, 1995) of the Swedish Police,
and examine relevant work practices in relation to the ambition to monitor and claim
responsibility using new technology. The police is a public authority with a broad
societal mission aimed at reducing crime and increasing security in society through
preventive, interventive, and investigative activities (Manning, 2008). This implies
that the police constitutes a concrete case of government work that must relate to a
variety of requirements for a responsible and lawful work. As a case, this will provide
access to a rich material of different aspects of technological affordances and
accountability.

By building the study on a qualitative analysis of different types of empirical material
collected through approximately 40 interviews, three focus groups, and document
studies, we generate new knowledge regarding the introduction and use of body-worn
cameras. The combination of these three data collection techniques is motivated by
our ambition to provide a rich and diversified material that reveals different aspects of
our studied phenomenon. It will also strengthen the ability to test and - when
applicable - verify the credibility of different interpretations.

3.2 Semi-structured interviews
The project will carry out individual interviews with approximately 40 police officers in order to document how different parts of the police organisation understand, describe, and relate to responsible handling and organising of body-worn cameras. We choose to conduct interviews as it is a useful technique for gaining good insight into the perceptions, experiences, values, feelings and understanding of individuals, and an understanding how they construct, make sense of and give meaning to their worldviews. The selection of interviewees will reflect different positions and responsibilities, and cover different levels within the police force, operational as well as strategical. We will strive for a number of interviewees evenly distributed between the different activities included in the study, as well as taking into account ethnicity and gender issues.

3.3. Focus groups

Through the individual interviews, 6-8 respondents will be recruited to three focus groups (Silverman, 2014). This type of data collection fills an explorative function and serves as a basis for the project's continued empirical collection. The focus groups will focus on the overall theme, i.e., how the individual police officers relate to responsible management and organising of body-worn cameras in service and how they relate to the public being able to use, for example, mobile phone cameras to document their actions. Focus groups are useful for gaining insight into the norms, tensions, and dynamics that exist within a group in relation to the studied phenomenon. Lee (1993) emphasises that the focus group technique is valuable for initiating discussion about sensitive subjects that can usually be difficult to approach such as, for example, mistrust or conflicts. An additional advantage that is usually emphasised with focus groups compared to e.g. individual interviews is that they reduce the interviewer's controlling role in the conversation, thus helping to initiate conversations between respondents where they can formulate different questions and statements to each other and clarify different dynamics in perceptions and values (Silverman, 2014). A broader and more explorative examination is made possible by the fact that several respondents together form and talk about different themes.

3.3. Document studies

In order to understand the relevant practices from several different views and further capture the broader organisational context, we will also collect and analyse both
formal and informal documentation that are relevant to the project. This can include everything from strategic policy and control documents to more operational meeting documentation, education literature and preliminary research material. Document studies will begin early and take place in parallel with the individual interviews. Through the document studies, we will have the opportunity to investigate the formalities surrounding the practices that characterise the police’s handling of body-worn cameras, and how these practices have been developed and are being developed in a wider historical, societal, economical, and political context. We think it is important to study the documents in their broader organisational context, as organisational systems should be understood on the basis that they do not occur naturally in society but always have a historical and political origin and benefit certain interests at the expense of others.

3.4 Analysis of the empirical material

We see the analysis as an integral part of the research process and not as an isolated part performed at a specific time in the project (Coffey & Atkinson, 1996). We therefore approach the material with an approach that leaves room for ongoing reflection on the empirical material collected. Our attention will be directed to both patterns and variations and we are well aware of the risk of focusing the analysis on identifying patterns can suppress identification of variations. Since we have a new phenomenon in the forefront, we are interested in a more exploratory understanding of the meaning that the interviewees assign to their work and their daily routines. Our attention will be directed to the possibilities of visualising values, tensions, dynamics, and disagreements. The analysis of the three different types of empirical material (interviews, focus groups, and document studies) will be designed in accordance with a qualitative content analysis (Silverman, 2014). This means that we start with careful reading of the material to obtain an overall picture, then we proceed to identify relevant phrases and sentences to be taken into account in order to create categories relevant to the project's questions. By identifying common features in an empirical material that is characterised by variation regarding the conditions and experiences that are expressed, the project has good opportunities for theoretically relevant generalisations. The project also intends to use appropriate digital tools for the analysis, such as nVivo and/or ATLAS.Ti.
3.5 Ethical considerations

Our project described in this research-in-progress paper was granted research funding in October 2017 and will formally start 1 January 2018 and run to 31 December 2020. We are now in the process of applying for ethical approval according to Swedish law concerning research relating to people at the Regional Ethical Review Board in Gothenburg. The reason for applying for approval is that we focus on police activities that can be surrounded by confidential or otherwise sensitive information, in the form of internal routines and procedures for conducting the business. In order to ensure that the project works in a responsible and research ethically correct manner regarding the retrieval, storing, and processing of empirical material, we will apply for such an approval. An approved ethics review will hopefully also have positive effects in making the respondents feel safer and more relaxed and thus facilitate access to information they would otherwise hesitate to share.

4. Expected contribution and conclusion

There is strong belief that the introduction of modern technology within the police will lead both to more transparent and to more efficient work methods. Studies show, however, that new technology also entails unforeseen consequences that risk limiting the efficiency sought (Manning, 2008). Now that body-worn cameras systematically begin to be used by Swedish police, we want to investigate the implications for individual police officers and their practice as well as for the organisation. There are also relatively few empirical studies on how the body-worn cameras affect the work of the police and the public's confidence in the police as an organisation. The police constitutes a clear example of an organisation that is exposed to the requirement to develop skills and practices that ensure responsible and lawful enforcement in a continuous manner. They constitute a case that can teach us a lot about how the logic that governs the requirements of a public sector also affects how public sector actors are organising themselves as a legal authority. Studying the emergence and organisation of new work practices in relation to the increased digitalisation in society is an example of a wider societal change strongly linked to technology development, which is of great importance for the organising of today's government work. The study also improves our understanding of how individual police officers are forced to handle different dilemmas related to the use of and exposure to technology, which
purpose is to control socially both citizens and the individual police in the field. Our results will be relevant to a variety of different functions within the police organisation, identifying the need for competence development as well as the ability to organise and adapt activities and occupational roles associated with society's digitisation. The lack of digital competence within the police is a top-priority issue emphasised in the societal debate (Riksrevisionen, 2015; BRÅ, 2016). From a scientific perspective, the study is expected to contribute to a theoretical frame of reference better adapted for analysing organisational changes in public authorities in general and within the police in particular, by identifying opportunities as well as challenges associated with digitisation.

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An Overview of User-level Usage Monitoring in Cloud Environment

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Abstract

Cloud computing monitors applications, virtual and physical resources to ensure performance capacity, workload management, optimize future application updates and so on. Current state-of-the-art monitoring solutions in the cloud focus on monitoring in application/service level, virtual and physical (infrastructure) level. While some of the researchers have identified the importance of monitoring users, there is still need for developing solutions, implementation and evaluation in this domain. In this paper, we propose a novel approach to extract end-user usage of cloud services from their interactions with the interfaces provided to access the services called User-level Usage Monitoring. We provide the principles necessary for the usage data extraction process and analyse existing cloud monitoring techniques from the identified principles. Understanding end-user usage patterns and behaviour can help developers and architects to assess how applications work and which features of the application are critical for the users.

Keywords: Cloud, Application, End-user, Usage Monitoring, Principles, Usage data

1 Introduction

In the last decade, we have witnessed the major change in software and applications in which cloud computing is becoming widely used, providing users with the possibility of using different devices to use (access) the cloud-based services seamlessly (Mell & Grance, 2011). The number of Cloud-based services has increased rapidly and strongly, offering various advantages over traditional software including reducing time to benefit, scalability, accessing through various interfaces and so on. However, it is also increased the complexity of the management of infrastructures behind these services. To properly operate and manage such complex infrastructures effective and efficient monitoring is constantly needed (Aceto, Botta, De Donato, & Pescapè, 2013).

Traditionally, the cloud provider (vendor) provides application performance management (APM) tools (for example, CloudWatch\(^1\) in Amazon Web Services) to

\(^1\) http://aws.amazon.com/cloudwatch/
monitor the status of the deployed applications, the amount of resources used by the applications based on the agreement between cloud vendor and the application provider called Service Level Agreement (SLA). These APM tools work at the infrastructure and service levels, providing mainly a vast amount of usage data of the resources used which can be turn into some knowledge for resource provisioning. However, it is nontrivial to obtain user-related information, for example how users satisfy with the given services or applications, from such kind of data. The application developers can also use various third-party monitoring tools like New Relic\(^2\), Binado\(^3\) and so on. But these tools mainly focus on monitoring application oriented usage including measuring the number of users logged-in to the application, identifying rare logins, cloud resource usage, idle times, license types etc. We firmly believe that exploiting usage data at a user level could give much more insights for the application development. Understanding usage data of an application has various uses such as to personalise the application according to the end-user's preferences (Yang et al., 2017), profiling users for security (Al-Bayati, Clarke, & Dowland, 2016), improvement in marketing of software products (Bucklin & Sismeiro, 2009) and to analyse the performance of the application in the deployed environment for maintenance purposes (Bezemer, Zaidman, Platzbeecker, Hurkmans, & Hart, 2010; Petruch et al., 2012).

In this paper, we provide principles for designing and developing a cloud monitoring tool, extracted from cloud standards such as ISO and TOG. Furthermore, we analyse the existing state-of-the-art monitoring solutions with respect to the monitoring level in cloud. As a result of the analysis, we have identified user-level usage monitoring as the research gap. With the improving of the data mining tools, these usage data can be gathered from online services by collecting all traces of user activity to produce clickstreams, sequences of timestamped events generated by user actions. For example, in web-based services, these might include detailed HTTP requests. For mobile applications, clickstreams can include everything from button clicks, to finger swipes and text or voice input (Wang, Zhang, Tang, Zheng, & Zhao, 2016). By using user-level usage monitoring, we believe the following challenges can be addressed:

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\(^2\)https://newrelic.com/

\(^3\)https://www.binadox.com/salesforce-saas-monitoring/
- **Usage based metering/billing**: user-level usage data helps cloud provider to design the billing policy to reflect the actual usage of the application by the end-user.

- **Resource provisioning**: based on the usage data, predict the resources that may be allocated to an application.

- **Focused application updates**: developers can determine features of the application that are critical to end-user. Hence, focus the development costs and time on such features.

- **Understanding user satisfaction**: instead of surveying and asking feedback, how users satisfy with an application can be revealed via their usage data.

- **Discovering user behaviour patterns**: Every user has their own pattern when using an application or a service. Understanding these patterns could help improve the service or discover the trends in advance. These patterns, can be discovered from the usage data.

Analysing and understanding the usage data from the user’s perspective can be used by the software developers and software architects to determine how much development time, development cost to allocate and spend for which features of the cloud application before rolling out new updates. As a part of our work, we aim to build the usage data extraction artefact and follow the evaluation approach using Design Science Research (Helfert, Donnellan, & Ostrowski, 2012). The terms *cloud service consumer, customer* and *end-user* mean the same and are used interchangeably in this paper.

The remainder of the paper is structured as follows: in Section 2, we discuss cloud standards, specifically the monitoring aspect of the cloud and propose the principles for a cloud monitoring tool/solution. In Section 3, we review the state-of-the-art cloud monitoring solutions. In Section 4, we present a comparative analysis of the cloud monitoring tools and as a result identify the research gap, usage monitoring. In Section 5, we provide conclusions and directions for future work.

## 2 Monitoring principles from cloud standards

Since the advent of cloud computing, various monitoring solutions emerged. However, existing cloud systems and enterprises incorporating them normally follow different architectures and standards bringing a vast amount of challenges in
communications as well as organisations for the applications and services in the cloud environment. As a result, the new services, applications and the monitoring solutions has the need to follow the principles set forward by the cloud standards (International Organization for standardization (ISO) defines \textit{standard} as “specifications for products, services and systems, to ensure quality, safety and efficiency” (ISO/IEC, 2014). Monitoring at user-level, consequently, should follow criteria and requirements as in other levels. For this purpose, in this section, we discuss and review widespread cloud standards and provide the principles a cloud monitoring tool should follow.

2.1 \textbf{International Organization for Standardization}

ISO in collaboration with International Electrotechnical Commission (IEC)\textsuperscript{4} drafted the “Information technology — Cloud computing — Reference architecture” document known as ISO/IEC 17789:2014 (ISO/IEC, 2014). This International Standard specifies the cloud computing reference architecture (CCRA). The reference architecture includes the cloud computing roles, activities, functional components and their relationships. The standard describes the activities of various components of the cloud. In this section, we focus our discussion on the activities of the monitoring component of the cloud. The monitor service activity monitors the delivered service quality with respect to service levels as defined in the service level agreement (SLA) between cloud service customer and cloud service provider. This activity uses the built-in monitoring functions of the cloud system. The ISO standard describes the following responsibilities of the monitoring activity:

- keeping track of how much use is being made of each cloud service, and by which users. This includes assurance that the use is appropriate;
- monitoring the integration of the cloud services with customer's existing ICT systems to ensure that business goals are being met;
- defining measurement points and performance indicators related to the service in question (e.g., service availability, service outage frequency, mean time to repair, responsiveness of the provider's help desk, etc.);
- monitoring, analysing and archiving of these indicator data;
- comparing the actual service quality delivered with the agreed service quality

\textsuperscript{4}http://www.iec.ch/
The standard also specifies integration of existing Information and Communications Technology (ICT) components and application with the target cloud services and its implications on the monitoring component which involves creating and monitoring specific user accounts and identities use of management interfaces for cloud services and integrating logging and security incident management between cloud services and user monitoring and management infrastructure. The user interface through which an end-user interacts with cloud service provider and with cloud services, performs customer related administrative activities, and monitors cloud services is described as user layer in the standard. A user interface is typically a thin client interface such as a web-browser, smartphone app or a command-line interface, can be collectively called “front-end interfaces” (Kesavulu, Helfert, & Bezbradica, 2017). A monitoring functional component in a cloud environment should provide the following capabilities:

- monitor the activities of functional components throughout the cloud service provider's system. This includes the components that are involved in the direct use of cloud services by the end-user: cloud service users including the service access and service implementation (e.g., the invocation of a cloud service operation by a specific user);
- report time-sensitive critical events based on monitoring cloud provider’s system behaviour (e.g., the occurrence of a fault, the completion of a task), or log system execution in the form of historical data (e.g., service usage data);
- storage and retrieval of data obtained from monitoring activity as logging records. The monitoring component is also responsible to guarantee the availability, confidentiality and integrity of the logging records.

2.2 The Open Group Standard

The Open Group (TOG)\(^5\) is a global consortium that enables the achievement of business objectives through IT standards. They provide a standard for cloud computing called “The Open Group Cloud Ecosystem Reference Model” which defines the cloud reference model and provides guidance on how to apply it with The Open Group Architecture Framework (TOGAF) and ArchiMate (open and

\(^5\) http://www.opengroup.org/
independent modelling language for Enterprise Architecture) standards to develop an Enterprise Architecture (The Open Group, 2014).

TOG standard specifies the following three activities of a monitoring component:

- Monitoring subscription (SLA monitoring): Service Providers design and utilise multiple subscription models for charging users based on resource usage by the end-users. Some examples of subscription models may include fixed, tier-based (e.g., Gold, Silver, and Platinum), pay-as-you-go payment terms (monthly, quarterly, annually). Monitor allocation and consumption of Cloud Services to enable cloud service providers to facilitate charge-back to their subscribed consumers based on subscription models.

- Resource Health Monitoring: provides a broad view of issues that impact cloud resources with the aim to improve performance, accountability, and business results. This includes identifying, diagnosing, reporting of the issues affecting the virtual and physical cloud resources.

- Service Health Monitoring: is similar to Resource health monitoring but the focus here is on the services provided by the cloud provider. In addition to identification, diagnosis and reporting, this activity is also responsible for providing tools to monitor defined SLAs.

<table>
<thead>
<tr>
<th>#</th>
<th>Principle for monitoring in the cloud</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ISO</td>
</tr>
<tr>
<td>P1</td>
<td>Monitor delivered service quality as defined in SLA</td>
<td>✓</td>
</tr>
<tr>
<td>P2</td>
<td>Monitor usage of services by user</td>
<td>✓</td>
</tr>
<tr>
<td>P3</td>
<td>Monitor the integration of the cloud services with customer's existing ICT systems</td>
<td>✓</td>
</tr>
<tr>
<td>P4</td>
<td>Monitoring component should ensure analysing and archiving of monitored data</td>
<td>✓</td>
</tr>
<tr>
<td>P5</td>
<td>User interface should be provided to the cloud provider and user to manage the monitoring tasks and visualise the results</td>
<td>✓</td>
</tr>
<tr>
<td>P6</td>
<td>Monitoring component should guarantee availability, confidentiality and integrity of the logging records</td>
<td>✓</td>
</tr>
<tr>
<td>P7</td>
<td>Consider different subscription models to define monitoring metrics</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 1: Cloud Monitoring Principles
3 Existing cloud monitoring solutions

Cloud providers offer diverse services to the cloud users using proprietary software and management techniques. Many of these providers use provider-dependent monitoring tools which complement their offerings. In addition, many monitoring solutions are being developed by researchers, enterprises. In this section, we review the state-of-the-art cloud monitoring solutions inspired by recent cloud monitoring survey paper by (Syed, Gani, Ahmad, Khan, & Ahmed, 2017).

3.1 PCMONS

The authors in De Chaves, Uriarte, & Westphall (2011) proposed an open-source architecture for cloud monitoring. The authors propose a three-layered architecture: (i) infrastructure layer; (ii) integration layer and (iii) view Layer. Infrastructure layer consists of basic hardware, software, network and operating system. Integration layer is responsible for visualisation environment and hypervisors to acquire infrastructural related information. The view layer is responsible for presenting the monitoring data appropriately to the type of user (here, a user represents actors such as developer, administrator or a manager, not an end-user). The authors also demonstrate the PCMONS tool in this paper using agent insertion based monitoring methodology (for every new VM). This method creates additional overhead affecting VMs performance. The monitoring component in this paper is called as VM monitor, which injects scripts into the VMs that send useful data (for example, processor load and memory usage) from the VM to the monitoring system.

3.2 GmonE

The authors in Montes, Sánchez, Memishi, Pérez, & Antoniu (2013) present a method to categorise the monitoring solutions according to monitoring level and vision, where monitoring level deals with layers of cloud computing as defined in Mell & Grance (2011) and cloud vision defines how to distinguish monitoring data to analyse and present to different actors (such as end-users, developers, architects, managers and so on). The authors define client-side monitoring vision as the client’s view of the cloud and deals with presenting the monitoring data to clients in terms of SLA agreement and contracts. The authors have proposed layered cloud monitoring architecture called GMonE, which is composed of four key components including GMo
monitoring Plug-ins, GMonEDB and GMonEAccess. The authors claim GMonEMon can run in any component of cloud that needs to be monitored to collect and send metric data to the GMonEDB and are implemented in the form of plugins. Monitoring data include status of the VMs, simultaneous network connections, application usage patterns. GMonEDB is responsible for receiving monitoring data and manages it for GMonE as a database. The GMonEAccess is a user interface which provides visualisation of monitored data.

3.3 NFM

In Suneja, Isci, Koller, & de Lara (2016), authors have proposed a novel cloud monitoring technique called Near Field Monitoring (NFM). The monitoring process is instantiated without inserting any agent into the user space. The operational logic of NFM include VM introspection using kernel data to extract system state and container namespace mapping, which enables the monitoring component to run irrespective of health of VM/containers. In NFM, a user/host can subscribe and unsubscribe the monitoring service as it runs independent of VM/container. Monitoring user interaction and user behaviour is not considered in the context of this paper.

3.4 MonSLAR

In Al-Shammari & Al-Yasiri (2015), the authors have presented a monitoring architecture called MonSLAR. The proposed architecture comprises of two versions of middleware, one for the user (client) side and one for the provider (server) side. Both the versions use REST (Representational State Transfer) protocols to dispatch requests and receive responses between client and server sides, thus enabling monitoring of components. MonSLAR provides information to the users about SLA if the services used by the user meet the agreed upon metrics. For the service provider, MonSLAR provides a method to measure the cloud user’s satisfaction using a combination of network Quality of Service (QoS) and SLA parameters and term this as Quality of Experience (QoE). However, this work does not consider user’s interaction with the cloud applications and the related implications on the cloud resources.
3.5 MonPaaS

In Alcaraz Calero & Aguado (2015) the authors present an open-source adaptive monitoring platform as a service (MonPaaS) tool. The proposed tool has two different monitoring modes including cloud provider monitoring and user monitoring (capability provided to user for monitoring the deployed cloud resources). MonPaas is implemented by integrating Nagios\(^6\) and OpenStack. This system intercepts the message queue of OpenStack, and use these messages to provide information about VMs. Both cloud providers and users can access the MonPaaS module in the form of API. The monitoring logic includes creation of separate VM for each new user, this creates additional performance overhead on the system. MonPaas uses Nagios for distributed monitoring, and DNX and Nconf to provide graphical management interface. MonPaas monitors physical and virtual resources and updates any change in physical or virtual infrastructure. However, user-level monitoring is not considered.

3.6 Monitoring-As-a-Service OCCI API

In Ciuffoletti (2016) the author proposes an on-demand monitoring as-a-service model as an extension to Open Cloud Computing Interface (OCCI) API\(^7\), an open source IaaS service API that provides some standards and protocols for the cloud systems. The monitoring logic introduces a monitoring agent called “Sensor”. Users can define the monitoring metric data through mixins, the sensor collects these user-defined metric data. Mixins have three different features including metric which defines the functionality of the requested entity, aggregator that defines how raw measurements should be processed, and publisher that defines how the metrics are used. The author also presents the monitoring extension as a prototype based on Docker. Although the focus of this work is to provide capability to user to define the monitoring metrics, only physical and virtual resources are monitored. User-level monitoring is not considered in the context of this paper.

3.7 DB Management Framework

In Zhao, Sakr, & Liu (2015), authors have presented a framework for the management of cloud-based database; with the aim to identify the consumer requirement to meet the terms defined in the SLA. The architecture of the proposed framework consists of

\(^6\) https://www.nagios.org/
\(^7\) http://occi-wg.org/
three modules: (i) the monitor module; (ii) the control module and (iii) the action module. The monitor module is responsible to gather information based on two metrics: (i) data freshness and (ii) transaction response time. Proposed model monitors database services and performs adaptive actions to avoid any violation of SLA defined by specific application. User behaviour or interactions are not considered in the context of this work.

3.8 SLA Monitoring

Service Level Agreement specifies terms and conditions of cloud services agreed between a cloud service provider and cloud service consumer. The SLA parameters need to be monitored to avoid SLA violation, which can result in the form of financial penalty. In Anithakumari & Chandrasekaran (2017), the authors have used monitoring techniques to analyse the parameters of SLA with the aim to predict any possible violation. The monitoring component monitors the Service Level Objective (SLO) values such as response time and job execution time from all the running instances, which forms the basis for determining SLA violations. In case, if SLA is not met, the penalty imposed is presented in SLO. Authors have also proposed an adaptive resource management. In this approach, additional resources (more VMs) are deployed to run when an SLA violation is predicted or occurred, with the aim to execute the current job and mitigate future SLA violations. Authors have also presented a prototype using GMOND module provided by Ganglia (Massie, 2004) for runtime monitoring and Java messaging service (JMS) and MySQL is used as a database. The emphasis of this work is mainly on monitoring SLA parameters on the server side. However, the implication of user interaction and user behaviour on SLA are not considered.

3.9 Dynamic Pricing Policy

In Anwar et al., (2015), a dynamic pay-per-usage charging solution for the cloud service providers is presented. By utilising monitoring agent, they have proposed a solution for charging with less overhead. The authors used OpenStack's Ceilometer to collect metering data. The advantage of this approach is that instead of using separate VMs for management (i.e. metering/monitoring etc.) they have utilised resources of the same VM for monitoring purpose. Additionally, the system automatically allocate new VM if the existing running VMs reaches maximum load. A down-side of this
approach is that the additional overhead on the performance of VMs. The main focus of this work is metering and the authors have only considered monitoring physical and virtual resources. User-level usage based metering is not considered.

3.10 Power and Performance Management

Users and user-side applications typically do not have access to information on cloud software and hardware resource utilisation and power consumption. Alternatively, public cloud offers little access to the information about user application requirement. Turk et al., (2016) aim to address this issue by proposing an architecture for monitoring by providing detailed information about the different layers of cloud for users and providers. This work utilises the Massachusetts Open Cloud (MOC), a public cloud established for research purpose. In the proposed work, authors focus on using cloud monitoring for power and performance management in the cloud data-centres. The proposed architecture is divided into four layers including Data collection layer, Data retention & consolidation layer, Services layer, and Advanced monitoring applications layer. The authors have used a combination of Sensu (open-source monitoring software), Ceilometer, LogStach (data acquisition and transport tool) and RabbitMQ (open-source message queue tool) for acquisition and collection of Data, and integrated InfluxDB, Elastic-Search, and MonoDB for database purpose in their proposed architecture. The monitoring component in this architecture monitors the cloud hardware resources and user-level usage and its implication and effects on power consumption is not considered.

4 Comparative analysis of cloud monitoring solutions

This section presents a comparative analysis of the cloud monitoring solutions discussed in Section 3. The focus of the analysis here is to identify the solutions based on the monitoring level (User, Application/Service, Infrastructure/Resource level) in cloud, techniques followed and implementation status of user-level usage monitoring.

User-level usage monitoring represents the usage data generated in the cloud system due to the user’s interaction with the cloud application. The authors in Montes et al., (2013) have considered user-level usage monitoring in their taxonomy but have not implemented in the GmonE tool. The author in Ciuffoletti (2016) introduces a monitoring agent named as the “Sensor”. The sensor collects metric data, defined in
<table>
<thead>
<tr>
<th>Monitoring Tools</th>
<th>Monitoring level</th>
<th>User</th>
<th>Application / Service</th>
<th>Infrastructure / Resource</th>
<th>User-level Monitoring Status</th>
<th>Monitoring technique</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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<td>✓</td>
<td>✓</td>
<td>Not Considered</td>
<td>Scripts in VM</td>
</tr>
<tr>
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<td>✗</td>
<td>✓</td>
<td></td>
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<td>Plugins in VM</td>
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<td>✗</td>
<td>✓</td>
<td>Not Considered</td>
<td>Kernel data in VM</td>
</tr>
<tr>
<td>MonSLAR</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
<td></td>
<td>Identified (User satisfaction for SLA)</td>
<td>REST Protocol</td>
</tr>
<tr>
<td>MonPaaS</td>
<td></td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>Not Considered</td>
<td>Special Monitor VM</td>
</tr>
<tr>
<td>Monitoring-as-a-Service OCCI API</td>
<td></td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>Not Considered</td>
<td>Server application</td>
</tr>
<tr>
<td>DB Management Framework</td>
<td></td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
<td>Not Considered</td>
<td>Database proxy software</td>
</tr>
<tr>
<td>SLA Monitoring</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>Not Considered</td>
<td>GMOND tool by Ganglia</td>
</tr>
<tr>
<td>Dynamic Pricing Policy</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td></td>
<td>Not Considered</td>
<td>OpenStack Ceilometer(^8)</td>
</tr>
<tr>
<td>Power and Performance Management</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td></td>
<td>Not Considered</td>
<td>Sensu, Ceilometer, LogStach</td>
</tr>
</tbody>
</table>

\(^8\) Ceilometer is an OpenStack service, used for metrics collection for billing

Table 2: Comparative Analysis of Cloud Monitoring Solutions
Mixins by users. But the important thing to note here is that a user defines the metrics of the monitoring agent, which is different from user-level usage monitoring as the user interaction is not monitored. In Alcaraz Calero & Aguado (2015), the authors use the term user monitoring, where a separate VM called Monitor VM (MVM) is created for each new customer. Each MVM monitors physical and virtual resources but not the user interaction. Similarly, majority of the monitoring solutions consider users in the cloud monitoring domain but user-level usage monitoring and its implications on the service and infrastructural resource usage in the cloud have not been considered.

Different cloud monitoring tools contribute to different characteristics of the cloud including metering, billing, SLA management, error and fault fixing, resource provisioning, workload management, and so on. In Kesavulu et al., (2017), we have defined criteria for the user-level usage data and proposed a usage data extraction framework adhering to the defined criteria. The idea of monitoring user behaviour is to understand how users interact with the application and this is mainly done through analysing the clickstreams (Banerjee & Ghosh, 2001; Bucklin & Sismeiro, 2009; Pachidi et al., 2014; Wang, Zhang, Tang, Zheng, & Zhao, 2016). The authors Cito et al. (2015) provide a high-level taxonomy of types of operation data that can be treated as user-level usage data:

- Monitoring data (Operational application metadata)
  - Performance data – service response times, database query times
  - Load data – incoming request rate, server utilisation
  - Costs data – hourly cloud virtual machine costs, data transfer costs per 10,000 page views
  - User behaviour data – clickstreams, page views,

- Production data
  - Data produced by SaaS application itself-placed orders, customer information.

Summarising in Table 2 are the current tools and applications for usage monitoring in the cloud domain. These tools and applications are suggested in Syed et al., (2017) showing that major of them are working on the monitoring data at service and infrastructure level while only GmonE and MonSLAR have identified the potential of user level monitoring (not implemented). This confirms our motivations to exploit and explore researches on this novel type of data to cope with the challenges pointed out in Section 1.
5 Conclusion and future work

In this paper we reviewed state-of-the-art cloud monitoring solutions that have considered the user’s perspective as a part of their tools. Furthermore, we have analysed the monitoring solutions according to their level of monitoring (user, application/service, infrastructure/resources) in the cloud and techniques used or adopted for the actual monitoring task. As a result of the analysis, we see that existing cloud monitoring solutions consider users in the cloud monitoring domain but user-level usage monitoring and its implications on the service and infrastructural resource usage in the cloud has not been considered. Consequently, we presented the related standards in ISO and TOG based on those, proposed the principles for cloud monitoring solutions to follow. We firmly believe that understanding the usage patterns of the end-users and usage behaviour can overcome the challenges mentioned in Section 1. The future work of this research includes (1) design and development of a novel approach to monitor cloud application usage by end-users, namely User-level Usage Monitoring, which is the process of identification, extraction and analysis of the data that represent users’ interaction with the cloud application (2) extending the review by considering other cloud standards and any principles that may reveal; (3) evaluation of the user-level usage monitoring tool.

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References


INHERENT GAME CHARACTERISTICS OF ELECTRONIC NEGOTIATIONS

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Abstract
Negotiation activities have often been referred to as a game. For example, negotiators dance around each other, play with different strategies, follow rules and protocols, decide on particular moves from a set of alternatives, and try to achieve the ultimate goal of agreement. This paper presents the results of an explorative literature study examining the inherent game characteristics of electronic negotiations. To consider the context of information system explicitly, we analyse e-negotiations conducted in negotiation support systems. Our results reveal among others a strong social interaction element, various levels of difficulties and challenges, different activity choices that may lead to the same goal and continual feedback during these activities. With respect to current IS trends such as serious games and gamification, these identified game characteristics may serve as a basis for a gamified negotiation support system.

Keywords: game characteristics, gamification, electronic negotiation, negotiation support system

1.0 Introduction
Negotiations are present in everyday life and arise in private life, between social groups, in politics or in business (Pruitt and Carnevale 2003). A negotiation is defined as “[…] an iterative communication and decision making process between two or more agents (parties or their representatives) who 1) cannot achieve their objectives through unilateral actions; 2) exchange information comprising offers, counter-offers and arguments; 3) deal with interdependent tasks; and 4) search for a consensus which is a compromise decision” (Bichler et al. 2003, p. 316).

For several decades, various IT systems have been employed to conduct negotiations electronically. These negotiation support systems (NSSs) aim at saving transaction costs in business negotiations, reaching an agreement in less time than F2F-negotiations and finding an agreement of higher quality (Bichler et al. 2003). NSSs enable asynchronous negotiations for parties residing at remote locations (Kersten and Lai 2010). NSSs do not only transfer the negotiation to an electronic media, but provide additional support for the communication and/or decision tasks of the
negotiators. In addition, they might offer document management, and conflict management (Schoop 2010).

Few negotiation researchers have characterised the negotiation activities as a game directed towards the goal of an agreement. Pruitt and Carnevale (2003) describe negotiations as a game of agreement including the following components: “a set of options that are available to two or more parties (the ‘players’), rules for making decisions among these options, and utility values associated with the possible outcomes of these decisions” (Pruitt and Carnevale 2003, p. 19). In addition to this rather game-theoretic perspective, they also use the term game of moves, relating to the employed tactics in a negotiation, such as concession making and information sharing.

Looking at the training phase of (future) negotiators, several aspects have game-related characteristics. For example, role games using different case studies are quite typical in negotiation courses. Furthermore, such negotiation courses also include trying out new negotiation styles and discovering their impact on the process and outcome (Köszegi and Kersten 2003).

Current research in Information Systems has drawn attention to new trends such as serious games and gamification. Serious games are games directed towards a specific learning goal, whereas gamification can be described as an extension of an information system with additional game elements (Blohm and Leimeister 2013; Deterding et al. 2011). Gamification in particular fosters user motivation and user engagement in non-entertainment contexts (Seaborn and Fels 2015).

Regarding the engagement in negotiations, prior research has shown that the exchange of more offers leads to more integrative agreements and that engagement is a significant factor for the probability to reach post-settlement agreements (Gettinger et al. 2012a; Gettinger et al. 2016).

Therefore, our overall research goal is to provide a NSS that utilises gamification to increase user engagement and outcome effectiveness and efficiency in negotiations. To the best of our knowledge, the analysis of gamification in NSS is a novel approach that has not been studied yet. As a first step, the game characteristics in negotiations and in NSSs need to be analysed which leads us the following research question for the current paper:

*Which inherent game characteristics are present in electronic negotiations?*
In the following, we will present the results of our explorative literature review which illustrates the presence of game characteristics in the various negotiation activities and components in NSSs. The results can serve as a starting point for an actual implementation of a prototype enabling the analysis of gamification effects in NSSs.

2.0 The Inherent Game Characteristics of Electronic Negotiations

First of all, there is fundamental distinction between playing and gaming: Playing is a “[… ] more free-form, expressiv, improvisational, even ‘tumultuous’ recombination of behaviours and meanings” (Deterding et al. 2011, p. 11). In contrast, gaming is governed by rules structuring the game and directed towards a specific goal (Deterding et al. 2011).

Developing or studying game artefacts requires a framework for the game characteristics. The MDA framework (Hunicke et al. 2004) distinguishes between game mechanics, dynamics, and aesthetics. Mechanics describe the game components at the data level, such as points. Dynamics specify the dynamic behaviour of the game while interacting with the player, such as awarding activities with a certain number of points. Finally, the aesthetics are the player’s emotional responses towards the provided game dynamics. In the following, we will investigate the negotiation process and the characteristics of NSSs to outline the presence of these game components in further detail.

2.1 Negotiations as an Interactive Process

As per definition, a game requires a specific goal and is structured by rules (Deterding et al. 2011). As already discussed, that the goal of negotiations is the achievement of an agreement (Bichler et al. 2003). The negotiation process is structured by a negotiation protocol. In electronic negotiations, precise protocols defining the activities which are undertaken by a human negotiator or by the NSS are required (Kersten and Lai 2007b). “The protocol may specify possible actions and their sequence, allowable offers and messages, timing of offers and messages” and may also “[… ] specify the syntax and semantics of the messages, and mechanisms in which alternatives are determined and assessed, offers are constructed, and concessions are made” (Bichler et al. 2003, p. 316). Hence, we can conclude that the
prerequisites for negotiations being perceived as a gaming instead of playing are fulfilled.

To investigate the negotiation process and its phases in further detail, the five-phase model from Braun et al. (2006, see Figure 1) will be used which is based on the eight phase model by Gulliver (1979) and has been adopted to meet a larger range of negotiation scenarios including those facilitated by NSSs.

The first phase is the planning phase. Negotiators determine their strategy, relevant issues, aspiration levels, reservation levels, and the best alternative to a negotiated agreement (Fisher et al. 1991). Furthermore, the communication strategy is planned and the overall approach (i.e. more collaborating vs. more competing) is chosen. These are individual planning activities carried out by each negotiator. Joint activities include selecting a negotiation location and the communication modes (Braun et al. 2006). In the second phase, negotiators jointly discuss the negotiation issues and their meanings and may try to add new issues or remove others, thereby setting the agenda and exploring the field. Eventually, they might also revise their preferences and strategies.

Then the negotiators start with the actual exchange of offers and arguments which characterises the third phase. They learn about each other’s preferences and priorities and identify potential conflicts (Braun et al. 2006). On an analytical level, negotiators may modify their strategy, determine possible concessions or revise their aspiration levels. At some point, the parties realise that they have successfully negotiated towards an agreement and develop joint proposals. The other alternative in phase four is that the parties agree to disagree and thus leave the negotiation table without a deal. Finally, in the conclusion phase the agreement is evaluated, might be improved further, or might be re-considered in a re-negotiation activity.

Figure 1. Negotiation process model (adapted from Braun et al. 2006, p. 274)
Negotiations are characterised as an interactive process between at least two parties (Bichler et al. 2003). The negotiators engage in negotiation-specific communication by exchanging offers, counteroffers or informal messages with the joint goal of mutual understanding and their individual goals (Schoop et al. 2003; Schoop et al. 2010; Schoop 2010). Apart from the given individual goals and planned behaviour of a negotiator, the actual behaviour will constantly be adopted according to the behaviour of the negotiation partner. Therefore, negotiations can be characterised as a social interaction process (Schoop et al. 2010). Negotiations can never be conducted by one party in pure isolation, as the negotiators rely on each other in order to reach their goals and the negotiation requires the achievement of a compromise solution (Bichler et al. 2003). Consequently, each negotiation consists of various communication elements depending on the current situation, e.g. arguing, convincing, accommodating, threatening, enquiring, clarifying etc.

The negotiators’ strategies are part of and affect the complete negotiation process. In general, a negotiator’s strategy is either distributive (competing) or integrative (collaborating) and can be implemented using several tactics (Lewicki et al. 2010). Distributive strategies are characterised by a fixed-pie assumption, where each of the negotiators claims the largest piece of the pie (Pruitt and Carnevale 2003). On the other hand, integrative strategies overcome this fixed-pie assumption and focus on creating additional value. Integrative negotiations require careful consideration of each of the negotiators’ interests in order to create mutual benefiting solutions. Integrative strategies focus on achieving win-win situations, are more relationship-oriented and thus focus more on cooperation amongst the negotiators. More mutually beneficial agreements can be reached through information exchange about the parties’ interests (Thompson 1991).

In a distributive setting, each negotiator strives for winning the negotiation. In the famous story of two siblings both dispute about only one orange left (Fisher et al. 1991). This seems to be a typical distributive setting, where the orange can be given only to one of the siblings. Alternatively, they may cut the orange into two pieces. The sibling receiving more than a half or the complete orange would have won this distributive negotiation. In an integrative setting, the children would exchange their preferences and interests first, e.g. one likes to eat the fruit, whereas the other one only needs the peel to bake a cake. Therefore, both siblings’ needs can be satisfied.
without cutting the oranges into two halves. These two approaches are two completely different solutions for the distribution problem.

So far we have outlined the two basic orientations of the negotiators, the interactive character of negotiations and the continuous communication exchange between the participants. Social Interaction is one element that can lead to enjoyment in a game (Lazzaro 2004). Social Interaction in games should support competition and cooperation between the involved players and it should enable interaction (e.g. via chat) among them (Sweetser and Wyeth 2005).

NSS allow interaction among the negotiators using electronic media and following a protocol structuring the message exchange (Schoop 2010). Similar to competition in games, the participants of a negotiation might strive for winning the negotiation against another person (Pruitt and Carnevale 2003). On the other hand, negotiations also allow to follow a cooperative approach, which focuses on the creation of win-win situations for each negotiator and which is more relationship-oriented. In negotiations including more than two parties, coalitions cooperating with each other in order to reach mutually desirable goals can be build up (Lewicki et al. 2010). Therefore, negotiation include a strong social interaction element.

2.2 Control in Negotiation Support Systems

Ströbel and Weinhardt (2003, p. 147) define an electronic negotiation as follows:

“An electronic negotiation conforms to this notion if it is restricted by at least one rule that affects the decision-making or communication process, if this rule is enforced by the electronic medium supporting the negotiation, and if this support covers the execution of at least one decision-making or communication task.”

This broad definition covers many systems facilitating negotiations. According to Kersten and Lai (2010), electronic negotiation systems can be further distinguished into five subtypes: E-negotiation tables, Decision Support Systems (DSSs), Negotiation Software Agents (NSAs), Negotiation Agent-Assistants (NAAs) and Negotiation Support Systems (NSSs). This classification, however, is not distinct and several system classes overlap.

DSSs were designed to assist negotiators in their decision-making processes only, e.g. by evaluating received offers or offers to be send. NSS requires all the capabilities of DSSs and also facilitates communication and coordination between the negotiators (Kersten and Lai 2010). In contrast to NSSs, NSAs conduct the negotiation or parts of
the negotiation automatically on behalf of their human principal (Kersten and Lai 2007a; Schoop et al. 2003). In NSSs however, the human negotiator is still in control of the negotiation process (Schoop et al. 2003). DSS components may e.g. evaluate offers or suggest appropriate counteroffers, though the decision about the next negotiation steps remains with the human negotiator.

This control over the negotiation process is also reflected in the game literature. In their GameFlow model, Sweetser and Wyeth (2005) describe control as an important element. Game players should feel a sense of control over their actions. This control also describes the impact of own actions to the game world, i.e. their actions lead to observable changes.

We already pointed out, that NSSs unlike NSAs never conduct any action autonomously. The decisions and actions are still part of the human negotiator’s tasks. Based on a given negotiation protocol, the negotiator has full control about the process. An agreement can never be settled against the negotiators’ will. Furthermore, one’s own actions lead to observable changes in the negotiation. On a technical level, a completed action initiates the negotiation protocol’s selection of new tasks to be completed for the negotiation partner or the negotiator (Kersten and Lai 2007b). On the content-related level of the negotiation, the negotiator might have successfully convinced the negotiation partner to make some concessions.

Consequently, negotiators using NSSs should feel a sense of control over their actions and are able to observe different reactions towards their completed action.

### 2.3 Negotiations as a Creative Decision Process

As discussed in section 2.1, preparation is an important task in negotiations and is part of the first phase of the negotiation process. Negotiators e.g. define their goals (i.e. the aspiration levels for the attributes) and their tolerance interval (i.e. the reservation levels for the attributes) and select a strategy and several tactics to implement the chosen strategy (Raiffa et al. 2007). Maximizing joint and individual benefits requires the definition of a set of tactical options. Such a strategy may consist of integrative as well as distributive tactics, which may be applied at the same time or are predominant in different negotiation phases (Pruitt and Carnevale 2003).

Similar to many games, different strategies and tactics can be used to achieve a specific goal. One important game characteristic describing these options is choice.
Choice refers to expressive, tactical and strategic options during the game play.

The initial strategy defined in the planning phase of the negotiation may also turn out to be unsuccessful in the further process of the negotiation. Like in many games, negotiators can change their strategy and tactics if their choices do not seem to be suitable anymore in driving them forward towards their goals.

On a more detailed level, achieving an integrative win-win situation for all sides comes along with several concrete choices and processes. As there is no standard procedure to follow in negotiations, negotiators have to define appropriate strategies and tactics. Furthermore, they need to construct a line of argument, which has to be organised and presented at appropriate times (Lewicki 1997). The shared pool of information should be carefully analysed in order to elaborate the areas of agreement and disagreement. Finally, negotiators search for a mutually beneficial compromise using logrolling or trade-offs. This search for a compromise requires negotiators to invent options which create mutual gain (Lewicki et al. 2010). Inventing options may e.g. include adding new negotiation attributes to the agenda.

Creativity is an element which is facilitated by several games, e.g. by allowing gamers to build their own worlds (Green and Kaufman 2015). Given an integrative situation, the activities listed above include creative choices in the later stages of the negotiation process. According to Lewicki (1997) creativity is a required negotiation skill to successfully conduct integrative negotiations.

2.4 Feedback for Negotiation Activities

Feedback is an important element in games (Sweetser and Wyeth 2005) and has been applied in many gamified systems (Hamari et al. 2014). Positive and constructive feedback increases the intrinsic motivation to complete a task, because they support feelings of task competency (Ryan and Deci 2000). Feedback may include information about the progress towards reaching the goal, immediate feedback on performed actions and some kind of status or score within the game (Sweetser and Wyeth 2005).

On their way to an agreement, negotiators proceed through different negotiation phases. Considering e.g. the phase model for electronic negotiations by Braun et al. (2006) described in section 2.1, each of the phases must be concluded in order to
reach an agreement. However, the authors also point out, that this process is not necessarily straight forward and negotiators might revise certain phases again. Completing each of the phases in a NSS are the intermediate goals of the overall negotiation goal. Ideally, the negotiation protocols structuring the process in the NSS are transparent, so negotiators can comprehend their current status within the different phases (Kersten and Lai 2007b). While being guided through these different phases, negotiators can observe their progress on their way to an agreement. The conclusion of the different phases is tightly related to the game characteristic goal: Besides a clear overall goal, games should also present clear intermediate goals (Sweetser and Wyeth 2005), which allow to monitor progression in the game or negotiation. Furthermore, the negotiators receive immediate feedback in NSSs during their offer construction (Kersten and Lai 2010). Typically, while selecting desired values for the different negotiation attributes, a utility value ranging from 0% to 100% depending on a defined preference function is displayed. This utility value supports the negotiators in evaluating their next offer and avoids non-desirable outcomes, which are below their reservation levels. Received offers are also evaluated using the same preference function, displaying the utility value in the offer history or in charts such as the history graph (Schoop 2010) or the dance graph (Gettinger et al. 2012b). Taking a look at the history graph of the NSS Negoisst (Schoop et al. 2003; Schoop 2010) illustrated in figure 2, converging lines would denote a higher probability for reaching an agreement, whereas diverging lines may require more time until an agreement can be reached. Besides, the received offer itself contains important feedback information from the negotiation partner and may require adapting or changing one’s own behaviour (Schoop et al. 2010). Negotiators are thus able to evaluate whether they were successful in reaching some concessions or whether their recent tactics hinder negotiation progression. The feedback element in NSSs can be summarised according to the following components: The negotiation protocol guides the negotiators transparently through the negotiation phases, the decision support components help to evaluate and construct offers, the communication support components display some feedback through the reaction of the counterpart.
Challenges are one of the most frequently used game characteristics (Charsky 2010; Lazzaro 2004; Sweetser and Wyeth 2005). Adequate challenges matching the player’s abilities can lead to a flow experience (Nakamura and Csikszentmihalyi 2002). In general, games should provide challenges with different levels of difficulty depending on the skills and the progress of the player (Sweetser and Wyeth 2005).

Transferred to negotiations, the skill of the negotiator describes his/her general ability to analyse and to communicate (Lewicki et al. 2010). Negotiation skills can be acquired through experiential learning, e.g. by case studies and role plays and an evaluation of the performance in these negotiations (Köszegi and Kersten 2003; Lewicki 1997).

The level of difficulty in negotiations differs in many aspects as follows. Firstly, there might be a single negotiation attribute, multiple or even an undetermined number of negotiation attributes (Ströbel and Weinhardt 2003). Single-attribute negotiations e.g. about a price are quite easy to handle; the negotiators might not even need a utility value to evaluate the offers and know their current score. Multi-attribute negotiations are more difficult to handle, as they require additional support to evaluate offers and
counteroffers. Furthermore, given an integrative setting, multi-attribute negotiations involve careful consideration of various options to create a win-win situation.

Secondly, a negotiation can be further described by its type, e.g. a bilateral or a multilateral negotiation (Bichler et al. 2003). In a bilateral setting, only two parties negotiate and need to find an agreement. Multilateral settings involve more than two parties and require the agreement of all parties for a compromise. Incorporating the interests of all parties in a multilateral setting is obviously more challenging than the consideration of one parties’ interests (Lewicki et al. 2010).

Thirdly, a negotiation’s level of difficulty always depends on the approach of the negotiation partners. Lewicki et al. (2010) describe four approaches: avoidance, accommodation, competition and collaboration (see Figure 3). Avoidance (also referred to as inaction) characterises negotiators that do not want to negotiate at all. Negotiators following an accommodating strategy show little interest in their own outcomes but rate the partners’ outcomes as being very important. In contrast, negotiators applying a competitive strategy are solely focussed on their own outcomes. Collaborative negotiators show interest in their own as well as in the outcomes of the partner(s). In figure 3, the concern regarding the outcome of the negotiation partners is represented by the importance of future relationships among the negotiators.

![Figure 3. Negotiation strategies (adapted from Lewicki et al. 2010, p. 112)](image-url)

The level of difficulty is consequently tightly related to the question whether the negotiation partner is interested in his/her own outcome and the quality of the future relationship. Negotiators following an accommodation strategy decide to lose the
negotiation and let the other win to maintain or establish a good relationship (Lewicki et al. 2010). Negotiating with accommodating partners is thus quite easy. The other extreme are negotiators following a competitive strategy. Competitive negotiators strongly pursue their own goals and show little concern for establishing or maintaining a good relationship. Somewhere in between these two extremes lies the collaboration strategy, reflecting high concern in both their own and the partner(s)’ outcomes. Collaborative negotiators will neither adhere to their positions as fiercely as competitive negotiators nor will they give in as easily as accommodating negotiators.

A special challenge of electronic negotiations is imposed by the medium itself: Social cues such as mimics, gestures, or non-verbal behaviour are filtered out (Friedman and Currall 2003). Compared to face-to-face negotiations, these missing cues make it more challenging to observe and recognise the emotions and reactions of the negotiation partner. Consequently, misinterpretations and misunderstandings are possible.

Challenges are also part of negotiation trainings using NSSs, which have been used in several studies (Köszegi and Kersten 2003; Melzer et al. 2012; Melzer and Schoop 2014). All of these studies have in common, that they build up negotiation skills by providing adequate case studies and simulations, which match the negotiator’s abilities. For example, Köszegi and Kersten (2003) conducted first of all a simple single issue negotiation simulation, which was followed later by a more complex multi-issue negotiation. Another solution for improving negotiation skills was the Tactical Negotiation Trainer (TNT) developed by Melzer et al. (2012). This automated negotiation partner can autonomously send new offers and underpin its position with text messages. The TNT was used as a training tool in a briefing teaching the actual use of the NSS Negoisst (Schoop et al. 2003; Schoop 2010) before the students participated in an international negotiation simulation.

In this chapter, we have outlined the various factors influencing the challenges and level of difficulty in electronic negotiations. In real negotiation scenarios, these factors are sometimes difficult to predict and control. However, teaching negotiations using NSSs can provide optimal challenges matching the negotiators’ abilities, e.g. by varying the complexity of negotiation simulations. Furthermore, tools such as the TNT can be configured w.r.t. their negotiation strategy and target values to simulate various levels of difficulties.
2.6 Experimenting with Negotiation Styles

Varying negotiation strategies and tactics are not only related to the negotiation partner and affect the difficulty, but may also differ for each negotiation. In the planning phase, the negotiators define their approach in terms of the strategy and tactics to be used. Using different approaches requires appropriate negotiation skills, i.e. different modes of communication (Lewicki et al. 2010). Once again, these negotiation skills can be fostered by electronic negotiation training.

Köszegi and Kersten (2003) reported that the anonymity in an electronic negotiation simulation used for negotiation training encouraged students to experiment with various approaches and negotiation styles and to reflect on the impact on negotiation process and outcome.

This study is a good example how people can also define their own goals, e.g. by experimenting with new approaches and how they perform using these approaches. Setting individual goals has been a topic in the game literature as well as in the gamification literature (Charsky 2010; Nicholson 2012). Nicholson (2012) describes the possibility to define individual short- and long-term goals as a way to provide meaningful gamification experiences. Goals set by the players are likely to increase intrinsic motivation, such that an activity is done for its inherent satisfaction (Nicholson 2012; Ryan and Deci 2000).

If persons decide to set their own goals, the target achievement needs to be evaluated afterwards. Transferred to the study by Köszegi and Kersten (2003), some students may have simply defined reaching an agreement using a completely different negotiation style as their goal. Others may have strived for certain utility values, for a good relationship with the negotiation partner or less time-consuming negotiation processes. These experiments also allow for comparison with other previously tried and tested negotiation styles.

3.0 Conclusion and Outlook

In this paper, we have identified several inherent game characteristics of electronic negotiations. Like games, negotiations are directed towards a mutual goal representing the end of the game, i.e. an agreement. Individual goals represent each negotiator’s/player’s own targets. Negotiations are structured by rules, i.e. the negotiation protocols. The mutual dependency in reaching an agreement between the
negotiators and the competitive or cooperative strategies used in the negotiation reveal a strong social interaction element. An agreement can be achieved by choosing from different possible strategies and tactics. Integrative negotiations demand vast creativity. In contrast to several other electronic negotiation systems, the users of an NSS are always in full control of their negotiation activities and can observe an impact of their activities by lots of feedback mechanisms. Negotiations are challenging processes with different levels of difficulties. These challenges are anticipated in negotiation trainings, where the participants may also experiment with new negotiation styles.

A central trait of games is the enjoyment during game play (Sweetser and Wyeth 2005). User enjoyment is equally important for hedonic systems as well as utilitarian systems (such as NSSs), influencing their perceived ease of use and usefulness of a system (Gerow et al. 2013).

However, many of the described game characteristics are only implicitly present in NSSs. Gamification, defined as the use of game design elements in non-gaming contexts (Deterding et al. 2011), is a promising approach to emphasise these inherent game characteristics in NSSs. Gamification facilitates engagement of users, which has been identified as a factor to be addressed for the design of NSSs as a particular form of information systems (Gettinger et al. 2016). We expect the inclusion of game design elements to lead to greater engagement, more extensive message exchange, and better agreements in terms of individual and joint utilities. Although the identified game characteristics might not be comprehensive, they can be used as a starting point for the design of various game design elements in NSSs.

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References


SMALL STEPS: IMPROVING HEALTHCARE WITH LOCAL INNOVATION

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Abstract

Integrating technological innovations into healthcare systems has proven to be challenging. It is possible, however, to make small but significant improvements to healthcare through technologies that are not connected to the massive electronic health records systems. This paper describes one such system, Walk the Ward, which was developed for a medical ward in a large regional hospital. Walk the Ward is a quiz-type game played by hospitalized patients to provide entertainment, social interaction and, most importantly, exercise, which promotes healing. Educational information is also provided in the game. Evaluations of the game have shown that patients found it enjoyable and useful, and it facilitated social interactions. Hospital staff also found the game beneficial because it both helped patients and did not increase staff workloads. While the game is currently used in only one location, the basic structure can easily be expanded to multiple settings at a relatively low cost.

Keywords: serious games, healthcare, innovation, elderly

1.0 Introduction

Healthcare systems across Europe, the UK and the US have all been described as facing a looming crisis due to a growing elderly population and a fixed or declining percentage of resources allocated to healthcare. Technological innovation is viewed as a means of addressing at least part of this challenge. However, promising innovations are often bogged down by regulations or slow-moving decision-making processes. In many cases, regulatory bodies find it more prudent to disallow innovations rather than risk approving an innovation that ultimately has negative consequences (Herzlinger, 2006). The extremely sensitive nature of healthcare data further increases the likelihood that
Improving Healthcare with Local Innovations

decision-making bodies will prohibit innovative healthcare technologies from being integrated with electronic health record (EHR) and related systems.

It is possible, however, to develop technological solutions that are patient-focused and effective in improving health and reducing healthcare costs, without engaging directly with prohibitive regulations. Some of these bottom-up solutions are driven by patients such as the ‘health hackers’ creating their own artificial pancreas systems (e.g. Omer, 2016), others by technology firms and researchers, and others by the healthcare providers themselves. Whereas the ideal situation might be one in which these systems are integrated with the EHR system from the start to facilitate maximal sharing of information between healthcare providers and patients, there are nonetheless potential benefits that can be achieved without such integration. It is possible that controlled evaluations of these independent medical systems may provide empirical results that eventually lead to approval for them to be integrated with the full healthcare system.

This paper reports on the first iteration of an on-going action research project that seeks to address a local healthcare issue. The purpose of the project is to investigate how modern technology can be used to activate patients in a way that has a positive impact on both mental and physical states, thus facilitating recovery, while at the same time not putting greater burden on the hospital staff. The remaining material is presented in the AR cycle of diagnosing, action planning, action taking, evaluation, and reflection (Susman & Evered, 1978; Davison et al., 2004).

2.0 Diagnosis: Immobile, Isolated Hospital Patients

In the medical ward involved in this study, patients are typically hospitalized for several days for issues related to chronic conditions (e.g., diabetes). Hospitalized patients experience an avalanche of emotions and feelings during their stay, such as boredom, loneliness, fatigue, pain or fear. In addition, the trend towards single rooms results in patients rarely leaving their rooms, which leads to isolation, a reduction of social contact, and a decrease of physical exercise. Inactivity, both physical and mental, can have a negative impact on recovery and general health, and is of particular concern with elderly populations, who are more likely to be hospitalized.
3.0 Action Planning: Game to Increase Mobility and Interaction

Preventative activities have been shown to be effective in combating isolation and lack of mobility (Clegg et al., 2013; Windle et al., 2010). In this regard, the research team focused on games for rehabilitation, both physical and mental. Such games are often aimed at addressing a specific condition or improving motor skills in the home environment, using different tools such as Nintendo Wii or Xbox Kinect motion-detecting consoles (Borghese et al., 2013; Griffiths, 2005; Jung et al., 2009), dance pads with games, or force platforms to assess posture and balance (Molina et al., 2014).

Among the mental benefits of games are better mood, increased self-esteem, reduced sense of loneliness, and improved memory. It has also been asserted that games can contribute to a reduction of pain; the distraction they generate helps one part of the brain's ability to shift from perceived pain to focus on the game (Griffiths, 2005). Additionally, when the games are fun, connected with reality, and involve other people, they help with mental well-being and social contacts (Borghese et al., 2013).

4.0 Intervention (Action Taking): Walk the Ward

The first version of the game, Walk the Ward, was developed in 2015. It is a tablet-based, quiz-type game that tracks points earned by answering questions correctly and steps taken by walking from one station (a poster with QR code) to another. At each of eight stations positioned throughout the ward, patients scan the QR code with the tablet, select a theme (such as ‘the garden’ or ‘diet’) and answer the multiple-choice question presented on the tablet. To reinforce the concept of movement, after the patient has scanned five stations, another screen opens which provides a ‘guess where you are’ question about a European city. The points and steps are recorded on the tablet until the patient decides to stop playing or is discharged from the hospital. At that time the patient’s game is ended and the tablet cleaned and reset so it can be given to the next patient who wants to play the game.

5.0 Evaluation

An assessment of Walk the Ward v1 was performed at the end of 2015 through early 2016. Eight patients, four men and four women, were recruited by ward staff to serve as testers. Because there was particular concern that the game could be difficult to use for elderly patients, all of the testers were older than 70. None of these patients suffered
Improving Healthcare with Local Innovations

from cognitive impairments such as dementia. To protect patients’ privacy, no names or other identifying information was recorded. Instead, only the patient’s age and gender were recorded, and if they were in a single or double room. The testers were given tablets with the game preloaded, brief instructions on how to use them and how to play the game, and then were allowed to keep the tablets for as long as they wanted during their stay. When the patient was discharged from the hospital or decided to stop playing the game, they were briefly interviewed about their experiences with the game. In addition, the staff in the ward were interviewed to gather their impressions of the game and its impact.

5.1 Patient testers
The patient testers were uniformly positive about Walk the Ward. They found it enjoyable and not too difficult to use. However, some of the testers were surprised that this was a game because it wasn’t clear who won. They believed that the game could contribute to increased social contact because if more people were playing they could encounter each other in the corridor and the game could serve as a social ‘ice breaker’. The only slightly negative feedback related to the themes (topics of the questions), the number of questions available and the noise the game made when an incorrect answer was chosen. One tester finished all of the questions available, and another wanted to be able to add new questions. Some testers wanted to continue playing when they went home. Observation of the testers identified another issue: holding the tablet and scanning the posters requires two hands, which could be a problem if the player has poor balance and needs support of a device when walking. The testers using rollators solved this problem by putting the tablet in the basket or on the seat when traveling from station to station and by sitting down to answer the questions.

5.2 Hospital staff
The staff reported that although they had been initially sceptical, they were quite happy with the game. They noted that patients playing the game were more ambulatory and appeared proud that they could participate. In addition, staff noted that after being provided with initial instructions, the patients could manage the game on their own. Patients who were not part of the study also got involved by walking along with the testers and giving input to select the correct answers. Some staff members said they would like to be able to play the game too!
6. Reflection and Next Steps

Overall the general concept of a game to improve physical activity and reduce isolation, without increasing staff workload, was deemed a feasible solution. However, the game could be improved to address some of the issues that came up during the assessment. A second version of Walk the Ward (WtWv2) is currently being developed and will be evaluated in the ward in early 2018. The issues addressed in WtWv2 include increasing availability by making the game web-based, allowing it to be played on devices other than those provided by the hospital. To make it more obvious that this is a game, stars are awarded for getting a question correct – and to make it more positive the player can keep selecting answers until correct (with three stars awarded if the correct answer is selected on the first try, two stars on the second try, and one star on the third attempt.) There is no noise played for a wrong answer. An ‘exercise of the day’ video was added to the home screen to encourage even more movement.

This prototype will be tested with a larger group of patients covering a broader age range. The length of the patient’s hospital stay will be recorded so that it can be compared with system averages for this type of patient. If it can be shown that increased physical activity and reduced social isolation through the use of such a game significantly reduces the length of hospital stays, this will provide motivation for decision makers to formally incorporate new technologies such as this into the broader healthcare environment.

Currently several other local hospitals have asked to get the game. The next step will be to create a content-management platform for the game which will enable hospital wards or other healthcare facilities, such as care homes or nursing homes, to add questions and to customize their own games using the appropriate language and themes. With a very low commitment of resources, many patients could be provided with a tool to improve – and potentially shorten – their stay in the hospital. Eventually it may be possible for physicians to access data from the game to assess their patients’ activity levels or even to provide particular exercises or themes that are relevant for particular patients.

Acknowledgements

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Qualitative Critical Realism in Information Systems Research

Abstract
Currently, undertaking qualitative multi-disciplinary studies in Information Systems (IS) domain has been increased. Accordingly, the congruence between research philosophy and methodology allows the IS researchers to identify the overall strategy of the study and avoid unnecessary efforts. Consequently, application of innovative research philosophies, such as critical realism, which benefits from ideas of multiple philosophies (e.g. positivism and interpretivism) is reflected to be more to meet the requirements of multi-disciplinary IS researches. Critical realism allows the use of a well-developed and well-structured path to the research through identifying core elements including mechanisms, structures, and events. This research attempts to provide a distinctive approach for unification of critical realism philosophy and qualitative research through a literature analysis and according to the supplies of qualitative approach and the idea of fishbone diagram. It also offers a novel strategy for the validation of qualitative research based on the qualitative validity criteria and the requirements of the empirical stratum of critical realism philosophy.

Keywords: Information systems, qualitative approach, critical realism, research methodology, research philosophy, validation

1.0 Introduction
Research methodology is the rationale for undertaking research that demonstrates a particular study has been carried out in an appropriate way. This implies that the research outcomes are reliable and useable for future studies (Wisker 2008). Research methodology has been categorised based on various principles and objectives. However, the most popular classification is carried out according to the nature of the phenomena and research subject, so that research can be conducted qualitatively or quantitatively. Quantitative research has originally studied natural phenomena, but now it is also conducted in the social sciences by quantitative survey, experiments, and other numerical methods. Qualitative research has been performed in social science and cultural phenomena, commonly by observation, interviews, questionnaire, and document analysis (Myers, 1997).

The focus of today’s academic Information Systems (IS) research has moved from technological to organisational, process, and people challenges. Thus, the application of qualitative approaches and a search for a suitable philosophy for IS research has been enhanced (Myers, 1997).

The philosophical foundation (also called worldview or paradigms) influences the study and helps to identify its requirements. It demonstrates how the research should be conducted (Tashakkori and Teddlie, 2010).
Various philosophies, including positivism, post-positivism, constructivism, interpretivism, critical realism, and pragmatism can be applied for academic research. Selection of a philosophy for research is a strategic choice that leads the researcher to generate, analyse, and evaluate data by applying appropriate methods (Crossan, 2003; Wisker, 2008; Maxwell, 2008; Creswell, 2009). The congruence between research philosophy (which informs research questions) and methodology is critical, especially in qualitative research. Also, following an appropriate philosophy to some extent satisfies the methodological rigour and improves the quality of qualitative research (Fossey et al., 2002). Thus, exploring the philosophical foundation is a significant step as it allows the identification of the overall strategy of the study, avoid unnecessary efforts for the research, and concentrate on what should be done and what method(s) should be selected (Crossan, 2003; Wisker, 2008; Creswell, 2009).

Moreover, undertaking multi-disciplinary IS studies have been recently increased. In addition, there are many approaches, strategies, and methods for IS research on each discipline. Therefore, creating boundaries between the philosophies and conducting IS research based on a single strategy and method is difficult (Maxwell, 2008). Furthermore, cross-paradigm arguments are currently more popular than discussions within a single paradigm. Consequently, innovative research paradigms such as interpretivism and critical realism have been initiated and application of these two philosophies in IS research has dramatically increased. Moreover, as discussed earlier, multi-disciplinary IS research is mostly being conducted qualitatively. As a result, it is important to choose an appropriate research philosophy for conducting a qualitative IS study, so that these two philosophical foundations, especially critical realism are becoming more significant. In addition, as the validation of qualitative approach has always been an imperative matter, this would also be significant to validate the research findings based on the philosophical principles of an IS study.

Interpretivism is a convergence of previous philosophies like idealism, hermeneutic, pragmatism, and phenomenology. Critical realism benefits from some ideas of positivism and interpretivism. It considers social, historical, and political perspectives (Orlikowski and Baroudi, 1991; Walsham, 1995; Myers, 1997; Light, 2003; Creswell, 2009; Mousa, 2011).

Critical realism does not believe that all reality is objectively given and humans have very limited control on it. On the other hand, it does not consider knowledge as reality
that is merely obtained through interpretation. This research concentrates on critical realism philosophy in qualitative IS research and attempts to explain and clarify the application and validation of qualitative methodology for conducting critical realist research in IS. The objectives of this study are as follows:

- Explore the principles of critical realism research philosophy and qualitative research approach in IS studies
- Offering a distinctive approach for unification of critical realism philosophy and qualitative research for conducting qualitative IS research
- Discussion and justification of validity for qualitative approach in critical realism and providing a novel strategy for the validation of qualitative IS research

The next section of this research reviews critical realism philosophy and its characteristics. Then, the research method by considering the critical realism perspectives will be discussed. Consequently, the discussion will be extended to the research approach, analysis, and validation of qualitative critical realist research. In the final section, conclusions are drawn.

2.0 Critical realism principles

We are living in an environment, which contains a number of structures and regulations that limit our options, however, through the critical realism perspective; we can address some of these limitations. During a research in IS, we can consider, evaluate, and change the limitations through our understanding and interpretation of different situations, according to the research goal. For example, a problem can be resolved by a number of means that have been practiced and approved before, commonly known as best practices in IS research. Based on the logic of critical realism, a researcher can provide a condition to modify, evaluate, and adapt the best practices for a similar problem in a different situation; and the decision is made by human through interpretation, consciousness, and volition, so that new understanding and knowledge are generated to resolve a problem. Thus, the reality is reproduced by the researcher, and it is continuously repeated by further studies. (Walsham 1995; Myers 1997; Mingers 2000; Jeppesen 2005; Morton 2006; Fox 2009; Sayer 2010; Archer et al. 2013; Simeonova 2015).

2.1 Reality in critical realism

Based on critical realism philosophy, access to reality is through knowing the reality (Mingers, 2000, 2004). According to the ontological assumption of critical realism philosophy, reality always exists, but it can be known or unknown (Sayer, 1992;
Bhaskar, 1998). Therefore, there is no reality if it does not exist. In other words, we cannot reduce the events to what have been observed or experienced, because they exist, regardless of being experienced or not. As a result, only the upper half of the figure 1 is applicable in critical realism philosophy (Jeppesen, 2005).

<table>
<thead>
<tr>
<th>Exists</th>
<th>Known</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Our existing knowledge</td>
<td>Should be investigated and be converted to knowledge</td>
</tr>
<tr>
<td>Doesn’t exist</td>
<td>There is no reality that does not exist</td>
<td></td>
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Figure 1. Dimensions of reality in critical realism perspective

Considering the best practices example, first row of this table is filled as represented in figure 2, and the task is to make unknown existents to known existents, which is reality.

<table>
<thead>
<tr>
<th>Exists</th>
<th>Known</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Best practices</td>
<td>How to achieve success based on best practices</td>
</tr>
</tbody>
</table>

Figure 2. An example for dimensions of reality in critical realism

Therefore, access to reality is through knowing the reality. The reality can also be natural or social; therefore, critical realism can be applied in both natural (physical) and social science. Nevertheless, knowing the reality can be achieved by conducting a journey through a stratified ontological system comprising real, actual, and empirical (Mingers, 2000, 2004; Morton, 2006) (Shown in Figure 3).
Figure 3. Stratified domains of reality

The real stratum includes structures, mechanisms, and events that all can be observable or non-observable. This stratum is actually the whole of reality (Mingers, 2004). However, the events in this domain may not occur. Based on critical realism epistemological principles, if the power of mechanisms and structures (regardless of being observable or not), as well as some other conditions related to the context (contextual conditions) are applied, the events occur (Wynn and Williams, 2012). These events are called ‘actual events (actuals)’, which create the actual stratum of reality. Again, these actuals can be observable, experienced, validated, or not. Based on critical realism methodological principles, the observable, experienced, and validated actuals are called ‘empiricals’, which create the empirical stratum of reality (Mingers, 2004; Wynn and Williams, 2012).

Structures

The structures are set of objects or practices, which are internally related (Sayer, 1992). Structures can be natural or social. In social or socio-technical environments, structures comprise people, teams, organisations, set of rules, practices, tools, IT, and some discursive entities, such as language and culture (Wynn and Williams, 2012). Natural structures, such as the mountains, the ocean, gravity, and so forth are independent from individuals, while social structures depend on human activities. However, it does not mean that people have flawless knowledge about the social structures (Sayer, 1992; Fox, 2009; Wynn and Williams, 2012). For example, the best practices that have been applied to solve a problem may be explicitly known by researchers and practitioners, who have identified and utilised them before. However,
a new researcher may need to identify, evaluate, understand, and perhaps modify and utilise them for different situations.

**Mechanisms**

Mechanisms are causal powers and tendencies that enable or limit what can happen as an outcome, by connecting correct variables within given context (Morton, 2006; Fox, 2009; Wynn and Williams, 2012).

**Events**

The concept of casualty in critical realism is mainly realised by understanding how the events are generated. Events are specific occurrences, which are generated by enactment of one or more mechanisms and structures. This is triggered by the human actions (Sayer, 1992; Wynn and Williams, 2012).

As a consequence, in academic research environment, if critical realism is utilised, to achieve a research outcome, the events should be created by structures and mechanisms through the research process, which is triggered by researcher’s action (Mingers, 2000, 2004).

### 2.2 Research method

Various research methods can be applied for critical realist research. Application of fishbone diagram, which has been used by Fox (2009), creates a generic critical realism diagram and makes it more understandable, especially in IS research. According to generic critical realism diagram (Figure 4), the research creates a condition that an action conducts the researcher to the outcome. The condition is also created by mechanisms and structures.

![Critical realism fishbone diagram (adapted from Fox, 2009)](image)

**Figure 4.** Critical realism fishbone diagram (adapted from Fox, 2009)

Again in best practices example, ‘action’ is ‘adaption of best practices for a new situation’. This enhances the value of explored phenomena, improves our
understanding, and creates knowledge (Jeppesen 2005; Morton 2006; Sayer 1992; Sayer 2010). If the action occurs, the outcome would be achieved, when the mechanisms and structures are available. This is called ‘retroduction’ as a significant feature of critical realism philosophy (Fox 2009; Robson 2002; Wynn and Williams 2012). The mechanisms create the actual events, which consequently generate the outcome of the research. The structures are available and embedded within the literature and they have been identified and experienced as best practices, but they have not been experienced in the new situation. Thus, they affect the mechanisms in order to obtain or lose the outcome. They are also agreed by the researcher, but can be changed during the research (Simeonova, 2015). The hypothetical mechanisms, structures, and context for this particular example, are listed as follows. (This list is not exhaustive and is dependent on the precisely defined for individual research):

- When the problem(s) in the new situation are identified (mechanism)
- When the problem(s) in the new situation are compared with the problems in the earlier occasions (mechanism): this is called mechanism because it is a condition for creating the actual events
- A consideration of similarities and differences between new and earlier situations are available (context)
- When the problem(s) in earlier situations is (are) known and they have been addressed by available best practices (structures)

In other words, this method creates the events by mechanisms and structures. For example, when a problem in a new situation is explored and is similar to a problem in earlier circumstances, those two are compared, and then the best practices of addressing that problem in the earlier condition will be candidate to address the problem in the new situation. This process creates an event and when this is repeated for all other problems, the fishbone diagram is completed, so that the actual events are generated. Then, they will be validated by a qualitative validation process, in order to achieve empirical events. Finally, the process represented by the completed diagram leads the research to the outcome.

Applying an established research philosophy like critical realism, allows researchers to use a well-developed and well-structured path to the research. Thus, the principles and guidelines of critical realism will assist in developing the other parts of the research process, so considering the fishbone diagram, mechanisms, structures, contexts, event, and so forth would be covered in other stages of a research, including research design, data collection, analysis, and validation (Maxwell, 2008).
3.0 A qualitative approach to critical realist IS research

Based on the critical realism perspectives, different types of knowledge objects exist and they have various characteristics. Thus, according to those characteristics, different research strategies and approaches can be applied to access mechanisms and structures that lead IS research to the outcome. However, the critical realism does not obligate the researcher to utilise only a particular approach and strategy in the research (Alvesson and Sköldberg 2009; Fox 2009; Given 2008). In other words, Roy Bhaskar (originator of the critical realism philosophy) has never recommended a particular research methodology for any critical realist research (Wynn and Williams, 2012). Critical realism is a heterogeneous philosophy that clarifies the way to move from ‘action’ to ‘outcome’ and assists the researcher in selecting a strategy and method for study based on a research question and its characteristics (Alvesson and Sköldberg 2009; Mingers et al. 2013; Scott 2007; Zachariadis et al. 2013).

Myers (1997) pointed out that selection of research approach is independent of research philosophy. Therefore, qualitative research can be positivist, interpretivist, or critical realist. Nonetheless, currently, critical realist researchers have attempted to provide maximum alignment between their research approach and their philosophy.

A variety of critical realism researches employ case study strategy and perform the inquiries through a qualitative approach, mainly interviews (Easton 2010; Myers 1997). For instance, Fox (2009) has involved one case study for his research in IS based on critical realism philosophy. Then, he has employed literature review, semi-structured interviews, and workshops to gather in-depth knowledge for the mechanisms and structures. On top, Easton (2010) believes that case study is a qualitative approach and completely conforms with critical realism philosophy, which is also well suited for investigating complex events in IS research subjects, such as inter-organisational relationships and flow of information amongst them. Similarly, O’Gorman (2013) has designed his IS research with a single case study based on critical realism perspectives. He has commenced his research with a comprehensive literature review and then utilised a qualitative approach to achieve the research outcome.

Traditionally, statistical approaches are not being utilised by critical realists, because these approaches work in a closed manner and try to provide certainty for the knowledge and this is against the critical realism philosophy, which believes we can
never know the knowledge, for certain (Bhaskar 1998; Olsen and Morgan 2005). However, recently, mixed approaches are being applied by IS researchers (such as McEvoy 2006; Zachariadis et al. 2013; Simeonova 2015). They mostly utilise the quantitative part for investigating the validity and generalizability of their mechanisms and structures, in order to move from actual to empirical stratum (see figure 3). In addition, McEvoy (2006) has carried out a quantitative study, and has provided a deeper understanding of the knowledge by employing a qualitative research based on critical realism perspective. Moreover, Zachariadis et al. (2013) believes that the retroduction should be repeatedly carried out between literature review, quantitative and qualitative research. Yet, the role of qualitative approach is more prominent, because it is more capable of providing in-depth understanding of phenomena, identifying the complex mechanisms, creating relationship between different mechanisms as well as between mechanisms and structures, and describing the actual events (Mingers et al. 2013). Furthermore, qualitative research is suited for exploratory and complex research, because it is more capable of explaining the complexities (Given, 2008). Besides, in qualitative approach the researchers utilise their interpretation to the mechanisms and events that is required by critical realism philosophy (Scott, 2007). Therefore, the marriage of qualitative approach and critical realism provides an adequate conceptualisation and rigorous description of the research (Maxwell 2004).

4.0 Validation of qualitative critical realist research on IS

To discuss validity of qualitative research, it should be firstly understood that validation of qualitative research is different from validity in quantitative study.

4.1 Validity in qualitative research

In the recent years the need for deeply understanding of phenomena, especially in multi-disciplinary research have been increased. Consequently, the use of qualitative research method has been raised. Therefore, ‘understanding’ in qualitative research is more important than validity. In addition, data or methods are not valid or invalid by themselves, but the inferences and circumstances that are drawn from data through those methods, make validity or invalidity for a qualitative study (Maxwell 1992).
However, validation of qualitative data and outcome(s) is being argued by researchers in the recent decades.

Validity, reliability, and generalisability are three principles that are usually discussed and assessed by the researchers, in order to answer the important question of ‘why we should rely upon the research outcome and apply it to overcome our issues?’ However, these terms (especially generalisability and reliability), are mainly used in quantitative research, and application of them for qualitative research has been argued by the earlier researchers (such as Lincoln and Guba 1985; Patton 1990; Maxwell 1992; Stenbacka 2001; Whittemore et al., 2001; Fossey et al. 2002; Pyett 2003; Shenton 2003; Golafshani 2003; House 2005; Morrow 2005). For instance, as pointed out by Stenbacka (2001), these terms are not only irrelevant, but also cause inappropriateness for qualitative research. Moreover, Golafshani (2003) believes that the terms validity and reliability are not appropriate in qualitative research and they should be redefined. Regarding generalisability, Hoepfl (1997) has argued that we do not generalise in qualitative research, we rather ‘extrapolate’ the outcome. This idea has also been confirmed by Golafshani (2003). She has also explained that generalisability can be achieved by providing quality for the qualitative research. The quality is also attained by verification of reliability and validity in qualitative research. Moreover, without validity there would not be any reliability (Lincoln and Guba 1985; Patton 1990). Thus, validity is the main principle that should be assessed in qualitative study.

Earlier researchers have also provided a number of criteria for validating the research with different terminologies (Table 1). However, there is no single criteria or set of techniques for all qualitative studies, and it all depends on purpose and circumstances of the research. In addition, the weight of each criterion is different per study (Marshall 1989; Maxwell 1992; Whittemore et al. 2001).

<table>
<thead>
<tr>
<th>Contributor</th>
<th>Validity Criteria</th>
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<tr>
<td>Thorne (1997)</td>
<td>Methodological integrity, representative credibility, analytic logic, interpretive authority</td>
</tr>
<tr>
<td>Maxwell (1992, 1996)</td>
<td>Descriptive validity, interpretive validity, theoretical validity, evaluative validity, generalizability</td>
</tr>
<tr>
<td>Lincoln (1995)</td>
<td>Positionality, community as arbiter, voice, critical subjectivity, reciprocity, sacredness, sharing perquisites of privilege</td>
</tr>
<tr>
<td>Altheide and Johnson (1994)</td>
<td>Plausibility, relevance, credibility, importance of topic</td>
</tr>
<tr>
<td>Leininger (1994)</td>
<td>Credibility, confirmability, meaning in context, recurrent</td>
</tr>
</tbody>
</table>
Table 1. Some validity criteria for qualitative research

<table>
<thead>
<tr>
<th>Authors/References</th>
<th>Criteria</th>
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<tbody>
<tr>
<td>Sandelowski (1986, 1993)</td>
<td>patternning, saturation, transferability</td>
</tr>
<tr>
<td>Credibility, fittingness, auditability, confirmability, creativity, artfulness</td>
<td></td>
</tr>
<tr>
<td>Eisenhart and Howe (1992)</td>
<td>Completeness, appropriateness, comprehensiveness, credibility, significance</td>
</tr>
<tr>
<td>Smith (1990)</td>
<td>Moral and ethical component</td>
</tr>
<tr>
<td>Lincoln and Guba (1985); Guba and Lincoln (1989)</td>
<td>Truth value, applicability, consistency, neutrality</td>
</tr>
</tbody>
</table>

Hence, validity should be assessed by qualitative researchers, but with a different translation, such as rigour, trustworthiness, authenticity, goodness, or quality of qualitative research. Nevertheless, Whittemore et al. (2001) pointed out that these translations have not been irresistibly supported by the researchers. Thus, he believes that the translation is not required, because the term validity provides instantaneous understanding of the purpose. However, it should be defined differently. Thus, validity, reliability, and generalisability of qualitative research are definitely achievable. Nonetheless, the definitions of these principles, their typology, and the procedure of their assessment for qualitative research are significant (Kirk and Miller 1985; Maxwell 1992). For instance, some researchers (such as Golafshani 2003; Patton 1990; Pyett 2003) defined them as ‘credibility’ of the research that should be verified during the research. However, in contrast with the quantitative researchers, who use various statistical tools, qualitative researchers are themselves the tools/instruments and they should equip the research outcome with credibility, during the research, especially through data collection and analysis phases. Thus, the validity as the main principle includes reliability and generalisability of the study that should not be misunderstood by its meaning in quantitative research. In other words, it should be understood with a different definition or interpretation (not translation), and as explained and implemented by former researchers, the terms rigour, trustworthiness, credibility, authenticity, goodness, quality, and so forth, help the researcher for this interpretation (Hansen 1995; Connell et al. 2001; Mousa 2011; Feldman et al. 2015). Hence, the researchers use some techniques and strategies for validation. For instance, triangulation is the most important method for testing the validity of qualitative study (Golafshani 2003). Respondent validation is also another technique for validation in qualitative research (Silverman, 2013). Some researchers
have also combined various techniques to provide an optimum validation for the qualitative research. For example, Feldman et al. (2015) has utilised a combination of triangulation and respondent validation for validation of his qualitative research.
Maxwell (2012) has brought the most important strategies together and provided a checklist for testing the validity in qualitative research. His checklist comprises the strategies as follows:

• Intensive: long term involvement
• Rich data
• Respondent validation
• Intervention
• Searching for discrepant evidence and negative cases
• Triangulation
• Numbers
• Comparison

Nonetheless, he has emphasised that not every strategy will work in a given research, and trying to apply all of them, which are feasible for that particular study might not be efficient. Thus, as discussed previously, it depends on purpose and circumstances, as well as addressing the most serious and plausible validity threats of a particular study.

4.2 Qualitative validation of critical realist IS research

In critical realist IS research the empirical aspect of mechanisms, structures, and events should be postulated. However, as discussed earlier, Roy Bhaskar has never pointed out that the empirical aspect for the results has to be provided by quantitative approach (Wynn and Williams, 2012). Thus, the critical realism philosophy does not obligate the validation to be quantitative. In addition, Myers (1997) believed that each technique in qualitative research collects empirical data. He also used the term ‘empirical material’ rather than ‘empirical data’, as qualitative data is non-numeric. Moreover, based on critical realism belief, the observation of mechanisms is rarely achievable by people. Thus, the existence of reality cannot be denied, because it is not observable, but if it is observed, we would be more confident. In addition, we may not be able to observe and measure them at the present time, but the observability may be provided by innovative approaches, tools, and further research in the future (Sayer 2000; Wynn and Williams 2012; Bhaskar 2013).

The main objective of validation in critical realism IS research is to show that the actual events are capable of leading action to the outcome. Wynn and Williams (2012)
have proposed five methodological principles for evaluation of this capability, as well as conducting their critical realism research. Those principles are explication of events, explication of structure and context, retroduction, empirical corroboration, and triangulation (Figure 5).

![Diagram of evaluation and critical realism research](image)

**Figure 5.** The principles of evaluation and conducting critical realism research (Wynn and Williams 2012)

Retroduction, which is key in critical realism research, has already been comprehensively described in previous sections. Accordingly, the events, structure, and context were also explicated. There are two more principles of ‘empirical corroboration’ and ‘triangulation’ that have to be met to achieve an empirical aspect of critical realism, and address the validity of the research. Empirical corroboration seeks to validate the inferences generated through retroduction. Triangulation is accomplished by collecting information from a diverse range of individuals, data types, sources, and settings, using a variety of methods and techniques (Maxwell, 2012; Wynn and Williams, 2012). These two principles are related to each other and triangulation is sometimes required for empirical corroboration. Therefore, Maxwell’s checklist needs to be extended to incorporate ‘empirical corroboration’, ‘retroduction’, and ‘explication of events, structures, and context’, as ‘triangulation’ already exists (Figure 6). The explication of events, structures, and context was also considered within retroduction strategy.
Previously published studies are not consistent in specifying the best strategy for validation of qualitative research. Thus, it is necessary to decide which validity threats are the most probable ones and then select the most suitable strategy and criteria for validation (Maxwell, 2012b).

5.0 Conclusions

While most of the critical realist studies utilises quantitative or mixed approach for their research, this study explained that how a qualitative approach can meet the requirements of critical realism philosophy in IS research. In this research, firstly, critical realism philosophy and its characteristics, especially in IS research, were reviewed. Secondly, the literature regarding qualitative approach in conducting IS research was reassessed. Then, the impact of critical realism on different aspects of qualitative research was discussed. Finally, the alignment of critical realism with qualitative methodology was rationalised. Hence, the innovative methodology provided by this research justified that qualitative research can be carried out to meet critical realism requirements in IS research. Thus, this study explained a distinctive qualitative methodology for conducting critical realist research on IS.
Based on this method, IS research is mapped into a critical realism fishbone diagram, so that mechanisms and structures can be identified by conducting qualitative research, in order to lead ‘action’ to ‘outcome’. This also informs all other aspects of IS research, including method(s), analysis, and validation of the research. Moreover, this research offered a novel strategy for the validation of qualitative research by combining ‘Maxwell’s qualitative validity criteria’ with ‘Wynn & Williams’s methodological principles of evaluating the capabilities of actual events to lead action to the outcome in critical realist research’ to address the validity of the research. Accordingly, the study critically analysed the checklists for validation of qualitative research and integrated them with validation principles in critical realist IS research. In addition, it explains how to identify the possible criteria for validation of critical realist qualitative research on IS. Thus, the study showed that different sets of validation criteria have to be assessed based on characteristics and requirements of each research and there is no single checklist for all IS research.

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2017).
Agility in Information Systems –
A Literature Review
on Terms and Definitions

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Abstract
Agility is a term used in many works in the context of information systems. When studying the concept closer, it became obvious that there is a terminological heterogeneity preventing a common definition whilst at the same time not preventing the frequent use of the term. In order to approach the term in a structured way, the following two paths were chosen. Firstly, the term was traced back to its roots which showed its first appearance in organisational theory. Secondly, the major IS conferences (ECIS and ICIS) and the requirements engineering conference as a major computer science conference were analysed from 2001 when the agile manifesto was published which led to a wave of works on agility. The descriptive results are presented in the paper.

Keywords: Agility, Agile Manifesto, Flexibility, Agile Information Systems

1.0 Introduction
Agility seems to be the latest buzzword in research and practice. Companies offer agile software development, projects are conducted in an agile way, scrum masters appear by the minute, research approaches use agile models, funding agencies put out calls for research on agility. When we started a new project on good agile project work, one of the first questions was that on a common definition of the term agility. This internal question led to the task of analysing differences in usage of the term agility in information systems research and practice.

To this end, a literature review was conducted. The starting point was the year 2001 when the agile manifesto was published which is seen as the birth of structured approaches on agility (Agile Manifesto, 2001). The two major IS conferences, namely the International Conference on Information Systems (ICIS) and the European Conference on Information Systems (ECIS) were analysed in terms of number of publications and contents. The same was done for the International Requirements Engineering Conference (RE) as agility is often associated with requirements analysis and requirements engineering in terms of changing requirements demanding quick
modifications. It soon became clear that additional work is required to look at various
definitions from other disciplines as well as looking at the development of the
principle of agility from a historical point of view.
Such descriptive analysis can never be complete but it is a structured starting point for
homogenising the terminological heterogeneity.

2.0 The Term Agility and its Roots

An analysis of the IS literature reveals that the term agility is ubiquitous but there
seems to be a lack of common understanding about the underlying concept of agility.
In everyday language, the term agility is used to refer to the ability of reacting flexibly
in case of changing requirements.
Before agility became relevant in IS research, there was considerable attention in the
field of organisational theory. Some researchers mention that the term agility appears
in the 1950s in the field of social sciences. Nevertheless, there is low approval about
the connection between these early works and the present concept of agility (Förster
and Wendler 2012).
Brown and Agnew (1982) form one of the first definitions of agility in the field of
organisational theory. They outline the importance of the ability to respond effectively
in an uncertain world and defined corporate agility as “the capacity to react quickly to
changing circumstances” (Brown and Agnew 1982, p. 29). They mention not only the
requirement of flexibility, but also point out the need for the commitment of key
resources to output-oriented goals. These three aspects, namely the flexibility for
changing circumstances, the clarity of output goals, and the heavyweight of key
resources (especially human resources), can be found in later writings and discussions
about agility.
Despite some early writings, the Lehigh report is referred to as the first work to detail
agility in the field of organisational theory and agile manufacturing (Hooper et al.
2001). The Lehigh Report defines agile manufacturing as:
“…A manufacturing system with extraordinary capabilities (Internal capabilities: hard
and soft technologies, human resources, educated management, information) to meet
the rapidly changing needs of the marketplace (speed, flexibility, customers,
competitors, suppliers, infrastructure, responsiveness). A system that shifts quickly
(speed and responsiveness) among product models or between product lines
(flexibility), ideally in real-time response to customer demand (customer needs and wants).” (Yusuf et al. 1999, p. 36).

After the Iacocca Institute of the Lehigh University published the 21st Century Manufacturing Enterprise Strategy Report in 1991 and the foundation of the Agile Manufacturing Enterprise Forum (AMEF) in 1992, the number of literature on agility and agile manufacturing started to accumulate. Different facets of agility and agile manufacturing were highlighted by many authors leading to a varied range of definitions in the literature.

As an extension of the Lehigh report, Goldman et al. published the book Agile Competitors and Virtual Organisations in 1995. They consider agility as a generic term which can be defined on different levels (i.e. marketing, production, design, organisation, management and the level of people) (Goldman et al. 1995). Furthermore they define agility as “a comprehensive response to the business challenges of profiting from rapidly changing, continually fragmenting, global markets for high-quality, high performance, customer configured goods and services” (Goldman et al. 1995, p. 4). This study was pivotal in introducing the early concept of agile manufacturing and the agile vision.

Much research has been conducted about the various definitions of agility as some form of new manufacturing paradigm (Ganguly et al. 2009, Bernardes and Hanna 2009, Yusuf et al. 1999). Research in agile manufacturing points out that there is not only a huge variety in definitions of agility but also a gap between practice and theory (Gunasekaran and Yusuf 2002, Bernardes and Hanna 2009).

Yusuf et al. (1999) suggest a comprehensive definition of agility that shares some properties with earlier definitions but also includes the aspect of different levels of agility highlighted by Goldman et al. (1995). They define agility as “the successful exploration of competitive bases (speed, flexibility, innovation proactivity, quality and profitability) through the integration of reconfigurable resources and best practices in a knowledge-rich environment to provide customer-driven products and services in a fast changing market environment” (Yusuf et al. 1999, p. 37).

Most definitions and concepts of agility cover essential characteristics of time, flexibility of the system and responsiveness (the ability to response), thereby indicating earlier definitions to be much more vague in their characterisation (Bernardes and Hanna 2009, p. 37, Gunasekaran and Yusuf 2002, p. 1361, Ganguly et al. 2009, p. 411).
It is also mentioned that agile manufacturing encompasses the concepts of lean and flexible manufacturing (Ganguly et al. 2009). There are different approaches to identify a differentiation between the terms agility and flexibility (Bernardes and Hanna 2009, Termer 2016, Evans 1991). Evans (1991) was one of the first who tried to differentiate between flexibility and agility and defines agility as a subset of the construct flexibility. Bernardes and Hanna (2009) reveal that the content of the terms agility, responsiveness and flexibility have overlapping notions in literature and therefore attempt to bring the three concepts to a higher level of abstraction. Based on this conceptual differentiation, Bernardes and Hanna (2009) identify that flexibility may be subsumed by agility. They characterise agility by the attribute of reconfigurability of the system itself to deal with unpredictable change. At the organisational level they define agility as “an approach to organize the production system that allows for fast reconfiguration and that requires resources that are beyond the reach of a single company” (Bernardes and Hanna 2009, p. 44). In addition to that, Backhouse and Burns (1999) reason that agility is the ability of an enterprise to adapt to unpredicted changes in the external environment, which is in contrast to flexibility as the ability to respond to a variety of customer requirements within defined constraints. Besides these approaches, Termer (2016) lists many other reconditioning of the definition of agility and flexibility. This comparison makes clear that there is no conceptual distinction of the terms in literature.

As a provisional conclusion, it must, therefore, be stated that there are various definitions of agility in the business and organisational theory literature and there is no clear differentiation between agility and flexibility.

### 3.0 Agility in the IS Literature

To understand the field of agility, its seminal sources need to be identified. Most of the definitions of the term agility have started to appear since 1991, drawn mainly from manufacturing and the organisational field. Termer (2016) identifies five main sources which are mostly referred to in the current WI and IS literature and which determine the definitions of the term agility in the current research literature. It is also mentioned that besides these five main sources there are numerous single sources which are used.
Besides the seminal publication of Sambamurthy et al. (2003) Sambamurthy et al. (2003) Termer also identified Goldman et al. (1995) as one of the main sources. This underlines the finding that the source of agility is in the manufacturing theory. For instance, Cockburn (2003), one of the early representatives of the agile development community, uses the description of Goldman et al. (1995) as the basic definition of agility and calls this definition the best he could find so far: “Agility is dynamic, context-specific, aggressively change-embracing and growth-oriented. It is not about improving efficiency, cutting costs, or battening down the business hatches to ride out fearsome competitive ‘storms’. It is about succeeding and about winning: about succeeding in emerging competitive arenas, and about winning profits market share, and customers in the very center of the competitive storms many companies now fear.” (Goldman et al. 1995, p. 42). Also Sambamurthy et al. (2003) derive their definition of agility from Goldman et al. (1995). They define agility as the “ability to detect opportunities for innovation and seize those competitive market opportunities by assembling requisite assets, knowledge, and relationships with speed and surprise” (Sambamurthy et al. 2003, p. 245). Both definitions deal with the aspect that agility is an ability to make use of the competitive markets. This ability encompasses the organisational experimentation with new alternatives and pursuit of knowledge about currently unknown opportunities for competitive action (exploration) and the use and development of things already known through refinement and extension of existing competencies, technologies, and knowledge (exploitation) (Sambamurthy et al. 2003).

3.1 Agile Software Development

The unprecedented rate of change in business and technology environments has made it difficult for software teams to determine user requirements. Since the mid-1990s, agile software development approaches have evolved as new alternatives to traditional approaches to improve the responsiveness to changing user requirements (Lee and Xia 2010). In 2001 a group of researchers, i.e. the so-called Agile Alliance, met to discuss their underlying concepts for agile software development methods. They all agreed on four core values and twelve principles and endorsed the publication of the Agile Software Development Manifesto (2001). These principles are not supposed to be understood as a formal definition, but more as guidelines to satisfy the customer through early and continuous delivery of valuable software
Since the manifesto was articulated, agile development has attracted much interest. Dingsøyr et al. (2012) highlight the extent of research on agile development undertaken during the past decade across different countries and also identify popular conferences and journals in which publications on agile research appear. As a result, they point out that the International Conference on Agile Software Development based in Europe has been the main forum for agile research and is followed by the Agile Conference in the US. The IEEE Software journal has the largest number of papers. Besides the area of software engineering the topic has gained traction also in the journal of Communications of the ACM with five articles on agile software development (Dingsøyr et al. 2012). Besides this study, there exist a number of systematic literature reviews and mapping studies of agile software development. Hoda et al. (2017) provide an overview of these reviews and studies on agile software development and identified ten different agile software development research areas. The category “Agile practices” is the area most of the systematic literature reviews focus on (Hoda et al. 2017). This range of different research areas underlines the finding, that there is a huge variety in the term agility and the research field. As a result, the concept of software development agility has not been well understood and organisations adopt these approaches without clear understanding how the term agility is defined or measured (Lee and Xia 2010).

3.2 The Term Agility in the International Conference of Information Systems, the European Conference of Information Systems, and the International Requirements Engineering Conference

The awareness of the term agility has grown rapidly after the agile manifesto was published. Whilst there is a huge number of systematic literature reviews and mapping studies about the main forums for agile research, our work observes whether and how intensive agility was a topic discussed in the International Conference on Information Systems (ICIS), the European Conference of Information Systems (ECIS), and the International Requirements Engineering Conference (RE). We especially focus on the years after 2001 when the agile manifesto was published. We searched for all submissions using the search phrase “agile” and “agility”.

Figure 1 shows the number of submissions concerning agility during the three conferences. As can be seen, the topic of agility pops up in ICIS in 2002 and 2003. In
contrast, the first submission in ECIS was in 2004 and started to be more important in the years 2006 and 2011. In total, there are 44 submissions with the term agility or agile for ICIS during the years 2001 to 2017. For ECIS, there are 46 submissions. This goes in hand with the findings of Dingsøyr et al. (2012), where the International Conference on Agile Software Development based in Europe has been identified as the main forum for agile research, followed by the Agile conference in the US. There is a slight tendency to draw the conclusion that the term of agility is more discussed in Europe than in international comparison. The International Requirements Engineering Conference has the first submission concerning the term agility in 2006. But as can be seen in Figure 1, the issue was not intensively discussed in RE.

![Figure 1. Number of submissions concerning agility](image)

Tables 1 to 3 list all submissions for the three conferences in detail.

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<thead>
<tr>
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<td>• Balancing Quality and Agility in Internet Speed Software Development,</td>
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<td>2003</td>
<td>2</td>
<td>• Agile Government and Global Market-Driven E-Commerce: The Cases of Denmark, France, and Germany</td>
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<td></td>
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<td>• Managing Information Technology for Strategic Flexibility and Agility: Rethinking Conceptual Models, Architecture, Development, and Governance,</td>
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<td>2004</td>
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<td>2007</td>
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<td>• Agile Practices in Use from an Innovation Assimilation Perspective: A Multiple Case Study</td>
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<td>• Agility, Improvisation, or Enacted Emergence</td>
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<td>2016</td>
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- **2008**: IT-Enabled Organisational Agility and Firms' Sustainable Competitive Advantage
- **2010**: Transforming Organisational Capabilities into Agile IT Adoption: A Case Study of Beijing International Airport
  - The Main and Interaction Effects of Process Rigor, Process Standardization, and Process Agility on System Performance in Distributed IS Development: An Ambidexterity Perspective
  - beyond budgeting and agile software development: a conceptual framework for the performance management of agile software development teams
  - conceptualizing interpersonal relationships in agile is development.
  - Enabling Agility through Routinized Improvisation in IT Deployment: The Case of Chang Chun Petrochemicals
- **2011**: Developing Routinized Information Processing Capabilities for Operational Agility: Insights from China
  - Comparing Apples with Oranges? The Perceived Differences between Agile and Lean Software Development Processes
  - Optimal Refactoring Policy for Agile Information Systems Maintenance: A Control Theoretic Approach
  - Evolving IT Organisational Identity as a Source of IT-enabled Enterprise Agility in China
  - Impact of Business Intelligence and IT Infrastructure flexibility on Competitive Performance: An Organisational Agility Perspective
- **2012**: Being Responsive to Your Customer: Developing Customer Agility through Information Management (Research in Progress)
  - Formulating Effective Coordination Strategies in Agile Global Software Development Teams (Research in Progress)
  - The Influence of Internet-Enabled Technologies on Customer Agility: A Strategic-Cognitive Perspective (Research in Progress)
  - Effect of Business Intelligence and IT Infrastructure Flexibility on Organisational Agility
  - Is Implementing ERP Like Pouring Concrete into a Company? Impact of Enterprise Systems on Organisational Agility
- **2013**: Do Organisational Competencies Influence How Enterprise Systems Foster Organisational Agility?
  - Exploring the Customer Perspective of Agile Development: Acceptance Factors and On-Site Customer Perceptions in Scrum Projects
  - How the Effects of IT Capability and Knowledge Capability on Organisational Agility are Contingent on Environmental Uncertainty and Information Intensity
  - Team Adaptability in Agile Information Systems Development (Research in Progress)
- **2014**: Exploring Coordination in Large-Scale Agile Software Development: A Multiteam Systems Perspective
  - How Agile Practices Influence the Performance of Software Development Teams: The Role of Shared Mental Models and Backup
  - Exploring the Influence of Service-oriented Architectures on Organisational Agility – A Case Study
- **2015**: The Effects of Task Conflict and Relationship Conflict on Workforce Agility: Moderating Role of Social Media Usage
  - Understanding Agility in ISD Projects
  - An Exploration of the relationship between Contribution Behaviours and the Decision Making Process in Agile Teams
- **2016**: Diving into the Relationship of Information Technology and Organisational Agility: A Meta-Analysis
  - In Search of Explanations: Conceptualizing the Relationship between Service-oriented Architecture and Organisational Agility
  - Realizing Value from Business Analytics Platforms: The Effects of Managerial Search and Agility of Resource
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<th>Allocation Processes</th>
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<tr>
<td>• Developing Socially-Constructed Quality Metrics in Agile: A Multi-Faceted Perspective</td>
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<td>• Problematizing Agile in the Large: Alternative Assumptions for Large-Scale Agile Development</td>
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<td>• Remote Working and Collaboration in Agile Teams</td>
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<td>• Self-Organisation in Agile ISD Teams and the Influence on Exploration and Exploitation</td>
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<td>• ICT Enabling Customer Agility: A Dynamic Capabilities Perspective</td>
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<td>• Internally or Externally-oriented IT Competencies: A Configuration Theory Perspective on How to Build Demand Management Agility</td>
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<td>• Journey Towards Agility: Where Are We Now and Where Are We Heading?</td>
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<td>• Team Diversity and Performance – How Agile Practices and Psychological Safety Interact</td>
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<td>• A Workaround Model for Competent Project Managers using Agile Development in a Traditional Organisation</td>
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<td>• Exploring IT/S Risk Management Agility</td>
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Table 1. ICIS submissions

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<td>Open source networks: an exploration of business model and agility issues</td>
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<td>Cost estimation in agile development projects</td>
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<td>Looking for a place to hide: a study of social loafing in agile teams,</td>
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<td>Towards the development of a simple tool to assist in agile methodology adoption decisions: agile adoption matrix</td>
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<td>Organizing for agility: A complex adaptive systems perspective on agile software development process,</td>
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<td>Mapping Social Network to Software Architecture to Detect Structure Clashes in Agile Software Development</td>
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<td>A Paradoxical Perspective on Contradictions in Agile Software Development</td>
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<td>Information Systems Integration Mechanisms within Supply Chain Agility in the Chinese Automotive Industry,</td>
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<td>presenting data for team-based decision-making in agile information systems projects</td>
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<td>A case study of risk management in agile systems development</td>
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<td>IT impacts on operation-level agility in service industries</td>
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<td>Understanding agility in software development through a complex adaptive systems perspective</td>
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<td>Combining Open Innovation and Agile Approaches: Implications for IS Project Managers</td>
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<td>IT-enabled strategic-level agility and firm performance: service versus manufacturing industry</td>
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<td>Business agility within is value research - proposing a measurement framework</td>
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<td>Agile &amp; distributed project management: a case study revealing why scrum is useful</td>
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<td>Tracking the digital footprints of customers: how firms can improve their sensing abilities to achieve business agility</td>
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<td>Impact of grid assimilation on operational agility in turbulent environments: an empirical investigation in the financial services industry</td>
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<td>From agile to lean: the perspectives of the two agile online</td>
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| 2012 | 4      | • The interpretation and legitimization of values in agile's organizing vision  
|      |        | • How sustainable are agile methodologies? Acceptance factors and developer perceptions in scrum projects  
|      |        | • Sensing social media for corporate reputation management: a business agility perspective  
|      |        | • Towards an understanding of the contextual influences on distributed agile software development: a theory of practice perspective |
| 2013 | 5      | • A Classification for Business Intelligence Agility Indicators  
|      |        | • Explaining the Changing Communication Paradigm of Agile Information Systems Development: A Research Model, Measurement Development and Pretest  
|      |        | • How IT-Enabled Supply Chain Integration Is Achieved for Supply Chain Agility: An Institutional-Political Perspective  
|      |        | • Agility of The Firm: Customers' Perspective (Research in Progress)  
|      |        | • Agile Behavior Of Business Intelligence Systems: An Empirical Study on The Impact Of In-Memory Technology |
| 2014 | 2      | • Adaptation Patterns in Agile Information Systems Development Teams  
|      |        | • We’ve Got 99 Problems, But A Phone ain’t One: Mobile ICT And Academic Agility in Information Systems Research |
| 2015 | 4      | • IS Agility Research: An Assessment and Future Directions  
|      |        | • Personality Traits of Scrum Roles in Agile Software Development Teams - A Qualitative Analysis  
|      |        | • Building Enterprise Systems Infrastructure Flexibility as Enabler of Organisational Agility: Empirical Evidence  
|      |        | • Toward a General Theory of Agile Project Management - A Research Design (Research in Progress) |
| 2016 | 4      | • Collaboration Amidst Volatility: The Evolving Nature of Boundary Objects in Agile Software Development  
|      |        | • Improving ISD Agility in Fast-Moving Software Organisations  
|      |        | • Governing for Agility and Innovation in Data-Rich Environments: The Role of Data Analytics Capabilities  
|      |        | • Team Agility and Team Performance – The Moderating Effect of User Involvement (Research in Progress) |
| 2017 | 6      | • Reinventing the IT Function: The Role of IT Agility and IT Ambidexterity in Supporting Digital Business Transformation  
|      |        | • Developing Intellectual Capital Within Agile IT Teams: A Literature Review  
|      |        | • How to Implement Agile IT Setups: A Taxonomy of Design Options  
|      |        | • Information Technology Competency and Organisational Agility: Roles of Absorptive Capacity and Information Intensity  
|      |        | • When Is Agile Appropriate for Enterprise Software Development?  
|      |        | • Adapting Agile Methods to Develop Solutions for the Industrial Internet of Things |
| total| 46     |             |

Table 2. ECIS submissions
Table 3. International Requirements Engineering Conference submissions

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<td>• Do We Know Enough about Requirements Prioritization in Agile Projects: Insights from a Case Study • Transition to Agile Development - Rediscovery of Important Requirements Engineering Practices • Realizing Business Agility Requirements through SOA and Cloud Computing • Guiding Requirements Scoping Using ROI: Towards Agility, Openness and Waste Reduction</td>
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<tr>
<td>2011</td>
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<td>• There's never enough time: Doing requirements under resource constraints, and what requirements engineering can learn from agile development • How to assign cost to “avoidable requirements creep”: A step towards the waterfall’s agilization</td>
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<td>2012</td>
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<tr>
<td>2014</td>
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<td>• Decisively: Application of Quantitative Analysis and Decision Science in Agile Requirements Engineering</td>
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<tr>
<td>2015</td>
<td>2</td>
<td>• Forging high-quality User Stories: Towards a discipline for Agile Requirements • Agile requirements engineering with prototyping: A case study</td>
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<tr>
<td>2016</td>
<td>1</td>
<td>• Trace++: A Traceability Approach to Support Transitioning to Agile Software Engineering</td>
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<tr>
<td>2017</td>
<td>3</td>
<td>• How Much Undocumented Knowledge is there in Agile Software Development?: Case Study on Industrial Project Using Issue Tracking System and Version Control System • Requirements Engineering Challenges in Large-Scale Agile System Development • An Approach to Support the Specification of Agile Artifacts in the Development of Safety-Critical Systems</td>
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4.0 Conclusion

The current paper was motivated by our quest for the definition of “agility” which was generally accepted and used by most authors. Whilst it seemed to be an easy task to accomplish, it became clear that there is a variety of definitions and underlying concepts leading to a terminological heterogeneity that is paired with different schools of thought based on different subjects such as organisational theory, manufacturing, information systems.

Therefore, we set about to conduct a descriptive study of research by analysing the literature and answering the questions of historical development of agility (stemming from the 1980s), main definitions that shaped important work, and the special conduct of research on agility including its definition in information systems.

The main conclusion is that the first impression of heterogeneity is indeed correct. However, there are approaches trying to structure what is out there after opening Pandora’s Box of agile approaches. The Agile Manifesto is the main source of communality in information systems. Nevertheless, an overall definition considering all influence factors is missing. A valid conclusion might be such an attempt is futile
because different research approaches (an indeed approaches in industrial practice) focus on different aspects of agility. We strongly argue for the need of definitions of agility for each approach instead and will do so for our project on good agile project work which is multidisciplinary (sociology, information systems, organisational theory) and has participants from research and practice.

Acknowledgements

We gratefully acknowledge the funding provided by the Federal Ministry of Education and Research and by the European Social Fund for the research project “diGAP (Good agile project work in the digitalised world)”.
References


INFORMATION TECHNOLOGY OUTSOURCING CONFIGURATIONS AND ORGANIZATIONAL OUTCOMES

Abstract

Research has reported mixed relationships between different Information Technology Outsourcing (ITO) (e.g., 'total' and 'selective') approaches and organizational performance. Most ITO research takes a reductionist approach, which only examines unidirectional linear relationships between specific ITO attributes and organizational performance. Configurational theory as an alternative approach has been suggested. This study employs a theory-driven and empirically-grounded list of attributes to construct ITO configurations. Then it uses a set-theoretic method to empirically examine the ITO configuration-organizational outcome relationship. Data were collected through a survey administered to the members of the International Association of Outsourcing Professionals (IAOP). Our findings suggest five different ITO configurations that lead to cost reduction, capability enhancement, and innovation. The theoretical foundation for ITO research and configurational approach is reviewed next. We then suggest five key attributes of ITO configurations and three common organizational outcomes. Thereafter, we present our findings and put forth several implications for ITO studies.

Keywords: Outsourcing, Configuration, Organizational, Outcomes

1.0 Theory

Configurational theory is concerned with the constellations of strategic, structural, and environmental attributes that can describe a large proportion of high-performing organizations (Miller 1981; Miller 1986; Mintzberg and Lampel 1999). The basis of configuration is the notion that the whole is best understood from a systemic perspective and should be viewed as a constellation of interconnected elements (Ragin 2008). Configuration thus recognizes multiple conjunctural causality, which is proposed as an alternative perspective to the reductionist perspective of unidirectional and linear relationships between external contingencies and organizational attributes (Meyer et al. 1993). In other words, configurational theory takes a holistic synthesis of reciprocal and nonlinear relationships among organizational attributes. It recognizes equifinality, which is the idea of multiple possible paths or configurations toward the same organizational outcomes. Thus, it is a useful lens to study complex phenomena, which often involve interactions of highly-related attributes (Fink 2010; Miller 1986; Mintzberg and Lampel 1999).

Configurational theory has been proposed to address some nagging issues in ITO research (Cullen et al. 2005; Fink 2010; Lacity et al. 2010). It can potentially expose
the complex dynamics of organizational attributes that sometimes lead to contradicting results in ITO studies (Cullen et al. 2005; Fink 2010). It also allows researchers to combine attributes from multiple theoretical perspectives in a more holistic investigation (Lee et al. 2004). Recent ITO review has called for more studies on ITO configurations to reveal the complexity in crafting and carrying out ITO contracts (Lacity et al. 2010).

Following Lee et al. (2004) and Cullen et al. (2005), we focus on ITO strategies and define an ITO configuration as a high-level description of strategic choices that underlie the making of ITO arrangements. Next, we review the extant ITO configuration literature.

1.1 Prior Studies on ITO Configurations and Our Approach

Although configurational theory has been applied in various studies (Ketchen et al. 1997), there is only a handful of ITO studies using configurational theory. Table 1 provides an overview of the three key studies. While these studies are helpful in understanding the complexity of ITO configurations and subsequent outcomes, several limitations remain. First, they are inconsistent in examining empirically the causal relationship between ITO configurations and organizational outcomes. Of the three exemplary studies, one uses regression analysis, one uses case comparison, and the other study suggests set-theoretic approach without empirical analysis. Second, they are inconsistent in constructing the list of attributes for ITO configurations. Two studies rely on a deductive approach to synthesize attributes from theories while one study use an inductive approach to generate attributes from qualitative observations.

To address these limitations, we utilize a theory-driven and empirical-grounded list of attributes to study ITO configurations, and employ a set-theoretic approach to examine the ITO configuration-organizational outcomes relationship (Fink 2010). Our configurational approach allows us to integrate multiple outsourcing theories and reconcile empirical contradictions while addressing issues from a reductionist approach. Prior IT configuration studies have simplified the causal link between IT configurations and organizational outcomes, which abstract away the interdependence of attributes (Lee et al. 2004).

<table>
<thead>
<tr>
<th>Configuration definition</th>
<th>Configurations of ITO strategy which is the underlying logic for ITO decisions</th>
<th>High-level description of structural choices in crafting ITO arrangements</th>
<th>Combination of strategy, structure, and environmental attributes in ITO relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical foundation</td>
<td>Transaction cost economics Residual rights theory</td>
<td>N/A</td>
<td>Process view Relational view Resource-based view</td>
</tr>
<tr>
<td>Attribute development</td>
<td>Deductive approach based on theory</td>
<td>Inductive approach based on data</td>
<td>Deductive approach based on theory</td>
</tr>
<tr>
<td>Key attributes</td>
<td>3 key attributes</td>
<td>7 key attributes</td>
<td>13 key attributes</td>
</tr>
<tr>
<td>Empirical approach</td>
<td>Survey of 311 South Korean firms</td>
<td>49 case studies of Australian firms</td>
<td>N/A</td>
</tr>
<tr>
<td>Analytical approach</td>
<td>Pattern counting and regression analysis</td>
<td>Case comparison</td>
<td>Set-theoretic approach</td>
</tr>
<tr>
<td>Identified configurations</td>
<td>3 key configurations: Independent Arm’s length Embedded</td>
<td>N/A</td>
<td>3 key configurations: Asset dependence Relational dependence Independence</td>
</tr>
<tr>
<td>Performance consideration</td>
<td>Outsourcing effectiveness</td>
<td>N/A</td>
<td>Outsourcing effectiveness</td>
</tr>
</tbody>
</table>

Table 1. Empirical Studies on ITO Configurations.

1.2 Attributes of ITO Configurations

One of the challenges in conducting configurational studies is the difficulty in determining key attributes in configurations (Ketchen et al. 1997; Miller 1996). Employing a narrow scope with an exclusive list of attributes leads to abstract configurations, but employing a broader scope with an inclusive list of attributes can lead to too many configurations that is difficult to interpret. The struggle of finding the right balance between “zooming out” and “zooming in” is prevalent in
configurational studies and require careful considerations in research design. Following prior studies, we review ITO literature to construct a list of core attributes for ITO configurations that satisfy two criteria: 1) they need to be grounded in theories, and 2) they are supported by empirical evidence to have strong causal relationships with ITO outcomes (Cullen et al. 2005; Fink 2010; Miller 1996). There are various theories used to explain how ITO delivers certain organizational outcomes: resource-based theory, resource-dependence theory, transaction cost theory, agency cost theory, among others (Cheon et al. 1995). In general, two major theoretical camps stand out: the first one includes governance-based theories (e.g., transaction cost theory, coordination theory, contract theory) and the second one includes capability-based theories (e.g., competencies theory, resource-based theory) (Fink 2010). We review the literature of these two major research camps and identify major attributes that have strong empirical evidence to support how such attribute contributes to ITO success. This approach allows us to later construct an inclusive survey instrument while maintaining a coherent structure for the respondents to follow. The details of these attributes are presented next.

1.2.1 Service Level Strategy
Service level strategy describes the degree of outsourcing for various IT functions, including application developments, operations activities, or management and support functions (Cullen et al. 2005). An organization can outsource different IT functions at various degrees. For example, outsourcing only technology supporting help desk or completely the whole help desk service. The degree of outsourced IT functions determines the level of IT capabilities an organization gains through outsourcing. The combination of all IT functions being outsourced and their degree of outsourcing constitutes an outsourcing portfolio, and the nature of this portfolio will have different implications on performance. For instance, organizations with a mostly outsourcing model are often outperformed by organizations with a partial outsourcing or insourcing model (Lacity and Willcocks 1998; Lacity and Willcocks 2001). An organization can be classified as using a mostly outsourcing model if 80% or more of IT services are outsourced; using a partially outsourcing model if between 20% to 80% of IT services are outsourced; and using an insourcing model if less than 20% of IT services are outsourced (Lacity and Willcocks 1998).
1.2.2 Supplier Strategy
Supplier strategy specifies the number of suppliers that provide ITO services. The supplier strategy determines how an ITO contract is carried out, and how IT capabilities are provided. Prior studies have suggested that supplier strategy can mitigate ITO risks (Currie 1998), provide capabilities for specific needs (Cullen et al. 2005), or increase the probability to find the best supplier fit (Levina and Su 2008). Following Cullen et al. (2005), we identify four different supplier strategies. Sole supplier refers to a situation in which one supplier provides all ITO services without any subcontracting. On the other hand, a prime supplier acts as a single point of accountability for the ITO contracts, but has multiple subcontracts with other suppliers to provide ITO services. An organization may also take a best-of-breed model in which it uses multiple suppliers for ITO services. Finally, a panel is where an organization chooses from a list of preferred suppliers for their ITO services. These suppliers compete with each other, and work is not guaranteed.

1.2.3 Commercial Relationship
Commercial relationship describes the high level relationship structure between an organization and its ITO suppliers. Such relationship can be captured in the contractual arrangements of an ITO relationship, that is, ITO contracts. Different ITO contract types have been found to significantly impact ITO performance (Fitoussi and Gurbaxani 2012; Oshri et al. 2015; Qi and Chau 2012). Lacity and Willcocks (1998) identified three types of ITO contracts: fee-for-service, strategic alliance/partnership, and buy-in contract. In fee-for-service contract, an organization pays a fee to a supplier in exchange for the ITO services. There are four major fee-for-service contracts. Generic contracts are off-the-self contract, provided by either the suppliers or the outsourcing organization without much customization. A detailed contract includes specific and detailed clauses for ITO services such as service scope, service levels, performance measures, and penalties. In contrast, a loose contract does not contain detailed clauses, but it does allow some customization as compared to a generic contract. Lastly, a mixed contract is a combination of detailed and loose contracts in which some detailed clauses are provided for service scope, service levels, performance measurement, and penalties.

The second type of contract is strategic partnership in which both the organization and its ITO suppliers pool resources together to create, add to, or maximize joint value.
They share benefits and risks in this collaborative inter-organizational relationship. The last type of contract, buy-in, refers to situations in which an organization buys in vendor resources to supplement in-house capabilities, and the vendor resources are managed by in-house management. This situation is similar to insourcing and therefore is excluded in our study.

1.2.4 Pricing Strategy

Pricing strategy describes the method by which the payment to the ITO suppliers is calculated. It is often considered a legal arrangement in ITO contracts and therefore significantly characterize the client-supplier relationship. Following Cullen et al. (2005), we define three main categories for ITO pricing framework. First, an organization can use a fixed price model in which the organization specifies a fixed amount for an ITO contract (e.g., $1 million per year for data center operations). In reality, this quoted price is rarely fixed but is often adjusted for fluctuated services or additional fees. The second option is to use unit price model in which outsourcing suppliers charge a price per a specific transaction unit (e.g., $100 per software update). The last option is to use a cost plus model in which suppliers charge the cost of ITO services plus additional markup (e.g., cost plus 5% markup) or management fee (e.g., cost plus $1 million fee). This approach is useful when uncertainty is high and the ITO contract needs some flexibility.

1.2.5 Contract Commitment

The last governance-based attribute is contract commitment, defined as the frequency with which an organization renews its ITO contracts (Cullen et al. 2005). A frequently renewable contract can provide outsourcing flexibility, mitigate risks from incomplete contracts, and allow reactive adaptation to changing environment (Harris et al. 1998; Tan and Sia 2006). An organization can choose to use a single term contracts with no renewable option; an evergreen contract with no expiry and is only terminated when one party invokes its termination rights; and a rollover contract is one in which it has a fixed initial term but also has options to extend depending on latter assessments (e.g., supplier performance).

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Definition</th>
<th>Theory</th>
<th>Empirical Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>The type of IT</td>
<td>Capability</td>
<td>(Lacity and Willcocks 1998;</td>
</tr>
<tr>
<td>Level Strategy</td>
<td>functions being outsourced and how they are provided to business units</td>
<td>Lacity and Willcocks 2001; Willcocks et al. 1999</td>
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</tr>
<tr>
<td>----------------</td>
<td>----------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Supplier Strategy</td>
<td>The number of suppliers that provide ITO services</td>
<td>Capability</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Currie 1998; Levina and Su 2008)</td>
<td></td>
</tr>
<tr>
<td>Commercial Relationship</td>
<td>The high level relationship structure between an organization and its ITO suppliers</td>
<td>Governance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Fitoussi and Gurbaxani 2012; Grover et al. 1996; Lacity and Willcocks 2001; Lee et al. 2004; Willcocks et al. 1999)</td>
<td></td>
</tr>
<tr>
<td>Pricing Strategy</td>
<td>The method by which the payment to the ITO suppliers is calculated</td>
<td>Governance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Gopal et al. 2003)</td>
<td></td>
</tr>
<tr>
<td>Contract Commitment</td>
<td>The frequency with which an organization renews its ITO contracts</td>
<td>Governance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Harris et al. 1998; Lacity and Willcocks 1998; Lacity and Willcocks 2001; Lee et al. 2004; Tan and Sia 2006)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Attributes of ITO Configurations.

1.3 Organizational Outcomes of ITO
Most ITO studies identify two direct organizational outcomes of ITO: cost reduction and capability enhancement (Gwebu et al. 2010; Lacity et al. 2010; Lacity et al. 2011; Levina and Ross 2003). By outsourcing IT functionalities to third-party, organizations can take advantage of economies-of-scale offered by these suppliers, utilize extra capabilities available in their services, and gain resources to focus on their core business activities (Gwebu et al. 2010; Lacity et al. 2010; Levina and Ross 2003; Levina and Su 2008). Recent studies also point out the possibility of using ITO services to create strategic innovation (Oshri et al. 2015). Strategic innovation is defined as ways that significantly enhance a firm’s existing product or service or enable the firm to enter new markets (Oshri et al. 2015). A strong outsourcing
relationship can enhance existing relational and contractual governance and allow firms to exploit new and innovative products, services, and markets. In sum, our study examines three organizational outcomes of ITO: cost reduction, capability enhancement, and strategic innovation (through outsourcing).

2.0 Method
To identify ITO configurations, we develop a cross-sectional survey, which is the recommended approach to study existing ITO arrangements across a large sample size (Fink 2010). It is important to note that given our purpose to study ITO configurations, our survey does not use variance-based questions that aim to identify latent variables but rather use questions to identify attributes of ITO configurations. Nevertheless, we follow survey development principles to establish credibility and reliability for our survey instrument (Czaja and Blair 2005; DeVellis 2003). Our survey was developed in two stages (Czaja and Blair 2005). In the first stage, survey design, we develop survey questions for ITO attributes using prior studies (Cullen et al. 2005; Grover et al. 1996; Oshri et al. 2015). All questions for independent variables were developed to capture ITO attributes on various degrees instead of identifying latent variables. For example, to capture the ITO service level strategy, the survey question asks respondents to rank their outsourcing level for different categories such as IT application, operations, management, and support. On the other hands, questions for dependent variables use instruments for latent variables based on prior studies. This approach has been used by prior studies on ITO configurations (Lee et al. 2004). All questions were adjusted to better fit our purposes as well as new ITO advancements, such as cloud sourcing. In the second stage, pretest, we discussed the survey instrument with seven academics with expertise in outsourcing research. We used the feedback to revise the questions. We then conducted a pilot study with four ITO professionals. The results were used to fine-tune the survey instrument. These steps helped validate the instrument and establish its reliability (Czaja and Blair 2005). Table 3 shows a summary of our concepts.

<table>
<thead>
<tr>
<th>Measurement description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITO Attributes (Independent Variables)</td>
<td></td>
</tr>
<tr>
<td>Service Level Strategy</td>
<td>Degree of outsourcing from “mostly outsourcing” to “never consider” on four categories: (Cullen et al. 2005)</td>
</tr>
<tr>
<td><strong>Supplier Strategy</strong></td>
<td>Percentage of outsourcing contracts using different types of supplier strategies: One supplier without any subcontracting, One supplier that subcontracts, Multiple suppliers, Pool of suppliers “on call”, and Others</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Pricing Strategy</strong></td>
<td>A 5-point Likert scale on how frequency a company uses the following payment method: A fixed amount for a project, Charge a price per a specific transaction unit, Actual cost plus markup or management fee, and Other</td>
</tr>
<tr>
<td><strong>Contract Commitment</strong></td>
<td>A 5-point Likert scale on how frequency a company uses the following type of contract: Single term contracts-fixed one-term contracts, Rollover-extendable contracts, Evergreen-in perpetuity, and Other</td>
</tr>
<tr>
<td><strong>Commercial Relationship</strong></td>
<td>A 5-point Likert scale on how frequency a company uses the following type of contract: Loose contracts, Mixed contracts, Detailed contracts, Strategic partnership, Generic contracts, and Other</td>
</tr>
<tr>
<td><strong>Organizational Outcomes (Dependent Variables)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cost Reduction</strong></td>
<td>A 7-point Likert scale on the degree of cost reduction a company receives from ITO services</td>
</tr>
<tr>
<td><strong>Capability Enhancement</strong></td>
<td>A 7-point Likert scale on the degree of capability enhancement a company receives from ITO services</td>
</tr>
<tr>
<td><strong>Strategic Innovation</strong></td>
<td>A 7-point Likert scale on the degree of innovativeness a company achieves from using ITO services</td>
</tr>
</tbody>
</table>

Table 3. Attributes of ITO Configurations.
The survey was then distributed to the member of the International Association of Outsourcing Professional (IAOP)—a large organization with more than 20,000 members worldwide. We also solicited the survey in two chapter IAOP meetings in order to increase response rate. We received 31 responses from companies that have outsourced their IT activities. The reason for the low response rate is that the majority of IAOP members are companies that provide outsourcing services. After reviewing the responses and filtering out unusable or incomplete data, we retained 20 responses for further analysis. Because we do not know the exact number of outsourcing client among IAOP members, we cannot report an exact response rate. However, 20 responses is deemed sufficient for a conference report, and we plan to continue data collection to increase the response number. Table 4 reports the correlation for dependent variables which were developed using survey instruments that aim to capture latent variables.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cost Reduction 1</td>
<td>5.05</td>
<td>1.19</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Cost Reduction 2</td>
<td>5.10</td>
<td>0.91</td>
<td>.383</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Cost Reduction 3</td>
<td>4.80</td>
<td>1.36</td>
<td>.461**</td>
<td>.738***</td>
<td>1</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>4.</td>
<td>Capability Enhancement 1</td>
<td>5.30</td>
<td>1.08</td>
<td>.478*</td>
<td>.342</td>
<td>.508*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Capability Enhancement 2</td>
<td>4.65</td>
<td>1.18</td>
<td>.723**</td>
<td>.278</td>
<td>.314</td>
<td>.457*</td>
<td>1</td>
<td></td>
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<tr>
<td>6.</td>
<td>Capability Enhancement 3</td>
<td>5.00</td>
<td>1.03</td>
<td>.517*</td>
<td>.225</td>
<td>.302</td>
<td>.380</td>
<td>.564**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Strategic Innovation 1</td>
<td>4.25</td>
<td>1.37</td>
<td>.572**</td>
<td>.273</td>
<td>.366</td>
<td>.657***</td>
<td>.706**</td>
<td>.374</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Strategic Innovation 2</td>
<td>4.55</td>
<td>1.23</td>
<td>.589**</td>
<td>.416</td>
<td>.320</td>
<td>.540**</td>
<td>.680**</td>
<td>.499**</td>
<td>.847**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Strategic Innovation 3</td>
<td>4.25</td>
<td>1.21</td>
<td>.320</td>
<td>.024</td>
<td>.160</td>
<td>.463*</td>
<td>.359</td>
<td>.509*</td>
<td>.564**</td>
<td>.397</td>
<td>1</td>
</tr>
<tr>
<td>10.</td>
<td>Strategic Innovation 4</td>
<td>4.60</td>
<td>1.57</td>
<td>.265</td>
<td>.213</td>
<td>.108</td>
<td>.230</td>
<td>.346</td>
<td>.654**</td>
<td>.342</td>
<td>.527**</td>
<td>.610**</td>
</tr>
</tbody>
</table>

Table 4. Correlation for Dependent Variables.

2.1 Data Analysis

The analyses for this study were performed using fsQCA 3.0 (Ragin and Davey 2014) and followed the steps specified by Liu et al. (2015). In the first step, we transformed the collected data into Boolean sets (Liu et al. 2015). For each of ITO attributes, we use cluster analysis to 1) descriptively make sense of the data and 2) transform multiple-scale questions into a single dimension that is suitable for fuzzy-set analysis. For example, the survey questions for supplier strategy ask for the percentage of ITO contracts that utilize different types of supplier strategy such as one supplier with subcontracts or pool of “on call” suppliers. A cluster analysis allowed us to identify
clusters of ITO practices regarding supplier strategy and transform the data into a binary classification. Particularly, the value of 1 represented one cluster while the value of 0 represented another cluster.

In the second step, we used the five transformed variables (or sets) to conduct a crisp set QCA analysis. The ITO outcomes were cost reduction, capability enhancement, and strategic innovation. Our analysis steps were described below:

Step 1: Data calibration. All ITO attributes were transformed into a crisp measure with two types of membership while ITO outcomes were transformed into fuzzy measures.

a. Service level strategy: membership of 1 equals to majority outsourcing strategy while membership of 0 equals to conservative outsourcing strategy. Organizations with majority outsourcing strategy will outsource IT functions in all four categories such as IT application, operations, management, and support while organizations with a conservative outsourcing mostly outsource their IT functions in IT application and operations.

b. Supplier strategy: membership of 1 equals to diversified supplier strategy while membership of 0 equals to flexible supplier strategy. Organizations with a diversified supplier strategy will mostly use multiple suppliers for their ITO services while organizations with a flexible supplier strategy will have a wide range of suppliers from one supplier to pool of on-call suppliers.

c. Pricing strategy: membership of 1 equals to fixed pricing strategy while membership of 0 equals to flexible pricing strategy. The former will set a fixed amount for their ITO contracts while the latter use various pricing strategy including fixed amount, per transaction, or mark-up on actual costs.

d. Contract commitment: membership of 1 equals to extendable contracts while membership of 0 equals to fixed-terms contracts. Organizations with extendable contracts allow their suppliers to extend ITO contracts while organization with fixed-term contracts set time limit to their ITO contracts, or no time at all.

e. Commercial relationship: membership of 1 equals to detailed contracts while membership of 0 equal to mixed-type contracts. The former will mostly use detailed clauses in their ITO contracts while the latter use various contract types with various degrees of details.

f. ITO outcome—cost reduction: a fuzzy measure with 1-4-7 thresholds. In other words, firms with Likert-scale value of 7 (Strongly agree) will have the full
membership of the cost-reduction set while firms with Likert-scale value of 1 (Strongly disagree) will have the full non-membership of the set
g. ITO outcome—capability enhancement: a fuzzy measure with 1-4-7 thresholds
h. ITO outcome—strategic innovation: a fuzzy measure with 1-4-7 thresholds

Step 2: Truth table construction. We constructed a truth table for each of the three organizational outcomes. To identify the most important and possible configurations, we use the suggested frequency of 1 and consistency of 0.7 as the cut off points (Liu et al. 2015; Ragin 2008).

Step 3: Obtain the solution sets. In fs/QCA analysis, three solution sets are possible: complex, parsimonious, and intermediate (Ragin 2008). They are different based on how strict the simplifying assumption is. Typically, the intermediate solution is preferred as it offers interpretable combinations.

Step 4. Interpret and evaluate the solutions. Using solution sets, we identified core and peripheral conditions for further interpretations of the solutions (Fiss 2011; Ragin 2008). Specifically, core conditions are those that appear in both parsimonious and intermediate solutions while the peripheral conditions only appear in the intermediate solutions. The coverage and consistency measures of the final solution were also reported. Our final interpretation is presented in the findings section.

3.0 Findings

In this section, we report the results of fsQCA analyses to identify ITO configurations that lead to three different ITO outcomes: cost reduction, capability enhancement, and strategic innovation.

3.1 ITO Outcome—Cost Reduction

Table 5 shows the result of the fuzzy set analysis of cost reduction outcome for ITO services. Following the notation in previous QCA-based studies (Fiss 2011; Liu et al. 2015; Ragin 2008), we use black circles (“●”) to indicate the presence of a condition, open circles (“○”) to indicate the absence of a condition, and blank spaces to indicate
“don’t care” or irrelevant conditions. The large size circles represent core conditions while small size circles represent peripheral conditions. Core conditions have a strong causal relationship with the outcome while peripheral conditions have a weaker causal relationship (Fiss 2011). In addition, we use the core conditions to further classify solutions into first-order and second-order solutions (Fiss 2011; Liu et al. 2015). Second-order solutions share similar sets of core conditions while first-order solutions have different sets of core conditions.

The results in Table 5 show that there are two major configurations associated with cost reduction in ITO services. All together, they have a consistency value of 0.77, above the threshold of 0.75 suggested by Ragin (2008). The configurations suggest that firms can have diversified suppliers and specified contracts or use majority outsourcing model to reduce cost. In the first configuration (solution 1a and 1b), firms that use diversified suppliers and detailed contracts need to control pricing through a fixed pricing strategy or continuously engage in extendable contracts. These patterns allow firms to engage with many outsourcing suppliers and minimize agency risk. In contrast, in the second configuration (solution 2), firms can use a mostly outsourcing model to focus on a wider range of outsourced IT services. These firms have a flexible strategy for suppliers but they emphasize fixed term contracts to reduce costs. This configuration seems counter-intuitive and we posit that due to the large number of firms involved with mostly outsourcing strategy, these firms use fixed term contracts as a way to standardize ITO management and minimize potential complexity from constant negotiation of new contracts.

### Table 5. ITO Configurations that Lead to Cost Reduction.

<table>
<thead>
<tr>
<th>Solution</th>
<th>Majority outsourcing</th>
<th>Diversified suppliers</th>
<th>Fixed pricing</th>
<th>Extendable contracts</th>
<th>Detailed contracts</th>
<th>Raw coverage</th>
<th>Unique coverage</th>
<th>Consistency</th>
<th>Solution coverage</th>
<th>Consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>0.284</td>
<td>0.127</td>
<td>0.786</td>
<td>0.723</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>0.379</td>
<td>0.221</td>
<td>0.749</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>0.218</td>
<td>0.218</td>
<td>0.755</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 3.2 ITO Outcome—Capability Enhancement

Table 6 below shows the result of the fuzzy set analysis of cost reduction outcome for ITO services. There are three sets of first-order configurations. Out of the three, configuration 3 has the lowest coverage and has no particular case with exact fit of
conditions. Thus, it can be an artifact of analysis. We dropped it from interpretation. The remaining two configurations are: 1) firms with diversified suppliers (solution 1a, 1b, and 1c), and 2) firms with majority outsourcing model, flexible suppliers, and fixed term contracts (solution 2). Together, the configurations have a consistency of 0.78, an acceptable value. In the first configuration, firms can use several conditions to complement a strategy of diversified suppliers: fixed pricing strategy, fixed term contracts, or specified contracts. We posit that this configuration uses a supplier diversity strategy to achieve extra capabilities, and other conditions help firms to minimize risk. On the other hand, in the second configuration, firms use an ITO service diversity strategy to outsource a wide range of IT services and therefore gain extra capabilities.

<table>
<thead>
<tr>
<th>Solution</th>
<th>Majority outsourcing</th>
<th>Diversified suppliers</th>
<th>Fixed pricing</th>
<th>Extendable contracts</th>
<th>Detailed contracts</th>
<th>Raw coverage</th>
<th>Unique coverage</th>
<th>Consistency</th>
<th>Solution</th>
<th>Consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>0.285</td>
<td>0.117</td>
<td>0.796</td>
<td>0.725</td>
<td>0.780</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>0.172</td>
<td>0.057</td>
<td>0.800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1c</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>0.172</td>
<td>0.120</td>
<td>0.803</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>0.212</td>
<td>0.212</td>
<td>0.740</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>○</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>0.052</td>
<td>0.052</td>
<td>0.730</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6. ITO Configurations that Lead to Capacity Enhancement.

3.3 ITO Outcome—Strategic Innovation

Table 7 shows the result of the fuzzy set analysis of strategic innovation outcome for ITO services. Only one configuration is identified (solution 1a and 1b). Although it has lower coverage than the other configurations, it has the highest consistency, indicating that the configuration is not common in practice but has a distinctive pattern. Specifically, the configuration suggests that there is a necessary condition for firms to gain strategic innovation outcome from ITO services: they need to have a majority outsourcing model with diversified suppliers and detailed contracts. This configuration makes sense because by using a wide range of outsourced IT services
using a wide range of suppliers, these firms are able to take advantage of the 
capabilities offered by numerous suppliers to be innovative with their products and 
services. The finding is consistent with previous studies which suggest that 
partnership contracts—using very detailed contracts—accommodate high-quality 
relationships between clients-suppliers to help achieve strategic innovation (Oshri et 
al. 2015). In our case, the detailed contracts augment the mostly outsourcing models 
and diversified supplier strategy to allow firms to achieve strategic innovation.

<table>
<thead>
<tr>
<th>Solution</th>
<th>Majority outsourcing</th>
<th>Diversified suppliers</th>
<th>Fixed pricing</th>
<th>Extensible contracts</th>
<th>Detailed contracts</th>
<th>Raw coverage</th>
<th>Unique coverage</th>
<th>Consistency</th>
<th>Solution coverage</th>
<th>Solution Consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>●</td>
<td>0.070</td>
<td>0.070</td>
<td>0.820</td>
<td>0.213</td>
<td>0.833</td>
</tr>
<tr>
<td>1b</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>0.143</td>
<td>0.143</td>
<td>0.840</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7. ITO Configurations that Lead to Innovative Achievement.

4.0 Discussions

Our five configurations are summarized in Table 8. Our findings contribute directly to 
empirical studies on ITO outcomes and configuration studies on ITO management. 
First, our findings help us understand multiple and conjunctural causalities that can 
contribute to ITO outcomes. While prior ITO research have identified numerous 
factors that contribute to ITO success in isolation (Lacity et al. 2010; Lacity et al. 
2009), it is not clear how these different factors interact and contribute to ITO success 
together. The ITO configuration approach aims to address this limitation by 
identifying different configurations or constellations of attributes instead of examining 
them in isolation. Second, we integrate across multiple theoretical perspectives and 
potentially reconcile any empirical contradictions. Prior ITO studies have called for 
integrated theoretical perspectives to have a more complete view of ITO outcomes 
(Cheon et al. 1995; Lacity et al. 2011). Our study builds on multiple theories, such as 
transaction cost theory, resource-based theory, or agency theory. The study offers a 
more complete view than studies that rely on specific theories.

Our five configurations can be described as follow. In the first configuration, reducing 
contractual hazards, organizations rely on a diversified number of suppliers to select 
the best contracts that allow them to save money. To reduce contractual hazards, these 
organizations use detailed contracts to minimize risks. Prior studies confirm this 
observation as organizations with detailed contracts often have higher ITO success
rates than other types of contracts (Lacity and Willcocks 1998). In the second configuration, matured outsourcing clients, organizations that have been doing ITO will have a larger number of ITO services to offer various IT services. Due to their experience, they do not rely much on detailed contracts but rather use fixed term contracts as a way to safeguard against agency risks. Fixed term contracts encourage ITO suppliers to perform well in order to warrant future ITO contracts (Cullen et al. 2005; Lacity and Willcocks 2001). As a result, these organizations will likely reduce ITO costs due to the high performance of ITO suppliers.

The third configuration includes organizations that follow a best-of-breed outsourcing strategy. These organizations use a large number of diversified suppliers for their IT functions, and often identify and choose suppliers that seem most appropriate for certain IT functions. As a result, they are able to enhance existing IT capabilities by selecting and using suppliers that can best provide certain IT functions. To safeguard against potential risks, these organizations rely on various tactics such as using fixed pricing to reduce costs, using fixed term contracts to encourage good ITO performance from suppliers, or using detailed contracts to minimize contractual hazards. On the other hand, organization in the fourth configuration are industry leaders that have greater experience with ITO. They outsource a majority of their IT functions and deal with a wide range of suppliers. These are often large companies with more than 10 years of ITO experience and annual revenue from $500 million up to $1 billion dollars. Due to the sheer number of ITO contracts they have, these organizations rely on fixed term contracts as a way to safeguard against agency risks and achieve good ITO services from their suppliers.

The last configuration includes organizations that are innovators using ITO services. These organizations outsource most of their IT functions using a diversified number of suppliers and utilizing detailed contracts. This strategy allows them to combine the best attributes from the best-of-breed outsourcing as well as matured outsourcing clients. As a result, these firms are able to leverage best-practices offered by ITO services to be innovative and disruptive, introduce new products, services, or enter new markets. It is not surprising that many of these innovators are companies with the shortest amount of ITO experience but are the largest in terms of size and revenue (more than 10,000 employees and $1 billion dollars in annual revenue). We posit that these companies are using best-practices in ITO services as a way to overcome their handicap in IT capabilities and break in new markets or areas.
ITO Configurations

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Organizational Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. &quot;Reducing contractual hazards&quot;: diversified suppliers and detailed contracts</td>
<td>Cost Reduction</td>
</tr>
<tr>
<td>2. Matured outsourcing clients: majority outsourcing model and fixed term contracts</td>
<td>Cost Reduction</td>
</tr>
<tr>
<td>3. Best-of-breed outsourcing: diversified suppliers (fixed pricing or fixed term contracts or detailed contracts)</td>
<td>Capability Enhancement</td>
</tr>
<tr>
<td>4. Industry leaders: majority outsourcing model, flexible-type suppliers, and fixed term contracts</td>
<td>Capability Enhancement</td>
</tr>
<tr>
<td>5. Innovators: majority outsourcing model, diversified suppliers, and detailed contracts</td>
<td>Strategic Innovation</td>
</tr>
</tbody>
</table>

Table 7. ITO Configurations and Organizational Outcomes.

In addition, we performed post hoc analysis to compare firms with different organizational outcomes in terms of their ITO experience, size, and revenue. We found that firms with high capability enhancement outcome have a lot more ITO experience (10 years) while firms with strategic innovation outcome is much larger in size and revenue (10,000+ employees and $1B+ in revenue). These findings suggest there are two possible pathways for successful ITO outcome. On one hand, there might be a maturity cycle in ITO – the longer a firm engages in outsourcing, the more capability is developed. The four configurations we identified for cost reduction and capability enhancement are also consistent with our maturity lifecycle interpretation – firms appear to first adopt ITO to reduce cost. As firms gain experience and become more mature, they begin to outsource more of their IT services to the point of using majority outsourcing model. Mature firms then move on to focus on using ITO to enhance capability. On the other hand, we posit that firms can choose to not follow a maturity cycle in ITO. Instead, firms with less ITO experience but have plentiful resources can apply “best practices” of ITO to leapfrog in their IT capabilities and use them as a strategy to disrupt existing markets or to break into new markets. These firms attempt to leverage the expertise of their ITO suppliers to allow them catch up in innovative initiatives and introduce new products, services, or ideas to strategically insert themselves into new markets.

Our findings have a number of implications for practice. For the clients on ITO, the multiple configurations we identified suggest different strategic intents for ITO. One key benefit of using fuzzy-set logics is the ability to identify multiple causal paths to the same outcome, or the idea of equifinality. Our findings suggest that ITO clients should configure their outsourcing arrangements to best fit their strategic intents and level of maturity. Similarly, for ITO suppliers, our findings suggest the need to adjust to these configurations as they pursue business with different clients.
Our study has a number of limitations. First of all, response rate to our survey is still relatively low and hence our sample size remains small, which limit the generalizability of our findings. We plan to continue to collect survey response and hope to increase our sample size in the future. Moreover, future research should explore further how firms use outsourcing as means to implement innovative initiatives. Understanding this emerging ITO objective can shed light on how firms reconfigure their overall organizations as they pursue strategic innovation.

5.0 Conclusion
In this study, we took the configurational approach to examine ITO-outcomes relationships. We adopted a set-theoretic empirical method to study conjunctural causality. Our findings suggest that there are indeed multiple patterns of using ITO to producing specific organizational outcomes, and managers should approach ITO from a configurational perspective, as opposed to managing ITO from the perspective of isolated factors. Our results contribute to a more holistic understanding of ITO, and take the first step toward greater integration of multiple theories and potential reconciliation of conflicting empirical findings.

References


PERSONALISED CONTEXT AWARE CONTENT RELEVANT DISEASE PREDICTION AND DIET RECOMMENDATION SYSTEM

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Abstract

Predicting the disease plays an important role in improving the public health. The problem of predicting possible diseases reduces some of the diseases may come in the future. The health recommendation system predicts the disease and recommends the suitable diet and exercises. Context aware recommendation systems produce more relevant recommendations with the help of contextual information. In this paper, we have proposed a context aware recommendation system to predict diseases based on the context of the user and recommend a suitable diet and exercises. The experimental results show that the performance of our proposed system is efficient in predicting the disease and recommending the diet and exercise.

Keywords: Context aware, recommendation system, Similarity Function, prediction, health, diet recommendation.

1.0 Introduction

A recommendation attempts to narrow down selections for users based on their expressed preferences, past behavior, or other required data. Different recommendation systems have been extensively studied in the literature first introduced it in (Otebolaku, A. M. et al, 2011; Vincent Wenchen Zheng et al, 2010) and several types of recommendation systems have been proposed in (Meng, Shunmei, et al. 2014, Chen Yan-Ying et al., 2013, Chen Li et al., 2013) and several context-aware recommendation systems like for restaurant, tourist based and location based studied in (Kyoung Jae Kim et al, 2010; Yu Zheng, et al, 2009; Lin Y.-F, et al, 2014).

The recommendation systems are classified based on their nature of working. Basically the recommendation systems are classified into four classes as Collaborative
filtering Approach, Content based recommender systems, Hybrid recommendation systems, and Location based recommendation systems.

Nowadays people can easily get their health status like glucose, blood pressure and other parameters. Self-management is the key factor in preventing major disease, but only few people can keep the healthy living style with an enough exercise and good diet habits. Most of are getting the major diseases younger than ever, because of their busy and high pressure modern life style.

Some of the health reports show that the major parts of the causes of the deaths are chronic diseases. Major causes of death are some kinds of chronic diseases, such as the heart diseases, hypertensions, diabetes, chronic liver diseases or kidney diseases. In the high-tension modern life, the result seems reasonable, but that it should not be acceptable, because there are many self-health management ways to make people dodge from the chronic diseases. Unlike cancers, most chronic diseases can be well controlled, even can be prevented, if people can live with a healthy lifestyle, such as the enough sleep, balanced diet and proper exercise.

The use of context-information for predicting diseases and recommendations is a good idea to improve performance of the recommendation system. In this paper we have proposed a context-aware health system to predict diseases and recommendation a diet.

The rest of the paper is organized as follows. Section 2 briefly presents the relevant concepts and definitions. In section 3, existing recommendation systems and challenges are presented. The problem description and proposed method is presented in Section 4. Section 5, illustrate the experimental results. The concluding remarks are finally made in Section 6.

2.0 Concepts and Definitions

The Similarity is one of the fundamental concept in recommendation systems and measured by how much closer two items are related. It is used for determining the degree of matching between the query and item. Similarity score is a normalized value ranges from 0 to 1. There are several functions existing for finding out the similarity value.
Definition 1: The similarity between two numeric contextual preferences is calculated as given below:

\[ \text{Similarity}(C_n, C_e) = 1 - \frac{|C_n - C_e|}{\text{Max} - \text{Min}} \]

\[ \text{Total Similarity} (C_n, C_e) = \text{Similarity} (C_n, C_e) * \text{Weight} \]

Here, \( C_n \) is the new context preference, \( C_e \) is the existing context preference, \( \text{Min} \) and \( \text{Max} \) are the maximum and minimum value of the \( i \)th contextual preference respectively.

Definition 2: Precision of disease \( X \) is given below:

\[ \text{Precision}(X) = \frac{\sum \text{Occurrences of Disease } X}{\text{Total Weight}} \]

Here, \( \text{Total Weight} \) is the normalized total weights of all the users whose normalized weight is greater than user defined threshold value.

2.1 Assigning Weights to Context Variables

When comparing two contexts, the variables which are used to compose the context are to be compared. In principle the entire context variable can be considered as equally important. All the context variables are not equally important, some of the context variables are more important than the other variables. Hence, user defined different weights are assigned to different variables. In this paper, the weights \([0 \text{ to } 1]\) are assigned to the context variables; the variables which are more relevant to the domain will get more weight i.e one and the variables which are not relevant to the domain will get less weight i.e zero.

2.2 Data Normalization

Data normalization is done in order to find the measure of exactness it determines the fraction of relevant items retrieved out of all items retrieved. We can understand very easily that if the sum of contexts total similarity is greater than the user defined threshold value then it initially computes the occurrences of each context variable and then divides it with the sum of all the context variables. To obtain the precision of each individual context variable after the normalization if more number of the diseases remains then there is a threshold value even for normalization. If the precision of each disease is more than that, then only it includes the diseases to the predicted diseases list.
3.0 Related Work

Jin, Yohan, et al. (2010) proposed a method which includes item-to-item collaborative filtering to discover meaningful interesting videos among the large scale of the videos. Meng, Shunmei, et al. (2014), proposed a method, which presents a personalized service recommendation list and recommending the most appropriate services to the users effectively. In this they used the collaborative filtering approach.

Chen Yan-Ying et al., (2013) proposed an approach, which concentrates on personalized travel recommendation and illustrates auspicious applications by utilizing the freely accessible community-contributed photos. Chen Li et al., (2013), proposed a novel clustering approach built on Latent Class Regression model (LCRM), which is basically ready to consider both the general ratings and feature-level opinion values to observe reviewers' inclination homogeneity.

Lin Y-F, et al., (2014) presented a social media-based recommender system which makes recommendations by considering a user's own health concerns, the trustworthiness of the information providers, the similarity between the user and the information provider, and the test item's general acceptance in the social media. In particular, they proposed a semantics-enhanced fuzzy-based model to facilitate recommendation. The model consists of three important factors affecting recommendation in health care social networking environments: trust, similarity and review. The Fuzzy logic is used in the model because it is tolerant of imprecisely defined data and can model non-linear functions of arbitrary complexity. Most importantly, fuzzy logic can accommodate vagueness, intuitive and experiences in modelling recommendation in a healthcare social network, because human observation forms the basis of recommendation assessments. Semantics-based profile similarity metric is adopted to measure the similarity and proposed Personalized Healthcare Recommender Based on Social Media in which item ratings are used in the Similarity function to give the suggestions to the users interactively.

Hengshu Zhu et al. (2014) illustrated how to extract personal context-aware preferences from the context-rich device logs, or context logs for short. It also, exploits the identified preferences for building personalized context aware recommendation systems. In this they presented three effective methods for mining common context-aware preferences based on two different assumptions about context data dependency. If context data are assumed to be conditionally independent, they
proposed an algorithm to mine common context aware preferences through topic models. Otherwise, the context data are assumed to be dependent, exploit the constraint-based Matrix Factorization techniques for mining common context-aware preferences and only consider those contexts that are relevant to content usage for reducing the computation complexity, but it takes large amount of time and memory which is not an efficient when there is lot of missing information.

Jerry C.C. Tseng et al. (2014), proposed a system, which analyzes the result of regular physical examination to evaluate the health risk and provide personalized healthcare services for users in terms of diet and exercise guideline recommendations. They developed some interactive ways for users to get the feedback. Also, they developed a system to get the suggestions for health management from the system.

Jong-Hun Kim et al., (2009) propose a personalization diet recommended service for the users who require the prevention and management for coronary heart disease. This service consists of a collection of modules that draws nutrients, which are to be adopted by users based on the collection of some constraints in users, a configuration module that determines the preference of foods through the input of the diet of users, and a scoring module that makes a score for the extractable diet.

4.0 Problem Description and Proposed System

Problem Statement: Similarity is for retrieving the most similar contextual situations and preferences. This is an important phase of the disease prediction process. To determine the expected preferences of the user in the current contextual situation, it requires a method or an algorithm for determining the degree of similarity between contextual situations.

4.1 Proposed System

The proposed system shown in figure 1 which consists three phases: (i) Pre-Processing System. (ii) Prediction System and (iii) Recommendation System.

Pre-processing System: The pre-processing system consists of new user registration, retrieving the context data, finding the minimum and maximum contextual preferences and finding the similarity. In the pre-processing, the registered user enters into the system through credentials. This phase collects the health data such as blood pressure, BMI, temperature, etc. in addition it also collects the symptoms and the highly influenced variable which consists the data about the history of diseases. This
Context log is maintained in the database. If the user is an existing user then it retrieves the existing contextual data. Find minimum and maximum value of each context variable. User defined weights are assigned to each of the contextual variable as described in the section 2.1. Based on the Definition 1, compute the similarity score with respect to each user context log in the database. Further, compute the total similarity score of each user log by multiplying each similarity score with weights. The disease is not depending on the weight of a single context variable; hence calculate the sum of weights of each user. If the sum of each context log is greater than the user given threshold value then it is consider for further processing, otherwise discard context log.

Prediction System: The prediction system consists of two major components one is the context normalization and the disease prediction. In the context normalization each of the disease is considered for the normalization, if it is passed the threshold test. The normalization of each context is done by dividing with sum of all other contexts contribution. Normalization threshold also has to be set to eliminate less probable diseases. In the disease prediction, calculate the precision of each disease in
the dataset, if the precision of each disease is greater than the threshold value then those diseases is considered.

Recommendation System: The recommendation system consists of two major recommendations one is the diet recommendation and the other one is the exercise recommendations. For each of the disease a database of diet’s and exercises is maintained, which is collected from the expert doctors. After the disease is predicted in the previous phase the diet is recommended based on the disease. Similarly, an exercise is recommended based on the disease.

4.2 Algorithms

Algorithm 1:
Input: New user \( C_n \), Users Database Context Variable list \((CV_i)\), Weight list \((W_i)\), User defined threshold \((t)\)
Output: Similarity Table \((ST)\)

Begin

\[ T_S \leftarrow 0 \quad /\!* T_S \text{ Total Similarity } */\]
\[ S \leftarrow 0 \quad /\!* S \text{ Similarity } */\]

for each \( CV \quad /\!* CV: \text{ Context Variable } */\)

\[ \text{max} \leftarrow \text{Find max} \ (CV) \]
\[ \text{min} \leftarrow \text{Find min} \ (CV) \]

For each \( C_{ei} \quad \text{where } i=1 \text{ to } n \)

If \( (C_n \neq C_e) \) then

\[ S = \text{Similarity} \ (C_n,C_e) \]
\[ \text{ST} \leftarrow \text{update(ST,S)} \]

End if

End for

return ST

End

Algorithm 2:
Input: Similarity Table \((ST)\), Weight list \((W_i)\), User defined threshold \((t_2)\)
Output: Diseases \((D)\)

1: Begin

2: Read ST
For each CVᵢ in ST
For each user Uⱼ
    ST ← ST(Uⱼ(CVᵢ) * wᵢ) /* Normalization */
End for
End for
For each user Uⱼ
    For each CV
        Z = Z + Uⱼ(CVᵢ)
    End for
    If (Z > t₂) then
        sum ← sum + Z
    End for
    prec(dᵢ) = dᵢ / sum
    if (prec(dᵢ) > t₁) then
        D = D ∪ dᵢ
    return D
End

Algorithm 3:
Input: Diseases (D), Diet and Exercise Database (de_db),
Output: Diet Recommendation (DR), Exercise Recommendation (ER)

Begin
    Read user Uᵢ
    If (dᵢ = d¹) then /* dᵢ is predicted and d¹ in the database */
        diet ← diet U d¹, diet
        exer ← diet U d¹, exer
    End if
    Rec_list ← Rec_list U {diet, exer}
End

5.0 Experimental Results
In this section we measure the accuracy of our proposed method. To evaluate the performance our proposed method we have conducted several experiments. All the experiments conducted in Intel 64bit PC with preinstalled Ubuntu, XAMPP, MySQL, and Python 3.6.2.

5.1 Input Dataset
To evaluate our proposed method, initially we used a synthetic dataset with 1000 users and 20 different diseases. The results are showed in Fig. 2, Fig. 3 and Fig.4. It is a medical dataset, containing details of the patients.

5.2 Results Analysis

We test our proposed algorithm to predict the disease. Figure 2, depicts the accuracy of the proposed method. The proposed method is better in predicting the diseases. Our method shows that the precision of the disease thyroid is approximately 0.78, because the dataset having the enough context log data about the thyroid. Whereas the prediction accuracy of leg pain is 0.54 is very less, because the dataset consists of less context about the leg pain and the user given weightage is plays vital role in the perdition accuracy of the disease.

![Disease Prediction Accuracy](image)

Figure 2: Disease Prediction Accuracy

In this, paper we have proposed our own similarity function. We tested our approach with the proposed similarity function and the Pearson correlation coefficient function. The results are shown in figure 3. When the dataset size is less both the functions
gives the approximate similarity score, when the dataset size is more our proposed similarity function is giving a better similarity score, whereas the Pearson correlation coefficient is giving very less score.

Figure 3: Proposed similarity function vs. Pearson correlation coefficient

Figure 4, shows the comparison results of different recommendation systems. In this we have used several diseases on X-axis and its respective accuracy on Y-axis. Here, we compared our proposed system with the existing Case-based recommendation system and the content-based recommendation system. Our recommendation system gives 76% more accurate results than the other two recommendation systems.
6.0 Conclusion and Future Work

In this paper, we have proposed a similarity function, which is used to find the similarities between the existing user’s context logs with the new user context log. We also, designed a Personalized Context Aware Content Relevant Disease prediction and Diet Recommendation System based the proposed similarity function. The proposed recommendation system based on the new similarity function is gives better results than the existing recommendation systems. The normalization process used in the proposed recommendation system helps to get the most likely diseases. The recommendation system gives better results when the disease context data is available in the context log of the existing users in the database. The diseases predicted in the from the existing log helps to recommend the diet and the exercises.

Our future research work include the design of better similarity functions, which are used to suitable for disease prediction and design of a real time prediction system which helps to predict the disease in real time.
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Abstract
The research history relating to Cloud ERP literature is investigated for the period of 2010 to 2015, with the aim of introducing an overview of academic research on the subject and to identify gaps in the literature in the stated period. Up to date literature in 37 research papers from various topics and sources has been discussed. Shortlisted publications are analysed and categorized into architecture, implementation, customization, mobility, benefits and disadvantages, and others. It appears that high attention has been paid by researchers to the benefits and disadvantages of Cloud ERP adoption as well as to its architecture and overarching plans for implementation. However, important issues such as integration of Cloud ERP with existing on-site legacy ERP systems and the quality of service given by respective cloud-based providers has been devoted limited attention by the authors reviewed.

Keywords: ERP, Cloud Computing, Cloud ERP, Information System.

1.0. Introduction
Cloud computing has changed software delivery models and provides a variety of new options for different enterprises of varying size Arnesen, S, (2013), GUO CHAO ALEX, P, & GALA, C, (2014), Mahara, TN, (2013). The adoption of cloud computing platforms and services by any business will have both benefits and disadvantages, meaning that careful planning and research into an appropriate Cloud enterprise resource planning (Cloud ERP) strategy will be required, and careful decisions made Arnesen, S, (2013), GUO CHAO ALEX, P, & GALA, C, (2014), Mahara, TN, (2013). According to Gartner forecasts, the service business software applications market’s revenue will have grown from over $10 billion in 2011 to over $30 billion by 2016 Centaur Partners, (2015). Cloud ERP adoption is on the increase and is being adopted by many key decision makers in business. According to a 2012 Gartner report, 70% of Chief Financial Officers (CFOs) are in favour of utilizing Cloud ERP within core business functions, citing the main reasons in favour of this
approach as being related to cost reductions and mobility MIRANDA, S, (2013). The CFOs surveyed by Gartner reported that cloud computing platforms and services were useful business analytics tools. And social collaboration, facilitated through online cloud-based communication and knowledge sharing, were also important factors in their vision MIRANDA, S, (2013).

2.0. Background Research
This section discusses the various aspects of the research in detail. It enables us to grasp a good idea about the different studies that have already been conducted relating to clouding computing and ERP.

2.1. Enterprise Resource Planning
The term ‘enterprise resource planning’ describes any business process management software that enables an organization to use a system of interconnected applications to manage their business. Such software packages often automate a number of back office functions related to services, technology, and H.R. Arnesen, S, (2013), GUO CHAO ALEX, P, & GALA, C, (2014), Mahara, TN, (2013) Sahin, N.Y., (2013). Cloud ERP then relates such business process management software that is hosted online, in the cloud.
There are three well-known cloud computing models, which mainly differ in terms of physical location of the required hardware Arnesen, S, (2013). The following bullet points set out definitions for each of these models as well as briefly explaining their benefits.

2.1.1. Public Cloud ERP
Public Cloud ERP applications are hosted at the cloud provider's data center with the software itself adopting a service architecture approach. Cloud ERP is offered as application packages paid for on a subscription basis. This model is mobile and flexible, faster to implement and represents an affordable enterprise solution, particularly for smaller-scale enterprises Arnesen, S, (2013), GUO CHAO ALEX, P, & GALA, C, (2014), Mahara, TN, (2013) Sahin, PwC, (2014) N.Y., (2013).

2.1.2. Private Cloud ERP
Private Cloud ERP applications are hosted at the enterprises own data center. Private cloud services are usually adopted by larger companies with, for example, a number of offices that share the same requirements Arnesen, S, (2013).
2.1.3. Hybrid Cloud ERP

Hybrid Cloud ERP is the result of integrating legacy ERP with more Cloud ERP Sahin, PwC, (2014), N.Y., (2013). Legacy ERP is installed at the premises of the enterprise comprising the physical hardware and a computer platform, which tends to be managed in-house by members of the organization’s team Sahin, PwC, (2014). This hybrid approach to software architecture tends to result out of a need to update legacy ERP that no longer satisfies the needs of the company by updating through the integration of cloud-based applications that better satisfy the enterprise’s requirements Sahin, PwC, (2014), N.Y., (2013).

2.2. Hosted Application Server Active Software Packages (ASP)

ASP is a host, that provides sources hardware, platform and support staff Arnesen, S, (2013). ASP is a Single-Instance, Single-Tenant legacy software application which means that supports individual customers. The customer has access to dedicated servers, the flexibility of access the application tends to be regularly upgraded Arnesen, S, (2013).

On the other hand, cloud computing makes use of Multi-Tenancy architecture in which a single instance of a software application which serves multiple customers. Many cloud customers share the same resources. A disadvantage of this might be that the customers have more limited control than they would in relation to a Single-Tenant application. Cloud-based application tends also to be subject to regular upgrades Arnesen, S, (2013). Cloud computing increases the availability and accessibility of an enterprises data and computer-based systems meaning that they can be accessed at any time from anywhere Sahin, PwC, (2014), N.Y., (2013).

2.3. Cloud computing and ERP

Along with businesses’ fast-growing requirements including web access and mobile sales, sourcing, recruitment and contract management, data mobility has become vital for organizations. The ability to utilize the organization’s applications and data from different locations and by using different devices is a technology trend that cannot be avoided in the modern Internet era GUO CHAO ALEX, P, & GALA, C, (2014), Mahara, TN, (2013) Sahin, PwC, (2014). Furthermore, in a global market, the need for flexibility and accessibility by customers, employees, and suppliers cannot be effectively addressed by traditional legacy, on-site, ERP systems Mahara, TN, (2013) Sahin, PwC, (2014).
Apart from facilitating connectivity, Cloud ERP is recognized to have multiple cost benefits factors including savings in hardware purchase, platform set-up and maintenance and support Arnesen, S, (2013), GUO CHAO ALEX, P, & GALA, C, (2014), Mahara, TN, (2013). In addition, Cloud ERP has proven scalability and performance advantage Arnesen, S, (2013), GUO CHAO ALEX, P, & GALA, C, (2014). Moreover, system upgrades are managed and supported by cloud system providers, thus reducing risk and cost associated with handling the same in-house. ERP implementation and time costs and requirements are vastly reduced in the integration of cloud-based packages, which is particularly advantageous and attractive to small to medium-sized businesses from a budgetary point of view Arnesen, S, (2013), Mahara, TN, (2013) Sahin, N.Y., (2013). Cloud computing and associated Cloud ERP systems new technology, and therefore do not require upgrading Arnesen, S, (2013).

In contrast to the advantages cited above, protecting data privacy represents a real concern for businesses considering utilizing a Cloud ERP, as well as a considerable challenge cloud-hosting providers. The physical location of data and its ownership, SLA and the data laws and regulations in the country where data is hosted are important factors which become significant with ERP data and functions Gartner, (2014), GUO CHAO ALEX, P, & GALA, C, (2014), Mahara, TN, (2013), N.Y., (2013). For example, the European Union have strict data protection laws and regulations which prevent cloud-hosting providers from moving data out of the country it is based in N.Y., (2013).

It is likely that securing data through strong authentication and authorization will be an important factor in protecting and securing Cloud ERP data Arnesen, S, (2013), GUO CHAO ALEX, P, & GALA, C, (2014), Mahara, TN, (2013) Sahin, N.Y., (2013). However, cloud-hosting providers invest highly insecurity in order to attract business advantage leading to a high standard of security in the services they provide Arnesen, S, (2013). Integration is more complex where on-premises legacy systems and cloud-based systems are integrated into hybrid Cloud ERP solutions Gartner, (2014), GUO CHAO ALEX, P, & GALA, C, (2014). Hence, complex integrations and high volume data exchanges may put more Cloud ERP implementation at greater risk of security breaches and data loss or leaks. Governance over Cloud ERP services and cloud-hosted data varies widely between different providers, and the level of control in this regard should form a serious consideration when an organization
chooses a Cloud ERP a particular cloud-hosting provider (2013) N.Y., (2013). Providers of new cloud-based technologies are still in the process of building solutions, whether from the ground-up or by modifying existing ERP systems. Therefore, their many functions that have not yet been made available or are only being used by small enterprises Arnesen, S, (2013). Also, annual subscription costs of Cloud ERP is higher than that of traditional on-site legacy ERP maintenance Arnesen, S, (2013).

While many small and medium-sized enterprises seem to be migrating core ERP functions to the cloud, a recent Gartner report found that larger enterprises were, as yet, not planning to move to fully commit to cloud-based technologies. Further, service providers are willing to move to cloud ERP due to the nature of their business, while banking and insurance are not Gartner, (2014). It seems that the most suitable ERP approach depends on the specific requirements and business needs of an organization, and its sector Arnesen, S, (2013).

The issues discussed above have been researched and analysed by many authors, and there is a great deal of literature available on the topic. For the purposes of this paper, the literature relating to Cloud ERP has been reviewed as far as time limits allow.

3.0. Data Collection

![Publications by year](image)

*Figure 1. Publication by year*

The data collection was limited to publications from 2010 with 37 research papers collected and analysed. Figure 1 illustrates the incremental progress in the number of publications from 2010, with drop substantially in 2015. However, this reduction in
the number of articles collected in 2015 can be explained by the fact that the data collection was limited to the first quarter of that year.

Figure 2. Publications by Digital library

Figure 2 shows the digital library where the publications downloaded. Journal articles were the main type of data collected as most of the publications relating to Cloud ERP were published in journals.

ERP systems of various disciplines, including business and information systems, were researched. The data collection was conducted to cover all aspects of Cloud ERP, which worked to narrow the research by shortening the number of results listed.

4.0. Classification Framework

After data collection, intensive note-taking was undertaken during the reading of all the cited publication. There were 6 main topics as introduced in Figure 3.
As shown in Figure 3, the collected publications on the subject of Cloud ERP fell into one of the following categories: cloud architecture, cloud ERP implementation, benefits and challenges, customization, mobility, and others. Importantly, the benefits and challenges were given the highest priority of the issues researched, followed by implementation and then architecture. The subjects of mobility and customization were not afforded a high priority in the research.

Figure 4 demonstrates the publication topics in detail. Important topics such as Cloud ERP blueprinting, quality of services and risk analysis were afforded average priority in the available research. The majority of researches discussed the general idea of adopting cloud computing for ERP together with providing reviews of the relative benefits and disadvantages of the same. Surprisingly, integration has largely not been addressed in the research papers collected.
5.0. Findings

Three issues relating to Cloud ERP architecture has been researched considerably: (1) ERP architecture's historical development; (2) the manner in which ERP extends functionally to both customers and suppliers; (3) considerations relating to cloud-based computing, service-oriented architecture and business intelligence Vasilev, J. (2013), Jian Zhang; Ran Wang, (2013); and finally (4) cloud blueprinting, Cloud ERP models and Cloud ERP’s potentiality Papazoglou, M. P., & Heuvel, W. v. d. (2011), Suciu, G. et al. (2011). Further, proposals relating to an intensive cloud integration web model designed specifically for business information systems including ERP is widely discussed Okezie, C. C., Chidiebele, U. C., & Kennedy, O. C, (2012).

The use of the hybrid cloud model is discussed in relation to situations where ERP's dealing with sensitive information are distributed across a private cloud, such as in the finance sector, or a public cloud, such as in the marketing and sales sector Johansson, Björn, et al. (2014).

Less importantly, distributing cloud resources in public PC's and offices as an alternative to storage in large data centres has been researched as an approach which may benefit ERP and resolve some obstacles to evaluating cloud-hosting service providers Suciu, G.; Cernat, C.; Todoran, G., (2012). For example, building large data centres is expensive. Availability of service is essential for Cloud ERPs, where vendors have different choices of infrastructure including storage, network and virtual
machines. A high availability Cloud ERP architecture is proposed Bao Rong et al., (2014).

Cloud computing as a new technology presents some concerns for business decision makers – they have to weigh up the relative benefits and disadvantages of adopting cloud computing technologies. These concerns have been highly addressed in the literature reviewed Awad, H. A. H, (2014), Alali, F. A., & Yeh, C, (2012), Weng, F., & Hung, M, (2014), Elragal, A., & El Kommos, M, (2012), Clohessy, T., Acton, T., & Coughlan, C, (2013), Mezghani, Karim, (2015), Gill, Ron, (2015), Appandairajan, P.; Khan, N.Z.A.; Madijagan, M., (2012). In addition, a great many risk analyses on ERP systems, such as those used in finance and accounting and auditing which deal with sensitive data, have been undertaken Alali, F. A., & Yeh, C, (2012). Risks including information security threats such as session hijacking, virtual machine escaping and insecure cryptography have been identified and researched Sahin, N.Y., (2013), Dixit, Ashish K, (2012).

Product and provider selection criteria and the quality of service, including support, provided by the cloud-hosting and Cloud ERP providers are significantly important considerations for business decision makers which seem to have been downplayed and given a low priority in the literature Mahara, TN, (2013), James, Jong Park and Hwa-Young Jeong, (2013) Schrödl, H.; Simkin, P., (2014).

Cloud ERP approach has a number of important benefits including the fast speed at which they can be implemented; however, customization of the ERP system is restricted. ERP providers can offer Single Tenant software applications where only one customer using the software instance or Multiple Tenancy applications where many customers share one software instance. The benefits and impact these respective tenancies have on the ability to customize, the level of customization and limitations have been researched Chin-Sheng Chena, Wen-Yau Liangb, Hui-Yu Hsub, (2015), Mijac, M., Picek, R., & Stapic, Z, (2013).

Cloud maturity and mobile computing and their benefits for ERP have been researched. Cloud ERP and supply chain management tend to have been discussed by authors and researchers with a history of SCM devices and its development with mobile devices Elena Geanina ULARU et al., (2013), Clemens, B., Cata, T., & Hackbarth, G. (2012).

Implementation of Cloud ERP is different in nature in comparison with on-site legacy ERP implementation, and this subject has been well-covered in the research Arnesen,

6.0. **Recommendations**

There are many subjects require organizations highest attention in addition to the topics covered in this paper, which are trending, essential, represent common mistake or affecting the competitiveness. It is highly recommended to review the following points before moving to Cloud ERP.

Comparing Cloud ERP that are designed for cloud to web-based ERP that have been shifted to cloud is a common mistake, as the cloud designed solutions gives the highest value of cloud technology. Selecting full stack Cloud ERP architecture which include delivering the cloud provider servers’ to the customer site, and hybrid cloud connectivity and orchestration would empower organizations growth and development.

Connected everything is trending in the era of Internet of Things, where connectivity scale from systems within organization to connect with other organizations, systems, people and devices’. Connectivity affect the digital transformation options and possibilities.

Intelligent ERP is emerging and becoming highly essential to organizations’ future, and to enable smart organization. Applying cognitive properties such as artificial intelligence, machine learning, advance analytics and deep learning would extract value from data and change the decision making approach. Further, ERP personalization, customer experience and localization shall be evaluated carefully while selecting cloud ERP provider.

Recently, leaders ERP technology and Cloud providers have team up to improve their cooperation, co-engineering, integration, which changes the ERP and cloud markets,
open new possibilities and go beyond traditional approaches. Acquisitions and merges also represent either risks or opportunities to ERP and cloud technologies and require organizations to consider them while selecting cloud ERP.

Cloud vendor evaluation is significant to the selection criteria, this factor does not focus on technology but on the cloud providing vendor. The provider financial stability, strategic plan, agility towards rapidly changing technology, functionality and regulations shall be studied carefully. The geographical distribution of the cloud providers is well-planned and selecting provider with best presences are highly considered success factor on performance, disaster recovery, local regulations, time zone and currency.

7.0. **Findings and Conclusion**

Latency reduction, availability and the quality of cloud services are important research areas that have not been adequately addressed by the present research. Fog Computing, which is another new technology related to cloud computing, is another area in which further focused research is highly recommended in order to contribute to the fulfilment of requirements for efficient information systems, ERP in particular, design and development.

Further, important legal issues relating to the provision of cloud-based technologies including service level agreement, security and privacy should be explored. Technical aspects such as sustainability and vendor technology roadmaps form vital research issues which were not adequately addressed. Finally, vendor agility in term of contracts, integration, customization, and cost should be researched to provide further ideas and foundations for the advancement of the new technology.

8.0. **Future Work**

With the passage of time cloud computing has become a very hot topic for researchers, and it has applications in several domains. Studies depict that researchers have already started deploying cloud computing in ERP implementations of higher education. As a future endeavour I would like to explore the drawbacks or shortcomings of ERP implementation in the stated domain. I would also like to present the guidelines on how to use cloud computing in ERP implementation particularly for educational institutes that provide higher education. Further, I will study some empirical studies to evaluate the early adopter’s experiences.
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Encountering camera surveillance and accountability at work – case study of the Swedish police

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Abstract

Today’s mobile cameras mean that anyone may easily be filmed and exposed to a wider audience meanwhile conducting their daily work. Police officers belong to an occupation that most frequently have to encounter this development. As state representatives, entitled to make use of violence at work, they end up being held accountable by a variety of actors capturing police initiatives on film. Police authorities around the world therefore have started to use body-worn cameras, aiming to enhance trust and transparency, but also as a means to control their work environment. On the one hand, cameras are described as a tool ensuring legal security and public trust in the police, on the other hand cameras are also associated with concern for surveillance and integrity. We intend to investigate what consequences this technology have on individual officers organising their own practices, and on the management of patrols wearing these cameras. The study is guided by the following questions: 1) What opportunities and challenges do individual officers associate with the introduction of cameras in their practice? 2) In what way is the use of cameras managed by the organisation, what tensions do they have to address between the individual officer’s practice, the management and the public? 3) What opportunities and challenges do the police associate with citizens using cameras to document the police? Theoretically the analysis draws on research on accountability, technological affordances and surveillance. Empirical material is planned to be collected through interviews, focus groups and document studies.

Keywords: body-worn camera, mobile camera, affordance, accountability, surveillance, police, social media
1. Introduction
Today’s widespread use of camera-equipped smartphones has enabled the public to take photos or videos of current events and, through e.g., social media, immediately make these available to a very large audience. This is the result of the ubiquitous or pervasive spread of a new digital infrastructure, allowing everyone to document everything and easily share it (Sörensen, 2010). This development has forced employees in many parts of the public sector to reflect upon questions regarding visibility and accountability. New digital technology offers opportunities to enhance transparency and public trust, but its introduction may also have negative impacts on individuals’ sense of integrity. In this study, we set out to investigate police officers as one of the occupational groups that are exposed to this development.

In addition, the police themselves have in a number of countries started to carry cameras placed on their uniforms to be able to film their practice, so called body-worn cameras. The motivation for adopting this technology is more or less the same across all countries: (i) the need to make police more accountable to society; (ii) the need for individual police officers to protect themselves against false accusations, and; (iii) the expected pacifying effect on the interactions between police and citizens (Coudert et al., 2015). Police officers carrying out their ordinary duties thus risk being filmed both by the general public and their own organisation.

We draw on the police in Sweden as a case allowing us to generate more knowledge about how the police as a profession is affected by these new circumstances. In the case of body-worn cameras, the explicit idea has been to use technology to improve transparency in a way that strengthen public trust in the police authority. To make sure that citizens understand the circumstances, the cameras used are placed visible on the police officers’ uniform, with the screen turned towards anyone being filmed. It is often left to the individual officer’s discretion to turn the camera on or off, despite potential negative consequences (see e.g., Maskaly et al., 2017).

Even if this initiative is described as a way to strengthen legal practices and public trust in police professionalism, there are concerns expressed about extended surveillance and the risk of violating citizens integrity and rights (Lee et al., 2016). Most studies so far have focused on aspects of integrity, whereas we know little about how the individual officers’ work is shaped by new demands on considering how to apply their use of cameras. It is this latter topic that is in focus in this study. As implied above, the aim to implement the cameras is to improve transparency and trust. However, before drawing any conclusions it is crucial to investigate what consequences these cameras have on the individual police officers’ practice and the organisation of work hosting these practices. We also need more knowledge about how police management approaches the use of these cameras while governing the officers and their work. In addition, to fully understand the police organisations’ perspective, this
study will also take in consideration how the public make use of digital cameras to film the police. That is, we will acknowledge the police use of body-worn cameras as a measure within a broader digital context in which they have to consider the fact that citizens also engage in surveying them (with their smartphones etc) as representatives of an authority (Lippert & Newell, 2016; Sandhu, 2016); so-called sousveillance.

The police use of body-worn cameras are thus understood as a response to the ubiquitous potential allowing everyone to watch everyone. We focus on how this ever present potential, and the spread of digital technologies like smartphones provide both opportunities and constraints in officers’ work practices and how the police due to these potentials try to manage and organise their practices in a legitimate manner. Legitimacy and accountability in relation to both their own organisation and the citizens are then seen as components that are always relevant to public authorities. However, due to extensive demands on how to represent both their specific authority and societal democratic principles (with violence if necessary) such legitimacy concerns emerge as particularly evident in the case of the police (Jackson et al., 2013).

It is because of such demands on legitimacy that police officers in many countries are encouraged to use body-worn cameras to document incidents and actions both among citizens and officers. There are extensive expectations that the use of these cameras will improve accountability as well as strengthen trust in the police (Lee et al., 2016). Body-worn cameras has emerged as a tool that may contribute in “civilising” the police as well as consolidating their legitimacy. However, concerns are also expressed about what effects the technology may have on the ability to monitor and whether there is a risk that they may violate citizens’ integrity (Lippert & Newell, 2016; Mateescu et al., 2016). The fact that these are concerns that to a high extent still awaits investigation, have not prevented authorities in many countries from introducing the technology (Mateescu et al., 2016). Amongst other things, it is both seen as a preventative measure as well as a way to reveal when officers violate their own public assignment, e.g. by using unjustified violence. By filming their own actions, the idea thus is that they improve their accountability, but officers are also said to learn how to adapt their behaviour to any situation where there is a risk of being filmed. They tend to apply ‘camera friendly work’ (Sandhu, 2016), which take the shape of strategies aiming at controlling how they are perceived by different people and officers filming them or looking at the films.

These are all different expectations, implying that the consequences that these cameras have on officers’ work practices should be understood both on an individual and on an organisational level. In accordance, this study draws on empirical material that will reflect both how the police authority as an organisation and the individual officers tackle different challenges in police work related to the use of body-worn cameras. It is about different challenges to how they maintain public services recognised as accountable and appropriate. In other words, we investigate how legally appropriate and responsible practices for the use of body-worn cameras emerge within the police. In what way do the organisation and/or the individual officer in practice tackle different expectations on legitimacy in action and in
relation to more general demands on a robust and legal system for managing big volumes of data.

*Purpose and research questions*

Thus, body-worn cameras have become more common in western countries, raising expectations on improved transparency and legitimacy. Nevertheless, a range of questions concerning policy, organisation of work, management of data and integrity remain to be investigated (Mateescu et al., 2016). Drawing on the initiative by the Swedish police to introduce body-worn cameras, this study investigates the consequences these cameras will have both for the individual officers’ daily work practices as well as for the police organisation and how it tries to govern these work practices. By doing so we start filling the gap of empirical studies investigating how body-worn technology shapes police work and public trust in the police. The analysis will be guided by the following research questions: 1) How do individual officers tackle different risks and opportunities related to body-worn cameras in their work practice? 2) In what way are the use of body-worn cameras introduced in the police organisation, and to what extent does it foster tensions between work practice, police management and the public? 3) What are the opportunities, challenges and dilemmas that are fostered by the increased use of cameras by the public, documenting and distributing films showing different police actions?

2. **Theoretical perspectives**

Organisational accountability, technological affordance, and surveillance are concepts that are central to the analysis to be conducted in this study. To begin with, investigated technology is conceptualised as a socially defined materiality (Orlikowski & Scott, 2008), holding certain features that promotes potential affordances (affordance, see Gibson, 1979). As a concept ”affordance” has been developed to understand how a certain technology or digital infrastructure – in this case body-worn cameras-interact with human actions. The aim is to explore how this interaction make technology actionable (Faraj & Azad, 2012; Majchrzak et al., 2013; Norman, 2011). In this study that would mean that we direct our interest towards how cameras enable and constrains a set of actions (Gibson, 1979; Norman, 2011), related to different forms of surveillance that in the context of any public authority foster various demands on accountability.

Thus, technological affordance may foster different types of accountability. The meaning of accountability may take different shapes depending on the interaction between human actions and the cameras. Thus, when police officers apply the camera and its ability to document and broadcast shortcuts from real situations, they will organise their actions in relation to a set of other actors and their demands on surveillance and accountability. For instance, it may mean that filmed data is turned into evidence in courts, or raises demands that individual officers adhere to formal accountability. Likewise, the public’s use of smartphones may generate films that are spread via social media or to journalists (Bekkers & Moody, 2014), films that may also be used in courts.
In the analysis of the type of accountability that is associated with body-worn cameras, this study draws on the fact that the police is forced to consider that this is a technology that can be used everywhere and in very different ways (Sörensen, 2010). Demands for accountable digital work are not only evident in situations when the police officer sits down at his or her office to conduct computer based administration. Instead, they have to reflect upon how to apply a more ubiquitous technology in a correct manner (Castells, 1998). To be in accordance with public directives, they have to acknowledge that this is a technology that Adam Greenfield (2006) has described as “everywares”, demanding awareness of the fact that they bring it with them into continuously new contexts. Hence, they have to reflect upon the fact that these cameras will be applied under different circumstances, where a variety of affordances and consequences are possible. By investigating how police officers relate to such circumstances, this study contributes with knowledge about how affordances associated with a mobile and pervasive digital technology for surveillance, shapes the form of digital accountability that will emerge as an organising principle within the police authority.

By analysing different forms of accountability we draw on an extensive international field of research. It is a field of research providing us with perspectives and ideas about how a variety of demands on accountable actions condition how organisations and practices of work emerge within the public sector (Mulgan, 2000; Millen & Stephens, 2012). Two different types of accountability is of specific interest to our analysis. To begin with we will therefore engage in identifying and scrutinising how police officers adjust themselves to demands on actions that meet certain norms and regulations (laws); i.e. normative accountability. Furthermore, we will bring attention to how to approach demands on accountability justified by goals and references to powerful or efficient applications of the technology; i.e. instrumental accountability (Roberts, 1991). In cases when the police watch or are being watched by citizens, they often have to consider how to manage complex combinations of these two different forms of accountability.

The study aims at examining how these two forms of accountability emerge as meaningful to police officers that constantly have to approach complex networks of digital relations with different implications for how they should approach public demands on accountable police work. By being an investigation into how digital technology enables different forms of surveillance, embedded and sometimes taken for granted in daily settings (Lyon, 2015), the study will then also bring attention to the field of studies that sometimes is referred to as research about panopticon (Foucault, 2003). More precise, the study recognises how surveillance, being distributed and organised, also can be explained by understanding the police as modern center for societal power (Lyon, 2006). Within this theoretical context, instrumental and normative demands on accountability will be investigated as conditions shaping the way police organise their work practices while applying these new digital opportunities to strengthen their capacity to watch; for instance, by considering how to organise their use of cameras without violating citizens integrity (Lyon, 2015).

Our application of panopticon as a concept by which we may analyse potential top- down surveillance, can be useful to provide opportunities to identify and understand meaning of
different surveillances systems pervasively embedded in our daily lives (Bauman & Lyon, 2013; Eneman, 2009: 2010). The fact that some researchers point out that this ubiquitous development counteract established power centers’ ability to control society, have meant that the study also draws on the concept of ‘synopticon’, referring to the distributed digital capacity in society to watch established authorities (Mathieson, 1997; Bauman & Lyon, 2013). By also scrutinising how citizens use digital technology to film and document how individual officers act, we will be aware of such situations. We will thus apply the concept of synopticon as a way to study how digital demands on police practices and accountability also may be associated with bottom-up surveillance.

3. Related research

Our focus to examine different types of affordance associated with different forms of demands of responsibility in exercise of public authority, could be seen as unique compared to the majority of research with a focus upon the technology within the growing areas of “ubiquitous computing” and “everywearables” (Sörensen, 2010). Our study will contribute with knowledge regarding how the interaction between digitalisation and other more organisational processes affect the ways to organise work within an authority as the police. With the use of body-worn cameras, the police now have access to new forms of powerful surveillance. Even though surveillance is not a new phenomenon in society, digitalisation has changed the surveillance capabilities radically. One of the most significant changes is that digital technology enables surveillance system to become more powerful, further automated and can be used for large-scale collection and storage of data. Additionally, surveillance systems are today often concealed and embedded in the environment (ubiquitous) and are thus invisible (Lyon, 2015). A consequence of this is that individuals are not always aware of when being exposed to surveillance, which could be seen as a serious threat to individuals’ privacy (Bauman & Lyon, 2013). Murray (2016) argues that digital technology enables even more powerful surveillance and control of citizens than what George Orwell predicted in his dystopian classic “1984”. Despite that the concept of panopticon (Foucault, 1991) has been subject for certain critique for its limitations to adequately understand contemporary surveillance systems where many watches many, it is still central and valuable in the discourse regarding surveillance, since panopticon is such a multifaceted concept that could be used for interpretation in a number of ways and in different contexts (Lyon, 2006).

The use of body-worn cameras enables the individual police officer to monitor the surrounding of both citizens and colleagues (and at the same time being monitored by other colleagues), which could be understood by the concept of governmentality (Rieken, 2013) to capture aspects connected to that everyone can collect information and monitor and control their surrounding/environment. In addition, the individual police officers’ use of body-worn camera could be understood as a form of self-regulation since their own behaviour is monitored. By wearing a camera, regardless if it is on or off, the potential risk or possibility of control is visible and constitutes in itself a form of disciplinary power (Foucault, 2003). Another effect of the camera use is that large volume of information about individuals’ behaviour is collected, which means that material consisting of personal information must be managed and stored within the organisation. Joh (2016) argues that the use of body-worn
cameras within the police must be regulated and that the regulation should focus both on the actual use of the cameras and the control of the data, for example during what circumstances data is allowed to be collected, how it should be analysed, stored and who should have access to the data.

A further dimension connected to surveillance is the public’s use of mobile surveillance technology, such as smartphones with built-in cameras, to document police officers in the field, which means that technology also enables for citizens to monitor and control the police’s government work and can be understood through the concept of counterveillance (Monahan, 2006) and sousveillance (Mann et al., 2003; Mann & Ferenbook, 2013). Sousveillance, surveillance of the observer, relates partly to the network society and the possibilities to rapidly access many users and partly to the expansion of mobile technology (Mann et al., 2003). Sousveillance is closely connected to the development of mobile technology, and the convergence between phones and cameras. Finally, It should be emphasised that powerful surveillance systems cause/provoke active resistance where different strategies are developed by individuals to avoid or disrupt the surveillance mechanisms (Eneman, 2009; Ball, 2006), which indicates that it is a mistake to believe that surveillance result in total disciplinary power (Lyon, 2015). The project will also contribute to the established research field regarding Surveillance, where our specific contribution problematises surveillance (as both risk and possibility) in relation to work practices within the context of public authorities.

4. Planned research design
The project will be designed as a case study (Walsham, 1995) of the Swedish Police, and examine relevant work practices in relation to the ambition to monitor and claim responsibility using new technology. The police is a public authority with a broad societal mission aimed at reducing crime and increasing security in society through preventive, interventive, and investigative activities (Manning, 2008). This implies that the police constitute a concrete case of government work that must relate to a variety of requirements for a responsible and lawful work. As a case, this will provide access to a rich material of different aspects of technological affordances and accountability. By building the study on a qualitative analysis of different types of empirical material collected through approximately 40 interviews, three focus groups, and document studies, we generate new knowledge regarding the introduction and use of body-worn cameras. The combination of these three data collection techniques is motivated by our ambition to provide a rich and diversified material that reveals different aspects of our studied phenomenon. It will also strengthen the ability to test and when applicable verify the credibility of different interpretations.

Semi-structured interviews
The project will carry out individual interviews with approximately 40 police officers in order to document how different parts of the police organisation understand, describe, and relate to responsible handling and organising of body-worn cameras. We choose to conduct interviews as it is a useful technique for gaining good insight into the perceptions,
experiences, values, feelings and understanding of individuals, and an understanding how they construct, make sense of and give meaning to their worldviews. The selection of interviewees will reflect different positions and responsibilities, and cover different levels within the police force, operational as well as strategical. We will strive for a number of interviewees evenly distributed between the different activities included in the study, as well as taking into account ethnicity and gender issues.

**Focus groups**

Through the individual interviews, 6-8 respondents will be recruited to three focus groups (Silverman, 2014). This type of data collection fills an explorative function and serves as a basis for the project's continued empirical collection. The focus groups will focus on the overall theme, i.e., how the individual police officers relate to responsible management and organising of body-worn cameras in service and how they relate to the public being able to use, for example, mobile phone cameras to document their actions. Focus groups are useful for gaining insight into the norms, tensions, and dynamics that exist within a group in relation to the studied phenomenon. Lee (1993) emphasises that the focus group technique is valuable for initiating discussion about sensitive subjects that can usually be difficult to approach such as, for example, mistrust or conflicts. An additional advantage that is usually emphasised with focus groups compared to e.g. individual interviews is that they reduce the interviewer's controlling role in the conversation, thus helping to initiate conversations between respondents where they can formulate different questions and statements to each other and clarify different dynamics in perceptions and values (Silverman, 2014). A broader and more explorative examination is made possible by the fact that several respondents together form and talk about different themes.

**Document studies**

In order to understand the relevant practices from several different views and further capture the broader organisational context, we will also collect and analyse both formal and informal documentation that are relevant to the project. This can include everything from strategic policy and control documents to more operational meeting documentation, education literature and preliminary research material. Document studies will begin early and take place in parallel with the individual interviews. Through the document studies, we will have the opportunity to investigate the formalities surrounding the practices that characterise the police’s handling of body-worn cameras, and how these practices have been developed and are being developed in a wider historical, societal, economical, and political context. We think it is important to study the documents in their broader organisational context, as organisational systems should be understood on the basis that they do not occur naturally in society but always have a historical and political origin and benefit certain interests at the expense of others.

**Analysis of the empirical material**

We see the analysis as an integral part of the research process and not as an isolated part performed at a specific time in the project (Coffey & Atkinson, 1996). We therefore approach the material with an approach that leaves room for ongoing reflection on the empirical
material collected. Our attention will be directed to both patterns and variations and we are well aware of the risk of focusing the analysis on identifying patterns can suppress identification of variations. Since we have a new phenomenon in the forefront, we are interested in a more exploratory understanding of the meaning that the interviewees assign to their work and their daily routines. Our attention will be directed to the possibilities of visualising values, tensions, dynamics, and disagreements. The analysis of the three different types of empirical material (interviews, focus groups, and document studies) will be designed in accordance with a qualitative content analysis (Silverman, 2014). This means that we start with careful reading of the material to obtain an overall picture, then we proceed to identify relevant phrases and sentences to be taken into account in order to create categories relevant to the project's questions. By identifying common features in an empirical material that is characterised by variation regarding the conditions and experiences that are expressed, the project has good opportunities for theoretically relevant generalisations. The project also intends to use appropriate digital tools for the analysis, such as nVivo and/or ATLAS.Ti.

5. Expected contribution
There is strong belief that the introduction of modern technology within the police will lead to more efficient work methods and enhance transparency and trust. Studies show, however, that new technology also entails unforeseen consequences that risk limiting the efficiency sought (Manning, 2008). Now that body-worn cameras systematically begin to be used by Swedish police, we want to investigate the implications for individual police officers and their practice as well as for the organisation. There are also relatively few empirical studies on how the body-worn cameras affect the work of the police and the public's confidence in the police as an organisation. The police constitute a clear example of an organisation that is exposed to the requirement to develop skills and practices that ensure responsible and lawful enforcement in a continuous manner. They constitute a case that can teach us a lot about how the logic that governs the requirements of a public sector also affects how public sector actors are organising themselves as a legal authority. Studying the emergence and organisation of new work practices in relation to the increased digitalisation in society is an example of a wider societal change strongly linked to technology development, which is of great importance for the organising of today's government work. The study also improves our understanding of how individual police officers are forced to handle different dilemmas related to the use of and exposure to technology, which purpose is to control socially both citizens and the individual police in the field. Our results will be relevant to a variety of different functions within the police organisation, identifying the need for competence development as well as the ability to organise and adapt activities and occupational roles associated with society's digitisation. The lack of digital competence within the police is an issue emphasised in the societal debate, and something that has been identified also internationally (e.g., Hitchcock et al., 2017). From a scientific perspective, the study is expected to contribute to a theoretical frame of reference better adapted for analysing organisational changes in public authorities in general and within the police in particular, by identifying opportunities as well as challenges associated with digitisation.
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The General Data Protection Regulation (GDPR), Emerging Technologies and UK Organisations: Awareness, Implementation and Readiness

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Abstract

The GDPR will be enforceable in May 2018 and its impact is expected to be significant, both in Europe and outside Europe. To date, many UK organisations are still unaware of the new legislation, with most still focused on the first implementation stage. A high number of organisations are expected not to be GDPR compliant, and therefore potentially liable to high sanctions. This paper draws upon research on the GDPR and organisations in the UK, carried out in 2017. The research intended to explore the relation between the GDPR and emerging technologies, and the impact of the new legislations on adopters of emerging technologies. The study aimed to understand knowledge, implementation and impact of the new legislation, its relation to emerging technologies and its future in the UK, particularly considering the impact of Brexit. The research results can help to understand the current state of awareness and implementation of the new data protection legislation in the UK.

Keywords: GDPR, Data Protection, Information Systems, Emerging Technologies, European Union, Brexit

1, Introduction

The European General Data Protection Regulation (GDPR) is the new legislation on Data Protection becoming enforceable across the European Union in May 2018. The GDPR strengthens the protection of personal data of individuals in the European Union and simplifies data law within the European Union. The coincides with a time at which Emerging Technologies (such as Cloud Computing, Big Data, The Internet

1 (Regulation EU 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, 2016)
of Things, AI, VR/AR) are producing an enormous amount of data, and the implications for Data Protection are significant but unclear. The impact of the GDPR on European and Non-European organisations is significant. However, to date many organisations are still unaware of the new legislation and its complexity, while others are still focusing on the first implementation stage. A high number of organisations are expected not to be GDPR compliant, and thus potentially exposed to the new high sanctions introduced.

This paper focuses on UK organisations, explores the Regulations’ impact and their relation to emerging technologies, and how UK organisations foresee the future of Data Protection, especially considering the uncertainty created by the Brexit Referendum.

2. GDPR – The Context

The GDPR was adopted in April 2016 after four years of discussions. It will become enforceable on 25 May 2018 providing uniform Data Protection within the European Union, and it will constitute the first update of Data Protection regulations since the Data Protection Act/DPA 1998 (Gov.UK, 1998), which enabled the 1995 EU Data Protection Directive (Directive 95/46/EC of the European Parliament, 1995), to be enacted in the UK. The GDPR is expected to have an impact on both data security and business outcomes. Its implementation may be expensive and time consuming where organisations need to implement solutions for preventing attacks, analysing and responding rapidly to breaches, although the cost will be dependent on the current levels of organisational compliance with data protection legislation According to global research conducted by Dell Software (2016), Digital/IT companies were lacking a general awareness about the GDPR: 97% of companies did not have a plan to prepare for GDPR, and only 9% of IT and business professionals were confident that they would be fully ready in May 2018.

A recent survey conducted by the international law firm Paul Hastings and published by Computer Week (Ashford, 2018) suggests that more than 90% of the US and UK companies believe they will be compliant in May 2018. However, the same survey shows other worrying data. Only 39% of the UK companies and 47% of companies
in the States have GDPR projects in place, with only a third getting specific support from third parties with their GDPR implementation.

2.1 GDPR – The Essentials
The GDPR formalises some concepts already developed through the courts and provides higher accountability and transparency (Kolah & Foss). While many concepts in the GDPR are similar to the existing UK Data Protection Act, others constitute a significant improvement (ICO, 2016). In this section we outline the areas of change against current legislation.

Global reach
The new Data Protection legislation will have a global application. It applies to entities and subjects based in the EU, and to entities based outside the UE that handle EU citizens and residents' data (Art.3). Therefore, Non-EU organisations that process data of individuals who are in the European Union, and do business in Europe must comply with the new regulation.

Definition of Personal Data
Under Article 4.1 …any information related to an identified or identifiable (living) natural person (‘data subject’) …who can be identified, directly or indirectly…by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person. The definition includes digital footprints, such as IP addresses and cookies, which are extremely important for location based marketing and data security.
Under Article 9 the definition of Sensitive Personal Data (special categories of personal data) is also expanded, with the inclusion of Genetic and Biometric data. Recital 51, for example, prescribes that the processing of photographs should not systematically be considered processing of special categories of personal data as they are covered by the definition of biometric data only when processed through a specific technical means allowing the unique identification or authentication of a natural person. Such personal data should not be processed, unless processing is allowed in
specific cases set out in this Regulation (e.g where it is in a member states’ public interest).

**Consent**
Where consent is given to collect, process and delete data it must be specific, informed, freely given, clear and affirmative (silence or pre-ticked boxes cannot be used to obtain consent, and that consent must be recorded and stored for audit purpose). Consent can be withdrawn at any time and it shall be as easy to withdraw as to give consent (Art 7).

**Subject Access Requests (SAR)**
Data Subjects can request access to personal data. There is a new, shorter deadline for organisations to respond (30 days and not 40) and it can be requested not only in writing.

**Data Portability**
A new right to have data exported onto a machine-readable format and transferred to another controller is introduced (Art 20).

**Extended Right to be Forgotten**
The right for Data Subjects to ask entities (both controllers and processors) to delete and destroy personal data is extended, and can be requested not only for search pages (as per Directive 95) but also in other cases, such as Facebook pages (Art 18). This right is not an absolute right but can be requested in specific case, for example when: the data was unlawfully processed, or retaining the data is no longer necessary (in relation to the original purpose), or this is necessary to comply with a legal obligation. Under the GDPR, the present of unwarranted and substantial damage or distress is not a necessary condition for exercising this right. However, if the processing does cause damage or distress, this is likely to make the case for erasure stronger. Data Subjects can also oppose the processing (where there is no overriding legitimate interest for continuing to do it) or withdraw their consent. (ICO, 2017, p 19)

**Automated decisions, profiling and rights to explanation**
GDPR introduces new requirements to provide greater transparency and more individual control. The GDPR introduces the definition of profiling (Gathering information about an individual or group of individuals and analysing their characteristics or behaviour patterns in order to place them into a certain category or group, and/or to make predictions or assessments about their ability to perform a task; interests; or likely behaviour), new rights for data subjects and obligations for controllers (rights of explanation and the right to request human intervention).

**Controller and Processor**
Under the GDPR both have specific responsibilities, an expansion on the current situation.

**Data Protection Officer (DPO)**
The DPO is an independent GDPR role within an organisation to inform, advise and monitor compliance. Some organisations must have a data protection officer (DPO): if they are a public authority (except for courts acting in their judicial capacity); carry out large scale systematic monitoring of individuals (for example, online behaviour tracking); carry out large scale processing of special categories of data or data relating to criminal convictions and offences.

**Obligation to report breaches within 72 hours**
Data breaches (e.g. cyberattacks or loss of company laptops or mobiles) must be reported within 72 hours after having become aware of it, both to Regulators and to individuals “unless the personal data breach is unlikely to result in a risk to the rights and freedoms of natural persons” (Art 33), or if “the data is anonymised or encrypted”. If the organisation does not report a breach, this will result in a double fine (for breach and missing communication).

**Data Protection Impact Assessments (DPIAs)**
Organisations must perform a DPIA in order to understand the potential risks from processing data (Art 35). They are required in cases of:
- Systematic and extensive processing activities, including profiling, and in case of decisions that produce legal effects on individuals (Art 35 a)
Large scale processing of special categories of data or personal data relation to criminal convictions or offences, including “processing a considerable amount of personal data at regional, national or supranational level…that affects a large number of individuals; and involves a high risk to rights and freedoms” (Recital 91).

Large scale, systematic monitoring of public areas (i.e. through use of CCTV) (ICO, 2017)

Privacy by Design and by Default
Data protection needs to be taken into consideration from the beginning of any project (Art 25.1), and the controller must ensure that by default “only personal data which are necessary for each specific purpose of the processing are processed “(Art 25.2). By default, the highest privacy setting should be automatically applied to a new product, and by default, personal data should be kept only for the time necessary.

High Sanctions
Organisations are required to demonstrate how they are complying with the GDPR, and Data Protection authorities can assess how they are using personal data (audit). Administrative fines in the case of non-compliance have been massively increased. Regulators can impose:
- Fines up to €10m or up to 2% of the total worldwide annual turnover in case of minor breaches (Art 83.4).
- Fines up to €20m or up to 4% of the total worldwide annual turnover in case of major breaches (Art 83.5) and in case of non-compliance with an order by the supervisory authority.

It can be seen that under GDPR there are a number of additional requirements on organisations and some existing areas have been strengthened. In the following section we explore the impact of GDPR on emerging technologies.

3. Impact of the GDPR on Emerging Technologies
New technologies are creating increasing amounts of data (ICO, 2016) and the digital economy is growing. The European Union has been very active in both promoting Data-driven economy measures and protecting personal data of EU Citizens and
Residents (European Parliament, 2015). While legal obligations and responsibilities in traditional transactions are well defined (organisation as data processor, and customer as data controller), boundaries and responsibilities in non-traditional exchanges are less clear. The GDPR endeavours to clarify rights and protection of Personal Data in digital societies. In the rest of this section, we briefly sketch the main areas within Emerging Technologies on which the GDPR will have a major impact: Cloud Computing, Big Data, AI, The Internet of Things, VR/AR.

3.1 Cloud Computing

The GDPR is quite prescriptive in relation to Cloud Computing, defining roles and responsibilities for Controller and Processor, outlining the content of the mandatory contract between the two (28.3), and regulating sub-contracting. The GDPR considers as Processors all kinds of cloud computing providers: Infrastructure as a service (IaaS), Platform as a service (PaaS), and Software as a service (SaaS) and defines their obligations in relation to:

- Data destruction “…Processor must delete or return all the personal data to the controller after the end of the provision of services relating to processing, and deletes existing copies…” (Art 28.3.g).
- Data Breaches, with processor to notify the Controller “without undue delay after becoming ‘aware’ of breach” (33.2).
- Security of Processing (Art 32) and record of processing activities (Art. 30.2).

The GDPR prescribes that controllers only use processors that can guarantee the technical and organisational measures to meet the GDPR’s requirements (Art 28.1), and it regulates sub-contracting, prescribing that “The processor shall not engage another processor without prior specific or general written authorisation of the controller…” (Art 28.2).

The GDPR’s compliance will be easier for the main players, as its requirements seem to be easily achievable by large organisations that can invest resources in technical and organisational changes, but will be more complicated for small organisations (Burton, 2016; Webber, 2016).
3.2 Big Data and Artificial Intelligence

According to existing data protection legislation under Directive 95/46, the processing and retention of personal data is only possible where it satisfies the concrete purpose of the original collection, and once this is done, data must be deleted. Re-processing data for a new purpose is allowed only if it is anonymised, compatible with the original purpose, and necessary to perform a contract, or is to comply with a legal obligation. Due to the existence of these constraints in Europe, some Big Data companies have tried to mitigate them asking consent on a wide purpose, keeping data for statistical purpose, or anonymising data (Mayer-Schönberger & Padova, 2015).

The principle of purpose limitation is retained by the GDPR (Art 5.b). However, the Regulation is more favourable to Big Data than the Directive, and seems to support innovation allowing some retention and re-use of data. Anonymous data are not subjected to the GDPR, but, for example, Art 89 prescribes appropriate safeguards, such as pseudonymization (Art 89.1) for processing scientific, historic or statistical purpose, and leaves the Member States to define the safeguards. Retention for statistical purposes is therefore still possible, and its applications are not rigidly defined by the GDPR, leaving to the Member States the competence to limit data subjects’ rights for statistical purposes.

The GDPR recognises another important right for individuals. While they cannot refuse to be subjected to automatic processing, they have the right not to “be subject to a decision based solely on automated processing, including profiling, which produces legal effects concerning him or her or similarly significantly affects him or her such as “performance at work, economic situation, health, personal preferences or interests, reliability or behaviour, location or movements…” (Recital 71 and Art 22) and to require human intervention in the decision, with the exceptions of:

- Decisions authorised by the European Union or by the Member State (for example in case of tax evasion prevention) or necessary for entering or performing a contract between the parts
- Clear consent to the automated processing

Therefore, with Recital (71) the European Union recognises the right of European citizens to have clarification about decisions made through automated processing, a
new right that Goodman and Flaxman (2016) call “The Right of Explanation”. They argue that the GDPR “highlights the pressing importance of human interpretability in algorithm design” and forecasts “a pressing need for effective algorithms which can operate within this new legal framework”.

The need to have effective “decision making" algorithms is becoming a pressing issue, and the GDPR Right of Explanation is particularly important considering how algorithms work. Algorithms are generally aimed at finding patterns in large datasets, and such patterns are correlations and not causation. “The correlations identified by the algorithms point to some type of relation between different data but without necessarily providing an explanation as to what that relation is, nor whether there is a causal link between the data” (Kamarinou, Millard, & Singh, 2016, p 17).

Automated processing can produce negative consequences for Data Subjects as they can recreate, for example, patterns of discrimination (Crawford, 2016). If predictions are made by machine learning processes trained with biased algorithm, the result is what the European Data Protection Supervisor calls a “vicious circle of self-fulfilling prophecies…where the feedback the machine receives reinforces the bias present in the first place.” (European Data Protection Supervisor, 2016, p 4). For example, getting a loan would depend on postcode areas, and groups that are already oppressed and marginalised could be further discriminated against by the use of biased processes (Rhoen, 2016).

Barocas and Selbst (2016) add another level of analysis which gives rise to some concern, as the discriminatory decision would be more difficult to demonstrate (also in judicial proceedings) being the result of an (apparently unbiased) automated process and not a human choice. The authors highlight that this can produce the “perverse result of exacerbating existing inequalities by suggesting that historically disadvantaged groups actually deserve less favourable treatment” (Barocas & Selbst, 2016, p 674). However, not all algorithms and processes are biased, and if carefully created they can make decisions potentially more transparent than those made by humans (Goodman and Flaxman; Kamarinou, Millard, & Singh). The EU Institutions are aspiring to is to have automated processes based on algorithms that are more transparent, auditable and less discriminatory (ibidem).
In relation to right of explanation and accountability, in case of decisions made using Machine Learning technologies, an interesting point is made by Kamarinou, Millard, & Singh. If decisions are made using different sources this requirement can be difficult to meet in order to be compliant, and the point will be “open to interpretation and need to be resolved in the implementation and interpretation of the GDPR…” (Kerry, Blythe & Long, 2016).

3.3 The Internet of Things – IoT

“Bentham’s panopticon is child’s play compared to surveillance in a fully functioning IoT” (Wisman, 2012, p 7).

With an estimated 200 billion connected devices by 2020 (26 connected objects per person, Intel, 2016), the Internet of Things presents an exceptional challenge for personal data protection. The GDPR poses some challenges for the IoT, as noted by Finlay & Madigan (2016) and Edwards (2016) specifically with regards to:

**Consent**

As per GDPR, consent must be informed, unambiguous, given with a clear affirmative act (Recital 33), and demonstrable. Consent is the most challenging GDPR requirement to be met, as IoT ecosystems exist “a priori” and collect data from the environment independently by possible consent. “IoT devices usually…do not have means to display privacy notices and…devices are usually small, screen less or lack an input mechanism (a keyboard or a touch screen)” (Edwards, 2016, p 42).

**Security**

IoT is more susceptible to security breaches. Considering the rigid rule of Art 33 (breaches to be reported within 72 hours), organisations need to make sure they have everything set up to respond to a breach.

Many other elements of GDPR are of relevance to IoT; in particular the Right to be Forgotten, data portability and the right not to be subject to automated decisions. Other areas, like Privacy by Design and Privacy Impact Assessment will place specific requirements on IoT. Both requirements can be challenging. Some points made by Edwards are compelling:
1. Including Privacy by Design and PIAs in planning a IoT system, for example in smart cities, it is easier in new cities, (created with a top-down approach, such as Songdo in South Korea), than in already existent cities.

2. Designing IoT privacy should be done adopting a holistic approach, and involving other subjects (such as urban planners and architects).

3. Involving IoT vendors in creating Smart Cities has consequences for privacy and data protection. “While local governments may well feel they have the power and duty to control the final design but actual (though perhaps not legal) control may rest with private vendors or investors and their sub and sub sub providers in the Cloud.” (Edwards, 2016, p 53).

Data protection is particularly relevant in relation to wearables technology, as this is one of the most powerful technologies able to collect data. Wearables use the Internet of Things ecosystem to collect and transfer data, and considering its growing popularity, data protection becomes particularly relevant especially for health data collected via wearables. The GDPR poses challenges for IoT environments and smart cities, and offers a new approach that take data protection and privacy from the start. Privacy by Design as the most important provision for the protection of personal data of individuals wearing personal devices (CMS Law Now, 2016).

Considering how personal data can be potentially accessed and personal privacy compromised in IoT ecosystems through for example, surveillance, sousveillance, and data driven economy, the challenges brought in by the GDPR are more than welcome.

3.4 Virtual Reality and Augmented Reality – VR/AR

The GDPR is also relevant for organisations using VR/AR technologies. Augmented Reality and Virtual Reality technologies are already applied in several sectors (such as Health, Entertainment, Defence, Education). As they are expected to grow in the next few years, concerns about Data protection and Privacy are huge.

Collecting data from locations where AR devices are placed, for example, can violate the privacy of individuals who are in those spaces and who have not given their consent. “AR automatically passes information about persons that the user sees, there
could be anything seen from social media, criminal record, and marital status” (Roesner et al, 2014, p.154).

In order to limit data violations, Brimsted (2016) for example suggests that “The processing of facial images, location and real-time data should be compliant prior to such activities taking place. This is just as relevant for start-ups as longer established businesses.” This last point about company size is particularly important as the perception seems to be that the GDPR is relevant only for large companies. Tozer and Mee (2016) analyse different aspects:

-The moments when personal info is collected in virtual reality environments: registration to access the service, and individuals’ interaction in the virtual space, preferences, location are all of interest when considering IoT applications. Considering the GDPR’s fines, VR/AR hardware, software and content providers must evaluate very carefully the potential legal consequences deriving from a not compliant data collection, data sharing, or location tracking in AR and VR environments are huge (Dentons, 2017).

4. Study Overview: Participants and Question Themes
The organisations identified for inclusion in the study were operating in various sectors (both public and private), and were chosen for being amongst adopters of emerging technologies. 50 potential participants (Senior Managers and Data Protection experts) were contacted for interview.

A general lack of awareness and knowledge of the GDPR emerged early in the empirical phase of this research, impacting considerably on both on the number of final participants and on the scheduled research timetable. Some manifested an early interest in being involved in research on data protection, but not on a specific research project on the GDPR, others were not aware of the Regulation. Interviews were conducted in February and March 2017.

9 correspondents gave their contribution; this included lawyer specialists in Data Protection and Privacy, Academics, IT Project Managers, and amongst them authors of numerous articles, blogs and publications on Data Protection. The group
encompasses considerable expertise in data protection and comprises individuals working extensively with organisations on GDPR.

Questions were based on 5 main themes:

A. General knowledge of the GDPR. Questions were focused on understanding the level of awareness, knowledge, involvement of professional bodies, the informing of management, and the training of staff.

B. GDPR Implementation. Questions were aimed at understanding what organisations had done and planned to do to implement the Regulation.

C. GDPR impact on business operations, with question related to potential challenges and disruptions.

D. GDPR and Emerging Technologies. Questions were focused on understanding potential specific challenges for adopters and for data created/processed via Emerging Technologies

E. Future of Data Protection, with questions aimed at exploring perceptions and expectations for Data Protection, particularly considering the impact of Brexit.

The questions were a combination of closed and open ended which gave space for participants to expand and choose how to shape the answer according to their experience.

5. Results

The primary data analysis was carried out considering the 5 main themes:

General knowledge of the GDPR

Most of the participants agreed on the general lack of awareness. UK organisations were, in general, not well informed about the future changes in Data Protection, and in some cases not even aware of the new legislation due to be enforceable in May 2018.

There were major differences in terms of organisation size and industry sector. Large organisations were more informed and up to date, as well as organisations operating in the regulated markets (such as the Financial and the Healthcare), and this was mainly due to the work done by Regulatory bodies. The Information Commissioner’s Officer, professional networks, business organisations, and large consultancies were raising awareness via specific guidance and informative events (organised mainly in
London), with Lawyers, Data Privacy and Info Security professionals being the first to get informed.

Considering the low level of GDPR awareness among Executives it was not surprising that internal training for staff seemed to be still far ahead. Companies had not started training their staff, as they were planning to do it nearer the time of implementation (probably using third parties). Data protection training awareness is a must for all staff as, in general, most data breaches are internal and not due to external hacks. Delayed training seemed to be particularly risky, and even more so in this case considering GDPR complexity, its innovative requirements and high sanctions.

**GDPR Implementation**

The low level of awareness translated into a general low level of implementation, except for those organisations who were more advanced in terms of Data Protection. The regulated market was ahead, with big banks having already GDPR programmes in place, and other sectors (such as Insurance) following.

The organisations which were more GDPR- “advanced” were: evaluating the future implications of the Regulation; reviewing their current data in terms of location, quality, and usage; starting the recruitment of some key GDPR roles (such as Data Protection Officers, data privacy teams and IT Project and Programme managers). Others were showing mixed approach, with some businesses adjusting and reviewing how they collected their data, and some others waiting for more clarity before taking action. It also emerged that some organisations were unable to deal with the GDPR and were getting rid of their data completely or leaving the market.

**GDPR impact on business operations (challenges and disruptions)**

The GDPR was expected to be extremely challenging and disruptive for organisations, and to have a major impact on projects, Business as Usual, budget (for GDPR training and projects), and resources, with the recruitment of DPO and Data privacy specialists. Staff shortages were also expected after May/June 2017, when organisations were anticipated to realise the impact of the GDPR and to compete for resources.
The disruption was also projected on internal processes, which needed to be adapted to new GDPR requirements: new specifications for consent, data breaches’ new deadline (72 hours), reduced processing time for subject access requests (30 days), protection of personal data from the beginning of the project/by design, GDPR training to reduce the chance of data breaches, and new processes for working with GDPR complaint third parties. Positive outcomes were also envisaged, with an increase of transparency and awareness seen as reasons for more business opportunities.

**GDPR and Emerging Technologies**
The GDPR was expected to impact on the implementation and popularity of Emerging Technologies, with organisations that are adopters of Cloud Computing, Big Data technologies, and Fintech and Data-driven Marketing industries particularly exposed.

The specificities of Emerging Technologies were mentioned by various participants. Data created/processed via emerging technologies produces huge challenges to Data Protection, especially in terms of: Data type, volume, velocity; Data purpose; Data ownership; Data location; Data flow, transfer and “interim steps” (For example, with regards to data encryption, or in the case of involvement of other parties, such as sub processors. In this case more clarity was required on data visibility, location, and the exact reason for their involvement); Data merging done with Big Data, the Internet of Things and Artificial Intelligence; Data Security (for both controller and processor).

Using data captured without clear consent (if not reliant on other lawful basis for processing) is unlawful according to the GDPR. Privacy by Design, privacy designed in from the beginning of the project is also a general obligation, prompting privacy notices available at the point of capture which is particularly interesting in the case of the Internet of Things.

**Future of Data Protection**
Data Breaches, reputation loss and increased awareness were highlighted. The future of Data Protection seemed to be expected to be one of non-compliance and data breaches. Numerous and massive data breaches were expected to create serious
consequences (such as reputational damages or loss of reputation in more serious cases), to affect the shareholders’ trust, and to impact business continuity of many organisations. High sanctions following breaches were considered as potential causes for forcing many organisations out of business. The amount and complexity of data was predicted to increase, as well as the awareness of individuals, who will be more confused by the complexity of data but will request more protection for their personal data.

Even though more certainty was required for some parts of the Regulation (for example, in terms of jurisdiction), the GDPR was thought by participants to increase transparency, accountability and user trust, and was expected to influence other legislations in other Non-EU countries (in order to be able to carry on trading with the European Union).

The Brexit referendum created uncertainty on the adoption of the GDPR, even though the UK was one of the EU Member States pushing for the creation and adoption of a new legislation on Data Protection. After a moment of ambiguity, the Government (guided by Theresa May) clarified that the UK was going to fully adopt the Regulation. The Regulation was expected by participants to be the main Data Protection legislation for the next few years, as creating a different UK Data Protection to repeal the GDPR was believed to be extremely costly for UK companies both in terms of new implementation costs and of trade with European partners. For example, a company only operating in the UK and processing the Personal Data of individuals in Europe, would be in any case subject to the GDPR, and therefore need to appoint a Representative within the European Union. Brexit was expected to create some issues, such as delays in GDPR implementation and more difficulties for UK companies in consolidating their position in Europe.

In March 2018 The UK is currently discussing the Data Protection Bill, the law that specifies some elements of the GDPR and this will be the UK data protection law after Brexit. At the time of writing the Data Protection Bill is still being discussed at the House of Lords, but it is expected to become law ahead of the May deadline for GDPR.
6. Discussion

The GDPR regulates how technologies create and process all personal data, and the protection offered was welcomed by most of the participants, as the amount of data collected, processed, shared, stored and re-used has increased dramatically.

The European Union is the most active political organisation in the world in protecting personal data of its citizens. It also recognises the importance of competition, international trade, and the enormous potentials deriving from Technology. The GDPR is the result of both interests, it recognises the potentials offered by Big Data and data-driven economy, and it strengthens Data Protection of individuals.

New provisions (such as those on consent, Privacy by Design and by Default, Data Protection Impact Assessment, Right to be Forgotten, high sanctions), will have an impact on how emerging technologies will be utilised by organisations. Furthermore, the GDPR attributes the responsibility of protecting personal data to organisations.

Most organisations are now using Cloud Computing. The GDPR is quite prescriptive in relation to Cloud Computing/Processor (Art 27-30), clarifying: roles and responsibilities of controller and processor; content of their mandatory contract; responsibilities in the case of sub-contracting; data transfer across countries. Some of these points were mentioned by participants, and concerns were voiced particularly with regards to data ownership, data location, data merging, profiling, and, in general, to the GDPR readiness of Cloud Computing companies, also in relation to big Tech companies. For example, one participant mentioned the white paper published by Amazon Web Services which did not contain any reference to the GDPR.

Cloud Computing technologies, with their unlimited capacity and low costs, are closed linked to the diffusion of Big Data and AI. Enhanced algorithm analysis, availability of data from IoT, and data mining applications are some of the features of the Big Data revolution. The GDPR takes Big Data into consideration, and it is more favourable to Big Data than the current legislation, in allowing, for example, processing for scientific, historic or statistical purpose (Art 5). The GDPR leaves
Member States to define the safeguards, and the UK is defining them in practice in the Data Protection Bill.

The Regulation recognises also the right of individuals:
- To have some clarification about the decisions - the so called “The Right of Explanation” (Goodman and Flaxman, 2016). The GDPR “highlights the pressing importance of human interpretability in algorithm design” (ibidem, p 26) and forecasts “a pressing need for effective algorithms which can operate within this new legal framework” (p 26).
- To refuse to be subject to decisions made only via automatic processing (such as profiling).

This clearly shows the importance placed by the GDPR on human interpretability in algorithm decision making. Both rights will be extremely useful for Data Subjects, and for those individuals and advocacy groups working on reducing existing inequalities, as they can be used to counteract the negative consequences caused by biased algorithms based on patterns of discriminations.

With regards to the Internet of Things and IoT ecosystems, the literature focused on some GDPR requirements, such as consent, security breaches and sanctions, Privacy by Design and Data Protection Impact Assessment/DPIA. Some participants expressed real concerns over possible surveillance through the IoT, and welcomed the future requirements, particularly with regards to consent and Privacy by Design.

7. Conclusions

Emerging Technologies are transforming how people live and work. Personal data is now the new oil, and new questions about power, agency and legitimacy arise. Legislations that protect individuals’ personal data and regulate the digitalisation of “everything” are now needed more than ever, especially considering the data-driven economy and surveillance, as noted by participants. The European Union has been very active in promoting technology innovation and protecting personal data. The GDPR is a product of both these interests and at the same time a compromise between the two, increasing people’s rights and providing rules for adopters of Emerging Technologies.
This research has shown that UK organisations are not very aware of the coming Regulation. Most of them are not well informed about the future changes in Data Protection, with low level of knowledge also prevalent amongst Executives. Large organisations and organisations operating in the regulated market tend to be better informed and up to date, while others are still unaware. Training delivered by professional bodies and UK Regulators were slowly raising awareness; however, the lack of training for internal staff is particularly hazardous, considering the high chances of internal breaches and massive sanctions for non-compliance. Both the literature review and the expert interviews showed the prevalence of a low level of implementation with the exception of a few organisations, mainly in the regulated market, that have already GDPR programmes in place. Other organisations were waiting or exiting the market.

The implications for organisations are expected to be massive. The GDPR is an extremely complex piece of legislation, whose importance and effects have not yet been completely understood by most UK organisations. Moreover, another influential factor was the Brexit Referendum, because it led some organisations to believe, or hope, that the GDPR was not going to be adopted as a consequence of Brexit. Organisations had 2 years for becoming compliant before the enforcement date. One participant predicted a general panic from the end of 2017, and Laberis (2016) uses the term Tsunami to give us an idea of the massive turmoil to be expected regarding the non-compliance or delayed GDPR implementation in the future. According to the survey conducted by the international law firm Paul Hastings mentioned above, the Tsunami seems to be still far away in the minds of UK companies.

With regards to the research question addressing the specific impact of the GDPR on organisations who are adopters of Emerging Technologies, a surprising discovery was made in the early stages of the fieldwork, which had a profound impact on the research process. The lack of awareness was not only limited to the GDPR requirements but also to the usage of Emerging Technologies within organisations. A high number of organisations and professionals immediately ruled out the interview invitation on the basis that their organisations were not using any of the Emerging Technologies mentioned by the researcher. While this was understandable for some of
the more recent technologies, such as AI and VR/AR, it was surprising for more mature technologies, such as Cloud Computing and Big Data, especially considering the high adoption rate of Cloud in the UK (90%). Therefore, the author found it easier to recruit Data Protection Experts working with various organisations, than Executives or Managers. For that reason, focusing the research only on adopters of Emerging Technologies was not possible due to time constraints. It turned out to be necessary to adopt a flexible approach and broaden the research question to focus on UK organisations in general and not only on adopters of Emerging Technologies.

The relationship between technologies and data protection is extremely fascinating. Rights can be enhanced or severely compromised, especially considering the most recent applications and potentials of AI. The role that Emerging Technologies will play in the future is exciting but also extremely worrying, which renders researching their implication on personal data and organisations necessary.

**References**


Digital Business Evolution: lessons from a decade of KTP industry projects

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Abstract
Digital transformation is a daunting process for many business leaders, who sometimes find themselves in unfamiliar territory. This challenge is particularly prominent for resource stretched and multi skilled small and medium sized enterprises (SMEs). This paper provides a context for this on-going discussion, and drivers for transformation will be discussed together with the challenges business leaders are currently facing. Following this, we argue that a digital business can be viewed as an information system (IS) with six common subsystems; people, data, hardware, software, process and communication, that must interconnect effectively. Finally HINGE the project planning approach is introduced and how twelve knowledge transfer partnerships informed this approach. The paper highlights that digital transformation is becoming a necessity and offers a phased approach that enables business leaders to construct a systematic project plan that enables their enterprise to reach new levels of digital maturity in a holistic and meaningful way.

Keywords: digital transformation, digital innovation, strategic change, SMEs, KTPs
1. Introduction

Digital transformation is a daunting process for many business leaders, who sometimes find themselves in unfamiliar territory. This challenge is particularly prominent for resource stretched and multi skilled small and medium sized enterprises (SMEs). A recent Accenture report (2018) claims that 95% of business leaders have aspirations to grow their digital maturity by investing into structure, people, processes and applications. Digital transformation is becoming a necessity and not engaging with this process could lead to a demise of an organisation (Evans, 2017). Many practitioners and consultant research findings are reporting a similar story of businesses being in various stages of transformation (Heinze et al, 2016) and yet business leaders seem to be in a state of perplexity on exactly how to fully embrace and exercise the shift to being digital. It can be argued that many businesses are currently at a transformational intersection. The surge of digital technologies and the fusion of once disparate technologies such as the Internet of Things, Artificial Intelligence, Machine Learning, Big Data, Virtual Reality and Augmented Reality, the potential of interconnectivity are forming the ‘perfect storm’. The resulting tsunami of change is radically disrupting and perplexing the business landscape and being likened to a similar state of flux that the industry revolution brought. Additionally, many of the named consultant groups are stating, that if businesses have not already started thinking and doing transformation, they will be left behind, given the predicted rapid change.

The aim of this paper is to present a new planning model for digital transformation, which has been informed by a research team’s work, of over a decade, with SMEs and Knowledge Transfer Partnerships (KTP). We argue that companies that engage with KTPs are embarking on a transformational process with digital underpinning associated activities. The authors have formed part of the academic team on 10 KTPs and 2 Knowledge Exchange Projects (KEPs) over the past decade, with one author also being an associate KTP Graduate. The authors have amassed a great deal of expertise on successfully managing the transformation process within SMEs environments. More recently, on the last two KEPS that the team are working on, there was a realisation by the team that a reusable model had organically emerged. With further development the HINGE project planning model was finalised. The structure for this work in progress
paper is to initially provide a context for this on-going discussion, the drivers for transformation will be discussed together with the challenges business leaders are currently facing. Following this, we argue that a digital business can be viewed as an information system (IS) with 6 common subsystems; people, data, hardware, software, process and communication, that must interconnect effectively. Finally HINGE the planning model is rationalised and justified followed by proposed future activities that will validate this research.

2. Context for Transformation

It could be an argued that the current digital transformation noise can be likened to 1990's MIT's Professor Mike Hammer and Boston Consulting Group's James Champy's approach to creating a competitive advantage via Business Process Re-engineering (BPR). Fundamentally the drivers for BPR are not dissimilar for business looking at transformation using digital technologies, improving customer experience, overall improving internal processes and ultimately reducing operational costs. A major impact of reducing costs when adopting BPR and streamlining and highlighting redundant processes was reduction in headcount and on the flipside a huge growth in the managing consultant sector. Hammer (1990:1) observed 'The usual methods for boosting performance—process rationalization and automation—haven’t yielded the dramatic improvements companies need. In particular, heavy investments in information technology have delivered disappointing results—largely because companies tend to use technology to mechanize old ways of doing business. They leave the existing processes intact and use computers simply to speed them up'. It is worth noting here that we do not apologise for this lengthy quote rather we want to highlight a number of insightful observations Hammer made almost 30 years ago, especially the issue that investment in IT was not being effective given that rather than radical redesign of processes, existing processes were being automated. Fellow MIT researchers (Soule et al 2016:3) are currently tackling a similar dilemma of 'Enterprises aiming to transform themselves through digital often focus on technology solutions to achieve specific tactical objectives...shows that value comes not from adopting technology, but from using technology to transform the way a company does business'. Almost three decades on the Holy Grail is still being pursued under a different guise of digital transformation as businesses are still looking for a way to perform better, reduce costs, and enhance customer engagement. For the purpose of this paper we situate transformation within a
SME context though it is worth highlighting, at this point, that other sectors such as health, government agencies and third sector are also concerned with this transforming.

Digital transformation is either happening in many organisations and if not happening yet it is definitely being considered (Evan 2017). Research by the larger managing consultancies, the likes of, Accenture's (2017) or Gartner are reporting on a number of common challenges that many businesses are facing regardless of their size. Harvard Business Review have conducted a recent survey (2017) and findings indicate that the inability to experiment quickly, legacy systems and existing siloed working practices are preventing agility and the ability for an immediate response to achieve a sustainable competitive advantage. There is a need to react in a rapidly changing competitive and emerging landscape. Additionally they found a number of cultural issues that are hindering the transformation process, such as a risk averse attitude, resistance to change, a lack of vision for digital and practical barriers were a lack of skills and talent, cyber security and insufficient investments.

3. Digital Business as an Information System

Not wanting to contribute to an already contested debate regarding defining what an 'Information Systems' is, we turn to Ray Paul’s (2010: 96) discussant paper on this often emotive topic. Paul makes the argument that it is ‘unclear what the meaning of an Information System is, and different meanings have different interpretations for different adherents’. As IS researchers and practitioners, we are sympathetic with this worldview, and have ‘tended’ many different evolving gardens to understand the dynamic nature of Information Systems. However what is interesting for this paper is Paul’s (2010:97) analogy of ‘IS as a model... a model of the organisation at some level of abstraction, approximation and aggregation’ as this is a similar argument that is being made in this paper, that a digital business is compared to an IS. Both Paul's and our proposed model (figure 1: The Digital Business as an Information System) are comparable in the principle that the IS as a model of an organisation will have to change or transform as the business flexes and shifts while accommodating internal influences and external forces. Like many researchers across many disciplines there are certain concepts, terminologies that we include and concur are part of our professional discourse. Such concepts as ‘knowledge’, ‘system’, ‘digital’ or ‘information’ are used with a universally believed definition attached. The truth is that we ‘conceive of them like of objects that we can store, process and retrieve in material form’ (Werner 2001:55). The
reality is they are not objects but nebulous entities that are shaped, informed, developed by a multitude of interactive, connected subjects (Nissen 2001).

Figure 1: The Digital Business as an Information System Model

We further argue the need to highlight that such concepts are fluid and in a constant state of change especially in this current period of digital transformation (Evans 2017) and those changes are influenced from both external and internal forces. The proposed model The Digital Business as an Information System (Fig 1) brings together six entities borrowed from a traditional Information System model that we suggest are found in a digital business: people internal needs for the right talent and skills, also a need for a digital culture, external pressures come from customers and gaining an holistic insight of the customer; communications, internal communication channels and documentation with external channels and content; processes being agile enough to adopt new and emerging business models, form the non-digital and cultural side of the model. This structure mirrors three digital entities of a digital business; data with external needs growing data analytics, visualisation and internal needs to acquire a data-centric view of IS/IT; software brings connectivity and the traditional models of building external partnership with enterprise systems are still required compared to licensed in-house applications, with an awareness of consequences of staff replacing Bring Your Own Devices (BYOD) with Bring your Own Apps (BYOA); hardware is constantly reviewed as cloud becomes more sophisticated, data storage and aggregation and workspaces changes and staff working environment globalises and time becomes fluid. It can be argue that businesses are gaining digital capabilities, however the challenge is, how do you change the inherent structure of a traditional business (Evan 2017)? We propose that the Digital Business as an Information System model provides a
digital centric lens for business stakeholder when considering the transformation process.

4. HINGE: Project Planning Approach for Digital Transformation

In this section we introduce the HINGE: Project Planning Approach (see Fig 2) that offers a phased methodology for SMEs undertaking digital transformation that has emerged from lessons learned by the combined experiences of the research team from a decade of working on Knowledge Transfer Partnerships (KTPs) industry projects. This approach is situated within an SME context with an acknowledgement of the constrained environment that these size businesses operate within alongside the need to adopt an agile attitude in order to keep pace with external changes and drivers. This emerging digital transformation planning approach has been co-constructed from the research team’s collaboration across twelve KTPs and Knowledge Exchange Projects (KXPs). Knowledge Transfer Partnerships were established over 40-year-olds and are government-funded schemes to facilitate innovation in UK businesses. They were part of the Department of Trade and Industry that was replaced by the Department of Innovation, Universities and Skills. The KTP partnership includes a team of academics, a company with a business problem and a graduate associate who works on a typically two year discrete project to solve the business problem. An ultimate goal of a KTP is wealth generation resulting from enhancing the competitiveness and productivity of the company. Recently KXPs have been introduced by a number of universities and have the same structure of KTPs but are Higher Exchange Internal Funded (HEIF) projects. Table 1 lists the companies and time frames of the KTPs/KXPs (please note that this data in in the public domain) that research team have work upon over the past decade and each projects has included the application of technologies in the transformation process.

<table>
<thead>
<tr>
<th>KTPs and KXPs</th>
<th>Year</th>
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<tbody>
<tr>
<td>1 Reputation Consultancy (KXP)</td>
<td>2018-2019</td>
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<tr>
<td>2 Hydro-X (KXP)</td>
<td>2017-2018</td>
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<td>3 Sigma Ltd</td>
<td>2014-2016</td>
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<tr>
<td>4 Pennine Telecom Ltd</td>
<td>2014-2016</td>
</tr>
<tr>
<td>5 Tameside Council</td>
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<td>6 Freeclaim / Tranters Solicitors</td>
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</tbody>
</table>
The combined experiences of working with 12 KTPs/KXPs and observations made of each business faced similar challenges in how to digitally transform their business in a practical manner. The research team realized that no matter the sector or business problem that was being resolved through the KTP process, a pattern of common stages emerged. The project planning for digital transformation tends to follow a five-stage cycle, the HINGE: Project Planning Approach, Horizon scanning, Internal auditing, New business model creation, Gap analysis, and Evaluation of options. This approach enables business leaders to construct a systematic project plan that enables their enterprise to reach new levels of digital maturity in a holistic and meaningful way.

Table 1: KTP and KXP Project

<table>
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<tr>
<th></th>
<th>Company Name</th>
<th>Years</th>
</tr>
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<tr>
<td>7</td>
<td>Fast Web Media</td>
<td>2011-2014</td>
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<td>8</td>
<td>ASC Ltd</td>
<td>2010</td>
</tr>
<tr>
<td>9</td>
<td>Cetus</td>
<td>2009-2011</td>
</tr>
<tr>
<td>10</td>
<td>BETA Group Ltd</td>
<td>2009-2011</td>
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<tr>
<td>11</td>
<td>Pressurelink Contracting Ltd</td>
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<tr>
<td>12</td>
<td>Foundry Ltd</td>
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</table>

Figure 2: HINGE: Project Planning Approach

The HINGE model as proposed in (Heinze et al, 2018) outlines the key stages of digital transformation as follows:
• Horizon Scanning - evaluation of the external environment, seeking out disrupters, accelerators and innovations that may act as an external stimulus for change within the organisation’s system.
• Internal Audit - auditing of the internal environment to understand influential external changes and the knowledge of the value created by these changes. An emphasis is made on the need to understand the internal challenges that may impede businesses ability to meet external drivers for change.
• New Models – developing a responsive business model that may not require radical change but its does require the willingness to change
• Gap Analysis - the gap between current and future digital business maturity stages and business models are identified, and plans made to bridge those gaps are formed.
• Evaluation of Options - The feasibility of the various options are assessed against the priorities that have been identified and these options are tested and evaluated

The research team is currently collaborating on academic teams for two KXPs that are at different stages of the HINGE: Project Planning Approach, one is the Gap Analysis stage and then other is at the Internal Audit Stage.

5. Future work
The team are currently working on two case studies SMEs with polar opposite businesses from the sector, size, business culture, heritage, structure, different products and services. The HINGE: Project Planning Approach has being adopted for both of these KEPs and current and future work involves the monitoring, observation and practical application of HINGE. These successful digital transformation case studies will then provide empirical evidence and validate the HINGE staged approach.

6. References


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Author Index

<table>
<thead>
<tr>
<th>Author</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addis, Maria Chiara</td>
<td>93</td>
</tr>
<tr>
<td>Adelakun, Olayele</td>
<td>89</td>
</tr>
<tr>
<td>Ahmed, Bakhtiyar</td>
<td>31</td>
</tr>
<tr>
<td>Algarni, Majed</td>
<td>91</td>
</tr>
<tr>
<td>Alraddadi, Albayan</td>
<td>28</td>
</tr>
<tr>
<td>Alsanad, Dr. Ahmad</td>
<td>91</td>
</tr>
<tr>
<td>Ameen, Nisreen</td>
<td>1</td>
</tr>
<tr>
<td>Anwar, Muhammad Naveed</td>
<td>32, 37</td>
</tr>
<tr>
<td>Augoye, Voke</td>
<td>40</td>
</tr>
<tr>
<td>Bezbradica, Marija</td>
<td>69</td>
</tr>
<tr>
<td>Boilson, Andrew</td>
<td>38</td>
</tr>
<tr>
<td>Brown, Irwin</td>
<td>34</td>
</tr>
<tr>
<td>Bui, Quang</td>
<td>89</td>
</tr>
<tr>
<td>Carlsson, Sven</td>
<td>34</td>
</tr>
<tr>
<td>Champion, Donna</td>
<td>28</td>
</tr>
<tr>
<td>Chowdhury, Gobinda</td>
<td>32</td>
</tr>
<tr>
<td>Connolly, Justin</td>
<td>38</td>
</tr>
<tr>
<td>Connolly, Regina</td>
<td>38</td>
</tr>
<tr>
<td>Coombs, Crispin</td>
<td>43</td>
</tr>
<tr>
<td>Dang-Nguyen, Duc-Tien</td>
<td>69</td>
</tr>
<tr>
<td>Dannhauser, Thomas</td>
<td>31</td>
</tr>
<tr>
<td>Davis, Paul</td>
<td>38</td>
</tr>
<tr>
<td>Eneman, Marie</td>
<td>68, 92</td>
</tr>
<tr>
<td>Eriksson, Jeanette</td>
<td>86</td>
</tr>
<tr>
<td>Feldman, Gerald</td>
<td>87</td>
</tr>
<tr>
<td>Fusaro, Magda</td>
<td>30</td>
</tr>
<tr>
<td>Harden Mugelli, Sue</td>
<td>86</td>
</tr>
<tr>
<td>Hastings, David</td>
<td>32, 37</td>
</tr>
<tr>
<td>Helfert, Markus</td>
<td>69</td>
</tr>
<tr>
<td>Inpongpan, Witthaya</td>
<td>66</td>
</tr>
<tr>
<td>Javidroozi, Vahid</td>
<td>87</td>
</tr>
<tr>
<td>Kehal, Mounir</td>
<td>35</td>
</tr>
<tr>
<td>Kesavulu, Manoj</td>
<td>69</td>
</tr>
<tr>
<td>Kilic, Ayse Begum</td>
<td>39</td>
</tr>
<tr>
<td>Kunze, Kai</td>
<td>36</td>
</tr>
</tbody>
</table>
Kutar, Maria 93
Lagna, Andrea 28
Leo, Ezekiel 89
Leon, Steven 33
Ljungberg, Jan 68, 92
Lo, Man Fung 41
Marin, Javier 86
Matsubara, Shigeo 36
Nakayama, Makoto 33
Ng, Peggy 41
Niamsorn, Suwitcha 67
Ononiwu, Chidi 34
Ozkan, Sevgi 39
Philip, Nada 31
Redman, Alex 43
Rolandsson, Bertil 68, 92
Russo, Nancy 86
Schirrmacher, Amelie Kim 88
Schmid, Andreas 85
Schoop, Mareike 85, 88
Shah, Hanifa 87
Sims, Julian 29, 30
Skoumpopoulou, Dimitra 41
Staines, Anthony 38
Stenmark, Dick 68, 92
Tag, Benjamin 36
Tangedipalli, Balakrishna 90
Tene, Ramakrishnudu 90
Tomlinson, Allan 40
Trusson, Clive 42
Vargo, Andrew 36
Willis, Robert 1
Wolf, Maxim 29, 30
Wong, Adam 41
Yang, Huadong 29
Keyword Index

accountability 68, 92
Adoption of mobile applications 1
affordance 68, 92
Age as a moderator 1
Agile Information Systems 88
Agile Manifesto 88
Agility 88
Application 69
Augmentation 43
Authentication 40
Automation 43

Background theories 34
Benefits Dependency Network 28
Benefits Realisation 28
body-worn camera 68, 92
business collaboration 32, 37

Cloud 69
Cloud Computing 91
Cloud ERP 91
collaboration factors 37
Collaborative Computing Systems 36
Communication-Driven Usefulness Hypothesis 33
Configuration 89
Context-aware 90
Critical realism 34, 87
cross case analysis 41
CSCW 36
Cyber Threat 40

Data Analytics 38
Data Protection 93
Decision Support System 31
Definitions 29
Developing Country Context 28
diet recommendation 90
digital divide 30
digital exclusion 30
digital literacy 30

e-exclusion 30
Educational Technology 67
eHealth 31
<table>
<thead>
<tr>
<th>Keyword</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>elderly</td>
<td>86</td>
</tr>
<tr>
<td>Electoral Fraud</td>
<td>40</td>
</tr>
<tr>
<td>electronic negotiation</td>
<td>85</td>
</tr>
<tr>
<td>Emerging Technologies</td>
<td>93</td>
</tr>
<tr>
<td>End-user</td>
<td>69</td>
</tr>
<tr>
<td>Enterprise Resource Planning</td>
<td>28</td>
</tr>
<tr>
<td>Enterprise social media</td>
<td>29</td>
</tr>
<tr>
<td>ERP</td>
<td>91</td>
</tr>
<tr>
<td>Expert System</td>
<td>31</td>
</tr>
<tr>
<td>Financial Advice</td>
<td>43</td>
</tr>
<tr>
<td>Flexibility</td>
<td>88</td>
</tr>
<tr>
<td>game characteristics</td>
<td>85</td>
</tr>
<tr>
<td>gamification</td>
<td>85</td>
</tr>
<tr>
<td>GDPR</td>
<td>93</td>
</tr>
<tr>
<td>Global Entrepreneurship Monitor</td>
<td>32</td>
</tr>
<tr>
<td>health</td>
<td>90</td>
</tr>
<tr>
<td>healthcare innovation</td>
<td>86</td>
</tr>
<tr>
<td>Healthcare Insurance Applications (HIAs)</td>
<td>33</td>
</tr>
<tr>
<td>Home-based business</td>
<td>32, 37</td>
</tr>
<tr>
<td>Human Resources Management</td>
<td>39</td>
</tr>
<tr>
<td>ICTs in Higher Education</td>
<td>67</td>
</tr>
<tr>
<td>Identity</td>
<td>42</td>
</tr>
<tr>
<td>Industry 4.0</td>
<td>39</td>
</tr>
<tr>
<td>Information Communication Technology</td>
<td>31</td>
</tr>
<tr>
<td>Information System</td>
<td>91</td>
</tr>
<tr>
<td>Information systems</td>
<td>87</td>
</tr>
<tr>
<td>Information Systems</td>
<td>39</td>
</tr>
<tr>
<td>Insider Threat</td>
<td>40</td>
</tr>
<tr>
<td>IT Profession</td>
<td>42</td>
</tr>
<tr>
<td>IT Service Management</td>
<td>42</td>
</tr>
<tr>
<td>IT Servitization</td>
<td>42</td>
</tr>
<tr>
<td>Job Quality</td>
<td>42</td>
</tr>
<tr>
<td>Knowledge Diffusion</td>
<td>35</td>
</tr>
<tr>
<td>Knowledge Management</td>
<td>35</td>
</tr>
<tr>
<td>Knowledge Repository</td>
<td>35</td>
</tr>
<tr>
<td>Language Versioning</td>
<td>36</td>
</tr>
<tr>
<td>Literature Review</td>
<td>29</td>
</tr>
<tr>
<td>Machine Learning</td>
<td>31</td>
</tr>
<tr>
<td>Middle-range theorizing</td>
<td>34</td>
</tr>
<tr>
<td>mobile camera</td>
<td>68, 92</td>
</tr>
<tr>
<td>Keyword</td>
<td>Page</td>
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<td>----------------------------------------</td>
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<tr>
<td>Monitoring</td>
<td>69</td>
</tr>
<tr>
<td>negotiation support system</td>
<td>85</td>
</tr>
<tr>
<td>OECD countries</td>
<td>32</td>
</tr>
<tr>
<td>Organisations</td>
<td>93</td>
</tr>
<tr>
<td>Organizational</td>
<td>89</td>
</tr>
<tr>
<td>Outcomes</td>
<td>89</td>
</tr>
<tr>
<td>Outsourcing</td>
<td>89</td>
</tr>
<tr>
<td>Partial least squares</td>
<td>1</td>
</tr>
<tr>
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<td>33</td>
</tr>
<tr>
<td>Perceived Usefulness (PU)</td>
<td>33</td>
</tr>
<tr>
<td>Philosophy</td>
<td>87</td>
</tr>
<tr>
<td>police</td>
<td>68, 92</td>
</tr>
<tr>
<td>prediction</td>
<td>90</td>
</tr>
<tr>
<td>Principles</td>
<td>69</td>
</tr>
<tr>
<td>Privacy</td>
<td>40</td>
</tr>
<tr>
<td>Public Health</td>
<td>38</td>
</tr>
<tr>
<td>Qualitative</td>
<td>43, 87</td>
</tr>
<tr>
<td>recommendation system</td>
<td>90</td>
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<tr>
<td>Research methodology</td>
<td>87</td>
</tr>
<tr>
<td>Robo-Adviser</td>
<td>43</td>
</tr>
<tr>
<td>serious games</td>
<td>86</td>
</tr>
<tr>
<td>Service Delivery</td>
<td>31</td>
</tr>
<tr>
<td>Similarity Function</td>
<td>90</td>
</tr>
<tr>
<td>Smart Classroom</td>
<td>67</td>
</tr>
<tr>
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<tr>
<td>Social Media</td>
<td>29</td>
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<td>social media</td>
<td>68, 92</td>
</tr>
<tr>
<td>Sport tourism</td>
<td>66</td>
</tr>
<tr>
<td>Supply Chain Management</td>
<td>39</td>
</tr>
<tr>
<td>surveillance</td>
<td>68, 92</td>
</tr>
<tr>
<td>Technology</td>
<td>38</td>
</tr>
<tr>
<td>technology acceptance</td>
<td>41</td>
</tr>
<tr>
<td>Thai Higher Education</td>
<td>67</td>
</tr>
<tr>
<td>Theory choice</td>
<td>34</td>
</tr>
<tr>
<td>Theory of Workarounds</td>
<td>28</td>
</tr>
<tr>
<td>Tourism expectation</td>
<td>66</td>
</tr>
<tr>
<td>Tourism in Thailand</td>
<td>66</td>
</tr>
<tr>
<td>Tourist</td>
<td>66</td>
</tr>
<tr>
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<td>40</td>
</tr>
<tr>
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<td>43</td>
</tr>
<tr>
<td>Keyword</td>
<td>Page</td>
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<td>69</td>
</tr>
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<td>87</td>
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<tr>
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<td>41</td>
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<tr>
<td>Young people in the UAE</td>
<td>1</td>
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