

IMPLICATIONS OF INDUSTRY 4.0 TO SUPPLY CHAIN MANAGEMENT AND HUMAN RESOURCES MANAGEMENT

Ayşe Begüm KILIÇ & Sevgi ÖZKAN

Informatics Institute, Middle East Technical University, Turkey

Email: aysebegumkilic@hotmail.com; sevgiozk@metu.edu.tr

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 (HR) 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.

Industry 4.0

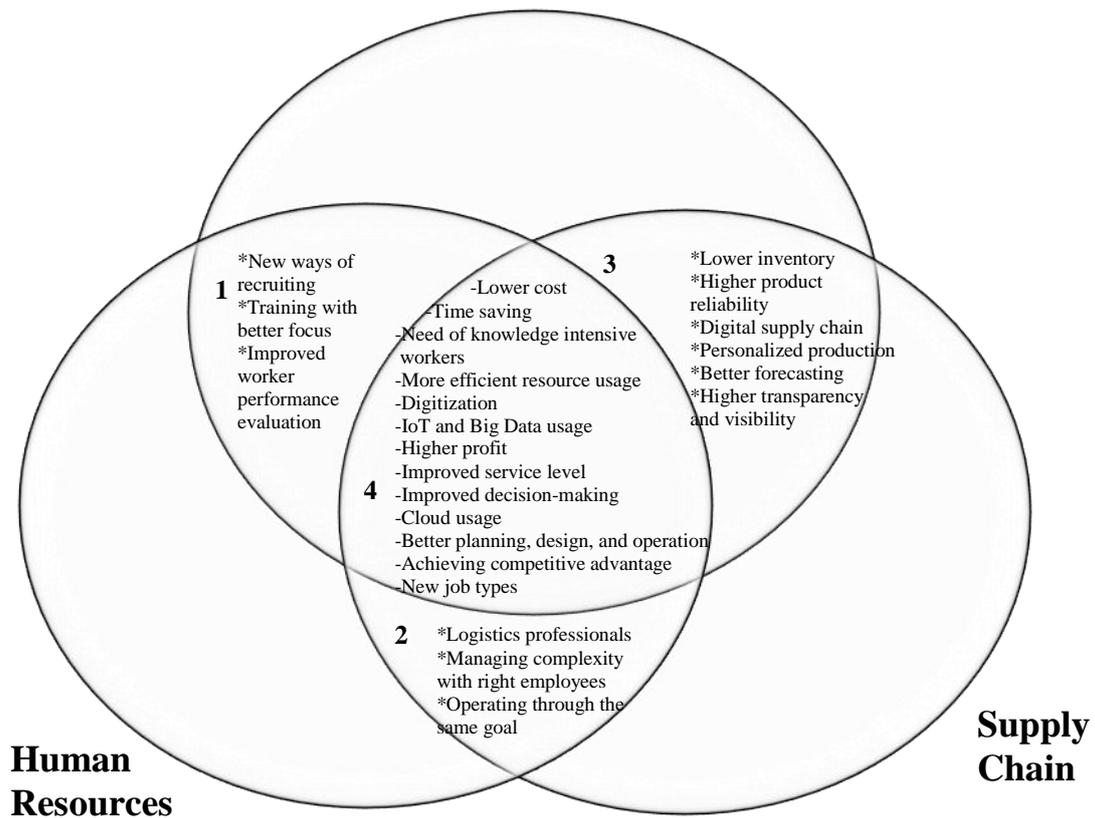


Figure 1: I4.0-HR-SC Venn Diagram

The figure below visualizes the cause and effect in the above paragraph;

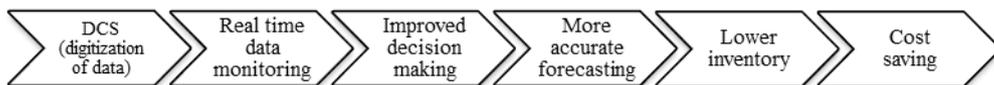


Figure 2: Flow of I4.0 and SC

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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