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Digital Transformation in the Value Chain – Effects on Major Stakeholders

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Abstract.

The digital transformation is characterized by a changing process via digital technologies which affects the entire society and especially companies in a significant way. Distinctively not only individual enterprises themselves are involved, moreover the digital automation of various processes has a substantial influence in the complete value chain. Systems are intelligently interconnected with each other and transform into self-organized organizational networks. The horizontal integration, which is one of the main features in the digital transformation process, therefore concerns not just internal stakeholders, moreover all interested groups along the entire lifecycle of products and services are highly related to this change. In order to demonstrate the impact of the digital transformation in the value chain, an empirical study on Austrian industrial companies has been done. Therefore, this paper shows recent developments on suppliers, employees and consumers in research and practice. As a result, an assumption of potential influences of the digital transformation in the value chain is achieved.

Keywords: Consumers; employees; horizontal integration; Industry 4.0; suppliers.

1. Introduction

The industrial value creation in the early industrialized countries is nowadays shaped by the development towards the fourth stage of industrialization – the so-called Industry 4.0 (Acatech, 2013). This development eliminates the boundaries between the real world and virtual reality, digitization allows completely new possibilities within production and processes. Systems are intelligently interconnected with each other and transform into self-organized organizational networks (Vogel-Heuser et al., 2017). The transparency between every value-adding step from the dispatched order until the end-of-life of the product or service is achieved. Consequently, Industry 4.0 doesn't affect just internal stakeholders, moreover all interested groups are highly concerned. Collaboration between suppliers, manufacturers and customers is substantial for the success of Industry 4.0 (Nagy et al., 2018).

All interdisciplinary potentials of the digital change can be entirely exploit with convinced employees that actively participate in these processes (Wagner, 2017). Hence, Industry 4.0 promises immense opportunities for realizing sustainable manufacturing by using digital technologies.

Recent developments in the field of digital technology help to improve processes for the whole value chain. The application of innovative technologies like in-memory computing, the

Internet of Things (IoT), Radio Frequency Identification (RFID) or Cyber-Physical-Systems (CPS) support enterprises which are facing a highly competitive global market with demanding customer requirements. Consequently, this leads to increased transparency and agility, and therefore the ability to handle the constantly increasing dynamic and complexity of globally acting value chains (Reinhart et al., 2013).

2. Methodology

This paper emphasis on the impact of Industry 4.0 (I4.0) on three primarily concerned stakeholders in the value chain. For this purpose, initially fundamentals of Industry 4.0 are outlined and the great relevance of suppliers, employees and customers in this context is demonstrated. Furthermore, this chapter stresses the demanded conditions and requirements for using digital technologies. An empirical study to analyse the impact of Industry 4.0 on the company's success with main focus on the three major stakeholders is introduced. As a result, an assumption of potential influences on the impact of Industry 4.0 is achieved.

3. Implications of Industry 4.0 on major stakeholders

3.1 Concept and Perspectives of Industry 4.0

Industry 4.0 triggers a vast variety on technologies, which enable digital networks of objects. Whereas so-called Industry 4.0-basic technologies like sensors or auto-ID-technologies build the base for digitalisation of a value network, advanced Industry 4.0-solutions (e.g. big data-analytics, advanced planning systems) allow automatic or even autonomous execution and control of various processes (Hofmann et al., 2017).

Over the last few years, lots of definitions concerning Industry 4.0 have been created. For instance, Hermann et al. define Industry 4.0 as a "collective term for technologies and concepts of value chain organization." They emphasize that over Internet of Things (IoT) and cyber-physical-systems (CPS) communication and cooperation with objects and humans in real time is offered and utilized by participants of the value chain. (Hermann et al., 2016). Whereas Roth et al. describes Industry 4.0 as a network of humans and machines along the whole value chain, but also the digitalisation and analysis of information in real time (Roth, 2016). Merging these two definitions we consider Industry 4.0 as a network of humans and machines by applying innovative digital technologies to optimise the efficiency of the whole value chain.

Therefore, significant features of Industry 4.0, which outline the characteristics of this term can be stated:

- Vertical integration and networked manufacturing systems: The integration of different IT-systems at diverse hierarchy levels in a company, provides real time data

of the production. Resources and products are networked, also materials and parts can be located anywhere at any time with CPSs (Abele et al., 2015).

- End-to-end engineering across the entire product life-cycle: This describes the intelligent cross-linking and digitalization throughout all phases of a product life cycle - from raw material acquisition to manufacturing, product use and disposal (Acatech, 2015).
- Horizontal integration across the entire value creation network: The integration of IT-systems within the whole value chain or even more the whole value network constitutes a key element of Industry 4.0. Material flows, information flows and financial flows are cooperating in an intelligent way within the company but also beyond the company's borders. Simulations along the entire value network, from supplier to customer, are enabled (Abele et al., 2015).

Regardless to the industry sector, cooperation between different functions involved in the value chain are necessary. However, depending on the types of business and final products or services supplied to the customers, these functions can be completely various. Hence, the integration and coordination of all the processes in the value chain are crucial to match supply and demand (Tjahjono et al., 2017). In this paper we examine the key stakeholders, which also represent the main actors within the horizontal integration of Industry 4.0. Thus, it can be assumed that they have a significant impact on the success of Industry 4.0.

3.2 Major stakeholders

Already in 1920s, managers recognized that companies consist of different shareholders, which have a common share, but also diverse interests on the company. The stakeholder approach means that companies interact constantly with the environment, which enables a sustainable future and the ability for self-organisation within the company (Eberhardt, 1998). Internal stakeholders exert a dominant influence on the business activities and company's decisions, in particular employees and the management level represent diverse interests and spheres of action (Simtion, 2016). In addition, the external stakeholders, like suppliers, customers or government, can exercise a decisive influence on the company, whereby they have a common interest in a successful enterprise (Gardberg, 2001). The importance of major stakeholders among the value chain is outlined subsequently:

a) *Suppliers* constitute to the traditional stakeholders because of their critical importance in the service delivery process of businesses. In addition to banks, suppliers are the most important creditors, because they can cause enormous costs through non-delivery or delay, especially in manufacturing companies. The more important the timely production and resale of products for a company, the greater the influence of suppliers. The substitutability of the supplier also plays a significant role in the power of this interest group: If the supplier has a monopoly position, because the company does not have an alternative supplier, his power increases (Skrzipek, 2005). Another point is the fact that suppliers and companies represent their own economic units which may lead to conflicting objectives. In this context, Portisch emphasizes the importance of

suppliers as stakeholders and justifies them with their contractual relationship with the company (Portisch, 1997). Wellner sees the reduction of its own substitutability and subsequently the increase of potential power as the primary goal of suppliers (Wellner, 2001).

b) *Employees* make a valuable contribution to achieve the company's goals and thus to the success. Like executives, they have a dual role, since they act in their own interest and also act in the interests of the company (Göbel, 2006). The main concern of employees is to increase their own quality of life, as measured by certain characteristics required for self-development. Subordinate issues of employees are according to Janisch the livelihood, the financing of livelihood and self-fulfillment (Janisch, 2001). Hence, the influence and the degree of dependency of this stakeholder group to the company are therefore very high.

c) *Customers* represent a key interest group of companies, which means they play a leading role in the value chain (Simtion, 2016). Dowling believes that customer need particular attention, as his status as a stakeholder is the highest (Dowling, 2001). Also Mast supports a similar view. According to him, the customers act as a central reference person and are centered to all corporate activities which means they form the basis for enterprise existence (Mast, 2013). Customers also have the resources to exert strong pressure on a company which comes along for instance with increasing corporate performance requirements (Svendsen, 2016). The development of recent years shows that customers do not justify their purchase decision with the product, but much more with corporate values. This is related to the fact that today emotional values such as image, brand or design gain importance (Simtion, 2016).

4. Impact of Industry 4.0 on Austrians Industrial Companies – an Empirical Study

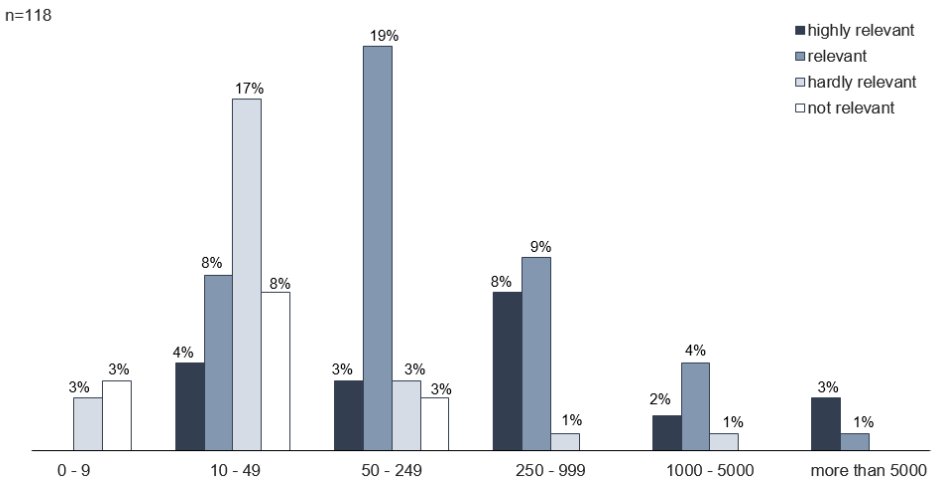
In order to identify the status quo of Austrian industry regarding the impact of Industry 4.0 on key stakeholders, an empirical study was conducted. As a research method, an online survey was selected to obtain the highest possible number of participants. Therefore, the online tool “Lime Survey” was chosen as survey software based on appropriate quantities on other research projects at the University of Applied Sciences JOANNEUM, Industrial Management. The online questionnaire with 28 questions was sent to a total of 2,237 Austrian industrial companies, whereby 260 companies participated. This results in a response rate of 11.62%. Of the 260 questionnaires, 114 were fully completely, 4 partially and 142 inadequately.

Thus, the considerable number in this scientific paper amounts to 118 questionnaires. For this paper, we show relevant excerpts of the survey with a special emphasize on the key stakeholders in the value chain.

For further evaluations the SME definition of the European Union was used for the classification of enterprises by company size, with the number of employees being used as a

decisive criterion for the allocation of size. Firstly, companies were asked about the relevance of Industry 4.0 for their operations.

Figure 1: Relevance of industry 4.0 based on the company size

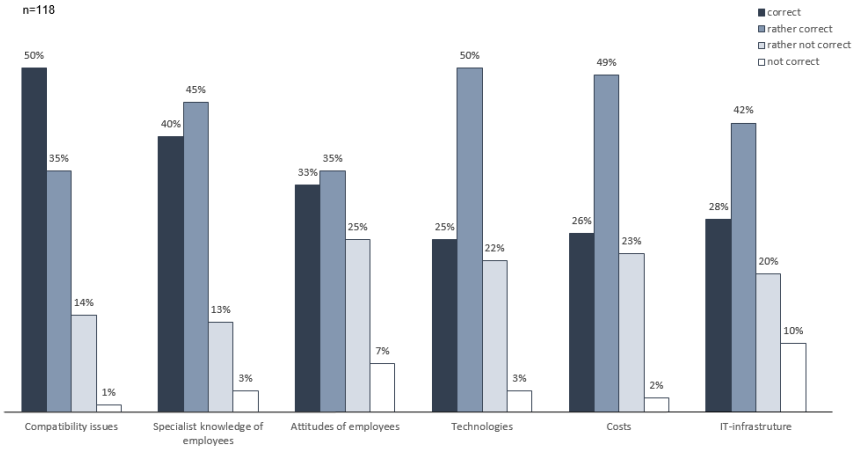


Source: Own diagram

As can be seen in Figure 1, the four choices range from very relevant to not relevant at all. The results derive that the relevance of Industry 4.0 tends to increase with company size. While Industry 4.0 is not very relevant or relevant to any single micro-enterprise and only about 34% of small-scale enterprises, the issue is more important for SMEs. After all, 80% of the medium-sized companies surveyed consider Industry 4.0 to be very relevant or relevant. In addition, as many as 94% of the large industrial companies participating in the survey rated Industry 4.0 as very relevant, or at least as relevant. This leads to the assumption that the importance of Industry 4.0 increases with the size of a company. Since in total for almost two-thirds of the companies Industry 4.0 is very relevant or at least relevant, it can be deduced that the digitization of industry is not only a reality in literature but also in practice.

The following figure shows the companies' results on the challenges they face by implementing Industry 4.0.

Figure 2: Challenges of Industry 4.0



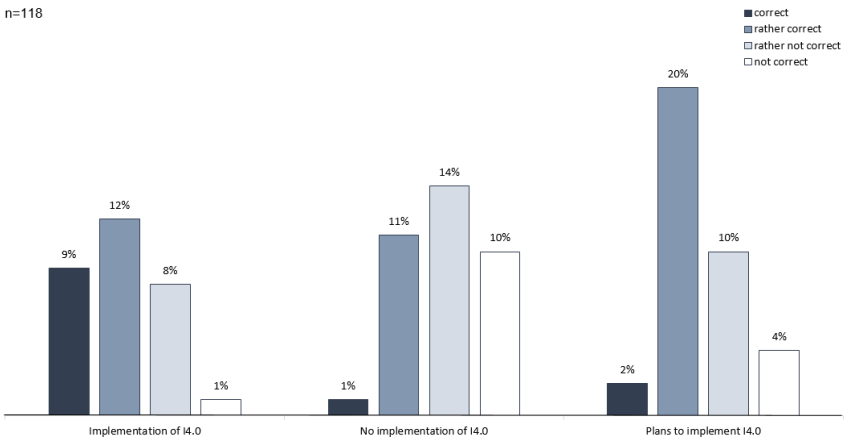
Source: Own diagram

This figure presents that a total of 85% of all 118 respondents fully agree that compatibility issues with existing processes and technologies associated with Industry 4.0 pose a challenge. The graph also illustrates that a lack of specialist knowledge of employees and their negative attitude to change represent a considerable problem. After all, 85% of respondents rated the expertise and 68% the attitude of employees as a challenge. Three-quarters of participants see the lack of maturity of available technologies as problematic. Furthermore, at least the short-term overhead costs caused by digitization is initially a hurdle for companies. More than two thirds of companies consider it a challenge to design the IT infrastructure at the current location Industry 4.0-capable. Hence, it can be deduced that Industry 4.0 represents a major change and challenge for the business and value adding processes.

4.1 Suppliers and Industry 4.0

In order to verify the assumption that Industry 4.0 supports collaborations with suppliers, figure 3 shows the view of the practitioners concerning networking with suppliers.

Figure 3: Networking between suppliers and production



Source: Own diagram

The figure illustrates how many of the companies improve their own service delivery through end-to-end and networked procurement and production processes. Based on a population of 102 companies answering this question, more than 20% use Industry 4.0-technologies. Nearly nine percent of these companies claim that collaborations with suppliers are applied and nearly 12 % choose the assessment more appropriate. Another nearly eight percent tend to disagree with the statement and one percent state that the digital networking of procurement and service delivery is not the case for their company. Hence, it can be deduced that digital networking in the value chain is an impact of companies that apply I4.0. A total of 35% of respondents do not use Industry 4.0 in their company. Of this, almost 24% don't network with suppliers in a digital way. Respondents for whom I4.0 is a future topic account for 35% of the total number of participants. More than 21% of them confirm that their procurement and production are interconnected via integrated processes. Two percent rate the statement as accurate, just under ten percent as rather inaccurate and the remaining nearly four percent as not true. It can be deduced from these results that companies wishing to use Industry 4.0 in the future largely pay attention to the networking processes of procurement and service topics.

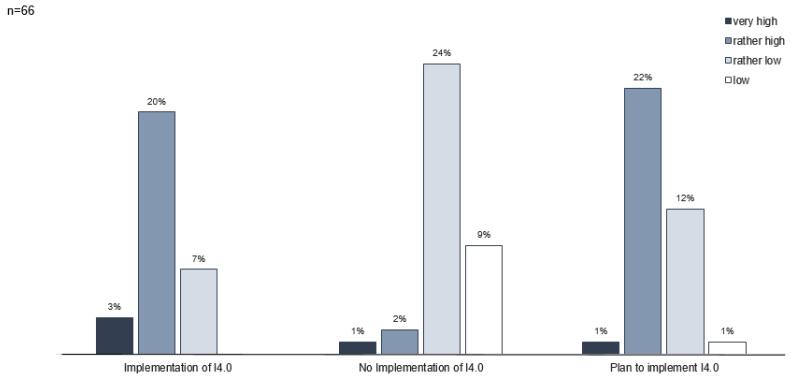
4.2 Employees and Industry 4.0

Subsequently, figure 4 illustrates the level of employee compliance with I4.0 based on the company's use of I4.0.

It can be seen that the approval degree of employees for companies who applied Industry 4.0 tends to be high. Almost 23% of this group can identify with the concept of Industry 4.0 in their work life. The same is valid for companies who plan to implement Industry 4.0. In contrary, employees in companies without Industry 4.0 applications are not convinced of the new paradigm, more than 31% rate the approval degree as low or rather low.

This might lead to the assumption that companies without the use of Industry 4.0-technologies have difficulties to persuade their employees of the potentials in the digitalization. Another conclusion can be drawn for companies which plan to introduce this concept: They try to improve the commitment of the employees regarding to the digital transformation in an active way, so that the future implementation can be successful.

Figure 4: Acceptance of employees on Industry 4.0

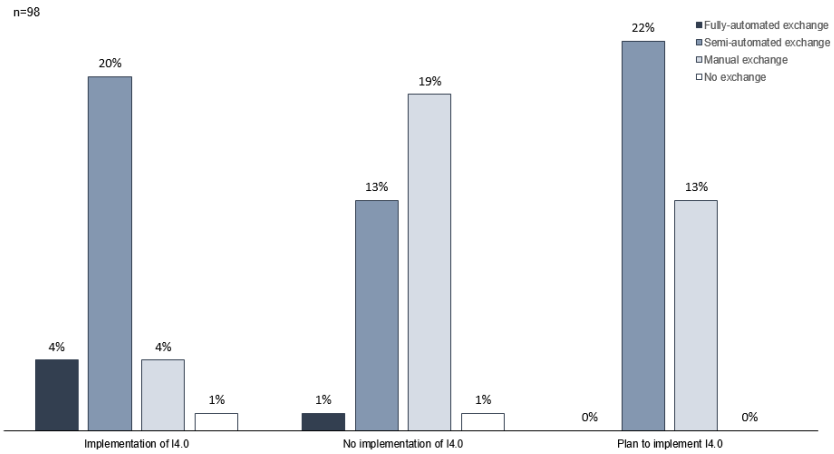


Source: Own diagram

4.3 Customers and Industry 4.0

Figure 5 shows the connection between the information exchange with customers and the use of Industry 4.0 in the companies.

Figure 5: Information exchange towards customers



Source: Own diagram

In this survey already 29% of the particpated companies use Industry 4.0-technologies. Of these, a good 20% said that their communication is semi-automated.

Four percent describe their information exchange as fully automated, also about four percent as manual and only one percent do not exchange information with their customers.

The analysis shows that only a fraction of the companies using Industry 4.0 carry out a fully automated exchange of information with their customers. The majority of these companies exchange information with customers in a partially automated manner. It can be deduced that even if Industry 4.0 has reached the companies, the automation of this process is not completed. Among those companies that do not use Industry 4.0, almost two-thirds say that they execute their information exchange manually and another third works semi-automatically. The remainder describes the exchange of information with customers as fully automated or as non-existent. Most of the companies in which I4.0 is planned have a partially automated exchange of data. The remainder indicates that the information exchange is done manually. From the results it can be concluded that companies which plan to use Industry 4.0 in the future, practice a partially automated information exchange with the customers. This indicates that they have recognized the benefits of digitization. Considering that only five percent of the participants utilize fully automated information exchange processes, enormous potentials are in this context still possible.

5. SUMMARY AND CONCLUSION

Rapid advancements in digital technologies have led to a new era in business life. Industry 4.0 is a synonym for a highly complex network, which interacts with the help of humans but moreover with intelligent objects to optimize the efficiency of the complete value chain.

In this article, we examined the impact of three major stakeholders in the value chain along the horizontal integration of Industry 4.0. In order to give a comprehensive understanding of the framework conditions, a short analysis of literature has been given. Subsequently, an empirical study to show the impact of Industry 4.0 on suppliers, employees and customers has been illustrated. In conclusion, due to the increasing digitalization the cooperation in the value chain, as part of the horizontal integration of Industry 4.0, is crucial. The study showed that suppliers which haven't applied Industry 4.0-technolgoies, don't cooperate efficiently with their suppliers, although literature promises great advances. The participation of employees in the change process is indispensable, since they have to implement this new paradigm into their work life. The study highlights, that without the approval of the employees Industry 4.0 is not in the context of these companies. Furthermore, there doesn't exist a broad distribution of fully automated information exchange processes with the customers in practice, although information of customers can be a sustainable competitive advantage in businesses. However, the digital transformation has an outstanding impact on

References

[1] Abele, E., Anderl, R., Metternich, J., Wank, A., Anokhin, Ol, Arndt, A., Meudt, T., & Sauer, M. (2015). Effiziente Fabrik 4.0: Einzug von Industrie 4.0 in bestehende Produktionssysteme. *ZWF Zeitschrift für wirtschaftlichen Fabrikbetrieb*, 3, 150-153.
[2] Acatech. (2013). Umsetzungsempfehlungen für das Zukunftsprojekt Industrie 4.0 – Abschlussbericht des Arbeitskreises Industrie 4.0.
[3] Acatech. (2015). Umsetzungsstrategie Industrie 4.0 Ergebnisbericht der Plattform Industrie 4.0. Available: https://www.its-owl.de/fileadmin/PDF/Industrie_4.0/2015-04-10_Umsetzungsstrategie_Industrie_4.0_Plattform_Industrie_4.0.pdf
[4] Dowling, G. (2001). *Creating Corporate Reputations*. New York, USA.
[5] Eberhardt, S. (1998). *Wertorientierte Unternehmensführung: Der modifizierte Stakeholder-Value-Ansatz. Wiesbaden*, Germany: Deutscher Universitätsverlag.
[6] Europäische Kommission, *What is an SME?*, Available: http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_de, 2016-12-14.
[7] Gardberg, N. (2001). How Do Indiviuduals construct Corportate Reputations?: Examining the Effect of Stakeholder Status and Firm Strategy on Cognitive Elaboration and Schema Complexity about Firm Performance. *Dissertation at the New York University*. New York, USA.
[8] Göbel, E. (2006). Unternehmensethik: Grundlagen und praktische Umsetzung. Stuttgart, Germany: Lucius & Lucius.
[9] Hermann, M., Pentek, T., Otto, B. (2016). Design principles for Industry 4.0 scenarios. 49th Hawaii *International Conference on System Sciences* (HICSS), IEEE, 3928-3937.
[10] Hofmann, E., & Oettmeier, K. (2017). Industrie 4.0-Anwendungen für die Supply Chain. Logistik und Fördertechnik, 07-08/2017. Available: https://www.alexandria.unisg.ch/250593/1/LO_2017_03_S42-43_GS1_ohne.pdf
[11] Janisch, M. (2001). *Das strategische Anspruchsgruppenmanagement: Vom Shareholder Value zum Stakeholder Value*. Bern, Swiss.
[12] Mast, C. (2013). *Unternehmenskommunikation: Ein Leitfaden*. UVK.
[13] Nagy, J, Olah, J., Erdei, E., Mate, D., & Popp, Jozesef. (2018). *The Role and Impact of Industry 4.0 and the Internet of Things on the Business Strategy of the Value Chain – The Case of Hungary*. Sustainablility, 10. Wiesbaden, Germany: Springer Gabler.
[14] Reinhart, G., Engelhardt, P., Genc, E. (2013). *RFID-basierte Steuerung von Wertschöpfungsketten*, Wt Werkstatttechnik online 103, 104-108.
[15] Roth, A., & Siepmann, D. (2016). Industrie 4.0 – Ausblick. In Roth, A. (Ed.), *Einführung und Umsetzung von Industrie von Industrie 4.0: Grundlagen, Vorgehensmodelle und Use Cases aus der Praxis* (pp. 249-259). Berlin, Germany: Springer Verlag.
[16] Simtion, A. (2016). *Stragegische Stakeholder-Ansprache: Eine Fallstudie zur BtB-Kundenkommunikation auf Messen.* Wiesbaden, Germany: Springer Verlag.
[17] Svendsen, A. (1998). *The Stakeholder Strategy*, San Francisco, USA: Berret-Koehler Publishers.
[18] Tjahojono, B., Esplugues, C., Ares, E., Pelaez, G. (2017). What does Industry 4.0 mean to Supply Chain? Procedia Manufacturing 13, pp. 1175-1182.
[19] Vogel-Heuser, B., Bauernhansl, T., & Hompel, M.T. (2017). *Handbuch Industrie 4.0, Band 1, Wiesbaden*: Springer.
[20] Wagner, G. (2017*). Digital Leadership – die Führungskraft im Zeitalter von Industrie 4.0*. Wiesbaden, Germany: Springer Verlag.
[21] Wellner, K. (2001): *Shareholder Value und seine Weiterentwicklung zum Market Adapted Shareholder Value Approach: Entwicklungslinien, Probleme und Lösungsansätze einer Shareholder Value orientierten Unternehmensführung*. Marburg, Slovenia: Tectum.