

Secondary activities are supporting activities to enable primary activities.

Technological progress and the digital transformation (Hofbauer/Sangl/ Engelhardt 2019) changed business operations heavily. The digitalization changed nearly all areas of activities in execution and performance. This is the reason and motivation to revise the concept of the value chain. All assumptions, prerequisites and consequences will be analyzed.

In chapter 2 the basic concept of the value chain will be explained and the primary and secondary activities will be introduced. The first question of research is whether these activities are still correctly assigned and all activities are properly integrated into the corresponding activities. The second question is about processes as a prerequisite for digitalization.

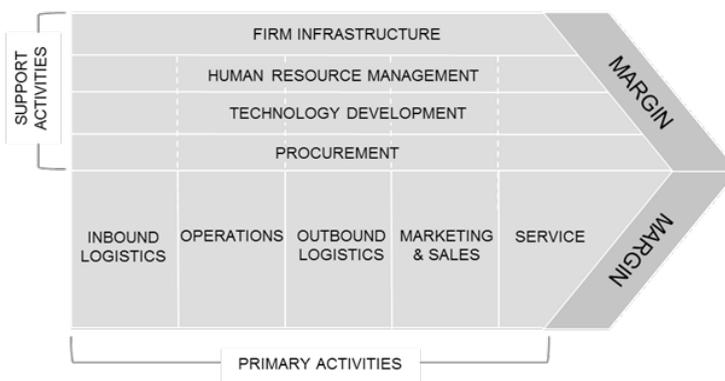
The benefit of this paper is the presentation of an updated conceptual framework of the value chain and the proof of preparedness of the value chain for digital transformation. This is the first consistent revision of the value chain under contemporary conditions in the age of digitalisation. This revised version may become subject of scientific discussion as well as application for industrial implementation.

2. Problem formulation and question of research

Porter's value chain (Porter 1985; 2004) supports the analysis of all activities of a company. Competitive companies have to perform all these activities perfectly in order to create value. Primary activities directly refer to the physical creation of a product and thus are considered to create value. Support activities are necessarily required to enable primary activities. The mentioned value chain (Figure 1) is a composition of business activities and differentiates primary activities and support activities.

Porter's value chain (Porter 2004)

Figure 1



The basic idea of this concept is, that the entire cost position is divided into different activities. Primary activities are supposed to directly create value. The whole area within the picture in figure 1 represents total sales of a company. The margin is calculated as total sales minus total cost of all activities. Innovative products with high value to the customer will push sales figures. The management has to perform all activities in an effective and efficient way at a minimum of cost. Hence the margin and value to the company will raise.

Porter (2004) characterized inbound logistics, operations, outbound logistics, marketing & sales as well as service as primary activities. This approach served as a management tool for 35 years now. The working hypothesis is that there is a need to revise of the value chain under current conditions.

The value chain should include all mandatory steps of value creation of a product in a structured process of activities. These activities refer to each other and they require resources. To be characterized as a primary activity, an activity has to be involved in the physical creation of the product (Porter 2004). Primary activities are characterized to create value which is higher than the cost of these activities. According to this logic the support activities consume resources without creating value. But they are necessary supporters of the primary activities.

The basic motivation of this paper is to examine the composition of the value chain and to verify, whether this tool is still applicable or it has to be adjusted due to changes in technology and transactions in business processes. Depending on the findings it will be considered how to rearrange the value chain. Especially the primary activities are under revision and will be rearranged after careful considerations. The secondary activities will be reviewed and updated, if necessary. The succeeding step includes the digitalization issues.

The first question of research of this paper can be formulated as follows:

Are all the activities of the value chain still correctly assigned and properly integrated? Based on previous work (Hofbauer/Sangl 2018 and Hofbauer/Sangl 2019) the following theses have already been answered:

Thesis no. 1: If it is verified that a value creating activity is missing, then this activity has to be allocated into the value chain at the appropriate position.

Thesis no. 2: If it is proven that a secondary activity is considered to create value, it has accordingly to be integrated into the primary activities.

Thesis no. 3: If it is shown that a primary activity is not creating value, then it has to be placed as a secondary activity.

The second question of research of this paper can be formulated as follows: How can all value creating activities be aligned in an adequate process as a requirement for digital transformation? This question leads to the following theses:

Thesis no. 4: If there is string of value creating activities identified, these

activities should be arranged in a logical and well-structured process.

Thesis no. 5: If there is an underlying process, this process can be digitalized.

3. Literature review and findings for recommendation

In this chapter the theses 1, 2 and 3 will be treated first. The completeness of value creating activities and the classification of selected activities will be argued. The argumentation is presented briefly, because those activities have already been discussed in detail (Hofbauer/Sangl 2018a, 2019). Then the theses 4 and 5 will be processed.

3.1 Reasoning to include a new activity into primary activities

In this chapter the question will be answered, why a so far missing activity will be integrated due to thesis no. 1. The reason is that innovation management is one of the most important entrepreneurial functions. The importance of innovation activities can be argued in terms of facts and figures on a quantitative basis. Large budgets are invested in the search of innovations and there is a huge impact of new products on the competitiveness and profitability of a company. The outcome in terms of new products or applications are inevitable requirements for prosperous enterprises. An innovative enterprise may be characterized by means of: introducing new products, entering new markets, development of additional benefits, increase of market share as well as enlargement of sales and profit (Hofbauer/Sangl 2018, pp. 71-76).

Innovations substantiate competitive advantage (Hofbauer et al. 2009). Innovation management in turn is driven by R&D activities. The outcome of R&D activities are goods, products and services, which provide a specific benefit for the customers. If the benefit is high, the customer is willing to pay a higher price. Hence all activities refer to the value of the enterprise, which is based on the value for the customer. The internal R&D mostly focuses on exploitation, whereas the exploration is more and more done by external sources (Hofbauer/Hofbauer 2016). Companies know that they have to exploit their existing knowledge and resources to achieve competitiveness. In addition to that open innovation (Brening/Hofbauer, 2017) is a major opportunity to get beneficial innovations done within a shorter time frame and with a lower budget. Innovation activities are vital for successful companies and prerequisites for establishing competitive advantage and value added. The empirical data show that innovation activities and corresponding budgets on the input side as well as the outcome of innovation on the sales side have a huge impact on companies and economies. Innovations

in terms of products and services are essential to create value for the company and for the customer (Hofbauer/Gandhi, 2016).

In collaboration with advanced procurement and with suppliers the most important issue is to detect and utilize innovations and innovative potential for the company. Once suppliers are identified, they should be closely involved into the research and development process of the company (Engelhardt/Hofbauer 2017). The utilization of open innovation processes provides additional creative potentials and provides a significant strategic advantage. The most important advantages are reduction of time-to-market and cost-to-market and an enhancement of fit-to-market and new-to-market. The first two issues concerning time and cost are related to advanced access to information about solutions of problems (Reichwald/Piller 2009, p. 172ff). The argumentation in this chapter is a strong indication that innovation should be included as a primary activity.

3.2 Reasoning to allocate a secondary activity as a primary activity

This chapter will answer the question, why a secondary activity should be classified as a primary activity according to thesis no. 2. The reason is that there evolved a strategic shift from simply purchasing to contemporary procurement. Initially Porter argued that procurement is one of the so-called support activities in the value chain. The argumentation of Porter's statement was that procurement is just the operational execution of an order, without adding any value. Porter recognizes a small value contribution of procurement departments for companies, but he argues that the cost proportion of procurement activities is quite low or even an insignificant share in total costs (Porter 2004). But since the late 1980s, when the competitive potential of procurement was emerging, the substance and impact of procurement is increasing. Meanwhile the procurement activities have a huge impact on the company's strategic position regarding benefit, overall costs, quality, innovativeness and its differentiation. So contemporary purchasing and procurement activities can strongly improve the cost and value proposition.

The significance of procurement was increasing over time. In the beginning of industrialization the purchasing department had to buy goods at the lowest price. The main task was effectivity and cost optimization. In the following step of evolution the buying process had to be executed in the most efficient way by introducing a structured process. Thereafter the process optimization focused on suppliers. The intention was to synergize the own supply chain with the value chains of the suppliers. Thus the performance of suppliers can be raised and discontinuities in the supply chains can be avoided. The latest step was

about integration management. So suppliers can be integrated in a vertical and horizontal way (Hofbauer/Sangl 2016).

In contemporary practice procurement is involved right from the very early beginning of the product development. This involvement ranges from advising the internal development department to supplier selection for utilization of external potentials (Hecht/Goldbach 2017). By doing this, the modern procurement contributes to a product's concept and so to its physical creation and value generation. These activities include frontloading, innovation management, and selection of (development) suppliers, production materials as well as manufacturing equipment and processes. In doing that, procurement operates as the link between the company and the relevant sourcing markets. Qualitative issues may arise from the shift towards strategic tasks like forward sourcing and frontloading. All these topics contribute to the value added. The importance and the impact of contemporary procurement was already shown and argued in detail in other publications (Hofbauer/Sangl 2017).

The scope of procurement is directly related to corporate objectives (Hofbauer 2017, Hofbauer/Hecht 2017, Hofbauer et al. 2016). Important objectives refer to assurance of quality, capability of suppliers and flexibility. These objectives are important to ensure continuous production, reliable supply with raw material and other bought-in parts, modules and systems. The increasing flexibility is a procurement objective as well, because this helps the OEM to react adequately on external influences. There is no doubt that procurement is nowadays a decisive activity and contributes a noticeable portion to the value added within the value chain of a company (Hofbauer/Sangl 2017). This becomes obvious as we take a deeper look into a typical cost structure. The value of the sourced material (including trading goods) ranges between 50 and 70% of the gross production value.

Different market forces put pressure on companies and competitors and caused the change from traditional purchasing towards a value creating character of procurement management (Hofbauer 2017). Many companies consider the leverage effect of procurement to be very important. A survey among nearly 400 companies of the Swiss Mechanical and Electrical Engineering Industries certifies the high importance of procurement: 60% of them indicate, that the optimization of the procurement activities will have a crucial importance to enhance sourcing efficiency and achieve noticeable cost reduction (Deloitte 2015).

In combination with the forward sourcing task of procurement there is a strong interrelation between R&D and procurement (Hofbauer/Wilhelm 2015). Both have to deal with R&D duties and challenges, both have to deal with innovations. Internal innovations have to be integrated into specifications for

goods to be sourced from outside. Furthermore the procurement activity has to look for external potentials and innovations to be applied for utilization in new products.

The arguments outlined in 3.1 und 3.2 strongly suggest to introduce a new activity in the beginning of the updated value chain. This compound activity consists of procurement in strong collaboration with innovation management. As explained above, both activities have an impact on the following value creating activities.

3.3 Reasoning of characterizing a primary activity as secondary activity

This chapter answers the question, why a primary activity after revision should be recognized as a secondary activity due to thesis no. 3. The reason is that for the classification as a primary activity it is essential, whether there is a value added or not. If not, this activity should be reclassified as secondary activity. The examination of logistic activities validates a reclassification, because of a lack of value creation.

The logistic activities are twofold: *Inbound logistics* cover receiving and storing of goods, these activities include the internal distribution of inputs, such as material handling, warehousing, vehicle disposition, inventory control and returns to suppliers. The *outbound logistics* put the relation to customers, retailers and wholesalers in execution. The company's offer has to be delivered, these activities contain order processing, storage, scheduling, warehousing, picking and physical distribution to customers as well as delivery vehicle operations.

Technological progress in terms of automatization as well as immediate accomplishment of activities changed the whole supply chain. These processes are highly automated nowadays and changed the configuration and workflow of the supply chain. The significance of logistic activities decreases in times of digitalization with automated supporting processes and sensor controlled internal supply as well as external supply chains across companies and modes of transport. In the near future these activities will be executed by autonomous systems. This is why added value to the product can hardly be observed anymore. Inbound logistics like receiving goods, storage, transportation and distribution of input factors are needful, but an increase in value added is not observable. The same argumentation can be provided for outbound activities. Consignment, stockpiling, collection, intra-plant logistics and distribution is quite needful as well, but value added in these activities is hardly to find, too. In consideration of these tremendous changes in technology and circumstances it is advisable to

have a closer look on the logistic activities. There are qualitative and quantitative reasons to be mentioned:

The basic *qualitative* argumentation is based on the work of Taiichi Ohno, former head of production at Toyota (Ohno 1988). He evaluated activities with regard to the additional value of respective activities. In doing this, he identified efficient principles in production technology. The ambition was to identify the activities, which facilitate effectiveness, meaningfulness, usefulness and feasibility. Ohno also introduced the term MUDA, which was the denomination for unnecessary effort or needless operating expense (Ohno 1988). His intention was to identify and eliminate unnecessary efforts in order to increase profitability. Coming from this perspective, it is major to understand that unnecessary means useless for value creation. It may be necessary to execute a specific activity, but in terms of value creation it can be considered as waste. It is a matter of fact that for the value of a product it makes no distinction by whom, where, how often and by what vehicle a specific item has been transported, stapled, collected or stored. Added value cannot be perceived.

Ohno identified seven types of unnecessary activities: transportation, inventory, overproduction, waiting, over-processing, defects and motion. The first three of them directly relate to the value chain. Beyond doubt these activities are requested to perform operations, but they are useless for value creation. In times of sensor controlled, connected and process optimized conditions within Internet of Things, there will be a huge potential to optimize logistic activities on a huge scale. By means of digitalization in the fourth industrial revolution operations can be executed and entire processes can be realized in an optimized way. Especially transportation, inventory and overproduction can be reduced to the minimum.

The *quantitative* reasoning refers to the percentage of logistic costs on total cost. There is only few statistical data, but one figure shows that the portion came down from 15% in 1990 to about 7% in 2008 (Handelsblatt 2009). In innovative industries like car manufacturing, electronics and precision engineering the portion already realized a level of 4.5% in 2012 (Hofmann et al. 2012). In the long run, the portion of logistic cost is estimated to reach a level of 3% (Fraunhofer 2017). So the absolute basis for cost savings through automation is very low and almost exploited. Thus it can be stated that the share of logistic costs is declining and with it the significance of logistic. 28% of surveyed industrial companies did not even know their logistic costs in detail. This finding emphasizes that the management attention on creating value has clearly shifted away from logistic activities. The costs of logistic activities are primarily driven by increasing cost of

energy, fuel and transport prices as well as rising personnel expenses.

On the basis of the *qualitative* and *quantitative* argumentation, the statement can be evolved that logistic activities have negligible impact on value creation. Because of these reasons it is evident to shift the logistic activities from the primary activities to the secondary activities.

3.4 Process-oriented activities in innovation management

The innovation management process will be shown exemplarily as a string of activities in this chapter. According to thesis no. 4, a string of value creating activities can be clearly identified in literature. These activities should be arranged in a logical and well-structured process. With the help of a systematic and process-oriented innovation activity promising ideas shall be detected by purpose rather than by chance. Figure 2 gives an overview of the multitude of innovation process models found in literature.

Selected innovation processes in academic literature

(Hofbauer/Wilhelm 2015, p. 10)

Figure 2

Authors	Phase Organization						
	1	2	3	4	5	6	7
Hofbauer/Sangi (2006)	Strategic Orientation	Idea Management, Innovation	Conception, Transformation	Product Development	Market Testing	Market Development	Product Lifecycle Management
Hauschildt (1997)	Idea	Detection/ Observation	Research	Development	Invention	Implementation	Exploitation
Reeder/Brierty/ Reeder (1987)	Idea Generation	Screening	Idea Evaluation	Preliminary Business Plan	Product Development and Testing	Formal Business Plan	Market Launch
Geschka/ Laudel (1992)	Strategic Orientation	Idea Finding	Selection of Proposals	Task Elaboration	Task Specification	Realization	
Brockhoff (1992)	Project Idea	Research & Development	Invention	Investment	Implementation		
Cooper/ Kleinschmidt (1991)	Idea	Idea Selection	Development	Testing and Validation	Production and Market Launch		
Trommsdorff/ Schneider (1990)	Problem Recognition	Idea Generation	Screening and Analyzation	Development	Testing and Validation		
Thom (1992)	Idea Generation	Idea Acceptance	Idea Realization				
Müller/ Deschamps (1986)	Invention	Incubation	Implementation				

The underlying idea and thus the creative element of innovation is the key component across all considered processes. The final stage is mostly characterized by the implementation into the market. An upstream positioned strategic orientation, however, is only the starting point for few authors. But nonetheless it is an important requirement to lead the activities into the right direction of value creation. The Integrated Product Management Process (IPMP)

by Hofbauer/Sangl (2018) is considered best suited for this research article in order to cover the widest range of innovation management. This process starts with the activity strategic orientation and ends up with lifecycle management.

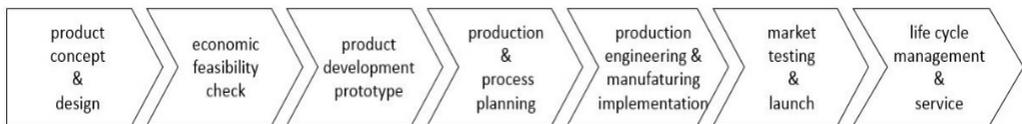
There is a commonality between above-average successful enterprises, which differentiates them strikingly from those less successful: no matter what situation they are in, they are never content with just sticking with the company's present success (Bailom et al. 2013). This continuing willingness to implement changes is considered by the authors as the most important property of particularly successful companies. Thereby all related activities have to be executed in the most effective and efficient way to create competitive advantage and to earn profits. Value can be created by executing these activities better, faster, and with lower cost expenditure than competitors. The execution is based on clearly defined value creating activities, which are connected continuously without any interruption (Hofbauer/Sangl, 2018, pp. 309-321).

According to a well-proven IPMP model, different process steps can be identified beginning with the product concept up to life cycle management (Hofbauer/Sangl, 2018, p. 341). Figure 3 displays more detailed process phases of value creation, which have to be executed and processed.

Activities in technical product management (own work)

Figure 3

Technical Product Management (TPM) is also referred to as Product Lifecycle



Management (PLM) which is defined as the activity of managing a company's innovation from womb to tomb, in the most effective way.

3.5 Digitalization of the value chain

As demonstrated in 3.4, there is an underlying process with distinguishable activities. Thus the necessary requirement for digitization is fulfilled and this process can be digitally transformed. In this chapter it will be demonstrated that the concept of the digital twin meets perfectly all requirements to be applied in order to connect all value creating activities and even foster the value generation.

For simplicity reasons similar activities are combined and reduced to a four step model:

Design covers the first three activities of figure 3. In this early stage of

the innovation process efforts are especially required from innovation (internal as well as open innovation) and procurement (external). This is why this initial activity is a combination of innovation management and procurement. Operation includes the activities 4 and 5 of figure 3. Utilization represents the activity 6 from the customer's point of view. This means the sales activity in the value chain from the company's point of view. And, last but not least there is the after sales and service phase as the activity no. 7.

Simplified version of TPM value chain (own work)

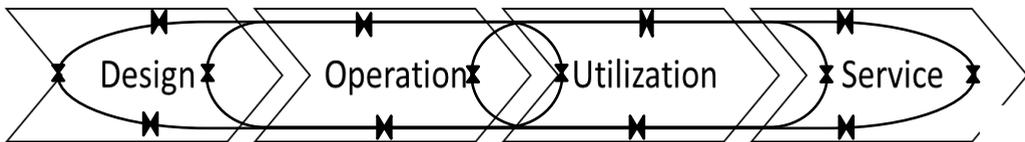
Figure 4



Given this version in figure 4, the question of the valuable integration of digital twins into the TPM process arises. As already outlined, the TPM contains all required value-creating activities of a product from the beginning to the end of the product life (Hofbauer/Sangl, 2018). Figure 5 shows the procedural interlinkage of all activities necessary for the value stream. This means that data are not only processed forward to be used for optimization, but also processed in a feedback loop with all advantages big data can provide.

Interlinkage of activities in TPM value chain (own work)

Figure 5

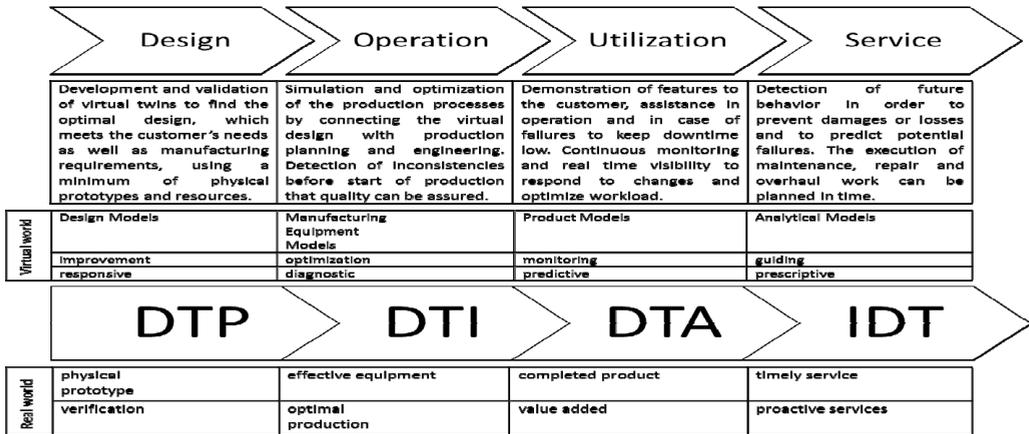


The data interlinkage can be effected for example by the digital twin. There are four different types of digital twins to be differentiated: Digital twin prototype (DTP), this type comprises all relevant information, which is necessary to create and specify a physical version. This virtual twin is created before there is a physical product. Digital twin instance (DTI), this type is related to a defined corresponding real-existing product. It represents this physical object throughout the whole lifecycle under all conditions and they can communicate to each other. Digital twin aggregate (DTA), this type is the aggregation of more than one corresponding DTIs. This twin has access to all related physical twins and thus generates a more significant database. In addition, there is the intelligent digital twin (IDT), this one is the most sophisticated one and works on the basis

of artificial intelligence. The character is proactive and prescriptive. Figure 6 displays the four phases of the TPM model and the corresponding types of digital twins for perfect application (Hofbauer/Sangl/Engelhardt 2019).

Activities in TPM and corresponding application of digital twins (own work)

Figure 6



4. Solution statement and proposal for digital transformation

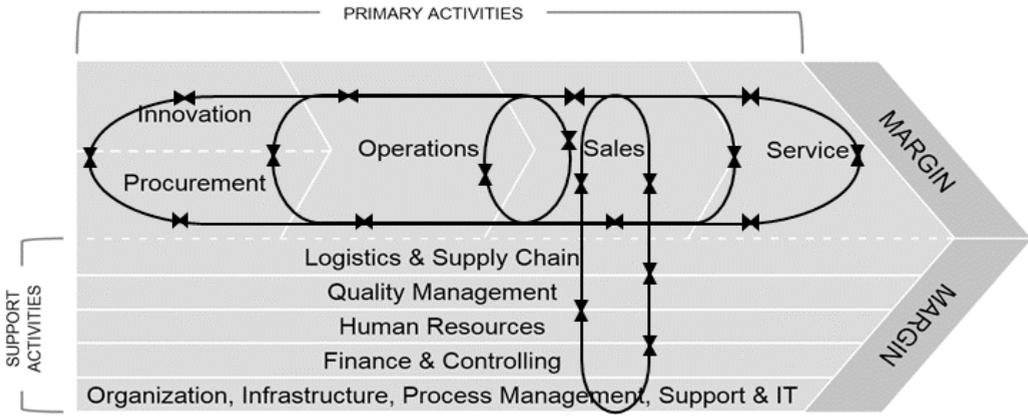
Summarizing all outlined arguments and observing all aspects a new proposal is made for the reviewed value chain. The principle of Porter's original value chain is not changed, some activities are newly arranged according to the outcome of chapter 3. Figure 7 shows the composition of the primary activities, where the support activities are stated below as a supporting platform where the primary activities are based on.

Besides the primary activities there are secondary activities that all businesses must include to some extent. These supporting activities are mandatory prerequisites for the fulfillment of the primary activities and the completion of the value chain process. These activities are described in detail in Hofbauer/Sangl (2019).

Support activities assist the execution of all primary activities and the realization of each other by providing resources in terms of employees (HR) or money (finance), transport inside and outside the firm (logistic and SCM) or providing the basic infrastructure of the company. The support activities facilitate the primary functions and comprise the following: logistics and supply chain management, quality management, human resources, finance and controlling as well as organization, infrastructure, process management, support

New proposal of the reviewed value chain prepared for digital transformation (own work)

Figure 7



and IT. Especially the IT is responsible to manage the data interchange and to make it happen in feed forward and feedback loops, as well as to apply artificial intelligence to collected data. As displayed in figure 7 the interconnection combines primary activities with each other and on request and for support primary activities with the supporting secondary activities (exemplarily shown for sales activity) as well.

5. Summary and Conclusion

The concept of the value chain is a reasonable tool to assess competitive advantage. As time changes, methods and tools have to be changed, because business processes and related activities are adapting and enhancing rapidly. The corresponding impact on the competitive advantage and relevancy on value creation is changing, too. Especially in the age of digital transformation and Internet of Things it is important to review all influencing factors. Competitive advantage is driven by the right execution of the primary activities.

Following this, the first issue of research is about the determining activities. It can be summarized that innovation management and procurement are contributing remarkably to competitive advantage by introducing new products, reducing cost, shortening time to market, reducing risks, raising performance and quality as well as increasing customer satisfaction and loyalty. The first conclusion is to consider innovation management and procurement as a combined primary activity. The second conclusion is that the logistic activities

are nowadays not contributing any more to value creation and thus should be reclassified as a secondary activity.

The second issue of research was about the process-oriented combination of value creating activities and their arrangement to be prepared for digitization. The literature research confirms that there is a broad variety of activities combined to an integral process. Based on this finding, one innovation process was chosen for further explanation. Using this example, the general preparedness for digitization in general and the application of the digital twin in particular was outlined.

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სტატიის მიზანია ციფრული ტრანსფორმაციის თვადსაზრისით ღირებულების ჯაჭვის ახალი კონფიგურაციის დანეგვა. ღირებულების ჯაჭვი – მენეჯმენტის უმნიშვნელოვანესი კონცეფციაა. დიგიტალიზაციის დროს ეს კონცეფცია უნდა იქნეს მოხვედრადი სხვადასხვა კომპონენტის შემადგენლობისა და უხითიეთქმეების თვადსაზრისით. შესაბამისად, სამეცნიერო მიდგომა უნდა იყოს კონცეპტუალური და ანალიტიკური. დასაწყისისთვის მოწმდება და წყდება ღირებულების შექმნის საქმიანობა, შემდეგ კი – დოკუმენტირება და უხითიეთქმეება გადამოწმდება, ხოლო დიგიტალიზაციის საფუძველი. სტატიის მიზანია ხელი შეუწყოს ღირებულების ჯაჭვის თანამედროვე მიდგომას, ციფრული გახდაქმნით აკადემიური დისკუსიის კომბინაციაში. საქმიანობის ხეობანიების დასაბუთება კი უნდა ემყარებოდეს საფუძვლიან თეორიულ და სტატისტიკურ გამოკვლევას.

კონკურენტული უპირატესობა კონკურენტულ ბაზრებზე კომპანიების გადახრენის აუცილებელი წინაპირობაა. პოტენცია ღირებულების ჯაჭვი შემოიღო 1985 წელს, ხოლო კომპანიის ბიზნესის საქმიანობის ანალიზის ინსტრუმენტი, კონკურენტული უპირატესობების დასადგენად. ის განახლავებს კომპანიის ბიზნესსაქმიანობას პიხვედად და მეოხად საქმიანობად. პიხვედადმა საქმიანობამ უნდა შექმნას ღირებულება, მეოხად საქმიანობა კი ძიითადი საქმიანობის დამხმარე ღონისძიებაა.

ტექნოლოგიუმა პროგრესმა და ციფრულმა ტრანსფორმაციამ (Hofbauer / Sangl / Engelhardt 2019) მნიშვნელოვნად შეცვალა ბიზნესის ოპერაციები და საქმიანობა თითქმის ყველა სფეროში. ეს ახის მიზეზი და მოტივაცია, ხათა გადაიხედოს ღირებულების ჯაჭვის კონცეფცია, გაანალიზდეს ყველა დაშვება, წინაპირობა და შედეგები.

აღნიშნულთან ეხთად სტატიაში ახსნილია ღირებულების ჯაჭვის ძიითადი კონცეფცია და შემოტანილია პიხვედადი და მეოხადი საქმიანობა. კვლევის პიხვედი საკითხია: აქტივობის სწოხად შეიჩევა და მისი სათანადოდ ინტეგრირება შესაბამის საქმიანობასთან. მეოხე საკითხი ეხება პროცესებს, ხოლო დიგიტალიზაციის წინაპირობას.

დაბოლოს, წინამდებარე სტატიის სიახლეა ღირებულების ჯაჭვის განახლებური კონცეპტუალური ჩახროს წახმოდგენა და ციფრული ტრანსფორმაცი-

ისთვის ღირებულების ჭაჭვის მზადყოფნის მტკიცებულება. ეს აჩის დიგიტალიზაციის ეპოქის თანამედროვე პირობებში ღირებულების ჭაჭვის, ფაქტობრივად, პიხვედი თანმიმდევხუდი გადასინჯვა, ანუ ეს შესწოხებული ვეხსია, ხაც შეიძლება გახდეს სამეცნიეხო განხიღვის საგანი, აგხეთვე, გამოყენებულ იქნეს ინდუსტრიაში ხეადრიზაციისთვის.

საკვანძო სიღყვები: ღირებულების ჭაჭვი, ციფრული გახდაქმნა, საქმიანობა, ინოვაცია, ტექნოღოგია.

JEL Codes: O30, O31, O32, O33