



SOCIAL PERCEPTION OF DIGITIZATION IN GERMANY

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ABSTRACT

Today's industry is historically shaped by the transformation from a seller's market to a buyer's market. Taylor and Ford are the pioneers of mass production. This principle is still used today in the production of goods. However, in this time companies face the increasing competitive pressure and the circumstances of this buyer's market through strong product differentiation and the development of new markets. Within this change, new challenges arose which made economic production more difficult. These include, for example, decreasing batch sizes and the parallel coordination of various orders due to the strong diversification of the product range. The consequences are increased throughput times and a decreasing adherence to delivery dates [20]. Digitalization enables the planning and control of production to be simplified and made more agile in order to meet the requirements of customer-specific production. Business processes can be made transparent, more efficient and more effective through digitalization and should allow companies to increasingly deal with the actual value-adding activities such as product development in the future [18]. This review examines the understanding of digitization in German economy. Furthermore, the importance of digitization in society is presented.

KEYWORDS

digitization, economy, Industry 4.0, production, manufacturing, information systems.

1. Introduction

From a technological point of view, digitization means the conversion of analogue data, information or signals into digital form. Data are formal representations of information that are suitable for interpretation, processing and communication. The structure of data is mostly characterized by the fact that the content is encoded in characters and these characters are subject to a set of rules or a syntax. If this data also has a semantic or interpretable meaning, it is referred to as information. If information is interconnected and new information can be generated by these interconnections, it is called knowledge. Figure 1 shows this connection and also illustrates the significance of this causal chain for the development and maintenance of competitiveness through the generation of competencies and the influence of human action. A signal is ultimately the representation of information and is described by a physical quantity in which "[...] one or more parameters (so-called information parameters) carry information about one or more variable quantities" [10]. Analog signals are characterized by their continuous physical description, whereas digital signals have been transformed by digitization mechanisms into discrete (discontinuous) signals with limited information parameters within certain limits [10]. The use of analog signals has been replaced by the use of digital signals with the exception of some unavoidable niches [12]. In society and industry, dig-

itization also means the conversion of analogue data such as text, images and sound into digital data. These data can be interpreted and displayed by certain terminal devices or applications on the basis of their specific format. Furthermore, the process of digitization in today's understanding of ergonomics consists not only of the transfer of information from an analogue to a digital state, but also of all activities for the introduction of digital technologies and the resulting changes in the company [2].

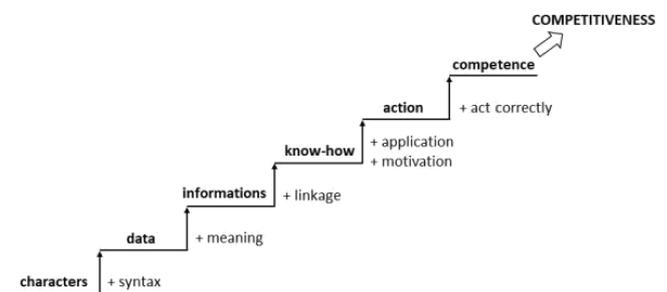


Fig. 1. Link between signs, data, information and knowledge on the road to competitiveness.

2. Role of an information system

An information system creates the basic prerequisite for digitization. In this respect, it is an elementary component in human-machine communication for the optimization of business processes. Figure 2 shows the rela-

tionship between data, information and the knowledge derived from it along a corporate value-added process. A current industrial problem is an abundance of existing information. An efficient and effective information system is based on knowledge of information needs, information supply and information demand to support business processes [6]. An information system is a socio-technical system that

1. the right information,
 2. to the right extent,
 3. in the correct form (preparation),
 4. at the right time,
 5. in the right place
- and partly automated [1].

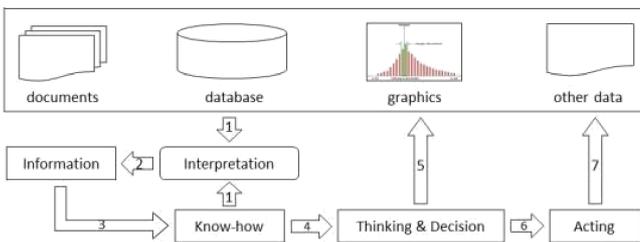


Fig. 2. Data relations.

In order to determine the need for information and the demand for information, the IT industry has undergone a change from function to process orientation. As a result, cross-departmental functions and dependencies of a company’s business processes are sufficiently analyzed and logical relationships between data and information are identified, which can lead to increased quality in terms of data consistency, redundancy and data integrity [16]. From the analysis and a corresponding representation of the processes, the requirements for the necessary software can then be determined [8]. Knowledge of the organization, its structure, the people working in it and their tasks, as well as general business process knowledge with the correlating data, in addition to hardware and software, are necessary building blocks of an information system [9]. Developments in engineering in general and, above all, in the demands placed on today’s engineers make the use of information systems indispensable. Due to its cross-functional activities, an information system must be able to support processes in all phases of the product life cycle [7]. Not only are planning, control and coordination tasks supported, but all employees should also be supported in analyzing problems, gaining an overview of complicated facts and developing products [16]. Due to the process proximity of an information system, companies renew their user systems every 7–10 years on average. It is therefore advisable to analyze and evaluate the processes that have taken place to date at least during this period [1].

3. Importance of digitization

Digitization increasingly affects value-adding areas and processes of a company’s product and service cre-

ation [15]. So far, the focus has been on the introduction of information systems to increase efficiency in company-internal administrative processes. The trend towards networking with customers or suppliers along the entire supply chain is currently intensifying [2]. Digitalization enables processes to be designed more effectively and efficiently and thus to be mastered. As a result, data today forms the foundation for economic action on the market [21]. The use of analog data must be questioned if it subsequently has to be digitized, analyzed and evaluated in a complex manner or if analog media are created in a complex manner that are not process-related and therefore may not contribute to value creation [13]. In addition to pure process optimization, the switch to digital processes enables completely new business models to be set up while products remain the same [5]. With regard to the current highly sought-after topic of “Industry 4.0”, it should be noted at this point that self-regulating and self-optimizing production can only take place if there is a digital overall image of production and its processes. In the context of Industry 4.0, digitization is no more, but above all no less than the basic prerequisite for this trend [3]. Both intralogistics and interlogistics processes benefit from digitized processes in many ways and in a wide variety of corporate functions (Fig. 3). These advantages are offset by a corresponding response from industry. According to a Deloitte study, almost 80% of medium-sized industrial companies state that the importance of digitization is important (45%) or very important (33%) for them [5]. Companies are increasingly trying to be process-oriented and create transparency about their processes. To this end, companies are increasingly using targeted digitization applications. In the course of the study, 41 companies were also asked which drivers they consider to be exactly relevant that lead to the digitization of their processes. The pure optimization of processes was rated as an internal driver at 76%, more than 50% behind the next point mentioned. In the case of external drivers, customer requirements were ranked first with 56% [5].

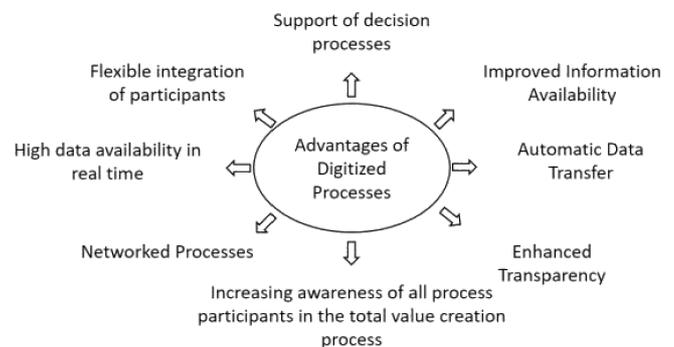


Fig. 3. Advantages of digitization.

In the field of ergonomics, digitization offers potential for increasing work effectiveness as well as work efficiency. The strain on the employee and the subsequent individual strain on the part of the technical applica-

tions could be reduced in the course of digitization [11]. For a successful digitization process, it is recommended that digitized work should be positively connected with fun by the employee. Not all long-standing employees or previously stable processes have to be digitized immediately and, if necessary, changed beforehand. Often small steps are sufficient for the change through digitization [19]. The digital transformation process is a company-wide and holistic change process and is therefore the responsibility of the company management. Management should analyze and take into account both the benefits and the effort and fears involved [4].

Another important point is that digitization is an indispensable prerequisite for companies wishing to exploit the potential of e-business. With regard to the economic dimension, the electronic capture, processing and dissemination of digitized information means considerable economies of scale and cost advantages for the company. The ability to transmit and make available standardized information in near real time also leads to the control of internal business processes through the use of more and more up-to-date information [14]. Despite this knowledge of many entrepreneurs about the multiple benefits of digitization, several studies show that companies often do not dare to take the step into implementation once the potential has been identified [17].

4. Conclusion

Data is the basis for deriving process information and process knowledge. Decisions and actions can be derived on the basis of this information. The digital data are considered to have special advantages. Within the framework of an information system, data is organized in a process-oriented manner and forms the basis for the support of complex engineering activities. In addition, companies confirm the pure process optimization as well as the fulfillment of customer requirements as the most important drivers for the digitization of business processes. Coded data are particularly suitable for effective digitization because they facilitate automated processing. In addition, both economies of scale and cost advantages are foreseeable through the use of digitized information. Security concerns, high investment costs and the high complexity and speed of digital technologies are the greatest obstacles to the use of digital technologies after medium-sized businesses. In the course of the digitization process, employee competencies should be taken into account in order to promote acceptance. At the same time, it is important to prepare the organization for digitization. The planning should identify which competencies are necessary for successful digitization and which already exist.

References

- [1] Abts D., Müller W., *Grundkurs Wirtschaftsinformatik. Eine kompakte und praxisorientierte Einführung*, 9. Auflage. Wiesbaden: Springer Fachmedien Wiesbaden, 2017.
- [2] Bengler K., Schmauder M., *Digitalisierung*, Zeitschrift für Arbeitswissenschaft, 70, 2, 75–76, 2016.
- [3] Bernhard R., *Digitalisierung. Selbst ist die Produktion*, [in:] Sonderheft in Logistik Heute – Software in der Logistik, pp. 12–13, 2017.
- [4] Cole T., *Digitale Transformation. Warum die deutsche Wirtschaft gerade die digitale Zukunft verschläft und was jetzt getan werden muss!*, 2nd ed. München: Franz Vahlen, 2017.
- [5] Deloitte & Touche GmbH Wirtschaftsprüfungsgesellschaft (Hg.), *Digitalisierung im Mittelstand. Aus der Studienserie "Erfolgsfaktoren im Mittelstand"*, Unter Mitarbeit von Jürgen Reker und Klaus Böhm, proofed: 24.04.2017, 2013.
- [6] Dippold R., Meier A., Schneider W., Schwinn K., *Unternehmensweites Datenmanagement. Von der Datenbankadministration bis zum Informationsmanagement*, 4. überarbeitete und erweiterte Auflage. Wiesbaden: Vieweg+Teubner Verlag (Zielorientiertes Business Computing), 2005.
- [7] Eigner M., Gerhardt F., Gilz T., Mogo Nem F., *Informationstechnologie für Ingenieure*, Berlin, Heidelberg: Springer Berlin Heidelberg, 2012.
- [8] Grupp B., *Das IT-Pflichtenheft zur optimalen Softwarebeschaffung von der Softwareevaluation zum Vertragsabschluss; Entscheidungshilfen zur Auswahl von Anwendungssoftware*, 2. überarb. Aufl. Bonn: mitp-Verl, 2003.
- [9] Hansen H.R., Neumann G., Mendling J., *Wirtschaftsinformatik. Grundlagen und anwendungen*, 11. völlig neu bearbeitete Auflage. Berlin, Germany, Munich, Germany, Boston, Massachusetts: De Gruyter, 2015.
- [10] Heinrich B., Linke P., Glöckler M., *Grundlagen Automatisierung*, Wiesbaden, Springer Fachmedien Wiesbaden, 2015.
- [11] Hoppe A., *Technik im Wandel – Technikstress als Folge?!*, [in:] Annette Hoppe (Hg.): Arbeit und Technik im Wandel, Aachen: Shaker (Wissenschaft im Dialog, 1), pp. 23–25, 2012.
- [12] Karrenberg U., *Signale – Prozesse – Systeme*, Berlin, Heidelberg: Springer Berlin Heidelberg, 2012.
- [13] Kletti J., Schumacher J., *Die perfekte Produktion. Manufacturing Excellence durch Short Interval Technology (SIT)*, Berlin Heidelberg: Springer Verlag, 2014.
- [14] Kollmann T., *E-Business. Grundlagen elektronischer Geschäftsprozesse in der digitalen Wirtschaft*, 6. überarbeitete Auflage. Wiesbaden: Springer Gabler (book), 2016.
- [15] Kreutzer R.T., Neugebauer T., Pattloch A., *Digital Business Leadership. Digitale Transformation – Geschäftsmodell-Innovation – agile Organisation –*

- Change-Management*, Wiesbaden: Springer Fachmedien Wiesbaden, 2017.
- [16] Laudon K.C., Laudon J.P., Schoder D., *Wirtschaftsinformatik. Eine Einführung*, 2. aktualisierte Aufl. München: Pearson Deutschland (IT), 2010.
- [17] Leyh C., Bley K., *Digitalisierung. Chance oder Risiko für den deutschen Mittelstand? – Eine Studie ausgewählter Unternehmen*, HMD, 53, 1, 29–41, 2016.
- [18] Sauter R., Bode M., Kittelberger D., *Wie Industrie 4.0 die Steuerung der Wertschöpfung verändert*, Hg. v. Horváth & Partner GmbH. Stuttgart, 2015.
- [19] Schmitz A., *Digital-Gipfel 2017: Was die Digitalisierung noch bremst*, Hg. v. SAP SE/SAP News Center. Online verfügbar unter <http://news.sap.com/germany/digital-gipfel-2017-digitalisierung/>, last update 13.06.2017, proofed 22.06.2017, 2017.
- [20] Wiendahl H.-P., Reichardt J., Nyhuis P., *Handbuch Fabrikplanung. Konzept, Gestaltung und Umsetzung wandlungsfähiger Produktionsstätten*, 2. überarb. u. erw. Aufl. München, Wien, Hanser, 2014.
- [21] Wittpahl V. (Hg.), *Digitalisierung. Bildung/Technik/Innovation*, Berlin, Heidelberg: Springer Vieweg (iit-Themenband), 2017.