Main impacts of digital innovation on the purchasing department in healthcare organizations

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ABSTRACT,

Over the past years, implementing digital technologies in organizational practices has become a trend. Governments and other technological companies are investing a huge amount of money in digital health technologies. Current literature suggest that digital innovation can offer multiple opportunities to the purchasing department, such as enhanced efficiency, facilitated cooperation with network partners, and greater transparency and visibility in healthcare organizations. However, these organizations also face challenges that need to be overcome due to the implementation of digital technologies, such as security issues and new competencies required from employees. This study investigates the impact of digital innovation on the purchasing department, specifically in healthcare organizations. Therefore, a case study research was carried out, containing semi-structured interviews. The findings show that the main opportunities brought by digital innovation were enhanced efficiency, transparency and a reduction in errors. On the other hand, healthcare organizations faced challenges due to the implementation of digital technologies as well. The main challenges identified were the functioning of the application, a knowledge-gap and issues regarding information security and privacy. This study concluded that the opportunities outweigh the challenges.

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Procurement Process, Purchasing Department, Supply Chain, Healthcare Organizations, Digital Innovation, Digital Technologies, Industry 4.0.

1. INTRODUCTION

1.1 Academic Relevance

For many decades the total government spending in the Netherlands has consisted for a large part out of health spending. Health spending spans the final consumption of healthcare goods and services, including personal healthcare and collective services, but excluding spending on investments (OECD, 2022). The Dutch healthcare expenditures account for 26.3% of the total government spending in the yearly budget of 2022, which is equal to 93 billion Euros (Rijksoverheid, 2022). Healthcare expenditures are expected to increase faster than the GDP over the period of 2008 to 2025. One of the main reasons for this are the improvements in healthcare, which were needed in order to improve the Dutch healthcare system (Rijksoverheid, 2021). In 2018 this resulted in the Netherlands being ranked 10th out of 31 European counties for highest healthcare spending (CBS, 2020). An important improvement that has been made in healthcare is the implementation of digital innovation (Ricciardi et al., 2019).

Not only the government, but also start-ups and established technological companies are investing a considerable amount of money in digital health technologies. The healthcare sector is becoming increasingly dependent on digital innovation (Improta et al., 2020). Also for the future, digital transformation of health services is expected to have a further fundamental impact on healthcare and healthcare delivery (Ricciardi et al., 2019).

Digital transformation refers to the introduction of new processes, new digital communication and information technologies. This exhibits an impact on the broader society, but also on the healthcare sector specifically. The use of digital technologies in production and the delivery of a product or service, is also called digitalization (Ricciardi et al., 2019). Industry 4.0 is a fundamental component of the digital transformation; however they are not synonyms. Industry 4.0 can be understood as a cluster of different technologies that are de facto agglomerated. Digital transformation on the other hand, is the result that the implementation of digital technologies can deliver to companies. The most important enabling technologies, that Industry 4.0 is characterized by, are the Internet of Things, big data, cloud, robotics, artificial intelligence and additive manufacturing (Martinelli et al., 2021).

The digitalization in the healthcare sector has caused some major changes in the purchasing department. For example, the procurement process can become much more efficient due to the elimination of redundancies (Büyüközkan and Göçer, 2018) (Laudien and Daxböck, 2016). Added to that, supply chain management processes are also improved due to the advancement of digital technologies (Müller et al., 2019). Lastly, digitalization can cause improved coordination and collaboration with network partners due to continuous communication (Büyüközkan and Göçer, 2018). According to research, digital technologies including Industry 4.0, aims to improve productivity, flexibility and customer orientation due to the interconnectedness of the processes in the supply chain (Müller et al., 2019). However, the impact brought by digital innovation in the purchasing department in healthcare organizations are not completely clear.

This study will focus on the impact of digital innovation on the purchasing department in healthcare organizations. In healthcare organizations, multiple important stakeholders need to be taken into account, such as patients and physicians, which makes healthcare organizations exceptional. Purchasing procedures can be highly benefited due to the implementation of digital innovation, by enhanced efficiency and transparency due to seamless integration of people, processes and technology (Büyüközkan and Göçer, 2018). Other benefits as a result of the implementation of digital technologies, will be explained in further detail later on in this paper. Furthermore, hospital supply expenses form the second largest cost category after labour expenses and have been rising faster than labour expenses in the past several years (Goodbaum, 2015). According to research, healthcare supply chains are filled with inefficiencies and are therefore, integrating technologies such as cloud technologies, to help aggregate crucial supply chain data (Goodbaum, 2015). Therefore, digital innovation presents great opportunities to improve the procurement process, especially in healthcare organizations.

1.2 Research Objective and Question

It is important to examine the impact of digital innovation on the purchasing department in healthcare organizations because it is undeniable that digital technologies have been revolutionizing the purchasing department of healthcare organizations. As a result of the implementation of digital technologies, the purchasing department in healthcare organizations, can obtain many benefits from it. However, it is still not clear what the main effects are and to whom these may be relevant.

Therefore, the research question stated in this paper is:

What are the main impacts of digital innovation on the purchasing department in healthcare organizations?

To answer this research question, one sub-question will be formulated. This is to create a more general focus on the effect of digital innovation on the procurement process. It is undoubtedly that digital innovation can significantly change the purchasing department. These changes can be attributed to the new ways of carrying out certain procedures. As these changes caused by digital innovation are still recent and ongoing, the purchasing department should adapt to this transition. In order to better adapt to this new situation, it is desirable to know what the main changes in the procurement process brought by digital innovation are. This way, the implementation of these new technologies can be conducted more easily.

Thus, the following sub-question is formulated:

What are the changes in the procurement process after the adoption of digital innovation?

Research has been done to investigate the effects of digital innovation on the purchasing department and on healthcare organizations, separately. This study will present new findings that contribute to existing literature, since to my best knowledge there is not much evidence on this specific topic yet. It is important to understand the effect of digital innovation on the purchasing department in healthcare organizations because it is a trend that has been consolidating, and the organizations need to

be prepared for this change. Understanding the impact of digital innovation can support managers to make better decisions and support the transition to this digital context. Therefore, both the challenges and the opportunities brought by digital innovation will be examined in this research.

After the introduction, the next section of chapter 2 will be a literature research that is conducted in the scope of this paper. The first part of the literature research will focus on the concept of Healthcare Purchasing and the second part will focus on the concept of Digital Innovation. After the literature review, the research design and data collection will be presented. Multiple purchasing managers in healthcare organizations will be interviewed for this part. Additionally, the analysis of the data and the results will be evaluated. Thereafter, the findings of this research will be discussed and based on that a conclusion will be established. Lastly, the limitations of this research will be given and based on that recommendations for future research will be presented.

2. THEORETICAL BACKGROUND

2.1 The Concept of Healthcare Purchasing

2.1.1 Definitions of Some Important Concepts

The first important concept that will be used many times in this paper is purchasing. Purchasing can be seen as a functional group, a formal entity on the organizational chart, as well as a functional activity. In a company, the purchasing department performs multiple activities to guarantee it delivers maximum value to the organization. Some important activities include supplier identification and selection; buying, negotiation, and contracting; supply market research; supplier measurement and improvement; and purchasing systems development. In purchasing, there are five goals, also referred to as the five rights: "getting the right quality, in the right quantity, at the right time, for the right price, and from the right source"(Monczka et al., 2015, p. 11). Another important concept in this paper is supply chain (management). According to La Londe and Masters (1994), a supply chain is a set of firms that pass materials forward and ultimately in the hands of the end user. Along the supply chain, materials, information and financial flows need to be coordinated in order to fulfil customer demands with the aim of improving competitiveness of a supply chain as a whole. This is the task of supply chain management (Stadtler, 2008, p. 25-27).

2.1.2 The Main Characteristics of Purchasing in the Healthcare Sector

Purchasing plays an important role in healthcare organizations for improving the health system and performance (Figueras et al., 2005) (Busse et al., 2007). To reach full potential, purchasing cannot be narrowly focused on individual elements, such as payment systems and contracts (Busse et al., 2007). In healthcare, purchasing focuses on linking health needs, plans and priorities with financial resource allocation to several sectors and interventions. This results in maximization of overall health gain, and in their turn, increased allocative efficiency. Overall, when purchasing is being executed correctly, it can result in improved efficiency, effectiveness and responsiveness (Figueras et al., 2005).

Purchasing in healthcare consists of two different areas, purchasing of care and purchasing for care. Purchasing of care is the process through which health financers, (e.g. health insurers), select care providers, contract care providers, and manage buyer-seller relationships with care providers, (e.g. hospitals and general practitioners). Purchasing of care takes place in all healthcare systems with a purchaser-provider split (Figueras et al., 2005). Purchasing for care, on the other hand, includes health care providers, who select, contract and manage relationships with suppliers of clinical and non-clinical inputs (van Raaij, 2016). An example of purchasing for care is a hospital purchasing cancer drugs. In most cases, purchasing for care takes place in a tetradic setting, consisting of the supplier, the purchasing professional, the medical profession, and the board of management of the provider organization, while purchasing of care takes place in a triadic setting, including the healthcare provider, the health care purchaser and the healthcare consumer (van Raaij, 2016).

2.1.3 Specificalities of the Healthcare Sector

The healthcare sector differs significantly from other sectors, which has an impact on the purchasing department. One important difference is the purpose of healthcare organizations. This is to improve and also safe lives of the patients, regardless of the profit the organization is making. In the Netherlands, most hospitals are non-profit organizations. This can result in misalignment or conflicts with suppliers, who work together with other shareholders and who strive a higher profit margin than hospitals do (McKone-Sweet et al., 2005). Another important difference is about the supply chain of healthcare organizations. Compared to supply chains of other sectors, healthcare supply chains involve more actors throughout the supply chain, such as patients, provider organizations (clinics, hospitals, etc.), clinicians and insurers. These different actors are jointly responsible for the efficiency and effectiveness of the supply chain (Begun et al., 2003). Furthermore, the type of products that healthcare organizations need, differs from the product needs that organizations in other sectors have. Hospitals have multiple clinical departments, all demanding specialized medical and pharmaceutical products and devices. Some patients need specific products for their treatment and a stock-out of these specific products can result in long-term disability or in worst case scenario, death (Abdulsalam et al., 2015). Additionally, some physicians prefer specific items over other items. The diverse preferences of physicians make the purchasing process very complicated while other sectors do not encounter this problem (Abdulsalam et al., 2015).

2.1.4 The Main Challenges Faced in the Purchasing Department in the Healthcare Sector

The healthcare supply chain has some specific characteristics compared to the supply chain of other industries, which introduces a few challenges. There are numerous reasons for the complexity in the purchasing department of healthcare organizations. First of all, due to the many actors that are involved in the health care supply chain, the supply chain is highly fragmented, which can sometimes lead to multiple deliveries each day (Landry et al., 2016). Key actors in this supply chain are patients who require accurate and adequate

medical supply according to their needs and therefore it can have a big impact on people's health (Mathur et al., 2018). Furthermore, purchasing departments of hospitals often outsource contract management to regional purchasing, group purchasing organizations or consolidated service centres, which can create challenges for hospital inventory management and logistics. This is because only a part of the stock-keeping units is available at the hospital itself while the rest is being held at suppliers or distributors (Abdulsalam and Schneller, 2019). The estimated cost-saving potential, when addressing these challenges in the purchasing department, is high and therefore research in this area has been popular among industry practitioners, management consultants and academics to identify specific improvement opportunities (McKone-Sweet et al., 2005).

2.2 The Concept of Digital Innovation

2.2.1 Digital Innovation and the Evolution Process

Digital innovation can be characterized by the implementation of digital technologies during the innovation process, which results in digital transformation (Karabulut, 2020). The definition of digital innovation includes three important phenomena. First of all, a variety of innovation outcomes are included in the definition of digital innovation, such as the development of new services, products and platforms. Second, a wide range of digital tools and infrastructure is used to make the innovation feasible. This does not necessarily mean that the outcome needs to be digital, but outcomes are being achieved by using digital technologies. Lastly, the outcomes may be adapted, assimilated or diffused to specific use contexts, which is normally experienced with digital platforms (Nambisan et al., 2017). Dornberger et al. (2018) identifies four streams of development in digital technologies: (early) Information Systems, E-Business Applications, Web 2.0 Revolution and (the renaissance of) Artificial Intelligence. The first development stream started around 1950 where computers were recognized to be increasingly useful in organizations. In the 1980s, computers were primarily used by organizations and individuals to store, enter, print and process data. Thereafter, a new form of information systems evolved, due to improvements in hardware and software, project management, programming, the Internet, the World Wide Web, and the connection of the latter two to computers. Organizations then needed to develop a well-elaborated information technology (IT) strategy and IT management. The second development stream started in the late 1990s where organizations knew the importance of information systems and started to develop their own usage of it. The development of E-business applications emerged and subsequently companies started to develop business software such as Enterprise Resource Planning systems and other enterprise applications. The purpose of this was to smoothen working together internally or interconnected with other enterprises or consumers. By implementing electronically supported processes, the collaboration of enterprises with customers, suppliers and other organizations has been improved, due to the managing and streamlining of the data flow. The next development stream Dornberger et al. (2018) identifies, referred to as the Web 2.0 Revolution, began in the early 2000 where the smartphone and social media made their first appearance. This made the development of new business models possible, by applying new mobile commerce scenarios. Additionally, the constant access to internet provides organizations with multiple possibilities, such as location-based services. To facilitate collaboration between multiple individuals, companies and organizations, cloud computing was established. This caused people to immediately access data from the internet whenever needed. The Internet of Things has been a major topic during the last stream of development, referred to as the renaissance of Artificial Intelligence. Every electronic device will be linked to the internet, due to the implementation of the Internet of Things. Also, due to the advancement of Industry 4.0 all production machinery can be connected to the internet. Industry 4.0 has been the result of automation and digitization of manufacturing environments, which has been made possible due to the advent of cloud services, Internet of Things, big data and analytics (Wang et al., 2015) (Tortorella et al., 2021). Other key technologies characterizing this stream are: robotics automation, 3D printing, cryptocurrencies and Artificial machine Intelligence (Dornberger et al., 2018).

2.2.2 Main Opportunities of Digital Innovation in Other Sectors

The advancement of digital innovation has several benefits to multiple business sectors. One important sector where the growth in digital technologies can be observed is the agri-food sector. New digital technologies are raising hopes for improved agricultural productivity and some crucial global problems related to biodiversity loss and climate change. Examples of some key technologies in the agriculture sector are precision farming comprising Global Positioning System for yield mapping, ground-based sensing systems, and wearable sensors for animal health and monitoring. Furthermore, digital innovation in decision support tools and applications can also help farmers, for example by reducing their input costs, increase profit and improve yields (Kosior, 2018). Another sector that is being influenced by digital technologies is the government since it can improve and promote governance. Some key digital tools are: Artificial Intelligence which has been applied to health regulation and restaurant inspection, the Internet of Things used to improve traffic flow control, and blockchain which is mainly used in the financial area (Kang et al., 2013) (Shackelford and Myers, 2017) (Filgueiras and Almeida, 2021, p. 52-53). Using digital tools in governance results in new communication channels between governments, society and firms. They can promote better service coordination and policy, decrease spending on repetitive bureaucratic activities, and increase policy effectiveness and efficiency. (Filgueiras and Almeida, 2021, p. 65-66). In addition to these two sectors, there are still many other sectors influenced by the digitalization, particularly the tourism sector, the retail sector, the automotive sector and the healthcare sector (Alexandrova and Poddubnaya, 2020, p. 121).

2.2.3 Main Opportunities of Digital Innovation in the Healthcare Sector

Worldwide, the implementation of digital technologies has been prioritized in the development of the healthcare sector. Every year this market is increasing by 25% (Ter-Akopov et al., 2019). Developments in digital technologies have resulted in a wide range of technologies, used in many different fields related to healthcare. In Table 1 a typology of digital health technologies is given (Lupton, 2014). As a result, the implementation of it can deliver better flexibility and accessibility of healthcare to the general public. It comprehends the availability of open information on the health, complications, treatments and biomedical research (Senbekov et al., 2020). Many digital health technologies have been developed due to the advancement of Industry 4.0, which had and still has a major impact on healthcare. Industry 4.0 technologies in healthcare, Industry 4.0 has been renamed as Health 4.0, which focuses on the use of digital technologies towards real-time customization of the healthcare provided to the patient (Thuemmler et al., 2017). There are several key technologies affecting the healthcare system. First of all, big data can be used to improve the quality of treatment and diagnosis, and in the development of a new drug. In the medical data storage, more information will be accumulated when medical gadgets will become more widely distributed, which opens up many opportunities for healthcare to distinguish trends, patterns, and develop new treatments. Another important technology is Artificial Intelligence, which can become an important support tool for medical decision making. It can also help doctors with detecting several diseases in the early stage, such as blood poisoning. Furthermore, virtual and augmented reality is proven to be helpful in the procedure of rendering medical aid, in surgery, for example, and in the process of rehabilitation for patients after surgery. Finally, robots can be increasingly helpful in the training of doctors, for example to learn how to handle a stroke (Blobel, 2020).

Table 1. Typology digital health technologies

Digital health technology	Description
Digital epidemiology	Tracking of disease outbreaks and spreading it by using digital media.
Digital health promotion	Disseminating health education messages.
Telemedicine and telehealth	Medical consultations, clinical diagnosis and healthcare delivery offered remotely.
Health informatics	Online health information, triage and appointment booking systems, such as electronic patient records.
Monitoring devices	Apps, smart objects and wearable technologies for monitoring and tracking bodily functions and activities.
Digital health games	Console, online and app games designed for fitness, tracking biometrics, health promotion and health education.

(Source: Lupton, 2014)

2.2.4 Main Opportunities & Challenges of Digital Innovation for the Purchasing Department

According to Laudien and Daxböck (2016) the adoption of digital technologies has several positive implications for supply chain operating models. First of all, it can be used to enhance the efficiency of internal supply chain operations due to technologies such as the Internet of Things. These technologies allow organizations to track materials and products throughout the entire production process, which results in enhanced efficiency. Furthermore, efficiency is caused by the automated execution of many tasks throughout the supply chain and the elimination of redundant tasks (Büyüközkan and Göçer, 2018). Second, the cooperation and collaboration with a high number of network partners is facilitated due to the implementation of digital technologies. This is because capabilities are harmonized within and beyond physical boundaries, increasing collaboration between involved actors of the supply chain. Therefore, organizations can leverage their network of partners to provide bundled customer-specific offerings, thereby improving customer service. Another benefit as a result of a digital supply chain is greater transparency leading to better decision-making. Among other things, this is caused by real-time visibility across the entire supply chain and because a digital supply chain allows easier information sharing (e.g. on production data) (Büyüközkan and Göçer, 2018). Lastly, improved understanding of customer's requirements is a result of implementing digital technologies in the purchasing department, which is caused by demand sensing and up-to-date sales information (Agrawal and Narain, 2018).

Besides these positive implications, digital technologies also bring some challenges with them. One important challenge identified by Luthra and Mangla (2018) are security issues as a result of digital transformation. Supply chain systems have security vulnerabilities, which can be exploited by attackers, resulting in mass data exposure. Another challenge identified by Ageron et al. (2020) is that employees require new competencies as a result of their work being more automated, connected and interdisciplinary. These competencies are technology-related, including basic skills in Information and Communication Technologies. Furthermore, high infrastructure, information technology-based facilities and technologies are crucial in effective adoption of Industry 4.0 technologies in the purchasing department. A lack of infrastructure and internet-based networks can form a challenge in the adoption of it. Additionally, a lack of integrating technology platforms can form a challenge for the implementation of digital technologies. Many different components need to be integrated and supported for an effective data exchange and analysis. Therefore, it is significant to design and develop a platform to integrate technology. Lastly, the coordination and collaboration with suppliers is necessary in understanding the organizational policies in adopting concepts of

Industry 4.0, otherwise it can cause problems (Luthra and Mangla, 2018).

3. METHODOLOGY

3.1 Research Design

As has been discussed in the introduction, the aim of this paper is to investigate the main impacts of digital innovation for the purchasing department in healthcare organizations. In order to answer the research question, a literature review was conducted. The following databases were accessed: Scopus and Google Scholar. During the literature review, the following keywords were used: Digital Innovation, Digital Transformation, Healthcare Purchasing, Procurement Process, Healthcare Sector, characteristics or differences, primarily focusing on the relationship between some of the keywords. For the field research, primary data is information that researchers collect first-hand. The primary data collection method will focus on interviews to provide and substantiate data. The interview questions are constructed as semi-structured, which was chosen due to the flexible and open nature of the interview. It also allows for the participants to give an in-depth answer and to elaborate as much as possible to give valuable information (Newcomer et al., 2015, p. 367).

3.2 Designing Questions

The interview consists of eleven basic questions, which can be divided into three categories. The asked interview questions can be found in appendix A. The first category contains context-related questions and includes questions regarding the procurement process. The interviewees were asked which types of medical supplies they purchase, the different steps in the procurement process and who is involved in the acquisition of medical supplies. The second category questions are questions about the digital transformation process that occurred in the organization. The interviewees were asked how digital transformation occurred in their organization and if they could give some examples of digital technologies. Lastly, questions about the effects of digital transformation on the purchasing department were asked. Questions about the challenges, benefits and impacts were included in the interview. Furthermore, interviewees were also asked how digital transformation helps to improve the procurement process. After conducting two interviews, the interview questions were critically examined, and two questions were included. The interviewees were now also asked to give reasons for the implementation of digital transformation and on which aspects of purchasing they can focus more due to the implementation of digital technologies.

3.3 Data Collection

Semi-structured interviews were conducted to collect the primary data. Selection criteria for the participants of the interviews were that they needed to be working in healthcare related organizations, such as hospitals and nursing homes, and have extensive knowledge on the procurement process. To get a deeper understanding of the digital transformation phase, managers in health technologies and digital innovation were also included in the sample size. Selection criteria for the hospitals and nursing homes were that they needed to be located in the province of Overijssel in order to conduct the interviews physically. Physical interviews were preferred over online interviews, since this made a better connection with the interviewee possible, and thus a better interpretation of their answers. Furthermore, it was essential that the selected organizations required some adoption of digital technologies in their purchasing department, which was therefore asked beforehand. This procedure was conducted to ensure that the interviewees were able to share their opinion about the effects of digital transformation. In Table 2 an overview of the interviewees is given with some details about them. Potential companies have been contacted by e-mail or telephone in Dutch. The interviews approximately took half an hour to complete. As all contacted companies are solely of Dutch origin, the interviews were conducted in Dutch. The interviews were performed in the period from the 13th of May till the 30th of May. After finishing the interviews, the recordings have been transcribed manually, because programs such as Amberscript were not accurate in their translations. This ensured the quality of the transcriptions to be as accurate as possible. During the coding phase, transcripts were being examined to obtain a first impression. Then, the actual coding activity started, which was the labelling of relevant points. The data was uploaded to the software program Atlas.ti to code all nine interviews. A total of 32 codes were used 242 times in an attempt to capture all relevant responses and data. With the program Atlas.ti it was possible to select and compare different codes, which made it more convenient to examine the relation between different codes. Furthermore, Atlas.ti made it possible to observe the frequencies of different codes, which indicates the importance of each code. In Appendix B an overview of all the codes is given. After examining all the different codes, ultimately an analysis was performed of the empirical findings. The codes were grouped in a total of three overarching categories, worked out into more detail in chapter 4.

Table 2. Overview of the interviewees

Interviewee	Company type	Position
1	Nursing home 1	Purchasing manager
2	Nursing home 1	Manager digital innovation
3	Nursing home 2	Purchasing manager
4	Nursing home 3	Purchasing manager
5	Hospital 1	Purchasing manager
6	Hospital 2	Tactical buyer
7	Nursing home 1	Advisor health technologies
8	Hospital 2	Operational buyer
9	Nursing home 1	Assistant purchasing manager

4. RESULTS

This research paper aims to understand the impact of digital innovation on the purchasing department in healthcare organizations. For this purpose, nine semi-structured interviews have been conducted to gain a more thorough understanding of the different challenges and opportunities caused by digital

innovation. This section will give an overview of all the relevant findings from the conducted qualitative research.

4.1 Procurement Process

Analysis of the interviews has shown that two different streams in the procurement process can be identified, where one is almost completely automated, and the other is still mainly being performed by the purchasing managers themselves. The first one is for standard products that need to be purchased weekly, such as catheters, bandages and other medical supplies. Two important software systems have been recognized for purchasing these types of products. These systems can take over most steps in the procurement process and make it possible to have one integrated system instead of having multiple software systems. Many interviewees have identified that the reason for this takeover by software systems, is because organizations are not willing to fall behind and because of the expected benefits, it offers. The other stream is for the procurement of investment products, following the six steps of van Weele (2018). In Figure 1 an overview is given of some technologies that have been purchased in this stream of investment products. The first column is about digital health technologies, improving the quality of life for the patient, according to the advisor health technologies. In the second column, the two software systems currently used by the purchasing department are provided, and the last column recognizes the main opportunities and challenges due to the implementation of them. These will be explained in further detail below.

Digital health technologies	Software systems
Electronical health record	AFAS
Compaan (tablet for elderly)	ProActive
Medication dispenser	
Heart rate sensors	

Challenges:
- Functioning of the application
- Knowledge-gap
- Information security & privacy

Opportunities:
- Efficiency
- Transparency
- Reducing errors

Figure 1. Digital (health) technologies

4.2 Challenges

Three main challenges have been recognized by the interviewees, which will be explained in detail below.

4.2.1 Functioning of the Application

The first challenge being faced by the purchasing department is during the implementation phase. According to interviewee 6, there are a lot of teething troubles that need to be figured out when implementing a new software system. One example of a teething trouble is the accuracy of the application, which sometimes led to multiple orders a day from the same supplier. This challenge was also mentioned by interviewees 1 and 8. Furthermore, it is also a challenge to keep the application running after it is being implemented. Failure of the application can be prevented for example by having a good Wi-Fi connection, but also by using digital equipment of high quality. This challenge was mainly addressed by the manager digital innovation. Lastly, a good relationship with the software supplier is also important, because they can introduce new features which could help in solving specific functionality problems of the system. Furthermore, when there is a good relationship with the software supplier, some problems can be more easily addressed to the supplier. Interviewee 1 mentioned the possibility of communicating specific features to their software supplier, which could be convenient, when it would be included in the system.

4.2.2 Knowledge-gap

Another major challenge in the implementation of digital technologies is the knowledge-gap being formed to people working in healthcare organizations and especially in the purchasing department. Interviewee 7 has stated that 20% of the employees still find it difficult to send an e-mail and would rather fold laundry than working with the computer. This is in alignment with a statement interviewee 9 has made. More specifically, she said that the average employee does not have the right competencies to work with digital technologies and therefore would do anything to avoid working with it. Looking at the procurement process, eight out of nine interviewees have identified that many steps have been taken over by software systems, which causes a whole new way of working. They are complex systems employees need to work with, which results in mandatory E-learnings that need to be completed by everyone involved in the procurement process. According to interviewee 9, giving the credentials and thinking that the employees will be fine working with the system, is not possible anymore, due to the complexity of the systems. Furthermore, the knowledge-gap is especially high among the older people, who oftentimes also have a lower willingness to switch to digital technologies. This problem can also be observed outside the purchasing department, when implementing digital health technologies, for example among nurses. According to the advisor health technologies, implementing new digital health technologies, always forms a challenge due to the willingness of the employees. Therefore, many healthcare organizations indicated they have assigned Digi-coaches offering help to the people struggling and guiding them trough the digital transformation process.

4.2.3 Information Security and Privacy

This study also shows that many organizations face information security and privacy problems, due to the implementation of digital technologies. According to interviewees 2, 5 and 7 this is the result of data being more easily accessible, also to people who do not always need this data. A statement interviewee 5 has made is that patient data is now also available to certain suppliers sometimes, whilst before the adoption of digital technologies, hospitals and other healthcare organizations were much more private on their patient data. An example the interviewee gave, is that when hospitals are having trouble with specific machinery, such as an X-ray, the supplier needs to check the X-ray, while

patient data is still visible in the X-ray. He stated that this is the result of using way more digital health technologies, than a couple of years ago. This comes with a lot of new risks in the field of information security and privacy, such as cyberattacks or leakages of confidential information. According to the manager digital innovation, this is not only a challenge for the purchasing department, but to the entire organization. He stated that around 70% of the employees failed a phishing mail test by clicking on the link and many of them also leaking their credentials, which could lead to an attack of hackers in real-life situation. Therefore, employees need to be educated more on this topic, for example which information can be shared or how to secure confidential data. This can be done by offering E-learnings or transferring knowledge with other locations.

4.2.4 Other Challenges

In addition to the main challenges that have been discussed above, there are two other challenges which have only been identified by specific interviewees. First of all, the manager digital innovation recognized it to be a challenge to find the right technology that fulfil expectations. This is considered to be a challenge due to the large number of different technologies being offered nowadays. The other interviewees, however, have not identified this to be a challenge for them. Second, interviewee 7 reasoned that due to digital innovations, employees have higher expectations of the purchasing department. An example he gave is that people can order something online and receive it the next day already. Employees therefore also expect this from the purchasing department, which is however not always possible. This can cause irritations among employees. Nevertheless, this has not been supported by the other interviewees.

4.3 Opportunities

Three main opportunities have been identified by the interviewees and will be explained in further detail below.

4.3.1 Efficiency

One of the most evident findings are that the implementation of digital technologies has caused a more efficient procurement process, due to time-savings. Less human intervention is needed throughout the whole process, because a major part of it is digitalized. An example of this given by interviewee 6, is that the approval of orders and backorders is now completely done by the system itself, without human intervention. An example that interviewees 3, 5 and 9 gave was the invoice matching process. The system checks if there is a match between the purchase order and invoice and if there is a match, payment can be made according to the agreed payment terms. Human intervention is only needed when there is no match, which therefore causes major time-savings. Multiple interviewees indicated that among other things, the continuous flow in the process, causes a significant reduction in waiting times. The continuous flow is the result of automating a major part of the process and therefore employees do not have to wait anymore on specific tasks that need to be performed prior to their tasks. A result of the automation of many steps and the time-savings it causes, is a shift in focus. Interviewee 1 mentioned that there is a shift from operational level to tactical level, and from tactical level to strategic level. This means that purchasing managers have more time to focus on strategic tasks, such as supplier relationship management and responding quickly to changing supply requirements. This shift in focus has also been recognized by interviewees 3 and 9.

4.3.2 Transparency

As already being mentioned in section 4.2.3 data is more easily available to the purchasing department. Despite that this forms challenges regarding information security and privacy, this transparency of data also forms opportunities for them. According to interviewee 4, where the digital transformation is still in the beginning phase, a major benefit already has been the easy access to information about expenses, product specifications, and inventory levels for example. Whereas before the implementation of digital technologies, a lot of information could only be retrieved from quarterly reports of their suppliers. Both interviewees 5 and 9 have indicated that information on the suppliers side is also more easily available, such as sales prices. Furthermore, an advantage mentioned by the advisor health technologies has been the visibility of delivery times to both the purchasing department and the department who gave out the order. This has also been confirmed by interviewee 8, who stated that the medical departments also benefit from the digitalization because of the visibility of the delivery times, for example. Due to the amount of information that is available, organizations have much more insights on their data, which gives them the opportunity to be more proactive. Trends can for example easily be signalled by the purchasing department and therefore they can react much faster than beforehand. This ultimately results in an improved decision-making process for the purchasing department.

4.3.3 Reducing Errors

The last opportunity this study indicated is that due to the digitalization of the procurement process, there is a significant reduction in errors, explicitly stated by five out of nine interviewees. Before digitalizing the whole process, it was very easy to make some small mistakes. An example given by interviewees 3, 5 and 9 is again about the invoice matching process, which needed to be done manually before the digitalization. Purchasing managers were included in the process to check whether there is a match between the purchase order and invoice, which always included a chance of error. The system now includes an invoice matching process, so payment can only be made when there is a match between the purchase order and invoice. When there is no match, payment can not be made, and human intervention is needed to identify what the issue is and to resolve it. Furthermore, interviewee 5 stated that the integration of multiple software systems into one software system also caused a reduction in errors, due to the fact that transferring data from one system to another already includes a chance of error. The manager digital innovation gave as reason that digital technologies are just made to cause less errors than humans do.

4.3.4 Other Opportunities

In addition to the main opportunities that have been discussed above, there are also some other opportunities which have only been identified by specific interviewees. According to interviewee 9, the implementation of digital technologies has

caused money-savings as a result of time-savings. Due to time-savings throughout the procurement process, time can be used more efficiently and effectively to focus on keeping costs down. This opportunity, however, has been offset by all the other interviewees who did not recognize money-savings to be an effect of digital technologies. Another interesting opportunity mentioned by interviewee 1 is the enhanced separation of functions, which causes employees to really specialize themselves in their own task. This opportunity has, however, not been mentioned by any other interviewee. Lastly, interviewee 2 identified remote working to be an opportunity as a result of digital technologies, while other interviewees did not mention this to be an opportunity.

5. DISCUSSION AND IMPLICATIONS

5.1 Discussion

5.1.1 Challenges

The results of the interviews are consistent with previous studies conducted upon the challenges of digital innovation for the purchasing department. In a study performed by Luthra and Mangla (2018), about the challenges of Industry 4.0 for the supply chain, it was found that security issues emerge due to the implementation of them. This is in line with results of the interviews, where three out of nine interviewees recognized information security and privacy issues as the biggest challenge. Digitalization has caused the unnecessary disclosure of patient data to certain suppliers, according to interviewee 5. According to the manager digital innovation this can be a real threat since employees are not ready yet for this digital transformation. The interviewees also identified solutions to these problems, such as implementing mandatory E-learnings where employees are educated on how to secure confidential data. Furthermore, Ageron et al. (2020) state that due to the implementation of digital technologies, the way of working has been transformed. This causes organizations to demand new competencies from their employees, in the field of Information and Communication Technology. Interviewee 7 stated that this is not only a challenge to the purchasing department, but also to nurses working with digital health technologies. He stated that due to this transformation, employees require new skills with regards to digital technologies. Two solutions have been proposed to this problem, which are mandatory E-learnings again and assigning Digi-coaches, specifically to help employees that are struggling. In addition, according to Luthra and Mangla (2018), other frequently occurring challenges were lack of integration of technology platforms and lack of infrastructure and internet-based networks. The lack of integration of technology platforms has only been identified by the organization that is still in the beginning of the digital transformation process. The other organizations all mentioned that the new software system made it possible to have one integrated system for everything, which is therefore an opportunity for them. Thereupon, in some way it is in line with present literature, however it depends on the phase of the digital transformation process the organization is in. Lastly, the lack of infrastructure and internet-based networks has also been identified as a challenge, according to Luthra and Mangla (2018). This is consistent with the interview results, where the functioning of the application has been identified as one of the biggest challenges. According to interviewees 1, 6 and 8, the first challenge occurs during the implementation phase, where still many teething troubles remain to be overcome. Furthermore, it is also a challenge to keep the application running after the implementation. However, for this challenge, solutions have been proposed, such as the use of high-quality digital equipment and having adequate Wi-Fi connection.

5.1.2 Opportunities

Existing literature upon the opportunities that the implementation of digital innovation offers to the purchasing department, are largely in line with the results of the interviews. Laudien and Daxböck (2016), state that due to the implementation of digital technologies, internal supply chain operations have been more efficient. This is in line with the interview results, where multiple interviewees recognized the enhanced efficiency. This enhanced efficiency can be explained by the continuous flow in the procurement process, caused by automating a huge part of it, resulting in major time-savings. Interviewee 1 stated that due to these time-savings, more focus can be placed on strategic tasks instead of administrative tasks. This shift in focus has not been recognized by existing literature yet. Furthermore, the study of Laudien and Daxböck (2016), states that cooperation with a high number of network partners is facilitated due to digital technologies, which helps organizations in providing bundled customer-specific offerings. This is not completely in line with the interview results since the healthcare organizations did not see this directly as a consequence of digital technologies. The interviewees stated that cooperation with a number of partners was also the case before the digital transformation process occurred and therefore not a result of it. Interviewees also did not state that this cooperation causes customer-specific offerings, which can be explained by the different type of customers healthcare organizations have. In a study performed by Agrawal and Narain (2018), upon digital supply chain management, it became evident that the implementation of digital technologies causes greater transparency, ultimately leading to improved decision-making. This is completely in line with the interview results, where multiple interviewees mentioned the easy access to data, causing greater transparency. Many of these interviewees also linked the greater transparency to the enhanced decision-making. In addition to existing literature, interviewees stated that this improved decision-making is the result of having more insight on data. Moreover, interviewee 4 mentioned the visibility of inventory levels as an example of the greater transparency. This is in line with a study done by Büyüközkan and Göçer (2018), who recognized real-time visibility across the entire supply chain as a result of digitalization. Lastly, the majority of the interviewees mentioned the reduction in errors as an important opportunity for the healthcare organization, which was not apparent in the most recent literature and can therefore be seen as an addition to existing literature.

5.2 Theoretical and Practical Implications

We can conclude that this study presents new findings that contribute to existing literature. It is supported in this research that the purchasing department of healthcare organizations is influenced by the implementation of digital technologies. Therefore, this study could be used as a foundation for more

elaborate and extensive research in the field. More specifically, the interviewees were active in hospitals or nursing homes, and therefore the results of this study can be used by these types of organizations. Other hospitals and nursing homes throughout the Netherlands can use this study as a starting point for implementing different technologies in the purchasing department, since this study shows multiple opportunities as a result of the implementation. Furthermore, this study also provides multiple solutions to the challenges encountered by the interviewed healthcare organizations.

6. CONCLUSION

This study was conducted to find an answer for the research question presented in the beginning: *What are the main impacts of digital innovation on the purchasing department in healthcare organizations?* It became visible that digital innovation does have a significant impact on the purchasing department in healthcare organizations. The most relevant opportunities identified by the interviewees were enhanced efficiency, transparency, and a reduction in errors. First of all, efficiency is the result of automating a major part of the procurement process, with less human intervention needed. This causes a shift from operational level to strategic level, focusing more on strategic tasks, instead of administrative tasks. Second, organizations have more data available due to the easy access to it. This enhanced transparency ultimately leads to improved decision-making. Lastly, digital technologies cause a reduction in errors, among other things due to the integration of multiple systems into one system and because digital technologies are made to produce less errors. On the other hand, digital transformation also forms challenges to the purchasing department of healthcare organizations. Three main challenges have been identified, more specifically the functioning of the application, knowledge-gap, and information security and privacy issues. First of all, functioning of the application forms a challenge both during the implementation phase, as well as after it has been implemented. During the implementation phase, a lot of teething troubles need to be solved, and after the implementation phase, it is a challenge to keep the application running. The second challenge encountered is the knowledge-gap among employees in the purchasing department, due to the new way of working. Therefore, employees require new skills related to Information and Communication Technology. Lastly, the easy access to data can also form challenges with regards to information security and privacy, which can result in cyberattacks or information leakages. For all the challenges identified, there were multiple solutions, such as offering E-learnings, assigning Digi-coaches and/or transferring knowledge with other locations. This paper suggests that using digital technologies in the purchasing department in healthcare organizations, offers multiple opportunities, but does not come without any challenges. Since all the challenges encountered, can be solved with specific solutions, the opportunities that digital innovation offers, outweigh the challenges.

7. LIMITATIONS AND FUTURE RESEARCH

This study adds new information to the current scientific literature. In addition, some new findings have been obtained, which can be used for further research. However, it is worth mentioning that this study also contains some limitations. The first one concerns the relatively small sample size of nine interviews. This can be considered insufficient to make definitive conclusions. Second, all the interviewees were working in healthcare related organizations, located in the province of Overijssel. Therefore, the conclusions drawn are limited to healthcare organizations located in the Netherlands. For further research it is recommended to repeat this research with a larger sample size. Furthermore, healthcare organizations outside the Netherlands can be included in the sample size, to generalize the conclusion across the entire healthcare sector. Lastly, it could be interesting to take a closer look at possible differences between hospitals and nursing homes.

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Appendix A – Interview Questions

Context related questions

1. What types of medical supplies does your organization purchase?
2. Could you describe the procurement process?
3. Who is involved in the acquisition of medical supplies?

Digital transformation related questions

4. How did the digital transformation process occur in your organization?
5. What were reasons to implement digital technologies?
6. Could you give some example of digital transformation in your organization?

Impact related questions

7. What are the main challenges faced during its implementation?
8. What are the main benefits gathered from the digital transformation for the purchasing department?
9. What are the main impacts of digital transformation in the purchasing department?
10. How digital transformation helps to improve the procurement process in your organization?
11. On which aspects of purchasing can you focus more due to the implementation of digital technologies?

Appendix B – Codes Atlas.ti

Code	Grounded
AFAS	7
Being in control	7
Better procuration	1
Decision-making	1
Digital transformation process	14
Efficiency	4
Examples digital technologies	11
Functioning of the application	5
High expectations	2
Improved quality	3
Information asymmetry	1
Information security & privacy	5
Integrating into one system	9
Involved in acquisition	16
Knowledge-level	6
Less flexibility	1
Market trends	10
Mindset	5
Money-savings	11
More transparency	20
Offering assistance	14
ProActive	2
Procurement process	26
Reducing errors	12
Remote working	2
Separation of functions	1
Shifting focus	18
Supplier evaluation	9

Time savings	24
Up to date	3
Usefulness & necessity	5
User-friendliness	7