MASTER'S THESIS

The impact of IT Ambidexterity on patient service performance

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The impact of IT Ambidexterity on patient service performance

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Abstract

The goal of this study is to determine whether IT ambidexterity improves a hospital department's patient service performance, and to establish whether these improvements are caused through the mediating effect of patient agility. The data for this study was collected through a survey, sent to various hospital departments in the Netherlands. The collected data was analyzed using SMART PLS 3.0, and revealed that IT ambidexterity improves a hospital department's patient service performance through the full mediating effect of Patient Agility.

Key terms

IT Ambidexterity, Patient Agility, Relative Patient Service Performance, Hospital Departments, The Netherlands

Summary

The goal of this study is to determine whether IT ambidexterity improves a hospital department's patient service performance, and to establish whether these improvements are caused through the mediating effect of patient agility.

Hospitals operate in a highly changing environment that is influenced by shifting demographics, and rapid innovations in technology. Shifting demographics caused by population aging has changed the service demands of patients. The Patient service performance of a hospital department represents its patient's overall evaluation of the service offerings. To improve their patient services, hospitals are in a continuous process of reform to keep up with these changes. In conjunction with these reforms, hospitals also need to open themselves up to new opportunities that continuously present themselves in the form of new medicine, organizational innovations and innovations in information technology.

IT ambidexterity is the ability of an organization to simultaneously explore new IT resources and practices as well as exploit their current IT resources and practices. When a hospital department engages in IT Ambidexterity, the simultaneous exploration of new IT resources and practices as well as the exploitation of their current IT resources and practices, could promote a state in which the hospital department continually innovates and improve its patient processes, enabling it to quickly react to environmental changes, thereby making it more agile. A hospital department's Patient agility represents the department's ability to sense and respond quickly to patient-based opportunities for innovation and competitive action

For this study a survey was developed and send to various medical professionals working in hospital departments in the Netherlands. This resulted in a total of 92 responses. For the data analysis SMART PLS 3.0 was used. The data analysis confirmed that IT ambidexterity improves a hospital department's patient service performance through the full mediating effect of Patient Agility

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1. Introduction

1.1. Background

Information technology (IT) has been used in hospital departments for a long time. Since last decade the position of information technology has shifted from a supportive role, towards a role in which building an enabling information technology platform has become one of the key principles for the delivery of value-based healthcare (Michael E. Porter & Lee, 2013). To increase the quality of patient care, Hospitals must understand their patients' demands and create solutions in which they can fulfill their patients' needs. Hospitals also need to look for ways in which they can explore and exploit new opportunities. New opportunities present themselves daily in the form of new technical breakthroughs but also in the form of novel ways to further develop their current IT resources.

1.2. Exploration of the topic

Population aging has increased the number of patients that hospitals need to service and has increased the amount of patients with multiple chronic conditions (Bouckaert, Van den Heede, & Van de Voorde, 2018). While at the same time technical breakthroughs such as wearable devices and health services driven by big data technology are quickly innovating the healthcare landscape (J. Wu, Li, Cheng, & Lin, 2016). To operate in this changing environment influenced by shifting demographics and rapid innovations in technology, hospitals are in a continuous process of reform. Patient agility is the hospital department's ability to sense and respond quickly to customer-based opportunities for innovation and competitive action (Roberts & Grover, 2012a). In practice, patient agility empowers hospitals to understand and to predict patient needs and enables hospitals to respond to these needs. Hospitals must also develop means in which it can grab new opportunities that are presented in the form of new medicine, organizational innovations, and innovations in information technology(Bouckaert et al., 2018).

IT ambidexterity is described as the ability of an organization to simultaneously explore new IT resources and practices as well as exploit their current IT resources and practices.(O. K. Lee, V. Sambamurthy, K. H. Lim, & K. K. Wei, 2015). Ambidextrous management of IT resources and practices can lead to the achievement of increased organizational agility. While in turn, Increased organizational agility can help a hospital to quickly sense and respond to their changing environments(D. Teece, Peteraf, & Leih, 2016).

For example, When a hospital has increased organizational agility it possesses organizational processes that are used to quickly alter resources (such as their patient services) to meet the requirements of their patients (Harsch & Festing, 2020). The same increase in agility had previously already been demonstrated in the context of organizational ambidexterity (which is more focused on exploring and exploiting existing competencies and exploring new opportunities in the general context of an organization) (V. Sambamurthy, K.-K. Wei, K. Lim, & D. J. I. p. Lee, 2007b). A 2013 meta-analysis on organizational ambidexterity (Junni, Sarala, Taras, & Tarba, 2013) revealed that organizational ambidexterity has a positive effect on the organizational performance in high-technology, manufacturing, and service industries.

1.3. Problem statement

Hospitals operate in a highly changing environment that are influenced by shifting demographics and rapid innovations in technology. Shifting demographics caused by population aging has changed the service demands of patients. An example of changing demands caused by population aging is an increase in multidisciplinary needs and an increase in the intensity of therapy likely required (Hubbard, O'Mahony, Cross, & Morgan, 2004). To successfully operate in these conditions hospitals need to react flexibly and adapt quickly to these shifting conditions (Harsch & Festing, 2020).

Met opmerkingen [WRvd1]: Probeer de layout ook meteen wat aan te passen.

Met opmerkingen [WRvd2]: Denk om de spaties…

Met opmerkingen [WRvd3]: Ik zie het probleem nog onvoldoende duidelijk. Probeer daar nog wat aandacht aan te besteden.

Met opmerkingen [WRvd4]: Dat heb je verteld, maar ga daar eens dieper op in, wat speelt er dan nog meer dat zo'n impact heeft?

To improve their patient services, hospitals are in a continuous process of reform to keep up with these changes. In conjunction with these reforms, hospitals also need to open themselves up to new opportunities that continuously present themselves in the form of new medicine, organizational innovations and innovations in information technology (Bouckaert et al., 2018). Empirical evidence reveals, however, that hospitals frequently struggle to implement innovations or fail to achieve the intended benefits of adopted innovations (Piening, 2011). In response to these problems, this study proposes to investigate if IT ambidexterity can improve the patient service performance of a hospital. Research in IT ambidexterity has shown that ambidextrous management of IT resources can make an organization more competent in introducing improvements to the information systems within the organization(O. K. Lee et al., 2015). Sofar, there have been no IT ambidexterity researches conducted in a hospital environment. Therefore, the exact influence of IT ambidexterity on a hospital department's patient service performance is unknown.

1.4. Research objective and questions

The objective of this research is to find out whether IT ambidexterity improves a hospital department's patient service performance and to establish whether these improvements are caused through the mediating effect of patient agility.

To achieve this objective the following main research question needs to be answered:

Does a hospital department's ability to simultaneously pursue exploration and exploitation in their management of IT resources and practice, improve the department's patient service performance, through the mediating role of Patient agility?

Before the main research question can be answer, the following sub-questions need to be answered first:

Does IT ambidexterity improve a hospital department's patient agility?

Does patient agility influence the patient service performance of a hospital department?

To answer these questions a framework needs to be created to determine the IT ambidexterity in a hospital setting. Also, a model needs to be developed to objectively determine hospital department's patient service performance.

1.5. Motivation/relevance

This study explores the relationship between IT Ambidexterity and patient services performance. When a hospital department's patient services performance is high it means that it is very capable at providing in patient's needs. This study will provide more insight in the way hospital departments can improve their patient services performance by simultaneously exploring for new, as well as exploit their current IT resources and practices. It also aims to provide more insight in how hospital departments can improve their patient services performance by creating an ability to sense and respond to changing patient's needs. This study is relevant because understanding the benefits of IT ambidexterity and patient agility could help hospitals in their struggle to implement innovations that meet patient's needs.

1.6. Main lines of approach

In the next chapter a theoretical framework is presented on which the study is build. In this theoretical framework a literature study is presented discussing recent studies regarding the topics of IT Ambidexterity, Patient Agility and Relative Patient Service Performance. The literature study also present potential answers to the research questions, therefore laying the foundation of the hypotheses for this paper. Chapter 3 presents the methodology that has been used to conduct this study, describing the technical design and how the data for this study was analyzed. The results of the study are presented in chapter 4 and consequently, the results are discussed in the following chapter. Chapter 5 also presents some recommendations for practice and for future studies, and ends with a conclusion for this study.

2. Theoretical framework

2.1. Research approach & Implementation

To develop the theoretical framework, a literature study was conducted to review the existing knowledge regarding IT Ambidexterity, Patient Agility, Relative patient service performance, and environmental turbulence. A list of all the queries that have been used can be found in Appendix A. To acquire all relevant literature, the information network of the digital Library of the Open University was used as the primary source for information. The digital library of the Open University has subscriptions for many leading scientific and business information platforms (including Springerlink, Wiley, and Jstor). Initially, google scholar was also used to find literature. However, none of the literature found through google scholar (that did not overlap with the literature found through the digital library of the Open University) was included to develop our theoretical framework because either no full article was available, or the articles had been superseded, or the ranking of the journal was too low. Also, a paper copy of Porter's ' Redefining health care'(M.E. Porter & Teisberg, 2006) was used as a reference regarding topics such as value-based medicine and the positioning of IT within medical care.

Met opmerkingen [WRvd5]: Ok, maar welke artikelen heb je nu gebruikt? Dat kan ik niet zien (allleen afleiden uit de tekst)

After each query search, the results of these queries were scanned by reading the title for relevance. When a title seemed to relate to the research, the abstract was read. In total, 86 articles were shortlisted based on the title and abstract. Consequently, these articles were evaluated for relevance: First, the year that the articles were published were determined. If an article was older than 10 years, a quick search was conducted in the digital library of the Open University, to determine if the article has been superseded. A check was also conducted to determine if the article was from a peer-reviewed academic journal. In case of doubt the rating of the journal was looked up in scimago (www.scimagojr.com). Finally, the articles were critically read and evaluated. The evaluation consisted of determining whether the research question and objectives of the article were sufficiently close to the research we were planning to conduct and if parts of the research supported or contradicted our initial arguments. A scan was also done of the articles mentioned in the references. In some cases, the references of the articles were also added to the shortlist (the snowballing effect). Usually these articles represented fundamental theory (such as Teece's theory about Dynamic capabilities). To prevent confirmation bias we tried to keep articles found through snowballing to a minimum. After critically reading the shortlisted articles only 41 articles were found relevant and ended up being used for the framework.

2.1.1. Dynamic capabilities

The problem of how organizations can successfully deal with a dynamic and unpredictable environment has always been a fundamental question in the field of strategic management. Teece et al. presented a strategy to tackle this problem with their Dynamic capabilities framework (D. J. Teece, Pisano, & Shuen, 1997). In the Dynamic capabilities framework, an organization focusses on building, leveraging and reconfiguring their internal and external organizational resources, to match and to influence the requirements of a changing environment while at, the same time it focusses on renewing existing competencies to achieve more flexibility (Sunder M, L.S, & Marathe, 2019; D. J. Teece et al., 1997). The core of the theory is that organizations should continually reconfigure their existing capabilities (Roberts & Grover, 2012a; D. J. Teece, 2007). Organizations achieve this in three ways: (1) they sense and shape opportunities and threats; (2) they seize market opportunities; and (3) they maintain competitiveness through enhancing, combining and reconfiguring the firm's intangible and tangible assets. Through its dynamic capabilities, an organization acquires organizational agility and develops the ability to quickly sense and respond to their changing environments (D. Teece et al., 2016). The organization's capability-building processes refer to how organization can integrate, build, and reconfigure internal and external resources to create dynamic organizational capabilities (D. J. Teece et al., 1997). The capability-building processes result in a hierarchy of organizational capabilities in which lower order functional capabilities are integrated to form higher order dynamic capabilities.

2.1.2. IT ambidexterity

Many organizations utilize IT as a key platform by which they improve their organizational agility (V. Sambamurthy, Bharadwaj, & Grover, 2003; V Sambamurthy et al., 2007b). IT can improve organizational agility not only by creating new information-based products and services, but also by streamlining work processes and building inter-organizational relationships (Overby, Bharadwaj, & Sambamurthy, 2006; V. Sambamurthy et al., 2003; V Sambamurthy et al., 2007b). The latest IT innovations regarding patient's needs in hospital departments for example have been focused on (1) improving patients' access to data created at the point of care as well as data generated by mHealth (practice of health supported by mobile devices) and related technologies, (2) enabling patient participation in and contributing to care delivery and health management, (3) more readily engaging patients in research, and (4) to positively identify, authenticate, and match patients with their data (Adler-Milstein, Embi, Middleton, Sarkar, & Smith, 2017). However, there are still many detrimental factors that inhibit a hospital department's ability to innovate: mainly low data quality and insufficient integration of their IT infrastructure (Chandra, Knickrehm, & Miller, 1995). Therefore, a hospital department should not only focus their attention in identifying new opportunities but also develop knowledge in the strengths and weaknesses of their current IT resources.

An organization's IT ambidexterity is the ability of an organization to simultaneously explore new IT resources and practices as well as exploit their current IT resources and practices(O. K. Lee et al., 2015). A central concern of the adaptive ability of an organization to changing environments is the relation between the exploration of new possibilities and the exploitation of old certainties (March, 1991). Exploration aims to create variety and experience. Therefore, exploration thrives on experimentation and free association(Holmqvist, 2004). In practice, IT exploration is the ability of an organization to locate resources and managerial time to gain an understanding of novel information technologies. Through experimentation, the organization then selects those technologies that are most likely to have a positive impact on current and future business operations. The aim of exploitation is to create reliability in experience; therefore exploitation thrives on productivity and refinement (Holmqvist, 2004). In practice IT exploitation is the ability of an organization to manage its current portfolio of IT assets. IT exploitation aims to leverage and reuse existing IT assets in different business activities and to invest in complementary technologies to improve their effectiveness. IT ambidexterity can, therefore, be seen as a dynamic capability as the use of resources for exploration involves sensing and seizing new opportunities while the simultaneous use of resources for exploitation involves the reconfiguration of current competences(O'Reilly & Tushman, 2008). Central to the idea of exploration and exploitation is that there needs to be an interplay between the two (Gupta, Smith, & Shalley, 2006; March, 1991). Organizations that engage in exploration without exploitation are likely to suffer the cost of experimentation without the gaining of its benefits while conversely, organizations that engaging in exploitation without exploration are likely to find themselves trapped in an suboptimal stable equilibria (March, 1991). To be responsive to environmental changes, firms should conduct both exploration and exploitation in a way that both complement each other and are balanced (Gibson & Birkinshaw, 2004). In his 2015 article, Lee et al. has demonstrated that IT ambidexterity enhances organizational agility through the mediating role of operational ambidexterity. Lee demonstrated that IT ambidexterity can improve an organization's operational ambidexterity by facilitating diverse operational processes within an organization. The operational ambidexterity is the ability of an organization to simultaneously pursue operational exploration and exploitation. Lee reasoned that the simultaneously pursuit of operational exploration and exploitation would allow an organization to continually innovate and improve its operational processes. When an organization can continually innovate and improve its operational processes, it can quickly react to environmental changes and thereby it is more agile. When a hospital department engages in IT Ambidexterity, the simultaneous exploration of new IT resources and practices (such as wearable devices and health services driven by big data technology) as well as the exploitation of their current IT resources and practices, could promote a state in which the hospital department continually innovates and improve its patient processes, enabling it to quickly react to environmental changes and thereby making it more agile.

Met opmerkingen [MPL6]: MPL: jaartal?

2.1.3. Patient Agility

In order to create a competitive advantage, one important competence of an organization is that it must sense and respond quickly to changes in customer preferences (Jayachandran, Hewett, & Kaufman, 2004). An organization's customer agility is an organization's ability to sense and respond quickly to customer-based opportunities for innovation and competitive action (Roberts & Grover, 2012b). Since it encompasses sensing and seizing (responding) components, it can be regarded as a dynamic capability. The sensing component of customer agility encompasses a scanning, creation, learning, and interpretive activity (D. Teece et al., 2016; D. J. Teece, 2007). Fort this reason it not only involves the investment in research activity and the repeated assessment of customer needs and technological possibilities, but it also involves understanding latent customer demands, the structural evolution of industries and markets, and supplier and competitor responses (D. J. Teece, 2007). Successful execution of these activities will result in spotting new market opportunities and being in the position to capitalize on them (Zaheer & Zaheer, 1997). The response component of customer agility refers to the quickness with which an organization can respond to environmental signals (D. Teece et al., 2016; D. J. Teece, 2007). Jayachandran et al. has highlighted that a customer response capability constitutes of two dimensions, namely customer response expertise and customer response speed(Jayachandran et al., 2004). The customer response expertise refers to the extend in which the response of an organization effectively meets the customer's needs, while the customer response speed refers to the extend at which its response to customer needs are rapid. In 2012, Roberts et al. conducted two surveys among 188 marketing managers in which they wanted to elucidate the impact of customer agility on a firm's performance. Roberts et al. concluded that there is a significant relationship between customer agility and the performance of a firm. They also noted that firm performance was higher when customer-sensing capability and customer responding capability were aligned than when they were misaligned. Currently, no customer agility studies have been conducted in a hospital environment.
Since a patient consumes the services provided by a hospital department, it can be established that a patient plays the role of a customer during a healthcare process. it can be reasoned that a hospital department's patient agility is a hospital department's ability to sense and respond quickly to patient-based opportunities for innovation and competitive action. When IT ambidexterity is connected with patient agility, it can be reasoned that IT ambidexterity could also innovate and improve operational processes that are involved in sensing and responding quickly to patient-based opportunities for innovation and competitive action, we hypothesize that:

H1. IT Ambidexterity has a positive effect on Patient agility.

Met opmerkingen [WRvd7]: Prima geschreven, wat schoonheidspuntjes nog, maar ik mis nog wel een beetje het healthcare perspectief. Kun je dat nog ergens kwijt.

Met opmerkingen [WRvd8]: Lijkt me dat je hiermee begint, dit is ook het begin van je model

2.1.4. Patient service performance

There are multiple ways in which the performance of a patient service can be determined. A common way to determine the performance of a patient service is to determine the level at which the outcome of a health service can improve a patient's quality of life (Boyer et al., 2012; Brown, Brown, Sharma, & Landy, 2003; Philip J. Van Der et al., 2014). This approach is patient-centric and provides information about the quality of the health service but is less suitable for determining the competitiveness of patient service.

Since we have established that a patient takes the role of a customer, the patient service performance of a hospital department can be approached as a customer service performance. The customer service performance of a service unit represents its customers' overall evaluation of the service offerings (Setia, Setia, Venkatesh, Joglekar, & University of, 2013). When a patient is satisfied with the hospital department's services, it can deliver the hospital department a competitive advantage compared to their competitors. Kessler and Mylod have demonstrated that patient satisfaction in a hospital service affects patient loyalty, meaning that satisfied patients are less likely to change hospitals in case of future treatments (Kessler & Mylod, 2011). This relation between service satisfaction and loyalty has also been demonstrated in studies in other industries(Han, Kim, & Hyun, 2011; Kumar, Pozza, & Ganesh, 2013). Studies have shown that high customer satisfaction could also lower costs, increase profitability and attract new customers(Bolton, 1998; Carden & DelliFraine, 2004). However, since there have been no comparable studies done in a hospital setting, patient service performance cannot be directly associated with these

advantages. In order to improve its patient services performance, hospital departments must continuously improve their quality of care by innovating both their medical and administrative service, while at the same time, they must satisfy the changing requirements of customers in a competitive market (Koufteros, Vonderembse, & Doll, 2002; I.-L. Wu & Hsieh, 2015).

When we relate Patient agility and IT ambidexterity to a hospital department's patient service performance, we hypothesize that:

H2. Patient agility has a positive effect on the patient service performance.

And

H3. IT Ambidexterity has a positive effect on patient service performance through the mediating effect of patient agility

2.1.5. Environmental turbulence

A turbulent environment is widely believed to have damaging effects on service performance(Boyne & Meier, 2009). Environmental turbulences are general conditions of uncertainty related to demand fluctuation, competitive intensity, and the frequency of technical breakthroughs (Mendelson, 2000). Considering the disruptive nature of environmental turbulence it is generally thought that environmental turbulence has a detrimental effect on the performance of an organization(Boyne & Meier, 2009; Power & Reid, 2005). Boyne and Meyer came to similar conclusions in their research on the effect of Environmental turbulence on the service of public organizations(Boyne & Meier, 2009). They concluded that organizations in that experience high environmental turbulence find it more difficult to perform well but that the negative impact of turbulence can be mitigated if organizations maintain structural stability. In contrast, Boyne and Meyer suggest that organizations that respond to external change by pursuing structural change are likely to perform more poorly that their stable counterparts. This is because structural changes cause turbulence to the internal environment that adds to the negative effect of the external turbulence it was already facing. The weakness of Boyne and Meyer's research, however, is that it mainly focusses on environmental turbulence caused by fluctuations in revenue (such as government funding) and the measures public organizations need to take to maintain service standards. The scope of the research also doesn't include any analysis of IT. In contrast, 2010 research by Rai and Tang in IT capabilities and competitive process capabilities for the management of interorganizational relationship portfolios, demonstrated that environmental turbulence has a positive moderating effect between a company's competitive process capabilities and the company's competitive performance(Rai & Tang, 2010). Rai and Tang demonstrated that organizations respond to environmental turbulence by developing flexibility that enables organizations to increase the variety of its competitive actions. When organizations consequently launch and execute these variety of competitive actions it can enable them competitive advantage in the often-small windows of opportunity available in turbulent environments. The same effect was demonstrated by Wilden and Gudergan. In their research in the impact of dynamic capabilities on operational marketing and technological capabilities(Wilden & Gudergan, 2015). In their study of 221 firms, wilden and Gudergan concluded that that frequent sensing and reconfiguring have stronger positive effects on a firm's performance in environments characterized by high environmental turbulence. Since the researches of Rai and Tang, and Wilden & Gudergan observed a positivemoderating effect of environmental turbulence on a company's capabilities and the company's competitive performance we hypothesize that:

H4. A high environmental turbulence has a positive moderating effect on the positive effect of IT Ambidexterity on patient agility

H5. A high environmental turbulence has a positive moderating effect on the positive effect of patient agility on patient service performance

When we reflect on our 5 hypotheses, we get the following conceptual model:

Met opmerkingen [WRvd9]: Er zitten door heel het stuk nog veel spelfouten en kleine slordigheden. Loop je teksten echt goed na.

Met opmerkingen [WRvd10]:

Met opmerkingen [WRvd11]: Zou 1 en 2 omdraaien.

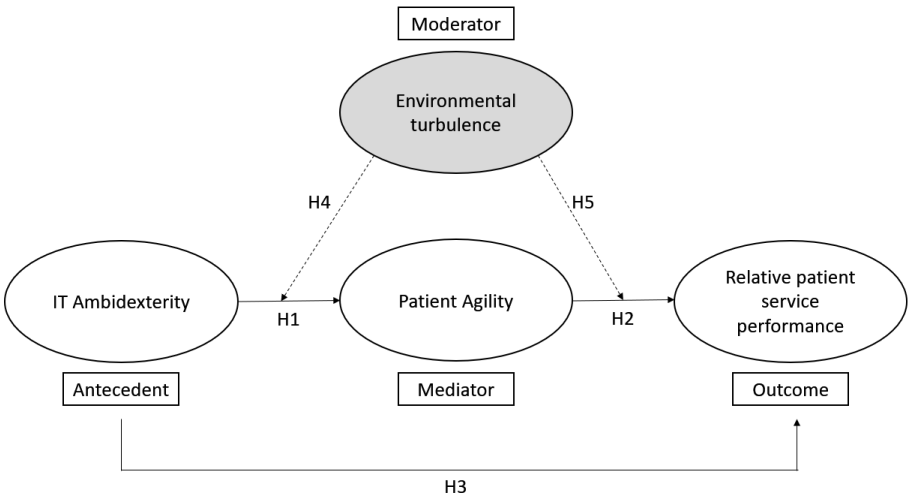

Figure 1: The conceptual model

Met opmerkingen [WRvd12]: Mooie plaat!!!!

2.2. Objective of the follow-up research

The objective of the follow-up research is to test our hypotheses in practice. When our hypotheses are confirmed we will proof that a hospital department's ability to simultaneously pursue exploration and exploitation in their management of IT resources and practice does influence the department's patient service performance. This might help hospital departments in allocating their resources for IT to better fulfill the needs of the patient. To test our hypotheses, we will need to collect information from multiple hospital departments and to collect data regarding their IT Ambidexterity, Patient Agility, Relative patient service performance and environmental turbulence.

3. Methodology

3.1. Research method

To test the theories presented in the theoretical framework. Information had to be collected regarding the subjects of interest (IT Ambidexterity, Patient Agility, Relative Patient Performance and Environmental Turbulence) in a hospital department setting. The logical target group to collect this information from, were medical professionals working in a hospital department. This target group was the logical choice because they operate in a hospital environment on a daily basis and have the best insight in their hospital department's IT processes and patient related processes.

To collect the data, a questionnaire survey was held. A survey strategy using a questionnaire was the right choice because it allows the collection of standardized data from a sizable population in a highly economical way, allowing for easy comparison(Saunders, Lewis, & Thornhill, 2016). Using a more qualitative approach would have meant the collection of large volumes of complex (non-standardized) data which would have been much harder and time consuming to process in order to address the research objectives and to answer the research questions. Since the result of the survey generated standardized, quantitative data in the form of measurements, the data could be easily and quickly analyzed using statistical software to reveal statistically significant relationships between the various subjects of interest.

3.2. Technical design: Elaboration of the method

A survey was created in Limesurvey and distributed to the target respondents, which were the senior staff members of hospital departments. The hospital departments included for the study were hospital departments from academic and top clinical hospitals in the Netherlands, whose primary task is to provide care to patients. A list of included hospital departments can be seen in table 1:

Met opmerkingen [WRvd13]: Dit kun je verder uitwerken met de feedback die ik maandag heb gegeven.

Met opmerkingen [WRvd14]: Wie zijn dat dan?

Table 1: A list of included hospital departments

General internal medicine	Anesthesiology	Pharmacy	Cardiology
Cardiothoracic surgery	Surgery	Dermatology	Endocrinology
Geriatrics	Infectious diseases	Intensive care	Throat, nose and ear diseases
Pediatrics	Neonatology	Immunology and rheumatology	Clinical hematology
Clinical oncology	Lung diseases	Gastrointestinal and liver diseases	Mouth diseases
Dental and jaw surgery	Neurology	Kidney diseases	ophthalmology
Orthopedics	Plastic and reconstructive surgery	Psychiatry	Revalidation
Emergency department	Urology	Vascular medicine	Gynecology

Hospital departments that provide support to other hospital departments (such as the imaging department or the hospital pharmacy) were excluded from our study. They were excluded because their supportive role most likely meant that (parts of) their IT processes and patient related processes were formed towards the needs of the supported hospital departments rather than solely on the patient's needs.

Met opmerkingen [WRvd15]: Welke dan wel?

Met opmerkingen [MPL16]: MPL: oké, maar leg uit expliciet waarom.

Initially, all the academic and top clinical hospitals in the Netherlands were mapped through a google search. Consequently, the webpage of each of these hospitals were visited and short list of all the departments that followed the inclusion criteria were made. Respondents included in the research were the head of the department, senior registrars (Chef de Clinique), Specialists (Doctors), Specialist trainees (PhD students) and Operational managers. Respondents were contacted through multiple online channels such as LinkedIn and Facebook. A connection invitation was sent and if the target respondent accepted

the connection request, an introductory letter was send including the link of the survey. Respondents were also contacted through the secretary of their hospital department. Each respondent was personally approached through e-mail. The e-mail consisted of a short description of the purpose of our research and a link to the survey. When the respondent did not answer the survey within two weeks, a phone call was made to the respondent, and the survey was filled in during the phone call, together with the student.

The survey consisted of two sections (see Appendix B). in the first section, eight questions were asked to document information about the respondent's position within the department, work experience and some general questions regarding the department. The second section of the survey consisted of a small section with definitions and questions (to acquire measurements) regarding IT Ambidexterity, Patient Agility, Relative patient service performance, and environmental turbulence. Before the collected survey data could be analyzed a structural model was created in SMART-PLS 3.0 (Ringle, 2015). In this model each of the subjects of interest was individually modeled in a construct. A construct is an abstract representation of each subject indirectly measured using proxy variables called indicators (Hair, Hult, Ringle, & Sarstedt, 2017) (see Appendix C). Since all indicators associated with its constructs were highly correlated with each other and any single indicator could be left out without changing the meaning of the construct, all the created constructs were modeled as reflective measures(Hair et al., 2017). In the structural model the relationship between the constructs were displayed by the paths.

Met opmerkingen [WRvd17]: Dit is nog steeds niet duidelijk. Er moet een measures and items sectie zin waarin je dit verwerkt.

Met opmerkingen [WRvd18]: Wel refereren naar de tool met literatuur.

The IT Ambidexterity construct was formed out of the two constructs IT Exploration and IT Exploitation (Figure 2). Each construct consisted of 3 indicators. The IT Exploitation construct consisted of indicators ITA1, ITA2 and ITA3. The IT Exploration construct consisted of indicators ITA4, ITA5 and ITA6.
Since the constructs IT Exploration and IT Exploitation each captures a specific domain of IT Ambidexterity their relationship with IT Ambidexterity is formative, since omitting any of these two constructs alters the nature of IT Ambidexterity.

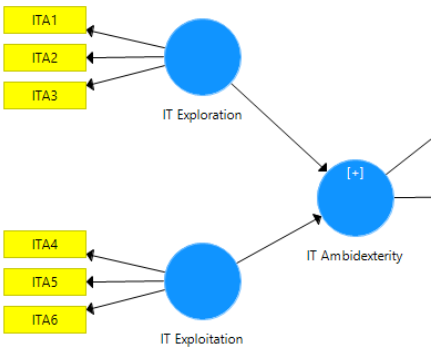

Figure 2: The constructs for IT Exploration and IT Exploitation

IT Ambidexterity is the higher order construct that is formed through the simultaneous execution of its two lower order constructs IT Exploration and IT Exploitation. The higher order construct was formed by interaction on indicator level. In this way the higher construct is created through the additive interaction of the indicators of both lower order constructs (figure 3). A similar approach was previously used by Gibson et al. to model Organizational Ambidexterity(Gibson & Birkinshaw, 2004).

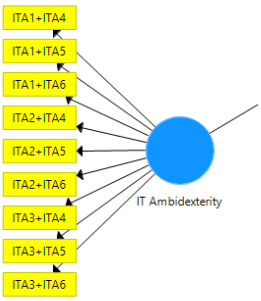

Figure 3: The higher order construct IT Ambidexterity

The Patient Agility construct was formed out of the two constructs patient sensing and patient responding capabilities (Figure 4). Each construct consisted of 5 indicators. The patient sensing capabilities construct consisted of indicators PA1, PA2, PA3, PA4 and PA5. The patient responding capabilities construct consisted of indicators PA6, PA7, PA8, PA9 and PA10. Since the constructs Patient Sensing and Patient Responding capabilities each captures a specific domain of Patient Agility their relationship with Patient Agility is formative, since omitting any of these two constructs alters the nature of Patient Agility.

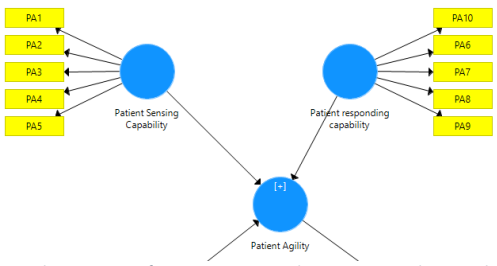

Figure 4: The construct of patient sensing and patient responding capabilities

Patient Agility is a higher order construct that consists of the lower order constructs patient sensing and patient responding capabilities. The higher order construct Patient Agility was formed through the two stage approach(Hair et al., 2017). In the first step the repeat indicator approach is used to obtain the latent variables scores for the two lower order constructs. In the second stage these lower order construct scores serve as manifest variables for the measurement model of Patient Agility (figure 5)

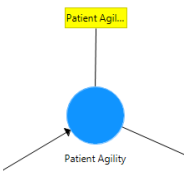

Figure 5: The higher order construct Patient Agility

The Relative patient service performance construct consisted of all the PR indicators (PR1-PR9) [Figure 6]

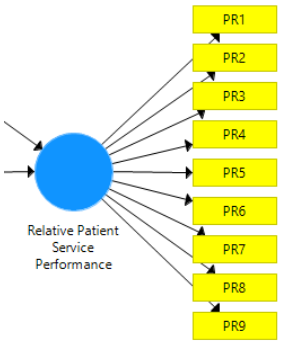

Figure 6: The Relative patient service performance construct

The Environmental turbulence construct consisted of all the ET indicators (ET1-ET4) [Figure 7].

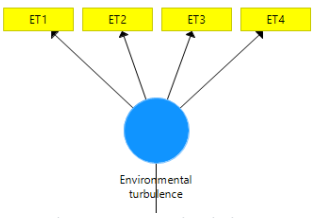

Figure 7: The Environmental turbulence construct

Approximately 2000 professionals working in a hospital department, were approached for the survey. In total 140 professionals have initiated the survey. From these 140 professionals 47 did not fully complete the survey. 10 of the respondents that did not fully complete the survey provided feedback for why they did not finish the survey. Their feedback revealed that they did not finish the survey because they felt that they did not have insufficient insight in the IT or patient related processes. Some also responded that they did not fully understood some of the survey questions. From the fully completed surveys one response was excluded because it was filled in by a professional that worked in the department Finance and Control. In total 92 fully completed surveys were included for the data analysis.

Met opmerkingen [WRvd19]: Dat is nog methode

Met opmerkingen [WRvd20]: Allemaal method

Met opmerkingen [WRvd21]: Je zou kunnen starten met een descriptives sectie

3.3. Data analysis

Since the survey data produces quantitative data. The analysis of the data is based on statistical methods and techniques. In this study a statistical analysis method was needed that can both, analyze the relationship between the indicators and the constructs, and analyze the relationship between the various constructs. Structural equations modeling (SEM) is a frequently used second-generation multivariate method that is capable to perform both these analysis (Hair et al., 2017). There are 2 types of SEM methods, one is covariance-based structural equations modeling (CB-SEM) the other is partial least squares structural equations modeling (PLS-SEM). CB-SEM is used to confirm (or reject) theories while PLS-SEM is primarily used for exploratory research and the development of theories. Since this is an exploratory research, PLS-SEM was chosen for the data analysis. An added advantage of PLS-SEM is that it is able to handle small sample sizes (Hair et al., 2017). With 92 fully completed surveys the sample of this study is relatively small but still larger than the minimum samples indicated by the 10 time rule: which means that the sample size of this study is larger than 10 times the largest number of formative indicators used to measure a single construct, or 10 times the largest number of structural paths directed at a particular construct in the structural model.

The PLS-SEAM analysis was conducted in SMART-PLS 3.0 (Ringle, 2015). For the data analysis, the systematic procedure for applying PLS-SEM as described by Hair et al. was followed(Hair et al., 2017). The goal of the data analysis is to evaluate the quality of the developed path model and to determine the model's ability to estimate the cause-effect relationships between the constructs.

The first stage of the data analysis consisted of the evaluation of the quality of the measurement model. Since all the constructs are reflective, only Hair's evaluation of reflectively measured constructs was conducted. The goal of this evaluation is to ensure the reliability and validity of the construct measure and to evaluate their suitability for the inclusion in the path model. For this assessment, first, the internal consistency reliability is assessed because it provides an estimate of the intercorrelations of the observed indicator variables. Consequently, the convergent validity is assessed because it expresses the extent to which a measure correlates positively with alternative measures of the same construct. The final assessment of the measurement model is to determine the discriminant validity. When discriminant validity is established this means that all constructs are truly distinct from other constructs by empirical standards.

The second stage of the data analysis consisted of the assessment of the quality of the structural model. This involves examining the model's predictive capabilities and the relationship between the constructs. First the structural model was assessed for collinearity issues. Since the estimation of the path coefficients is based on ordinary least square regression of each endogenous latent variable on its corresponding predecessor constructs, the path coefficients may be biased if the estimation involves critical levels of collinearity among the predictor constructs. When no collinearity issues are found, the path coefficients are assessed. The path coefficients are assessed to reveal the significance of the relationships between the constructs. Consequently, the Coefficient of determination and the f^2 effect size were assessed. The Coefficient of determination represents the amount of variance in the endogenous constructs explained by all the exogenous constructs linked to it, while the f^2 effect size evaluates how substantive the impact of the exogenous constructs on the endogenous constructs is. The assessment of the structural model is finished with an assessment of the predictive relevance Q^2, and the q^2 size. The predictive relevance Q^2 is an indication of the path model's predictive relevance for a particular dependent construct, while the q^2 size indicates how substantive the impact of the predictive relevance of an exogenous construct on the endogenous constructs is.

Finally, once the quality of the path model has been validated a mediation and moderation analysis was conducted. The mediating effect was determined using the Bias-corrected and accelerated bootstrap, two tailed testing function of Smart PLS with a significance level set at 0.05. The moderating effect was determined using the two-stage approach as described by chin et al. (Chin, 2001).

The dataset from the survey had 87 cases of missing values (Appendix D). all cases of missing values were in the survey questions regarding Relative Patient Service Performance. This is because respondent had the option to answer with a default answer which was 'Unknown/ I do not know'. Every 'Unknown/ I do not know' generated an empty value (null). All cases of missing values were manually replaced with the missing data label '-99' before they were uploaded in SMART PLS 3.0. The missing values to question PR8 (Attaining desired market share) exceeded more than 15% (n=16), therefore the observations of PR8 were not included in the further data analysis. All other cases of missing values were handled in SMART PLS 3.0 by mean value replacement.

Met opmerkingen [WRvd22]: Wel refereren naar de tool met literatuur.

Met opmerkingen [WRvd23]: Tja, dat is zeker waar, maar waarom en wat levert je dat dan op?

Met opmerkingen [WRvd24]: Heb je ook (missing) values replaced? Soms zijn de data bijna compleet ingevuld behalve het laatste deel. Dan kun je wellicht gemiddelde nemen voor die missing values (onderbouwd met literatuur).

Met opmerkingen [WRvd25R24]:

4 Results

4.1 The assessment of the measurement model

Before the determination can be made how well the theory fits the data, various evaluations were made of the model. The first evaluation was an evaluation of the measurement models. Since the model only consisted of reflective measurement. The various lower order constructs were evaluated for their Internal Consistency, Convergent Validity, and Discriminant validity.

Met opmerkingen [WRvd26]: Check ook goed de spelling.

With the exception of the environmental turbulence construct, the internal consistency of all the lower order constructs was sufficiently high (table 2), meaning that they all have a Cronbach's alpha and composite reliability higher than 0.7. In the case of the constructs IT Exploration and Patient responding capability, both the Cronbach's alpha and the composite reliability were very high, exceeding a value above 0.9. The environmental turbulence construct had a Cronbach's alpha of 0.524 which is lower than the acceptable range of 0.5. On the other hand, the composite reliability of the environmental turbulence construct was 0.702, which is sufficiently high.

Table 2: The internal consistency and convergent validity of the lower order constructs (after the removal of indicators PR4, PR5, ET2, ET3)

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
IT Exploitation	0.854	0.911	0.774
IT Exploration	0.926	0.953	0.871
Patient Sensing Capability	0.898	0.925	0.713
Patient responding capability	0.936	0.951	0.797
Relative Patient Service Performance	0.821	0.859	0.51
Environmental Turbulence	0.445	0.782	0.643

With the exception of the Relative Patient Service Performance construct and the environmental turbulence construct, the convergent validity of all lower order constructs was sufficient (meaning that they have an AVE higher than 0.5). The Patient responding capability construct initially had an AVE of 0.451. An inspection of the outer loading of the Relative Patient Service Performance construct showed that 5 of the 8 indicators had a weak outer loading between 0.4 and 0.7 (as can be seen in Appendix E). The other 3 constructs had an acceptable outer loading of higher than 0.708). The removal of the indicator with the weakest outer loading (PR5) did not sufficiently improve the AVE. The removal of the two indicators with the weakest outer loading (PR4 and PR5) improved the AVE for the Relative Patient Service Performance construct to 0.510 which is above the acceptable threshold of 0.5 (Table 2). As can be seen in Appendix F. The removal of indicators PR4 and PR5 slightly decreased the Cronbach's alpha (from 0.841 to 0.821) and the composite reliability (from 0.865 to 0.859). Even after the decrease, the Cronbach's alpha and the composite reliability for the Relative Patient Service Performance construct remained sufficiently high.

Met opmerkingen [WRvd27]: Respond capability heeft toch geen 8 items maar 5?

The Environmental turbulence construct initially had an AVE of 0.389. An inspection of the outer loading of the Patient responding capability construct, showed that 2 of the 4 indicators had a weak outer loading between 0.4 and 0.7 (as can be seen in Appendix G). The removal of the indicator with the weakest outer loading (ET3) did not sufficiently improve the AVE. The removal of the two indicators with the weakest outer loading (ET2 and ET3) improved the AVE for the Patient responding capability construct to 0.643 which is above the acceptable threshold of 0.5. Removal of ET2 and ET3 did decrease the Cronbach's alpha even further from 0.534 to 0.445 but increased the composite reliability from 0.702 to 0.782. Since the removal of the two indicators lead to an increase of the convergent validity above the acceptable threshold and the removal also increased the composite reliability, and the option of keeping one or both indicators

Met opmerkingen [WRvd28]: Is dat geen probleem, waarom niet.

did not increase the internal consistency reliability above threshold. Removal of ET2 and ET3 was the logical choice.

The discriminant validity of all the lower order constructs was validated by assessing the heterotrait-monotrait ratio (HTMT). Since all constructs had a HTMT value beneath 0.9, the discriminant validity of the constructs was established (table 3). Consequently, bootstrapping was performed to derive a distribution of the HTMT statistics (table 4). Since none of the confidence intervals between the constructs included a value of 1, the bootstrap further established that all the constructs are truly distinct.

Table 3: The Assessment of the heterotrait-monotrait ratio (HTMT)

	Environmental Turbulence	IT Exploitation	IT Exploration	Patient Sensing Capability	Patient responding capability	Relative Patient Service Performance
Environmental Turbulence						
IT Exploitation	0.536					
IT Exploration	0.486	0.546				
Patient Sensing Capability	0.642	0.576	0.388			
Patient responding capability	0.285	0.345	0.318	0.557		
Relative Patient Service Performance	0.363	0.262	0.284	0.3	0.431	

Table 4: Bootstrap confidence intervals of HTMT

	Original Sample (O)	Sample Mean (M)	Bias	2.50%	97.50%
IT Exploitation -> Environmental Turbulence	0.536	0.569	0.033	0.195	0.879
IT Exploration -> Environmental Turbulence	0.486	0.516	0.03	0.15	0.738
IT Exploration -> IT Exploitation	0.546	0.541	-0.01	0.336	0.708
Patient Sensing Capability -> Environmental Turbulence	0.642	0.685	0.043	0.25	0.914
Patient Sensing Capability -> IT Exploitation	0.576	0.572	-0	0.377	0.726
Patient Sensing Capability -> IT Exploration	0.388	0.387	-0	0.213	0.569
Patient responding capability -> Environmental Turbulence	0.285	0.34	0.055	0.076	0.554
Patient responding capability -> IT Exploitation	0.345	0.345	-0	0.149	0.532
Patient responding capability -> IT Exploration	0.318	0.314	-0	0.129	0.5
Patient responding capability -> Patient Sensing Capability	0.557	0.558	0	0.347	0.692
Relative Patient Service Performance -> Environmental Turbulence	0.363	0.454	0.091	0.167	0.584
Relative Patient Service Performance -> IT Exploitation	0.262	0.308	0.046	0.132	0.455
Relative Patient Service Performance -> IT Exploration	0.284	0.315	0.031	0.115	0.484
Relative Patient Service Performance -> Patient Sensing Capability	0.3	0.336	0.037	0.183	0.428
Relative Patient Service Performance -> Patient responding capability	0.431	0.453	0.022	0.27	0.596

4.2 The assessment of the structural model

Since the assessment of the measurement model confirmed that the construct measures are reliable and valid, the next step was to assess the structural model results. The structural model was assessed for

Collinearity issues, its path coefficients, its coefficient of determination, its F^2 effect Size and for its predictive relevance Q^2. As a final step, the assessment of the structural model was concluded with an assessment of the q^2 effect size.

The assessment revealed no collinearity issues. Each construct had a Variance Inflation Factor (VIF) of well below 5 (Appendix H). The path coefficients were evaluated with the assumption of a significance level of 5%. This means that the observed p-values must have a value smaller than 0.03 to indicate a significant relationship. Significant relationships were determined between IT Ambidexterity and Patient Agility (p = 0.000), and between Patient Agility and Relative Patient Service Performance (p = 0.000) [Appendix I]. The assessment of the path coefficient between IT Ambidexterity and Relative Patient Service Performance, however, did not reveal a significant relationship (p=0.365). Since the path coefficient between IT Ambidexterity and Relative Patient Service Performance did not reveal a significant relationship the pathway was removed from the structural model for the remaining assessments.

Met opmerkingen [WRvd29]: Heb je hem dan vervolgens ook uit het model gehaald bij het draaien van de rest van de analyses, dat moet namelijk. Dat gaat impact hebben op R2 en F2 en Q2!!!!

The assessment of the coefficient of determination revealed that the construct IT Ambidexterity (R^2 =0.229) is very weak (R^2 value lower than 0.25) at predicting the amount of variance in Patient Agility (See Appendix J). the construct IT Ambidexterity (R^2 =0.199) is also very weak at predicting the amount of variance in Relative Patient Service Performance. Even though IT Ambidexterity is very weak at predicting the amount of variance in the two endogenous constructs its effect size was still relevant (Appendix K).

The assessment of the F^2 effect size demonstrated that IT Ambidexterity has a medium effect on Patient Agility (f^2 = 0.297). Patient Agility also has a medium effect on Relative Patient Service Performance (f^2 =0.249).

Met opmerkingen [WRvd30]: Niet toch, 144 is niet heel klein.

The Q^2 values of both endogenous constructs were also higher than zero demonstrating that the model has a predictive relevance for the two endogenous constructs (Appendix L). The assessment established that Patient Agility has a Q^2 value of 0.204 and Relative Patient Service Performance has a Q^2 value of 0.064. The corresponding q^2 effect size (Appendix M) for these Q^2 values were $q^2_{\text{Patient Agility}}$ = 0.796 and $q^2_{\text{Relative Patient Service Performance}}$ = 0.031. IT Ambidexterity therefore has a large (q^2 larger than 0.35) predictive relevance for Patient Agility and has a small (q^2 between 0.02 and 0.15) predictive relevance for Relative Patient Service Performance.

4.3 The mediating role of Patient Agility and the moderating role of Environmental Turbulence

After the assessment of both the measurement model and structural model have been made and all the quality criteria have been met, an evaluation was made of the mediating effect of Patient Agility and the moderating role of Environmental turbulence. The mediating effect of Patient Agility was determined through bootstrapping (Appendix N). The bootstrapping revealed that the relationship of IT Ambidexterity to Patient Agility was statistically significant (t=4.405, p=0.000). Patient Agility in turn, also formed a significant relationship with Relative Patient Service Performance (t=3.710, p=0.000). Since the indirect effect is significant and the indirect effect is insignificant (established during the assessment of the structural model) the bootstrapping demonstrated that Patient Agility acts as a full mediator between IT Ambidexterity and Relative Patient Service Performance.

To demonstrate the significance of the moderating effect of environmental turbulence the two-stage approach as described by Hair et al was used (Hair et al., 2017) followed by bootstrapping (figure 4). The bootstrapping demonstrated that Environmental did not have any significant effect on the relationship between IT Ambidexterity and Patient Agility (t=0.934, p=0.351) or on the relationship between Patient Agility and Relative Patient Service Performance (t=0.635, p=0.934) [Appendix O].

5. Discussion, conclusions and recommendations

5.1 Discussion and reflection

The objective of this study was to find out whether IT ambidexterity improves a hospital department's patient service performance and to establish whether these improvements are caused through the mediating effect of patient agility.

The results have demonstrated that IT Ambidexterity is very weak at predicting the amount of variance in Patient Agility. Even though this predictive power is very weak, IT Ambidexterity does produce a medium f^2 effect. The path coefficient has demonstrated that there is a statistically significant relationship between IT Ambidexterity and Patient Agility, confirming the first hypothesis, that IT Ambidexterity does have a positive effect on Patient Agility. This strengthens Lee's reasoning (O. K. Lee et al., 2015) that the simultaneously pursuit of operational exploration and exploitation allows an organization to continually innovate and improve its operational processes. When an organization is continually innovating and improving its operational processes, it can quickly react to environmental changes, thereby making it more agile. In practice the relationship between IT Ambidexterity and Patient Agility will mean that the ability of a hospital department to simultaneously explore new IT resources and practices as well as exploit their current IT resources and practices will help them with their ability to sense and respond quickly to patient-based opportunities for innovation and competitive action. In turn, the path coefficients have also demonstrated that there is a statistically significant relationship between Patient Agility and Relative Patient Service Performance. This confirmed the second hypothesis that Patient Agility has a positive effect Relative Patient Service Performance. A hospital department's ability to sense and respond quickly to patient-based opportunities for innovation and competitive action therefore will help them in improving the patient's overall evaluation of the hospital departments' service offerings.

Since the path coefficient between IT Ambidexterity and Relative Patient Service Performance did not reveal a significant direct relationship, the ability of hospital department to simultaneously explore new IT resources and practices as well as exploit their current IT resources by itself does not improve the patient's overall evaluation of the hospital departments' service offerings. Therefore, IT Ambidexterity only has a positive effect on Relative Patient Service Performance through the full mediating effect of Patient Agility (thus confirming the third hypothesis).

Met opmerkingen [WRvd31]: Ja wel, via patient agility is het toch significant?

The results revealed that Environmental neither has any significant effect on the relationship between IT Ambidexterity and Patient Agility or on the relationship between Patient Agility and Relative Patient Service Performance. This means that the fourth and fifth hypothesis could not be confirmed.

In reflection, this is the first study that explores the topic of IT Ambidexterity in a hospital department setting. The elucidation that IT Ambidexterity has a positive effect on Relative Patient Service Performance through the full mediating effect of Patient Agility is very relevant. Since hospitals departments frequently struggle to implement innovations or fail to achieve the intended benefits of adopted innovations (Piening, 2011). Investing more resources in IT Ambidexterity and stimulating the developing patient agility could lead to a better success rate in implementing innovations that do increase Relative Patient Service Performance.

5.2 Conclusion

To conclude this study an answer is given to the main research question:

Does a hospital department's ability to simultaneously pursue exploration and exploitation in their management of IT resources and practice improve the department's patient service performance, through the mediating role of Patient agility?

Through the full mediating role of Patient agility, a hospital department's ability to simultaneously pursue exploration and exploitation in their management of IT resources and practice does indeed improve the department's patient service performance.

5.3 Recommendations for practice

To improve their patient services hospital departments should consider investing in activities that improve their IT Ambidexterity and Patient Agility. They should, however, realize that their patient services will not improve solely by investing in IT Ambidexterity. Considering the full mediating effect of Patient Agility, it is paramount for hospital departments to invest in both IT Ambidexterity and Patient Agility. Better knowledge of how to exploit their current IT resources with simultaneous exploration of new IT technologies will have a positive effect on a hospital departments' ability to sense and respond quickly to patient-based opportunities for innovation and competitive action. This in turn will have a positive effect on the hospital department's Relative Patient Service Performance.

5.4 Recommendations for further research

While conducting this research certain limitations have been observed. During the survey some responders did not complete the survey because they felt that they did not have insufficient insight in the IT or patient related processes or that they did not fully understood some survey questions. The data that had been collected during the survey could therefore contain bias because professionals with relatively high knowledge of the current IT or patient related processes are more likely to fill in a complete survey. To tackle these issues in future research, one should consider requesting the approached professionals to review the current state of their current hospital department's IT or patient related processes first, before taking the survey. However, such a request could increase the threshold for taking the survey which could in turn lead to a lower response rate. Another consideration that could be made is to invest more time in guiding the responders in answering the survey. Since some professionals indicated that they did not fully understood some survey questions. Taking the survey together with a researcher could enable the responders to ask for more information in case of doubt. However, this method also has disadvantages. The first disadvantage is that this method is more time-consuming for the researchers. The second disadvantage is that this method could lead to interviewer bias. Especially when the researcher takes an active stance in guiding the responder through the survey.

This study has demonstrated that IT Ambidexterity has a positive effect on a hospital departments' relative patient service performance, through the mediating role of Patient Agility. Since hospital departments have limited resources to spend in IT Exploration, IT Exploitation, and sense and respond actions. Future research should focus on which investment ration between these four actions produce the strongest positive effect on relative patient service performance. Elucidating the optimal investment ratio between these four actions will help support the hospital department's managers in the development of their strategies to improve their department's patient service performance.

Met opmerkingen [WRvd32]: Voor?

Met opmerkingen [WRvd33]: Duidelijke structuur aanbrengen voor praktisch en theoretisch

5.5 Reflections

Looking back, as it is with every big project there are many things that were executed well, and many things that, in hindsight could have been executed differently. In general, I am satisfied how everything progressed:

Starting with the support, from the Open university and in particular from my supervisor Prof.Dr.Rogier van de Wetering. I am very satisfied with the great support that I have received. From the first day, I was pointed in the right direction. I received great advice regarding ways in collecting relevant literature for the theoretical framework, and the best way to approach respondents for the survey. Initially, my greatest concern lied in obtaining enough respondents to conduct a reliable data analysis. and at the start, the number of respondents that completed survey the was a bit low. With Prof.Dr.Rogier van de Wetering's advice regarding the best way to approach respondents on LinkedIn the amount of respondents considerably grew.

Concerning the literature study. In my opinion the literature study went well. I did not experience any obstacles in finding relevant literature to form a solid theoretical framework. The only thing that I would do better in a future study is the administration of my search queries. In the beginning I did not keep track of the search queries I used. This meant that during the writing of the research approach I needed to repeat my literature search to connect the used literature with the literature sources.

Regarding the survey there were some issues in the beginning. The initial respondents were close acquaintances that work in a hospital. Based on their feedback, they found it difficult to understand some topics or survey questions. Certain concepts (such as IT Ambidexterity) are very abstract and some of the initial respondents found it difficult to interpret these concepts. In a future study I would involve these acquaintances in an earlier stage of developing the survey. This way I can obtain a survey that is a bit more attuned to the target respondent earlier on. The approach of the target audience went well. In a future study I would also mainly focus on LinkedIn when I would like to approach possible respondents.

The data analysis also went well. The last time I used statistics in previous work was 10 years ago. But Hair's book regarding PLS-SEM was very clear. I did not experience any difficulties analyzing the data.

Finally, I would like to finish this reflection with some remarks regarding time-management. I think overall there was enough time planned to perform a decent research study. Surveys can be tricky because obtaining results heavily rely on outside forces (finding willing respondents to do the survey). But for this study, in my opinion, the obtaining survey respondents went well. Personally, I reserved 4 weeks for the data analysis and to write the thesis. But due to unforeseen circumstances and obligations at work, I only had 2 weeks to do the data analysis and write the report. This meant that I had to make some choices along the way influenced the final result. In MoSCoW terms, I think that I did a good job at reporting the "Must haves" and "Should haves". I think the report covers all the essentials and that there is enough emphasis on finding an answer to the main research questions. However, looking at the data that was acquired with the survey I must admit that there are still some "Could haves" that have not been included in my final report. The survey respondents also provided data regarding the various types of hospital departments, hospitals and positions within the hospital. A nice "Could have" would be diving deeper into this data. A multi group analysis could provide interesting insights because it could reveal unforeseen patterns when we categorize and analyze these data.

Met opmerkingen [WRvd34]: Reflectie moet nog en ook conclusie

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Appendix A: The Queries used to create a theoretical framework

NOTE: The list does not include the queries that did not result in an included article

Digital library		Query	date of search	items retrieved	excluded	included
OU	Q1	Hospital Information technology	23-02-19	3	2	1
Google scholar		Hospital Information technology	23-02-19	6	6	0
OU	Q2	Hospital IT service innovation	23-02-19	2	1	1
Google scholar		Hospital IT service innovation	23-02-19	0	0	0
OU	Q3	IT Ambidexterity	23-02-19	4	3	1
Google scholar		IT Ambidexterity	23-02-19	3	3	0
OU	Q4	Patient response capability	23-02-19	2	1	1
Google scholar		Patient response capability	23-02-19	1	1	0
OU	Q5	"Organizational Ambidexterity"	23-02-19	5	2	3
Google scholar		"Organizational Ambidexterity"	23-02-19	1	1	0
OU	Q6	Dynamic capability	24-02-19	1	0	1
Google scholar		Dynamic capability	24-02-19	2	2	0
OU	Q7	Dynamic capability and Teece	27-05-19	3	0	3
OU	Q8	Organizational agility	27-05-19	3	1	2
OU	Q9	IT "exploration and Exploitation"	28-05-19	6	1	5
OU	Q10	"The Interplay between Exploration and Exploitation" + Gupta	28-05-19	1	0	1
OU	Q11	Patient Agility	26-05-19	1	0	1
OU	Q12	Customer Agility	26-05-19	8	2	6
OU	Q13	IT Challenges healthcare	23-02-19	1	0	1
OU	Q14	Customer response capability	23-02-19	6	3	3
OU	Q15	Customer satisfaction	23-02-19	6	5	1
Google scholar		Customer satisfaction	23-02-19	3	3	0
OU	Q16	Patient loyalty	26-05-19	3	0	3
OU	Q17	Patient service performance	25-05-19	4	3	1
OU	Q18	Customer service performance	25-05-19	4	2	2
OU	Q19	Environmental turbulence	27-05-19	7	3	4

Q1	(Lee, McCullough, & Town, 2013)
Q2	(Bouckaert et al., 2018)
Q3	(O. K. Lee et al., 2015)
Q4	(Setia, Setia, et al., 2013)
Q5	(V. Sambamurthy, K.-K. Wei, K. Lim, & D. Lee, 2007a), (Junni et al., 2013),(Raisch, Birkinshaw, Probst, & Tushman, 2009)
Q6	(D. J. Teece et al., 1997)
Q7	(D. J. Teece, 2007; D. J. Teece et al., 1997),(Sunder M et al., 2019)

Q 8	(D. Teece et al., 2016),(Chakravarty, Grewal, & Sambamurthy, 2013)
Q9	(Benitez, Llorens, & Braojos, 2018), (Grant, 1996), (O'Reilly & Tushman, 2008), (Holmqvist, 2004), (March, 1991)
Q10	(Gupta et al., 2006)
Q11	(Roberts & Grover, 2012a)
Q12	(Bernardes & Hanna, 2009),(Y. Chen et al., 2014),(Overby et al., 2006),(V. Sambamurthy et al., 2003), (Zaheer & Zaheer, 1997),(Roberts & Grover, 2012b)
Q13	(Adler-Milstein et al., 2017)
Q14	(Jayachandran et al., 2004),(Koufteros et al., 2002),(I.-L. Wu & Hsieh, 2015)
Q15	(Saad Andaleeb, 1998)
Q16	(Kessler & Mylod, 2011),(Han et al., 2011),(Bolton, 1998)
Q17	(Boyer et al., 2012)
Q18	(Philip J. Van Der et al., 2014),(Brown et al., 2003)
Q19	(Boyne & Meier, 2009),(Mendelson, 2000),(Wilden & Gudergan, 2015),(Rai & Tang, 2010)

Appendix B: The survey

Section 1:

Constructs	**Sources**
1. Please indicate how many doctors (fte) work in your department.	
1. Please indicate the total size-class of your department. (total fte including support and secretary staff)	
2. Please select your hospital type:	Universitair Medisch Centrum (UMC) Samenwerkend Topklinisch opeldingsZiekenhuis (STZ) Samenwerkend Algemeen Ziekenhuis (SAZ) Overig Algemeen Ziekenhuis (OAZ) ● Anders, namelijk:
3. Please indicate your department (type)	Cardiologie Cardio-thoracale chirurgie Dermatologie Heelkunde Interne geneeskunde Keel-, Neus en Oorheelkunde Kindergeneeskunde Klinische geriatrie Longziekten en tuberculose Maag-, Darm- en Leverziekten Mondziekten en kaakchirurgie Neurochirurgie Neurologie Obstetrie en gynaecologie Oogheelkunde Orthopedie Plastische chirurgie Psychiatrie Reumatologie Revalidatiegeneeskunde Urologie Anders, namelijk:
4. Please indicate the age of your Department.	0–5 years 6–10 years 11–20 years

	20–25 years Over 25 years
5. Please indicate the amount of your working Experience	0–5 years 6–10 years 11–20 years 20–25 years Over 25 years
6. Please indicate the number of patients your departments sees annually	< 4000 4000 – 6500 6500 – 9000 9000 – 11500 11500 – 14000 > 14000
7. Our department's primary specialization is:	Verzekerbare zorg Niet-verzekerbare zorg Allebei (ongeveer evenveel)
8. Please indicate your current function within the organization:	Afdelingshoofd Chef de Clinique Arts (Specialist) AIOS ANIOS Manager bedrijfsvoering Anders, namelijk:

Section 2

IT Ambidexterity We define IT ambidexterity as the department's ability to simultaneously pursue exploration and exploitation in their management of IT resources and practices. *Indicate the degree to which you agree or disagree with the following statements about whether the organization can (1 – strongly disagree 7 – strongly agree)*	(O.-K. Lee, V. Sambamurthy, K. H. Lim, & K. K. Wei, 2015)
IT exploitation	
Reuse existing IT components, such as hardware and network resources	
Reuse existing IT applications and services	
Reuse existing IT skills	
IT exploration	
Acquire new IT resources (e.g., new generation of IT architecture, potential IT applications, critical IT skills)	
Experiment with new IT resources	
Experiment with new IT management practices	
Patient agility Patient agility is defined as the degree to which the department is able to *sense* and *respond* quickly to patient-based opportunities for innovation and competitive action. *Please choose the appropriate response for each item* *(1 – strongly disagree 7 – strongly agree)*	(Roberts & Grover, 2012a), Zie ook (Bradley, Pratt, Thrasher, Byrd, & Thomas, 2012; Jayachandran et al., 2004)
Patient sensing capability	
We continuously try to discover additional needs of our patients of which they are unaware.	
We extrapolate key trends to gain insight into what patients in a current market will need in the future.	
We continuously try to anticipate our patients' needs even before they are aware of them.	
We attempt to develop new ways of looking at patients and their needs	
We sense our patient's needs even before they are aware of them.	
Patient responding capability	
We respond rapidly if something important happens with regard to our patients.	
We quickly implement our planned activities with regard to patients	
We quickly react to fundamental changes with regard to our patients	
When we identify a new patient need, we are quick to respond to it.	
We are fast to respond to changes in our patient's health service needs	

Environmental turbulence	(Rai & Tang, 2010)
Environmental turbulence *Please choose the appropriate response for each item* *(1 – strongly disagree 7 – strongly agree)*	
Patient preferences change rapidly in our market segment.	
There is intense competition for market share in our industry.	
Forecasting patient demand in our segment/field is very difficult.	
Technological innovations have brought many new health service ideas to our field of expertise in the recent years.	
Relative patient service performance Rather than solely focusing on productivity measures, we explicitly focus on the quality of the output of patient response processes as health service quality takes the patient's view into account. *Please choose the appropriate response for each item* *(1 – strongly disagree 7 – strongly agree)* *During the last 2 or 3 years, we perform much better than comparable departments from other hospitals in:*	
Achieving patient satisfaction	(J.-S. Chen & Tsou, 2012; Setia, Venkatesh, & Joglekar, 2013; L. Wu & Hu, 2012)
Lowering operational costs	(Setia, Venkatesh, et al., 2013)
Keeping current with patients	(Setia, Venkatesh, et al., 2013)
Providing high-quality service	(Setia, Venkatesh, et al., 2013; L. Wu & Hu, 2012)
Retaining existing patients	(Setia, Venkatesh, et al., 2013)
Attracting new patients	(Setia, Venkatesh, et al., 2013)
Building a positive branch image	(J.-S. Chen & Tsou, 2012; Setia, Venkatesh, et al., 2013; L. Wu & Hu, 2012)
Attaining desired market share	(Y. Chen et al., 2014; Rai & Tang, 2010; Setia, Venkatesh, et al., 2013)
Attaining desired growth	(Y. Chen et al., 2014; Rai & Tang, 2010; Setia, Venkatesh, et al., 2013)
Improving the accessibility of medical services	(L. Wu & Hu, 2012)

Appendix C: The measurement model

Construct	Indicator	Description
IT Ambidexterity		
IT exploitation	ITA 1	A measurement of the reuse of existing IT components, such as hardware and network resources
	ITA 2	A measurement of the reuse of existing IT applications and services
	ITA 3	A measurement of the reuse of existing IT skills
IT exploration	ITA 1	A measurement of the acquisition of new IT resources (e.g., new generation of IT architecture, potential IT applications, critical IT skills)
	ITA 2	A measurement of the amount of experimentation with new IT resources
	ITA 3	A measurement of the amount of experimentation with new IT management practices
Patient Agility		

Patient sensing capability	PA 1	A measurement of the continuous effort to discover additional needs of our patients of which they are unaware.
	PA 1	A measurement of the extrapolation of key trends to gain insight into what patients in a current market will need in the future
	PA 3	A measurement of the continuous anticipation of the patients' needs even before they are aware of them.
	PA 4	A measurement of the attempt to develop new ways of looking at patients and their needs
	PA 5	A measurement of the sensing patient's needs even before they are aware of them.
Patient responding capability	PA 6	A measurement of the respond speed if something important happens regarding the patients.
	PA 7	A measurement of how quickly planned activities are implement regarding the patients
	PA 8	A measurement of how quickly is reacted to fundamental changes regarding the patients
	PA 9	A measurement of how new patient need are identified, and how quick to respond is to that need.
	PA 10	A measurement of how fast is responded to changes in the patient's health service needs
Relative patient service performance		
	PR 1	A measurement of how well patient satisfaction is achieved
	PR 2	A measurement of how well costs are lowered
	PR 3	A measurement of how well Keeping current with patients is achieved
	PR 4	A measurement of how well high-quality service is being provided
	PR 5	A measurement of how well existing patients are retained
	PR 6	A measurement of how well new patients are attracted
	PR 7	A measurement of how well a positive branch image is being build
	PR 8	A measurement of how well desired market share is being attained
	PR 9	A measurement of how well desired growth is being Attained
	PR 10	A measurement of how well the accessibility of medical services is being improved
Environmental turbulence		
	ET1	A measurement of how patient preferences change rapidly in our market segment.
	ET2	A measurement of the intense competition for market share in our industry.
	ET3	A measurement of how the difficulty of forecasting patient demand.
	ET4	A measurement of how technological innovations have brought many new health service ideas to the field of expertise in the recent years.
Reference		
	Ref1	The size-class of the department. (Number of employees)
	Ref2	The hospital type
	Ref3	Category organization

	Ref4	Age of the department
	Ref5	Amount of work experience
	Ref6	Percentage IT budget of the total budget
	Ref7	Function within the organization

Appendix D: Missing values

Indicators:	Indicator Correlations	Raw File
	No.	Missing
PR1	32	6
PR2	33	13
PR3	34	7
PR4	35	10
PR5	36	9
PR6	37	6
PR7	38	12
PR8	39	16
PR9	40	8

Appendix E: Outer loadings of the Relative Patient Service Performance construct

Outer Loadings

Matrix

	IT Ambidexterity	IT Exploitation	IT Exploration	Patient Agility	Patient Sensin...	Patient respon...	Relative Patient Service Performance
PR1							0.761
PR2							0.588
PR3							0.816
PR4							0.556
PR5							0.504
PR6							0.674
PR7							0.627
PR9							0.782

Appendix F: Internal consistency and convergent validity before the removal of indicators PR4, PR5 and ET3

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
IT Exploitation	0.854	0.911	0.774
IT Exploration	0.926	0.953	0.871
Patient Sensing Capability	0.898	0.925	0.713
Patient responding capability	0.936	0.951	0.797
Relative Patient Service Performance	0.841	0.865	0.451
Environmental Turbulence	0.524	0.702	0.389

Appendix G: Outer loadings of the Environmental turbulence construct

Outer Loadings

Matrix

	Environmental Turbulence
ET1	0.804
ET2	0.437
ET3	0.430
ET4	0.731

Appendix H: Assessment for collinearity issues

Collinearity Statistics (VIF)

Outer VIF Values | Inner VIF Values

	IT Ambidexterity	Patient Agility	Relative Patient Service Performance
IT Ambidexterity		1.000	1.298
Patient Agility			1.298
Relative Patient...			

Appendix I: Assessment of the Path coefficients

Path Coefficients

Mean, STDEV, T-Values, P-Values | Confidence Intervals | Confidence Intervals Bias Corrected | Samples

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
IT Ambidexterity -> Patient Agility	0.479	0.478	0.082	5.810	0.000
IT Ambidexterity -> Relative Patient Service Performance	0.115	0.120	0.127	0.907	0.365
Patient Agility -> Relative Patient Service Performance	0.386	0.401	0.109	3.543	0.000

Appendix J: Assessment of the Coefficient of determination.

R Square

Matrix | R Square | R Square Adjusted

	R Square	R Square Adjusted
Patient Agility	0.229	0.221
Relative Patient...	0.199	0.191

Appendix K: Assessment of Effect size f^2.

f Square

Matrix | f Square

	IT Ambidexterity	Patient Agility	Relative Patient Service Performance
IT Ambidexterity		0.297	
Patient Agility			0.249
Relative Patient Service Performance			

Appendix L: Assessment of the predictive relevance Q^2

Construct Crossvalidated Redundancy

Total | Case1 | Case2 | Case3 | Case4 | Case5 | Case6 | Case7

	SSO	SSE	Q^2 (=1-SSE/SSO)
IT Ambidexterity	828.000	828.000	
Patient Agility	92.000	73.276	0.204
Relative Patient Service Performance	552.000	516.587	0.064

Appendix M: Assessment of the effect size q^2

Construct Crossvalidated Redundancy

Total	Case1	Case2	Case3	Case4	Case5	Case6	Case7

	SSO	SSE	Q^2 (=1-SSE/SSO)
IT Ambidexterity	828.000	828.000	
Relative Patient...	552.000	533.396	0.034

Construct Crossvalidated Redundancy

Total	Case1	Case2	Case3	Case4	Case5	Case6	Case7

	SSO	SSE	Q^2 (=1-SSE/SSO)
IT Ambidexterity	828.000	828.000	
Patient Agility	92.000	73.276	0.204

q^2 Patient Agility $= \frac{0.204-0.204}{1-0.204} = 0.796$

q^2 Relative Patient Service Performance $= \frac{0.063-0.034}{1-0.063} = 0.031$

Appendix N: Evaluation of the mediating effect of Patient Agility

Path Coefficients

Mean, STDEV, T-Values, P-Values | Confidence Intervals | Confidence Intervals Bias Corrected | Samples

	Original Sampl...	Sample Mean (...	Standard Devia...	T Statistics (|O...	P Values
IT Ambidexterity -> Patient Agility	0.408	0.399	0.093	4.405	0.000
Patient Agility -> Relative Patient Service Performance	0.381	0.372	0.103	3.710	0.000

Appendix O: Evaluation of the moderating effect of Environmental turbulence

Path Coefficients

Mean, STDEV, T-Values, P-Values | Confidence Intervals | Confidence Intervals Bias Corrected | Samples | Copy to Clipboard

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Moderating Effect Environmental Turbulence 1 -> Patient Agility	0.132	0.107	0.141	0.934	0.351
Moderating Effect Environmental Turbulence 2 -> Relative Patient Service Performance	0.087	0.122	0.137	0.635	0.526