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# The impact of digital transformation

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# The impact of digital transformation

A survey based research to explore the effects of digital transformation on organizations.

**Master Thesis Report**

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## Preface

This report is the outcome of a nine month internship at Cognizant, between November of 2014 and August of 2015. During this time I conducted my master thesis project which enabled me to obtain my Master degree in System Engineering, Policy Analysis and Management from the Technical university of Delft.

I would not have been able to complete this research without the help of others. I would like to thank my graduation committee for their support, feedback, and guidance throughout this period. First, I would like to thank Yao-Hua Tan for being the chair of my graduation committee. Next, I would like to thank my supervisors; Bram Klievink, for the guidance and constructive feedback which enabled me to shape, structure, and complete my thesis and Mark de Reuver for his expertise and input regarding business models, the survey and statistical analysis.

I am grateful for the opportunity provided by Cognizant. It not only allowed me to finish my Master's degree but also provided me the possibility to learn a lot in an inspiring environment. It greatly developed my understanding of IT consultancy and provided me with useful business insights. Special thanks to my external supervisor Jeroen Futselaar. He provided tremendous and invaluable support, feedback, and guidance throughout the entire research which not only allowed me to finish my research, but also helped me to develop as a person.

Last but not least I would like to thank my family for their unconditional love and support along the way, not just during this graduation project, but especially during the many years of education that have led to my graduation.

After completing my draft version I started as a graduate at Cognizant. The first months I've had very little to no time for my master thesis due to the overwhelming and time-consuming start of my career. Only now – months after I started working – I've found the time to complete my thesis.

**Irik Tolboom**
Amsterdam, August 7th.

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## Executive Summary

Many organizations nowadays feel pressured to change in order to meet customer demands and competitive pressure. In an attempt to do so, they often undergo so-called digital transformation initiatives. Digital Transformation is quite a trend; the global digital transformation market is expected to grow from $150 billion to $369 billion in the coming five years. Despite some research, digital transformation remains a buzzword with holistic definitions. This study shows that:

*Digital transformation is a social, mobile, analytics or cloud induced change that significantly affects three or more dimensions on individual, firm, and/or societal level*.

Although there are studies that describe the organizational effects of the social, mobile, analytics and cloud technologies in isolation, there are few studies that describe the effects from a digital transformation perspective i.e. a combination of those technologies.

Studies that do so mainly focus on customer insight, costumer relations and customer-organizations interactions which leaves the effects on organizational elements such as products and service offerings, internal processes and the usage of resources and accompanied costs relatively unknown. Additionally the described effects are mostly qualitative and it's uncertain if these are applicable outside their research scope or industry.

This research aims to contribute to the understanding of digital transformation by identifying the impact of digital transformation on organizations' their business model across industries in a quantitative way based on expert opinions using an business model framework suitable for IT-induced changes. To do so the following research question was answered:

*"What are the impacts of digital transformation on organizations' their business model?"*

In order to answer the research question, and determine the impact of digital transformation on organizations several steps had to be taken. First the concept of digital transformation was described to define the concept and formulate the hypothesized effects. Second the business model canvas from Osterwalder and Pigneur was operationalized using literature from various business models to create the framework and measures for the survey to the expected effects.

The survey to the expected effects was held through a self-administered online questionnaire between the last week of June and first two weeks of July 2015. The final sample includes 92 senior level+ consultants from Cognizant, from 20 different countries, with an average reported digital transformation expertise of 5.14 out of 7.

The survey findings show that digital transformation is expected to change organizations across many different fronts as almost all nine business model constructs have at least one element that is expected to change moderately or even stronger. Some business model constructs even have moderately or strong expected changes across all underlying elements.

The greatest impact will be to organizations' their value proposition, the customer segments they can identify and serve, the way organizations reach their customers, and the resources they use. As this research shows many different changes are expected across different business model elements. Throughout the variety of changes there is a single group that benefits the most; customers. When looking at the research outcomes regarding value proposition customers' their value for money increases a lot. Products and services are expected to increase in customization, performance, accessibility and convenience whilst prices are expected to decrease a little.

Customers additionally benefit from the increased numbers of new products and services introduced to the marketplace. The research outcomes regarding channels and customer relations show that customers' their communication and interaction with organizations is expected to improve. There will be greater awareness of the products and services in the market and it will become easier to evaluate them. Furthermore customers are given more possibilities in purchasing, delivery and customer support and levels of service through self- and automated services will increase. Moreover organizations will empower customers by expanding current mutual beneficial elements such as co-creation and communities.

For organizations this means that they should adopt a very strong customer focus and in invest digital capabilities while remaining agile enough to respond to changing social and technological environments to ensure they will not become obsolete in the marketplace. Organizations can to do so by taking the following measures:

- Invest in analytic capabilities to allow "hyper" customization of services and products,
- Invest in a flawless omni-channel customer experience with self and automated services and,
- Explore and adopt an enterprise-wide cloud-based strategy.

Overall this research contributes to existing literature as it's a unique study that addresses the expected effects of digital transformation across the entire spectrum of organizations' their business models across industries.

The findings of this research regarding increased customer segmentation, increased personalization of products and services, and increased online customer-organizations interaction confirm findings from previous research to digital transformation. Moreover it takes those findings one step further by providing quantified expected effects instead of qualitative findings. Furthermore this research shows that multiple other business model elements are expected to be impacted as well. It is worth noting the majority of these findings correspond with studies that have focused on these elements with only one underlying technology considered.

Additionally by pinpointing the exact expected changes of digital transformation this research should help organizations to build and substantiate digital transformation business cases more accurately and efficiently allowing for reliable and factual investment decisions. This is much needed as only half of the organizations create a business case for their digital transformation initiatives and only 25% compute key performance indicators.

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# 1. Introduction

## 1.1. Digital Transformation

Information, communication and connectivity technologies (ICT) have improved greatly during the last decade creating new functionalities (Bharadwaj, Sawy, Pavlou, & Venkatraman, 2013). These ICT tools further enable the production, storage and handling of information, and facilitate communication between human beings and electronic systems (Ibem & Laryea, 2014).

ICT tools are often called digital technologies and are shaping the way people live, communicate, consume and work, breaking the barriers of time and space (McDonalds, M. Russel-Jones, 2012). The past decade some organizations have successfully adapted these digital technologies leading to a rise of companies such as Google, Netflix, Amazon and Apple while other companies such as Borders, Blockbusters and Kodak failed to do so and became obsolete.

Many organizations nowadays feel pressured to change in order to meet customer demands and face competitive pressure (Westerman, Calmejane, & Bonnet, 2011). In an attempt to do so, they often undergo so-called digital transformation initiatives. Digital Transformation is quite a trend, the global digital transformation market is expected to grow from $150 billion to $369 billion in the coming five years (MarketsandMarkets, 2015). The solution that enable digital transformation are so called social, mobile, analytics, and cloud technologies and can be considered the underlying technologies of the digital transformation phenomena (Bharadwaj et al., 2013).

While there are several consultancy-related studies such as Fitzgerald et al. (2013) and Westerman et al. (2011) that state the importance and potential upside of digital transformation there is very few truly academic literature available on the concept of digital transformation. As such digital transformation remains a popular buzzword. To illustrate the buzz around digital transformation; as of October 2015 google search yields over 23.5 million hits, google trends shows a steep increase in searches, and all major IT consultancy organizations provide service offerings regarding digital transformation and the concept is being discussed in journals such as Information Systems Research and MIT Sloan Review.

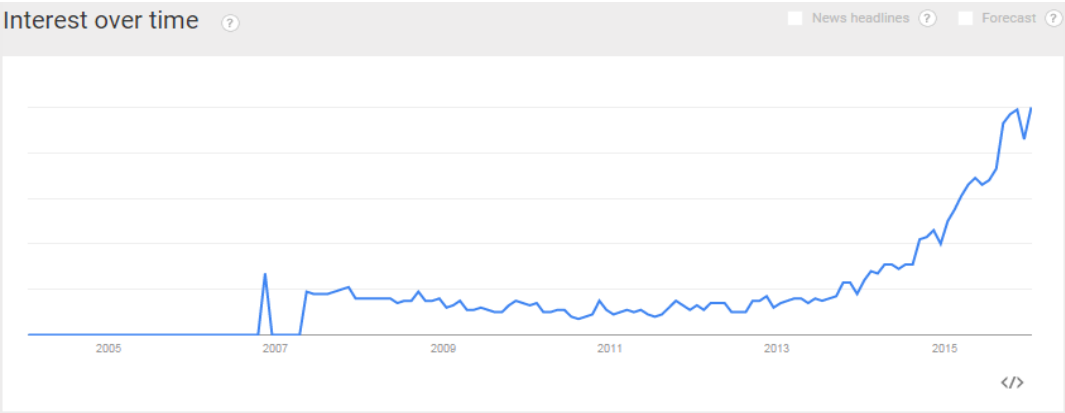


**Figure 1: Google Trends, Growth of Digital Transformation as "search word"** (Google, 2015)

The attempts to conceptualize digital transformation by Westerman et al. (2011), Stolterman and Croon Forst (2006) and Lankshear and Knobel (2008) have led to holistic definitions that do no break down the concept. One aspect that became apparent is that digital transformation does not entail gradual incremental changes, but fundamental “radical” changes due to digital technologies. Additional clarification of the concept is needed.

Furthermore few studies have focused on the effects that digital transformation has on organizations. As Piccinini et al. (2015) have concluded the limited digital transformation research so far has primarily focused on managerial issues. Bhardwaj et al. (2013) and Granados and Gupta (2013) describe how organizations should use digital technologies as part of their business strategy to compete in a digital world. While Lucas et al. (2013) specify examples of IT transformations that occurred in four distinct sectors and the implication for organizational policies. In addition Setia et al. (2013) specifically addresses the customer-side of digital business strategy.

## 1.2. Research Problem

Although there are studies that describe the organizational effects of the social, mobile, analytics and cloud technologies in isolation, there are few studies that describe the effects from a digital transformation perspective i.e. a combination of those technologies. To date only some effects of digital transformation on organizations have been described by Li (2015) Piccinini et al. (2015) and Westerman et al. (2011) mainly focusing on customer insight, costumer relations and customer-organizations interactions.

Li does this through case studies in the creative industries and Westerman et al. (2011) do so through a few case studies. Piccinini et al. (2015) focus on the relationship between customers and organizations due to emerging digital technologies. The effects described by Li (2015) Piccinini et al. (2015) and Westerman et al. (2011) are described in a qualitative way making it difficult to pinpoint the exact magnitude of an effect.

In particular, Li (2015) addresses the elements of consumer insight; how organizations can identify profitable customer that want to pay premiums, create products to their preferences resulting into increased market segmentation. Li also states the benefits of digital channels usage for an increase in customer experience, digital interaction and new revenue models.

Piccinini et al. (2015) describe through a meta-study that customer-organization interaction is especially changing due to new digital technologies and digital transformation. They identify changes in customer informedness, accessibility to products and services, democratization of content through social media and customer engagement.

Westerman et al. (2011) focus more on the digital channels and platforms, the effects those have on interactions between customers and partners; such as improved marketing and sales, knowledge sharing through communities, and increasingly shared digital services.

Contrary the effects of digital transformation on elements such as products and service offerings, internal processes and the usage of resources and accompanied costs are relatively unknown.

In addition the effects identified by Li (2015) are potentially only applicable to the creative music industry since it's unknown if these effects are similar for other industries. Furthermore the effects observed by Westerman et al. (2011) are identified through various business cases for which the selection procedure is unknown. Consequently the results seem to be gathered through a seemingly unstructured approach and might therefore not be applicable to the broader phenomena of digital transformation.

To sum it up; research on the effects of digital transformation on organizations is heavily focused on customer insight, costumer relations and interactions, leaving the elements of products and service offerings, internal processes and the usage of resources and accompanied costs relatively untouched. In addition the effects described are mostly qualitative and it's uncertain if these are applicable outside their research scope.

This research aims to contribute to the understanding digital transformation by identifying the organizational effects of digital transformation across industries in a quantitative way based on expert opinions using a business model framework suitable for IT-induced changes.

## 1.3. Research Questions

As presented in the research problem there is currently no literature that addresses the effects of digital transformation organizational-wide across industries in a quantitative way. The objective of this research is to address this gap. In order to do so a research question is formulated;

***"What are the impacts of digital transformation on organizations' their business model?"***

The sub questions of this research are described below and serve as a means to answer the main question. Each sub-question is follow by the used methodology, which will be explained later on. The first sub-question aims to clarify the concept and phenomena of digital transformation which is currently only done holistically. Furthermore clarification is needed to determine what kind of technologies and what types of changes should be incorporated in this research. Sub-question two determines what business model framework is suitable for the impact measurement of digital transformation. The third sub-question aims to identify the expected impact of digital transformation to (a) form the hypotheses that are needed to answer the research questions and (b) observe based on the survey tested hypotheses what impacts are expected.

1. What is Digital Transformation? [Literature study]
2. What business model framework should be used to assess the impact of digital transformation on organizations [Literature study]?
3. What are the expected impacts of digital transformation on organizations [Literature study & Survey]

## 1.4. Research relevance

From a scientific point of view this research contributes to understanding of the effects of Information Technologies on organizations. In literature there are many studies that explore the effects of the individual underlying technologies of digital transformation - social, mobile, analytics, and cloud - in isolation. Armbrust et al. (2010) i.e. describe the potential of cloud computing for organizations. Similarly there is research such as (Agarwal & Dhar, 2014; Kaplan & Haenlein, 2010; Sanakulov & Karjaluoto, 2015) for each of the underlying technologies that describe potential effects, provide a strategic view or identify barriers for adoption. This research differs from current academic research because it does not describe a single technology but a combination four technologies and the effect combined implementation has on organizations. Today there are no studies that do so for an entire organization across industries.

Next to the scientific relevance, this research also contributes in a practical way. Currently only half of the organizations create a business case for their digital transformation initiatives and many fail to compute key performance indicators such as Return on Investment. Merely 25% of businesses succeed in establishing key performance indicators (Fitzgerald et al., 2013) while those KPIs are needed to justify investments based on value and costs (Westerman et al., 2011). Due to the abstinence of sound economic business cases decision-makers can't make the decision to approve transformational IT project. The rejection of potentially profitable projects will hurt organizations in the long run since their peers will be outperforming them (Fitzgerald et al., 2013). Determining the quantitative effects of digital transformation should aid organizations in the identification of potential effects. This assists organizations to compute business cases more effectively and efficiently, enabling them to make better informed decisions on transformational IT Projects.

## 1.5. Research Approach

In this paragraph the approach of this research is discussed. The different parts of the research are presented along with the steps that are taken to answer the research questions. The specific methodology is discussed in the relevant chapters. This research consists of three distinctive parts;

- A literature research to conceptualize digital transformation and its effects,
- The creation of a measurement framework based on business model literature and,
- Empirical research through a survey to determine the impacts of digital transformation on organizations.

This research starts with the exploration of the concept of digital transformation by reviewing the relevant literature and associated technologies. This will result into a definition and characteristics of digital transformation along with the technologies that enable digital transformation and the effects on organizations in general. The structure of the literature review and articles used can be found in chapter two.

The second part of the research consists of the development of a measurement framework to determine the impact of digital transformation on organizations' their business model. This

measurement framework will provide a clear and structured organizational overview enabling the identification of qualitative and quantitative effects on these respective components.

To do so four different business model frameworks are presented of which one is selected. The selected business model framework consists of nine building blocks and serves as the basis for the operationalized measurement framework. The nine building blocks that form the body of the framework are operationalized using business model literature from several relevant meta-studies. After the operationalized framework is completed the hypotheses regarding the expected change of digital transformation are formulated based upon the literature review.

The third part of the research consists of empirical data gathering through a survey to test the hypotheses and quantify the effects of digital transformation on organizations. Based on the data the theory-formed hypotheses are tested. In addition, the data allows the identification of changes that occur simultaneously through correlations.

A survey is chosen as method because it's the most efficient method to collect a large sample of quantitative information on the effects of digital transformation on organizations. The survey aims at gathering the opinions of IT consultant on the expected impact of digital transformation on organizations. IT consultants are chosen as they are arguably the most knowledgeable group when it comes to bringing digital transformation into practice. This is due to the fact that they have specific expertise which they have used across different organizations and environments as opposed to other groups that lack knowledge or have limited experience in applying their knowledge outside their own organization.

## 1.6. Research Demarcation

As with any research certain demarcations are set to study the research problems within a certain context and period of time.

The first demarcation of this research is the concept of digital transformation. Digital transformation can be an ambiguous buzzword used by both academics and practitioners. To avoid misconception a definition of digital transformation is used during this research: *digital transformation is a social, mobile, analytics or cloud induced change that significantly affects three or more dimensions on individual, firm, and/or societal level*. The research was conducted in the context of this definition; results and conclusions will therefore not, or in a limited way apply to other definitions of digital transformation one might have. The definition process can be found in chapter two at page 18.

The second demarcation of this research is made with regards to the measurement of impacts of digital transformation. The effects of digital transformation are based on the opinions of consultants. There are a lot of moderating variables that can influence the expectations of these consultants; those moderating variables are not measured explicitly and not taken into account. In addition the outcomes are the combined view of numerous organizations across different industries. If one wants to determine specific organizational or industry effects to determine e.g. a business case, specific organizational or industry variables are needed which are outside the scope of this research

## 1.7. Thesis Outline

In **chapter 2**, digital transformation as a concept is described. A definition of digital transformation is provided which enables classification whether technology-induced changes are transformational or not, and describes the underlying digital technologies. There are four underlying digital technologies that drive the current innovation; social, mobile, analytics, and cloud technologies. Furthermore the changes in customer demand and behavior due to emerging digital technologies are described along with the consequences for organizations. More specifically the effects on products and services, customer-organization interaction, revenue models, key processes and partnerships are described.

In **chapter 3**, four business model frameworks are presented of which the Business Model Canvas is selected to form the basis for further operationalization into survey measures.

In **chapter 4**, the Business Model Canvas is further operationalized allowing for measurement of digital transformation impact. To do so several businesses model meta-studies and the literature of those studies are used to select elements of measurement for the nine structural components of the Business model Canvas. At the end of chapter 5 hypotheses are formulated on the expected impact of digital transformation on organizations using the literature from chapter 3.

In **chapter 5**, the hypotheses of chapter 4 are tested, using data obtained through a survey amongst Cognizant consultants. The first part of the chapter consists of the survey design where the measures, sample and method are presented. The second part of the chapter uses the obtained data to test the hypotheses of chapter 4, describe the impact of digital technologies on organizations and determine which impacts occur simultaneously using correlations of the measures.

In **chapter 6**, the findings and implications of this research are presented and discussed reflecting on both digital transformation as a concept and the nine organizational elements in particular. Furthermore the limitations of the research are present along with the recommendations for future results.

In **chapter 7**, a personal reflection of the research is provided which includes the scope, methodology, results, and research process.

# 2. Digital Transformation

Academics and practitioners have used digital transformation as an ambiguous buzzword in relation to organizational changes influenced by digital technologies; a clear definition is not widely adopted. Within academic literature there are some papers that mention digital transformation, but few dissect the concept. There is more information available on the individual underlying technologies, often gathered through case studies. This chapter brings together these individual studies in an attempt to dissect the concept of digital transformation.

## 2.1. Method

In order to find the relevant academic literature three types of search methods were used. Firstly articles from highly ranked magazines in the field of information systems were scanned on relevance to digital transformation. There are various measures that determine the rank of magazines. Ferratt et al. (2007) showed, using a mean rank of six studies, that MISQ and ISR are two highest ranking magazines in the field of information systems research. As such articles from both magazines from 2010 and onwards are scanned on relevance. The year 2010 is chosen as cut-off point because little research regarding digital transformation was done prior to 2010.

For the second technique a wide variety of relevant keywords were used to find relevant articles in literature search engines such as google scholar and Scopus. The search terms were (combinations of); Digital Transformation, Digital Technologies, Digitalization, Digital business, Digital enterprise, Organizations, Organizational Change. To avoid exclusion of research that encompasses the same concept but is not labeled as digital transformation, an additional search was performed using the term SMAC and combinations of social, mobile, analytics, and cloud. This search only yielded four new articles which indicates that most relevant research is actually labeled as digital transformation or as an affiliated term.

The third technique used was the "snowball" method; this technique aids to identify appropriate academic sources by exploring the references of relevant research. This technique is also used in a reversed matter; searching for academic sources by exploring research that has cited relevant literature.

## 2.2. The concept of digital transformation

Patel and McCarthy (2000) were one of the first to mention the concept of digital transformation but did not go as far to conceptualize the term. Till date only few studies provide a definition of the concept. The Capgemini research of Westerman et al. (2011, p. 5) specifies digital transformation as: *"the use of technology to radically improve performance or reach of enterprises"*. Similarly Stolterman and Croon Forst (2006, p. 689) define digital transformation as follows: *"Digital transformation can be understood as the changes that digital technology causes or influences in all aspects of human life".* From another perspective Lankshear and Knobel (2008) describe digital transformation as the final level of digital literacy. At this level digital technologies enable innovation and creativity, and stimulate significant changes in professional and knowledge domains.

All of the above definitions are holistic by nature and do not break down digital transformation in specific technologies and specific changes. One aspect that becomes apparent is that digital transformation does not entail gradual incremental changes, but fundamental "radical" changes due to digital technologies. Evidentially using a new digital technology within an organization does not necessarily mean that an organization undergoes digital transformation, i.e. a fundamental radical change.

Radical changes are quite an arbitrary measure to determine whether a change is transformational or not. Lucas et al. (2013) present seven different dimensions to classify technology-driven transformations. They propose that when three of the dimensions are significantly impacted, a technology-driven change is considered transformational as proposed.

The criteria of three and the dimensions itself are based on the work of (Dehning, Richardson, & Zmud, 2003, p. 654). Dehning et al. list three criteria for a technology to be transformational:

- Fundamentally alters traditional ways of doing business by redefining business capabilities and/or (internal or external) business processes and relationships,
- Potentially involves strategic acquisitions to acquire new capabilities or to enter a new marketspace,
- Exemplifies the use of IT to dramatically change how tasks are carried out.

Lucas et al state that: "It is quite possible that in using these criteria there would be disagreements among different raters as to whether a technology is transformational or not" (Lucas et al., 2013, p. 373). Additionally they hope that the proposed definition will be progressively refined by others. Despite the potential debate and disagreement about the dimensions and impact criteria, using the seven dimensions of Lucas et al. and the criteria of three seems to be the best step forward in quantifying the arbitrary measure of transformational change.

The seven dimensions and the criteria of impact are (Lucas et al., 2013: adopted from table 1):

**Table 1: Seven dimension and impact criteria, adopted from (Lucas et al., 2013).**

| # | Dimension | Threshold |
|---|---|---|
| 1 | Processes | More than half of the steps in an individual's or firm's process are changed |
| 2 | The creation of new organizations | Worth more than $100 million or change two hours of individual behavior a day. |
| 3 | Changes in relationships between organizations and costumers | More than half of the contact or double the contacts of individuals and/or firms or change two hours of individual behavior a day. |
| 4 | Changes in the markets | Change of at least half of one's vendors, entering or leaving a market served and/or the creation of a new market ($100 million+). |
| 5 | Changes in user experience | A change in user experience of two hours a day |
| 6 | Changes in the amount of customers | If an organizations serves at least 50% more customers. |
| 7 | Disruptive impact | If one or more competitors are forced to operate at losses, and/or exit markets or a reduction of more than $100 million in transactions costs. |

The above dimensions and criteria do not only provide a quantitative measure to determine transformational changes, but also identify the areas that digital technologies can influence or change on individual, firm and societal level (Lucas et al., 2013).

Digital technologies are considered combinations of information, computing, communications and connectivity technologies (Bharadwaj et al., 2013; Fitzgerald et al., 2013). Applying digital technologies is often referred to as digitalization. Digitalization is characterized by Fichman, Santos and Zheng (Fichman, Santos, & Zheng, 2014, p. 5) as the "practice of taking processes, content or objects that used to be primarily (or entirely) physical or analog and transforming them to be primarily (or entirely) digital". Digitalization is something which occurred before the hype of digital transformation and is something that will most likely happen indefinitely.

According to Frank, Malcom and Pring (2014, p. 57) we are currently at the crossroad between the fourth and fifth wave of corporate IT. The fifth of corporate IT is referred to as SMAC (social, mobile, analytics and cloud) technologies. In each IT wave the number of connect devices grows ten-fold (Frank et al., 2014) resulting in a total number of at least 25 billion connected devices in 2020 (Gartner, 2014).

These social, mobile, analytics and cloud technologies are recognized as the digital technologies currently driving business innovation affecting social and economic life by multiple leaders in the IT industry such as Capgemini, Cognizant, KPMG, and PwC (Bharadwaj et al., 2013; Fitzgerald et al., 2013; Frank, Roehrig, & Pring, 2013; Jace, 2015; PwC, 2012; Udhas, Sridharan, & Raman, 2015). The subsequent shifts in society are considered the driving forces behind the current phenomena of digital transformation (Fitzgerald et al., 2013; Seeger & Bick, 2013).

It can be concluded that, currently, digital transformation is a social, mobile, analytics or cloud induced change that significantly affects three or more dimensions on individual, firm, and/or societal level. In the near future there could, and probably will, be new waves of digital technologies that will drive innovations. As such the digital technologies that fall under the concept of digital transformation will change. The results of this research will therefore only hold for the technological snapshot of the current landscape (Social, Mobile, Analytics, and Cloud).

## 2.3. Effects of Digital Transformation

As described during the research problem there are few studies that describe the combined effects of digital transformation but no studies that do so across organizations and across industries. There are however multiple studies that focus on the effects of social, mobile, analytics, and cloud on customers and organizations in isolation. This paragraph serves as brief overview of these digital technologies to get an understanding on the potential and observed effects. The literature used in this paragraph is either from the digital transformation studies of (Li, 2015; Piccinini et al., 2015; Westerman et al., 2011), studies the have cited or studies that include one or more of the technologies that drive current digital transformations; Social, Mobile, Analytics, and Cloud. The effects and studies used in this paragraph form the first step towards the formulation of the hypotheses in paragraph 5.3.

### 2.3.1 Changing customer demand and behavior

From a customer-perspective digital technologies are becoming more and more embedded into our workplace and home, as part of our daily lives (Aral, Dellarocas, & Godes, 2013; Oestreicher-Singer & Zalmanson, 2013). Stolterman and Croon Forst (2006) describe that we are not only using more standalone IT artifacts in our daily lives, but that these IT artifacts are blending with most other artifacts. Information technologies are tying together, becoming part of systems and networks that can instantly communicate. The usage of more IT artifacts, IT imbedded artifacts and increasingly tied networks and systems leads "to a world that is increasingly experienced with, through and by information technology" (Stolterman & Croon Forst, 2006, p. 690). This has a fundamental impact on the way we communicate, consume and create (Aral et al., 2013; Oestreicher-Singer & Zalmanson, 2013). As a result consumer demand and behavior is changing along with the relationships between consumers and producers (Lucas et al., 2013; Setia et al., 2013).

Piccinini et al. (2015) conducted a literature study to determine, amongst others, how customer behavior is changing due to digital technologies. Consumer informedness is greatly increased due to increased accessibility and availability of products and services through digital devices, anytime, anywhere to everybody (Hennig-Thurau et al., 2010; Smith & McKeen, 2008). Customers now know the exact products and services available, their prices and attributes influencing and are changing their purchase decisions (Clemons, 2008; Kauffman, Li, & Heck, 2010). Consumers also develop their digital competence, they are able to evaluate and purchase products and services online, without consulting intermediaries (Granados & Gupta, 2013; Lucas et al., 2013).

Furthermore "democratization of content" is taking place. Information is no longer controlled by organizations and solely distributed to consumers by marketing channels. The perception of customers is also influenced by customer generated content, such as reviews and blogs, shared through digital media (Aral et al., 2013; Clemons, 2008). Such information sharing between customers has become increasingly influential and important (Clemons, 2008; Zhu & Zhang, 2010).

As a result interactions between organizations and consumers are changing (Piccinini et al., 2015). Consumers' expectations towards organizations have changed, they expect easy usability of digital products (Smith & McKeen, 2008; Yoo, 2010). In addition they want the flexibility to interact with organizations through various channels 24/7 when they might want to order products, make transaction or track and send packages (Andal-Ancion, Cartwight, & Yip, 2003; Weill & Woerner, 2013).

In short, customer informedness increases through the accessibility and availability of information and customers share more and more information amongst each other democratizing the content of organizations resulting in higher customer expectations regarding usability of products and flexibility of organizations.

### 2.3.2 Organizational responses

Organizations need to respond to these changes in customer demand and behavior and they are doing so. Multiple changes in organizations have been identified through – amongst others - large case studies of Westerman et al. (2011) and Li (2015).

**Effects on products and services**

Products and services are changing greatly. They are increasingly more personalized to the specific customer preferences (Andal-Ancion et al., 2003; Li, 2015). Organizations are increasingly able to launch new product and services and enhance their existing products and services due to the use of digital technologies (Fitzgerald et al., 2013). Accessibility of products and services is improved trough the usage of digital devices and digital channels (Hennig-Thurau et al., 2010; Smith & McKeen, 2008).

**Effects on customer segmentation**

Analytic technologies allow organizations to better understand customer behavior and needs (Westerman et al., 2011) and their willingness to pay premiums for certain offerings (Li, 2015). Because of the improved customer insight the ability to segment markets increased (Li, 2015; Westerman et al., 2011) , enabling organizations to provide different offerings for different segments (Li, 2015) better attending to their needs (Dutta & Biren, 2001).

**Effects on customer-organization interaction**

Digital channels and technologies have enabled digital interaction changing both the relationships and interactions between customers and organizations (Li, 2015). Customer awareness is improved (Kurniawati, Shanks, & Bekmamedova, 2013) due to an evolved online presence enabled by social media campaigns and mobile marketing (Westerman et al., 2011). Communication with customer is improved, personalized, and possible through an increasing number of (social) platforms (Westerman et al., 2011). Marketing-wise strategies have improved a lot (Kurniawati et al., 2013) due to predictive marketing, better customer engagement and specific customer targeting (Kurniawati et al., 2013; Westerman et al., 2011). New interfaces have led to new ways of selling and purchasing processes (Li, 2015) allowing the option to skip certain distribution channels (Westerman et al., 2011). The integration of customer data has led to improved and personalized sales and support processes within organizations (Westerman et al., 2011) providing a more timely and accurate customer service (Kurniawati et al., 2013).

Overall the digital customer experience is hugely improved (Rishika, Kumar, Janakiraman, & Bezawada, 2013). Digitalization of customer-organization interaction increasingly enables self-service through various channels (Li, 2015). In addition organizations exploit customer knowledge for product improvements to create new and improve and products and services (Huang, Pan, & Zuo, 2012) through increased expert and consumer community knowledge sharing (Westerman et al., 2011). Organizations also integrate more user-driven innovations resulting from co-creation (Leclercq-Vandelannoitte, 2015).

**Effects on revenue models**

Digital technologies have created new ways for organizations to generate revenue. Licensing of (intellectual) property is something which is becoming increasingly popular. Licensing is fairly profitable since the reproductions costs are low (Li, 2015). New pay per usage models have

been introduced and through the increasing online presence of customer online advertising fees are increasing (Li, 2015). Due to increased digital competence consumer no longer need to consult intermediaries (Granados & Gupta, 2013) potentially reducing intermediation fees. No notable changes in asset sale and renting of products and services have occurred (Li, 2015)

**Effects on internal processes**
Digital technologies and the accompanied digitalization also affect the internal processes of organizations. Standardization of process using digital technologies is high on the agenda of many organizations (Westerman et al., 2011). Automation of internal processes is driving operational efficiency by integration (operational) processes and data (Westerman et al., 2011). Several studies notice that operational process are becoming more and more standardized due to the digitalization within organizations (Agarwal & Dhar, 2014; Bharadwaj et al., 2013; Markus & Loebbecke, 2013).

**Effects on partnerships**
The eco-systems in which organizations operate are also changing, new interfaces facilitate new interactions between partners and competitors (Li, 2015). Partners in supply chains are increasingly tightening together (Bharadwaj et al., 2013), and global digital services are increasingly integrated and shared (Westerman et al., 2011). Digital technologies also enable new ways for competitors and complementary vendors to cooperate (Li, 2015).

In short, organizations have changed and are still changing due to changes in customer demand and behavior. Their products and service offerings are changing along with the interaction they have with customers. Organizations have improved customer insights which allow them to segment markets and accommodate to customer preferences. These changes affect their revenue models, key processes and partnerships. New ways to generate revenue are used, internal processes are standardized and integrated, and partnerships are increasingly tightened through new interfaces and shared digital services.

**Effects on resources and costs**
Cloud technologies allow organizations to pay by the hour of computing resources and even though the hourly rate is higher than if you own one it's cheaper in the long run due to no underutilization and less physical infrastructure (Armbrust et al., 2010). This trend is often referred to as Infrastructure as a service and Software as a service. This results in a decrease of physical resources and increase of intellectual resources. Furthermore cheaper and more cost-effective solutions and the benefit of widely applied economics of scale (Bharadwaj et al., 2013) should lead to overall reduction of organizational costs. Aside from cheaper digital technologies and associated costs, digital technologies also enable virtualization of work processes. Employees can collaborate and share knowledge through virtual platforms reducing costs (Huang et al., 2012; Nambisan, 2002).

# 3. Framework Selection

In this chapter, a business model framework is selected that forms the basis for further operationalization into survey measures. The operationalization into survey measures is done in chapter four.

## 3.1. Business Model Literature

Business models are an important and new unit of analysis that provide a systemic perspective which can be used regardless of firms, industry or network characteristics (Zott, Amit, & Massa, 2011). This is due to the fact that business models are a relatively new study within scientific literature. The first publications only date back from the end of the 1990's (Al-Debei & Avison, 2010; Zott et al., 2011). The diversity and newness causes that businesses models are a fuzzy and vague concept to many practitioners (Al-Debei & Avison, 2010). Many different scholars and practitioners use definitions that fit the purpose of their study (Zott et al., 2011). To avoid confusion the following definition of business models is used during this thesis "A business model describes the rationale of how an organization creates, delivers and captures value" (Osterwalder & Pigneur, 2010, p. 14).

Throughout literature there are many concepts of business models available. Al-Debei and Avison have tried – through an extensive meta-study - to create a unified business model by combining and aligning different concepts. Although there are many differences in concepts and purposes of business models, they've identified four different business model dimensions that are common elements throughout literature. These elements are value proposition, value architecture, value finance and value network and are well-founded in literature (Al-Debei & Avison, 2010; Al-Debei & Fitzgerald, 2010).

Based on the various academic writings they've defined value proposition, value architecture, value finance, and value network in the following way (Al-Debei & Avison, 2010, p. 366):

> **Value Proposition**: The way that demonstrates the business logic of creating value for customers and/or to party involved through offering products and services that satisfy the needs of their target segments (Amit & Zott, 2001; Magretta, 2002; Osterwalder, Pigneur, & Tucci, 2005; Petrovic, Kittl, & Teksten, 2001).
>
> **Value Architecture**: Architecture of the organization including its technological and organizational architecture that allows the provisioning of products and services in addition to information flows (Timmers, 1998; Venkatraman & Henderson, 1998).
>
> **Value Network:** The way in which an organization enables transactions through coordination and collaboration among parties and multiple companies (Amit & Zott, 2001; H Bouwman, 2002; Gordijn & Akkermans, 2001).
>
> **Value Finance**: The way in which an organization manages issues related to costing, pricing and revenue breakdown to sustain and improve its creation (Linder & Cantrell, 2000; Rappa, 2008; Timmers, 1998).

## 3.2. Business model frameworks

Within the academic field of business models there are several frameworks that can be used to design business models for organizations. These frameworks go one step beyond the previously described elements of value proposition, value architecture, value network and value finance. In the following paragraph five dominant (ICT-related) business model frameworks are briefly described. These five frameworks are;

- Visor (Sawy, Pereira, & Fife, 2008),
- Business Model Canvas (Osterwalder & Pigneur, 2010),
- Entrepreneurs business model (Morris, Schindehutte, & Allen, 2005),
- STOF (Faber, Ballon, Bouwman, & Haaker, 2003), and
- C-SOFT (Heikkila, Heikkila, & Tinnila, 2005).

In order to select the best alternative for further use; the frameworks and their elements are presented in the following paragraphs. The C-SOFT framework is an extension to the STOF framework. The STOF framework will therefore not be mentioned separately.

### 3.2.1. Visor

The visor business model framework is tailored for networked digital industries where many partners and stakeholders are involved in creating customer value. It is designed to develop IT-intensive business models and consists of five different elements; Value, Interface, Service platform, Organization model, and Revenue/Cost sharing (Sawy et al., 2008).

- **Value**: Determining which particular customer segment would value an enterprise's products and services and is willing to pay a premium price.
- **Interface**: Important aspect in the perceived value for customers. The user interface determines easiness of use, simplicity and convenience with which a customer uses a product and/or service.
- **Service Platform**: Describes the (IT) platforms and business processes needed to deliver the value proposition to customers.
- **Organizing model**: Describes how an enterprise or multiple partners have to collaborate in order to deliver the products and services. This includes business processes, value chains, and partner relationships.
- **Revenue/Cost Sharing**: Describes the way in which the delivered value is captured and divided amongst the involved partners along with the division on who bears what costs.

### 3.2.2. Business Model Canvas

The Business Model Canvas (BMC) is a framework based on nine different building blocks. It serves as a practical way to map and re-design organizations' business models. The canvas is a result of co-creation between academics and practitioners and can be applied to a wide variety of organizations and industries. The nine building blocks of the BMC are: customers segments, value proposition, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure (Osterwalder & Pigneur, 2010, pp. 16–17):

- **Customer segment:** Describes distinct segments of customers based on need, behaviors and/or attributes with the aim to identify profitable customers (pp. 20)
- **Value proposition:** Describes the bundle of products and services that create value for a specific customer segment (pp. 22).
- **Channels:** Describes the way how a company communicates with and reaches its customers to deliver the value proposition (pp. 26).
- **Customer relationships:** Describes the types of relationships a company establishes with specific customer segments (pp. 28).
- **Revenue streams:** Represents the cash a company generates from different customer segments (pp. 30).
- **Key resources:** Describes the assets required to create and offer a value proposition, reach markets, maintain relationships, and earn revenues (pp. 34).
- **Key activities:** Describes the actions a company must take to operate successfully. Similarly the activities are required to create and offer a value proposition, reach markets, maintain relationships, and earn revenues (pp. 36).
- **Key Partnerships:** Describes the network of suppliers and partners that allow an organization to operate (pp. 38).
- **Cost Structure:** Describes all the cost incurred in creating value, maintaining customer relationships and generating revenue (pp. 40).

In addition to the nine building blocks, Osterwalder and Pigneur have specified the elements that make up the different building blocks.

### 3.2.3. Entrepreneur's business model

The entrepreneur's business model (Morris et al., 2005) has three layers. The first layer is the foundational level that describes the basic components of a business model. The second layer is the proprietary which describe the different ways components operationalized to create a unique combination for an organization. The third layer is the rules level and describes the basic set of operating rules. The basic components are:

- Who do we create value for? (Value proposition)
- For whom will we create value? (Customer segment)
- What is our source of competence? (Internal capabilities)
- How do we competitively position ourselves? (Competitive strategy)
- How do we make money? (Finance architecture)
- What are our time, scope and size ambitions? (Strategic positioning)

### 3.2.4. C-SOFT

The C-SOFT framework is an extension of the STOF model (Faber et al., 2003). The STOF model consists of a service domain, technology domain, organization domain, and finance domain and is designed for ICT-related services on ICT platforms. In the C-SOFT framework Customers relations are added to the framework (Heikkila et al., 2005).

- **Customer relationships:** Describes the customer segment or segments that are targeted, their needs and the established relationships between the organizations and the customer.
- **Service domain**: The service domain depicts the intended value for the customer, the way it is created and the way it is provided.
- **Technology domain**: describes the information and communication technology needed to support operations and collaboration.
- **Organization domain**: The organization or network component defines the roles, tasks and operations that each network participant has to perform.
- **Finance domain**: The finance components focuses on cost issues and revenue sharing. There are four categories; Capital, Costs, Revenues and Risks.

## 3.3. Framework selection

Digital transformation encompasses social, mobile, analytics, and cloud technologies that influence many aspects of an organization for different industries. The selected framework should be able to measure these effects regardless of industry or technologies used in order to ensure as most as possible that all potential effects can be measured.

Two of the frameworks VISOR and C-SOFT are tailored specifically to networked digital industries and ICT services on digital platforms. Using these frameworks potentially excludes changes that lay outside digital platforms or the ICT-industry, which would not measure the full spectrum potential effects from digital transformation. Hence, they are not used.

The remaining two frameworks, the BMC and entrepreneur's model, differ in the number of building blocks and level of detail. The BMC has more building blocks with clearer and distinct elements that represent more organizational aspects. For instance both frameworks cover value proposition and customer segmentation but the BMC links these elements together in a more distinct way, explaining how value is delivered through customers (channels) and what types of customer relationships are needed to do so (customer relationships). Similarly the entrepreneur's model describes to less extent what activities, resources and partnerships are needed to create market and deliver the value proposition (key activities, key resources and key partnerships). Due to a clearer and more detailed level of representation the BMC is selected as framework for further operationalization.

# 4. Framework operationalization

In this chapter the Business Model Canvas framework of Osterwalder and Pigneur (2010) is further operationalized into a measurement framework. Furthermore the hypotheses regarding the effect of digital transformation on organizations are formulated.

Firstly the articles and studies that are used to operationalize the framework and the rationale behind the selection are presented. Secondly, each of the nine elements is operationalized separately based on the relevant business model literature and business model frameworks. Lastly hypotheses are formulated for each of the nine operationalized elements based on findings and literature from chapter 3.

## 4.1. Method

In addition to the nine building blocks that make up business models, the business model canvas specifies which elements play a role within each of the building block. The elements are verified, extended and where necessary replaced or removed based on articles and research in the field of business model literature. An overview of the nine building blocks and the selected elements can be found in paragraph 4.2.10. on page 35.

In 2005 Osterwalder, Pigneur and Tucci performed a meta-study of business model literature which would eventually become the basis of the BMC (Osterwalder et al., 2005). Such meta-studies contain a lot of relevant articles which can be used to operationalize the framework. In addition to Osterwalder and Pigneur there are several meta-studies that provide an overview of business model literature, their building blocks and corresponding elements. Three additional meta- studies are used to identify the appropriate operationalization for each of the nine building blocks.

The meta-studies are selected based on their relevance, exhaustiveness and period of publication. A spread of the period of publication is maintained to ensure articles and/or studies from different timespans are incorporated. Those studies - including Osterwalder and Pigneur - are:

- Clarifying business models (Osterwalder et al., 2005),
- The power of business models (Shafer, Smith, & Linder, 2005),
- Analyzing the business model concept (Burkhart, Krumeich, Werth, & Loos, 2011),
- An exploration of business model development in the commercialization of technology innovations (Dmitriev, Simmons, & Truong, 2014).

In addition to the articles and studies from the above meta-studies elements from the entrepreneurs business model (Morris et al., 2005), the C-SOFT framework (Heikkila et al., 2005) and Process Classification Framework (APQC, 2015) were used since they included relevant information that was not covered by the meta-studies.

## 4.2. Operationalization of the BMC

The following paragraphs contain the nine operationalized elements of the business model framework that will be used as a measurement framework for the impact of digital transformation on organizations. At the end of this section an overview of the nine operationalized elements is presented.

### 4.2.1. Value proposition

Osterwalder and Pigneur present nine elements that contribute to the value proposition in their business model canvas, which are: performance, customization, design, brand and status, price, cost reduction, risk reduction, accessibility, and convenience and usability (Osterwalder & Pigneur, 2010).

A lot of the elements have strong foundations in literature such as the newness of products and services as an element of value proposition described by Amit & Zott (2001), and Demil & Lecocq. The same applies to the customization of products and services described by Morris et al. (2005), Amit & Zott (2001), and Dubosson-Torbay et al. (2002). Since both elements occur in other articles besides the BMC framework, they are incorporated in the measurement framework.

The combination and bundling of products and services is an element that is frequently mentioned in the articles such as: Kindström (2010), Morris et al. (2005), Demil & Lecocq (2010), Amit & Zott (2001) but not in the value proposition elements of the BMC. Due to the frequent appearance of in literature, the combination of products and services is added as an element to the framework.

The importance of the price and costs (reduction) to the value of products and services is recognized by Mahadevan (2000), Magretta (2002), Dubosson-Torbay et al. (2002) and van der Vorst et al. (2002). While Osterwalder and Pigneur (2010) present price and cost separately they often have a similar meaning in literature and are therefore combined into one element.

In the business model theory both brand and status are rarely stated as a contributor to the value proposition, although one might argue otherwise. Due to the lack of literature foundation the element of brand and status is removed. The same applies to the element of risk reduction; in the reviewed articles risk was not mentioned as an element of the value proposition and is therefore removed as an element.

The value proposition element of accessibility occurs in the reviewed relevant articles as well. Morris et al. (2005) speak of the accessibility to the value proposition while Mason & Spring (2011) refer to value access. Since accessibility has sufficient foundation in literature it used as an element.

More ambiguous are the elements of design, convenience and usability used within the BMC. Throughout literature similar elements are named as part of the value proposition. Teece (2010) refers to the utility derived from products and services and Magretta (2002) explains the convenience as an element of the value proposition. Since the three elements more or less describe the same they are combined into the element of convenience.

The last element Osterwalder and Pigneur (2010) describe is performance. In the business model literature the same element is used but described somewhat differently. Mahadevan (2000) mentions the attributes of product in relation to what it can do and Alt & Zimmerman (2001) refer to the features of products and services. Though the wording is not the same, there is enough based in literature to include the element of performance.

### 4.2.2. Customer segment

For the customer segment Osterwalder and Pigneur describe five types of market segments; mass markets, niche markets, segmented markets, diversified markets and multi-sided platforms (Osterwalder & Pigneur, 2010). The types of markets are not described as elements of customer segments – which are the different markets - within the relevant business model literature.

Before the five types of markets, Osterwalder and Pigneur (2010) state that the segments are based on needs, behavior and attributes. As opposed the five previously stated elements, these elements have a strong foundation in literature.

The customer segment construct is about identifying and understanding the right markets (Kindström, 2010; Petrovic et al., 2001), which is done by identifying the right target segments (Dubosson-Torbay et al., 2002). The element of markets segments is understandably mentioned a lot within literature such as: Chesbrough and Rosenbloom (2002), Morris et al. (2005), van der Vorst et al. (2002) Teece (2010) and Dmitriev et al. (2014) and is therefore used as an element in the framework.

As Heikkila et al. state the segmentation is done based on needs and characteristics of customers (Heikkila et al., 2005). Segmentation based on customers' needs is also recognized by Johnson et al. (2008), Kindström (2010), Teece (2010). Due to the broad recognition of customer needs in literature it's included as an element.

Johnson et al. (2008) identify customer characteristics as an element as well but they mentioned it as customer attributes which is in line with Osterwalder and Pigneur (2010). Since the element of customer attribute/characteristics is present in business model literature it is included into the framework as customer attributes.

Along with Osterwalder and Pigneur (2010), Magretta (2002) also mentions identification based on customer behavior. Since behavior is distinctly different from attributes and needs it's incorporated as a separate element in the framework.

Besides identifying customer segments based on needs, attributes and behavior several articles explicitly state the fulfillment and/or satisfaction of customers. Teece (2010) refers to satisfying the customers' needs while Dubosson-Torbay et al. (2002) and van der Vorst (2002) mentioned it as fulfillment of customers. Since fulfillment and/or satisfaction are inherently different than identification it is incorporated separately for needs, attributes and behavior as an element. To describe this element accommodation to needs, attributes, and behavior is used.

### 4.2.3. Channels

According to Osterwalder and Pigneur the channels building block has five phases of communicating, reaching and delivering the value proposition to customers. Those five phases are creating awareness, the evaluation of an organizations value proposition, the purchasing of a products or service, the delivery of that product or services and the post-purchase customer support (Osterwalder & Pigneur, 2010).

All of the five stages are mentioned as an element in the various articles on business models and are incorporated as such into the framework. The element of creating awareness and evaluation of the products and services is often described as communication and marketing. Petrovic et al. (2001), Morris et al. (2005), Magretta (2002) and Timmers (1998) all mention the importance of marketing the value proposition of organizations. Amit and Zott (Amit & Zott, 2001) emphasize the importance of marketing, advertising and communication to allow customer to make informed purchased decisions which aligns with the second phase of evaluation an organization's value proposition.

Timmers (1998) and Morris et al. (2005) state the importance of selling products and services as an element within organizations business models, this element is reflected by the purchase phase. Kindström (2010), Petrovic et al. (2001) and Magretta (2002) in line with Osterwalder and Pigneur mention delivery and service as important aspects in the process of selling products and services.

### 4.2.4. Customer relationships

Osterwalder and Pigneur specify six types of customer relationships; personal assistance, dedicated personal assistance, self-service, automated services, communities and co-creation. The first four relationships are the self-explanatory standard types of customer-producer interaction and added to the framework as such. The latter two are frequently mentioned in the business model literature. Co-production as a type of relationship is mentioned by Timmers (1998), Kindström (2010) and van der Vorst (2002) and contributes to the value of the created products by design and/or content. Mahadevan (2000) and Timmers (1998) address the usage of virtual communities that bring together people with common interests to share knowledge and insights. Since both co-creation and communities have a presence in literature they are added as an element.

### 4.2.5. Key Activities

In the key activities part of the BMC, three types of differentiating activities of companies are described; problem solving, production creation and network/platform activities (Osterwalder & Pigneur, 2010). These activities are the elements through which an organization creates its unique value proposition but they do not describe the actual activities performed within an organization. Similarity all relevant articles mention the importance of key activities within organizations but rarely in a structural way. Only Johnson et al. (2008) mention the activity categories of operational en managerial processes.

Activities that are mentioned within literature are often in line with the channel steps described previously. In order to operationalize the activities in a structural way the process classification framework (PCF) of APQC (2015) is used. The PCF mentions twelve high level processes in the categories; operational, support and management processes. Each of the twelve processes is operationalized to the level of individual activities.

There are five operational processes of which four are included into the framework.

The included processes are:

- Develop and management of products and services,
- Marketing and selling of products and services,
- Delivery of products and services,
- Management of customer services.

The PCF describes the operational process of developing mission and vision which is left out since it does not fit the intended aim of the framework. The management and supporting processes are divided into seven processes. Incorporating all the seven processes would surpass the goals of this framework and survey. Therefore management and supporting process are used as an element without further operationalization.

### 4.2.6. Key Resources

Osterwalder and Pigneur (2010) mention four types of key resources an organization uses, which are: physical, human, intellectual and financial resources. Throughout business model literature there is consensus about the physical, human and intellectual elements. Dubosson-Torbay et al. (2002) mention the usage of tangible, intangible and human resources with organizations which aligns with the physical, intellectual and human resources of Osterwalder and Pigneur. Hedman and Kalling (2003), Demil and Lecocq (2010), and Johnson et al. (2008) all refer to physical and human resources as an element of the key resources of an organization. In addition Teece (2010) mentions the intellectual property used within organizations adds to the importance of this resource. There if scientific literature to incorporate physical, human and intellectual resources in the framework.

None of the sources mention financial resources as an element and Osterwalder and Pigneur mention financial resources are only used in a few companies to make their business model work (Osterwalder & Pigneur, 2010). Since it's not common within organizations and it has no presence in literature, financial resources are excluded.

### 4.2.7. Key Partnerships

With regards to key partnerships Osterwalder and Pigneur (2010) only refer to the motivations organizations can have to take on partnerships, not the different types of partners and relations. In the business model literature the different partners' organizations can have are mentioned along with the type of partnership. There are three different type of key partners; supplier, channel intermediaries and complementary vendors.

Suppliers are mentioned most often as key partners. Mahadevan (2000), Hedman & Kalling (2003), Demil and Lecocq (2010), Kindström (2010), Amit & Zott (2001), Hamel (2001) and Dubosson-Torbay (2002) state the importance of suppliers as partners in various ways.

Ross et al. (2002) and Mahadevan (2000) state the possibility for channel intermediaries to partner up. Demil and Lecocq (2010) and Hamel (2001) mention the possibility for complementary vendor to combine efforts through coalitions.

Aside from the types of partners there are two important reasons – mentioned in the business model literature - for organizations to partner; cooperation and sharing responsibility to reduce risks. Mahadevan (2000), Hamel (2001), van der Vorst (2002) and Ross et al. (2002) mention cooperation to obtain outside knowledge, efficient access to resources and improved (supply chain) operations as motivation to partner. Ross et al. (2002) also mention the ability to share risk trough shared responsibility as a motivation to create a partnerships.

### 4.2.8. Revenue Streams

With regards to the revenue streams Osterwalder and Pigneur (2010) mention seven different elements that represent different types of possible ways to generate cash along with an explanation of fixed and dynamic pricing. The seven types of revenues present are; asset sale, usage fees, subscription fees, licensing, renting/lending/leasing, brokerage fees and advertising. All of these elements are mentioned by various business model articles and are used as elements in the framework. No other types of revenue where identified in the reviewed articles.

Mahadevan (2000), Johnson et al. (2008) and Dubosson-Torbay et al. (2002) all mention the possibility of revenue through direct sales of products and/or services. Paying depending on the usage of an asset through usages fees is mentioned in the articles of McGrath (2010) and Dubosson-Torbay et al. (2002). Similarly subscription fees as a revenue stream is brought up in the articles of Johnson et al. (2008), McGrath (2010) and Dubosson-Torbay et al. (2002).

Generating revenue through the licensing of intellectual property is touched upon by Morris et al. (2005) and Teece (2010).Renting, lending and/or leasing is only described by Johnson et al. (2008), but since it is such a well-known and frequently used method of generating revenue it is incorporated into the framework.

Advertising as a source of income is described frequently in literature. Mahadevan (2000), McGrath (2010) and Dubosson-Torbay (2002) et al. mention it as a means through generated revenue on platforms with “free” users. Although revenue through commission on platforms/networks that bring together multiple users is only mentioned by Dubosson-Torbay (2002) et al. it’s is a distinct different way of generating revenue than the other six and added to the framework.

### 4.2.9. Cost Structure

In the cost structure Osterwalder and Pigneur (2010) describe two elements, two attitudes an organization can have towards their cost structure and two means two reduce overall costs. The two elements of costs described are fixed and variable costs. Although there are many types of cost involved within companies they all fall under either fixed or variable costs.

Chesbrough and Rosenbloom (2002) divided the costs under unit cost and fixed cost which is similar to fixed and variable costs. Since fixed and variable costs arguably represent the costs an organization incurs they are incorporated as elements. The combination of fixed and variable costs result into the total costs of organizations, which is an important unit of measurement. Since the total cost can't be estimated through variable and fixed costs measure in the survey due to the quantitative scaling, total cost is added as well.

### 4.2.10. Overview of the framework elements

In the table below the overview of the operationalized BMC framework is presented. For each of the nine building blocks the selected design variables are shown. This framework serves as the blueprint for the survey and measures, which are presented in the next chapter.

**Table 2: Measurement framework and elements**

| | Value proposition | Customer segment | Channels | Customer relationships | Key activities | Key resources | Key partnerships | Revenue streams | Cost structure |
|---|---|---|---|---|---|---|---|---|---|
| **#1** | New products and services | Identification of customer needs | Customer awareness | Personal assistance | Development and management of P&S | Physical | Suppliers | Asset sales | Fixed cost |
| **#2** | Combination of products and services | Identification of customer attributes | Value proposition evaluation | Dedicated personal assistance | Marketing and selling of P&S | Intellectual | Channel intermediaries | Usage fees | Variable cost |
| **#3** | Performance of products and services | Identification of customer behavior | Purchasing of products and services | Self-service | Delivery of P&S | Human | Complementary vendors | Subscription fees | Total cost |
| **#4** | Customization of products and services | Market segmentation | Delivery of products and services | Automated services | Management of customer services | | Cooperation between key partners | Lending/ renting/ leasing | |
| **#5** | Price of products and services | Accommodation to customer needs | Post-purchase customer support | Communities | Management processes | | Shared responsibility between key partners | Licensing | |
| **#6** | Accessibility of products and services | Accommodation to customer attributes | | Co-creation | Supporting processes | | | Brokerage fees | |
| **#7** | Convenience of products and services | Accommodation to customer behavior | | | | | | Advertising | |

## 4.3. Hypotheses

Based on the literature identified in chapter two hypotheses are formulated for each of the measures from the nine framework building blocks based on expected change due to digital transformation.

**Value proposition**

Products and services are becoming more personalized (Li, 2015) and more accessible (Hennig-Thurau et al., 2010; Smith & McKeen, 2008). Organizations will create new products and services, and will enhance existing ones (Fitzgerald et al., 2013; Huang et al., 2012). Since products and services are more tailored towards customer preferences (Li, 2015) and usable through digital devices and channels (Hennig-Thurau et al., 2010; Smith & McKeen, 2008), convenience will most likely increase (Yoo, 2010). No hypotheses can be formed on the change in the combination of existing products and services, and the prices of products and services based on prevailed literature.

Due to digital transformation…

- VP1: The creation of new products and services will increase
- VP2: *No hypothesis on the change in combination of existing products and services*
- VP3: Performance of products and services will increase
- VP4: Customization of products and service will increase
- VP5: *No hypothesis on the price change of products and services*
- VP6: accessibility of products and services will increase
- VP7: convenience of products and services will increase

**Customer Segment**

Organizations will become better in analyzing customers (Westerman et al., 2011), allowing them to better segment markets (Li, 2015), providing different offerings to different segments (Li, 2015) better attending to the customers (Dutta & Biren, 2001).

Due to digital transformation…

- CS1: The identification of customer needs will increase
- CS2: The identification of customer attributes will increase
- CS3: The identification of customer behavior will increase
- CS4: The segmentation of markets will increase
- CS5: The accommodation to customer needs will increase
- CS6: The accommodation to customer attributes will increase
- CS7: The accommodation to customer behavior will increase

**Channels**

Organizations are changing the way they communicate with, reach, and deliver to customers. Customers are getting more and more informed (Li, 2015); know the exact products and services available, their prices and attributes (Clemons, 2008; Kauffman et al., 2010). Their awareness of products and services is increasing along with the capability to evaluate the value of these products and services (Westerman et al., 2011). The digital competence of consumers is increasing enabling them to purchase products online (Granados & Gupta, 2013) through various (new) digital channels (Li, 2015). Products and services are becoming more accessible through digital devices and digital channels (Hennig-Thurau et al., 2010; Smith & McKeen, 2008) enabling new ways for organizations to deliver their offerings. In addition organizations are able to provide more accurate customer service (Kurniawati et al., 2013) through new interfaces (Li, 2015) and various channels (Weill & Woerner, 2013).

Due to digital transformation…

- CH1: Customer awareness of products and services will increase.
- CH2: The possibility to evaluate products and services will increase.
- CH3: The ways and means to purchase products and services will increase.
- CH4: The ways and means to distribute products and services will increase.
- CH5: The ways and means to provide post-purchase customer support will increase.

**Customer relationships**

The interaction between customers and organizations is changing due to the availability of digital technologies (Li, 2015). Digitalization increasingly enables self-service (Li, 2015), knowledge sharing through communities (Westerman et al., 2011) and (Huang et al., 2012) co-creation (Leclercq-Vandelannoitte, 2015). Customer engagement through digital channels and predictive analytics are improving (Kurniawati et al., 2013), one can expect an increase in the automated services provide to customer similar to increase use of self-service. Although relationships are becoming more personalized (Westerman et al., 2011) no sources mention changes in the usage of personal assistance or dedicated personal assistance, therefore no hypotheses are formulated.

Due to digital transformation…

- CR1: *No hypothesis on the change of personal assistance*
- CR2: *No hypothesis on the change of dedicated personal assistance*
- CR3: The usage of self-service will increase
- CR4: The usage of automated service will increase
- CR5: The usage of communities will increase
- CR6: The usage of co-creation will increase

**Key activities**
Processes within organizations are affected by digital technologies. Operational processes in general are expected to integrate (Westerman et al., 2011). With regards to standardization all operational processes are expected to standardize but there are no reference to change of management and supporting processes.

Due to digital transformation…

- KA1: The processes of development and management of products will both standardize and integrate
- KA2: The processes of marketing and selling products and services will both standardize and integrate
- KA3: The processes of delivering products will both standardize and integrate
- KA4: The processes of management of customer services will both standardize and integrate
- KA5: The management processes will integrate. *No hypothesis can be formed on the standardization.*
- KA6: The supporting processes will integrate. *No hypothesis can be formed on the standardization.*

**Key resources**
Digital technologies enable organizations to own less physical resources (Armbrust et al., 2010; Bharadwaj et al., 2013) since they need less in their daily operations and are able to outsource infrastructure and usage it as infrastructure or software as a service (Armbrust et al., 2010). This and the increase use of digital technologies increases the usage of intellectual resources. In the consulted literature no reference is made to the usage of human resources, therefore no hypothesis is formulated

Due to digital transformation…

- KR1: The usage of physical resources will decrease
- KR2: The usage of intellectual resources will increase
- KR3: *No hypothesis on the change of usage of human resources*

**Key partnerships**
New interfaces enable new interactions between partners enabling new ways of cooperation (Li, 2015). Partners are increasingly tightening together (Bharadwaj et al., 2013) sharing and integrating services. Although digital technologies change and facilitate interaction between key partners no reference are made to and increase or decrease in the number of partners. Therefore no hypotheses are formulated on the number of suppliers, channel intermediaries and complementary vendors.

Due to digital transformation…

- KP1: *No hypothesis on the change in number of suppliers*
- KP2: *No hypothesis on the change in number of channel intermediaries*
- KP3: *No hypothesis on the change in number of complementary vendors*
- KP4: The cooperation between key partners will increase
- KP5: The shared responsibility between key partners will increase

**Revenue streams**

Digital technologies enable new ways for organizations to generate revenue. Licensing is becoming increasingly more popular as well as new pay per usage models (Li, 2015). Due to an increase online presence advertising is increasing (Li, 2015). Since digital competence of consumers is increasing they no longer need intermediaries, hence the usage of brokerage fees is expected to decrease (Granados & Gupta, 2013). According to Li (2015) no notable changes in the usage of asset sales and renting occurred. No sources observed the usage of subscription fees so no hypotheses can be formulated.

Due to digital transformation…

- RS1: The usage of asset sales will not change
- RS2: The usage of usage fees will increase
- RS3: *No hypothesis on the change of subscription fees*
- RS4: The usage of lending / renting / leasing will not change
- RS5: The usage of licensing will increase
- RS6: The usage of brokerage fees will decrease
- RS7: The usage of usage advertising will increase

**Cost structure**

Organization able to own less physical resources (Armbrust et al., 2010; Huang et al., 2012) but due to increased usage of software use more intellectual resources (Armbrust et al., 2010). This results to decreased fixed cost and increased variable costs. Due to cheaper are more cost-effective digital solutions and benefits from economics of scale (Bharadwaj et al., 2013) total costs are expected to decrease.

Due to digital transformation…

- CS1: fixed costs will decrease
- CS2: variable costs will increase
- CS3: total costs will decrease

# 5. Survey

In the previous chapter several hypotheses on the effect of digital transformation on organizations are formulated. These hypotheses are tested using the data acquired through a survey amongst consultants from Cognizant Technology solutions. In addition the correlations of measures are used to determine which changes occur simultaneously.

Firstly the method is discussed including the sample and measures. The measures are derived from the operationalized BMC framework in the previous chapter, and are tested using T-tests. Secondly the results of the survey study are discussed which include both the testing of the hypotheses testing and the explorative findings of the survey data. At last the limitations and conclusions are presented.

## 5.1. Method

In this section the methodology of the survey is described which includes the sample, measures, and data preparation. During the survey design some other IT-related business model surveys were used as a reference such as;(de Reuver, Bouwman, & Haaker, 2009; de Reuver & Bouwman, 2008; Madian, de Reuver, Bouwman, & Molina, 2015).

### 5.1.1. Sample

The data was collected through a self-administered online survey between the last week of June and first two weeks of July 2015. Respondents were contacted via an e-mail distribution list on which two senior digital experts replied; stating the importance of filling out the survey. The first reply was immediately after the survey distribution and the second three days later which functioned as a reminder.

The intended respondents of this research are IT consultants. As explained in the introduction IT consultants are chosen as they are arguably the most knowledgeable group when it comes to bringing digital transformation into practice, and thus determining the effects of digital transformation on organizations. The sample of this research includes only Cognizant Technology Solutions consultants that are well enough acquainted with digital transformation. Given the time and accessibility limitations no other IT consultants were included which makes the sample a convenience sample. As such it's difficult to determine whether the finding from this sample can be generalized for the entire population.

Respondents should be able to determine and oversee the full range of organizational impacts of digital transformation projects. Such an overview is typical present at senior manager level and up, consequently consultants that are senior manager and up are the intended respondents. To control for the level of knowledge on digital transformation a question was incorporated on which respondents could indicate their level of knowledge on the subject. The intended respondents were located through the internal HR database and include all consultants of senior manager level and up working at Cognizant in June 2015.

A total of 696 consultants were invited to take the online questionnaire of which 108 respondents started the survey. 69 respondents answered the questionnaire after the initial invitation and 39 answered after the reminder three days later. Of the 108 respondents, one was removed because of insufficient digital transformation knowledge and ten were removed

because they only provided their contact details. Out of the remaining 97 respondents, three were not eligible to participate and one respondent answered all questions with “4”, their cases were removed. Out of the remaining 93 respondents, 73 completed the entire questionnaire and 20 partially completed the questionnaire. The respondents that partially completed the questionnaire were not removed from the final sample, since the partial survey data is useable.

The final sample includes 93 respondents from ten different countries. Most respondents were from the USA (33), followed by India (18) the UK (16) and Germany (11). The other respondents were from the Netherlands (4), Singapore (3), Switzerland (2), Nordics (2), Australia (2) and Japan (1) as can be seen in the figure below. All respondents from Northern America were from the USA, Europe is split between Continental Europe (CE) and the UK.

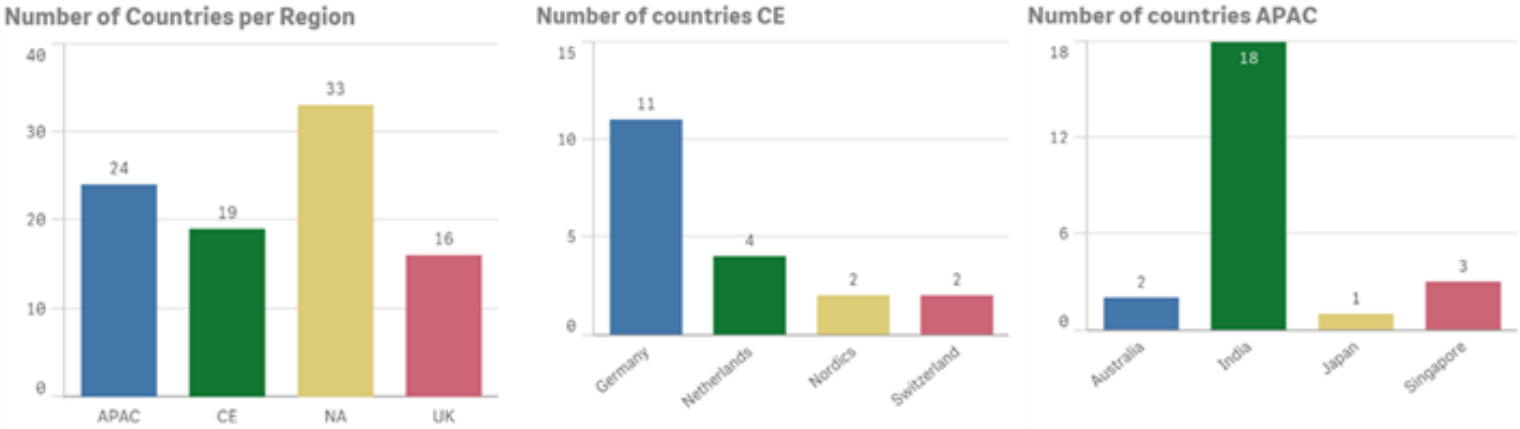


Figure 2: Respondents per Region and Country

The respondents are spread across 20 different consultancy practices such as retail, banking and insurance, manufacturing and logistics, life sciences, program management, strategy services, communications and technology and infrastructure management as can be seen in the graph below. The explanation of the abbreviations can be found in Appendix 1 at page 73.

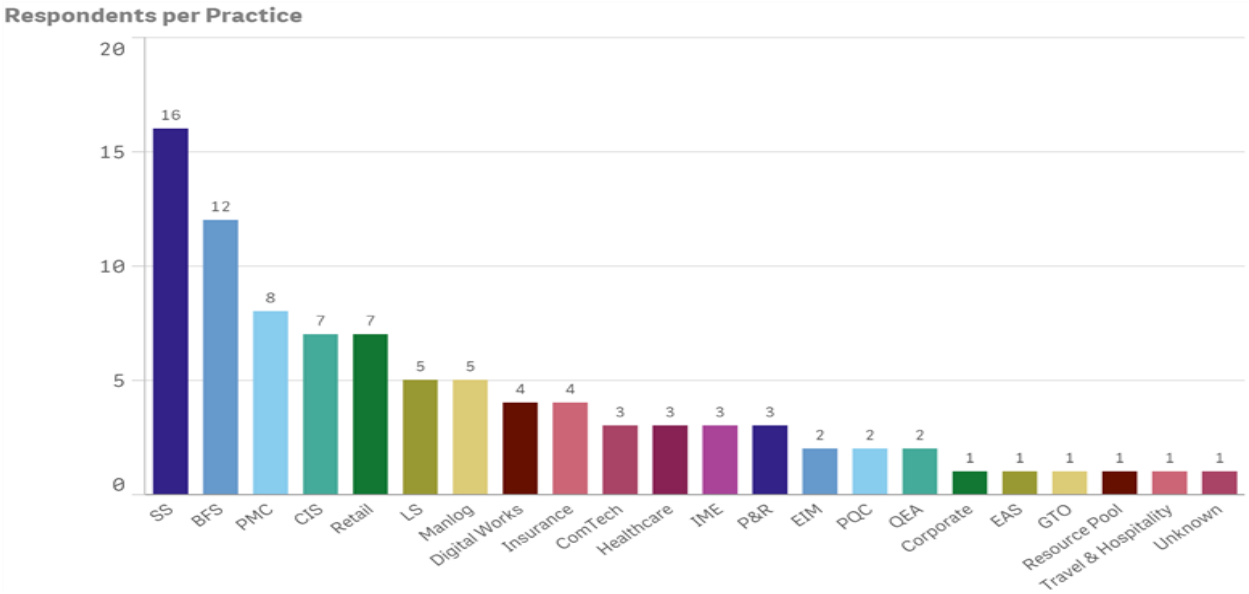


Figure 3: Respondents per Practice

The respondents were asked to fill-out the questionnaire based on experience and examples from their fields of expertise to increase the validity of measurements. On average respondents estimate their level of knowledge on digital transformation at 5.14 out of 7 with a standard deviation of 1.15.

### 5.1.2. Measures

To measure the impact of digital transformation on organizations nine constructs were used, these constructs are derived from the nine different business model elements of the BMC (Osterwalder & Pigneur, 2010). Each construct has between three and sixteen different indicators of changes. These indicators of changes are based on the operationalization of the BMC in chapter 5 on page 28. The survey was pre-tested by five respondents from the sample to check on clarity of the measures and questions, and cohesion. No significant issues were mentioned so the survey was kept as such. The survey as distributed can be found in appendix 2 at page 74.

Respondents were asked to indicate the expected change that digital transformation would have on an organizations on a symmetric 7 point Likert-scale. Only the extremes were given to ensure the highest probability of equal intervals between the answer options, allowing the data to be treated at interval level. A 7-point scale is chosen because it's the best trade-off between the time it takes to fulfil the survey and the reliability of the data while leaving in a neutral answer option (Green & Rao, 1970).

To provide the proper context for the respondents a definition of digital transformation was provided. This definition was the internal definition used within Cognizant technology solutions. The internal definition was deliberately provided instead of the definition used in thesis because respondents could affiliate more with the internal definition and would – if another definition was given – most likely still base their answer on the internal definition of digital transformation.

The internal definition and this thesis' definition of digital transformation differ on two main points. The internal definition does not specify which digital technologies drive digital transformation, which could result into respondents taking the questionnaire with other digital technologies in mind. Although this is a potential threat to the research validity, chances of occurrence are relatively low since the internal definition implicitly entails the same technologies. A larger threat is the difference in the transformational aspect. In the internal definition no measures are attached to transformation. Respondents apply their own idea of transformation which could potentially not meet the transformational classification standard of Lucas et al. (2013). As a result changes due to digital technologies could be classified as transformational while they are not. This potentially dilutes the results by including changes that are less impactful lowering the validity of the research. As a consequence results obtained from the survey might not, or to lesser extent, apply to the context of this research.

The value proposition represents the bundle of products and services an organization offers to specific customers segments. The respondents were asked to indicate in what way the service and products of organizations would change due to digital transformation opposed to the current state of products and services. This change was measured on a 7 point Likert-scale (strongly decrease – strongly increase).

**Table 3: Measures of change in value proposition**

| Item | Please indicate the expected change in the following value proposition elements |
|---|---|
| VP_1 | Creation of new products and services |
| VP_2 | Combination of existing products and services |
| VP_3 | Performance of products and services |
| VP_4 | Customization of products and services |
| VP_5 | Price of products and services |
| VP_6 | Accessibility of products and services |
| VP_7 | Convenience of products and services. |

The customer segment represents the different segments of customers an organization can identify and serve. The segmentation of customers is done based on needs, behavior and attributes. The respondents were asked to indicate in what way changes due to digital transformation would result in changes in the identification and accommodation to customer needs, attributes and behavior along with the overall segmentation of markets. This change was measured on a 7 point Likert-scale (strongly decrease – strongly increase).

**Table 4: Measures of change in customer segment**

| Item | Please indicate the expected change in the following customer segment elements. |
|---|---|
| CS_1 | Identification of customer needs |
| CS_2 | Identification of customer attributes |
| CS_3 | Identification of customer behavior |
| CS_4 | Segmentation of markets |
| CS_5 | Accommodation to customer needs |
| CS_6 | Accommodation to customer attributes |
| CS_7 | Accommodation to customer behavior |

Channels represent the way a company communicates with and reaches its customers to deliver the value proposition. The respondents were asked to indicate how the five channel indicators would change due to digital transformation. This change was measured on a 7 point Likert-scale (strongly decrease – strongly increase).

**Table 5: Measures of change in channels**

| Item | Please indicate the expected change in the following channel activities |
|---|---|
| CH_1 | Customer awareness of an organization's products and services |
| CH_2 | Possibility to evaluate an organization's value proposition for customers |
| CH_3 | Ways and means of purchasing products and services |
| CH_4 | Ways and means of delivering products and services |
| CH_5 | Ways and means of post-purchase customer support |

Customer relationships represent the types of relations an organizations can have with customers. The respondents were asked to indicate for each type of relationship if they will occur more often or less due to digital transformation. This change was measured on a 7 point Likert-scale (strongly decrease – strongly increase).

**Table 6: Measures of change in customer relationships**

| Item | Please indicate the expected change in the following customer relationships |
|---|---|
| CR_1 | Usage of personal assistance |
| CR_2 | Usage of dedicated personal assistance |
| CR_3 | Usage of self-service |
| CR_4 | Usage of automated services |
| CR_5 | Usage of communities |
| CR_6 | Usage of co-creation. |

Key activities represent the activities a company must take to operate successfully. The respondents were asked to indicate how the nature of the activities will change due to digital transformation. The different process within an organization can be affected in two ways. The expected change are therefore measured twice for each type of relationship, activities can either standardize or diversify, and integrate or separate (Ross, Weill, & Robertson, 2006). These changes are measured on a 7 point Likert-scale (strongly standardize – strongly diversify) and (strongly integrate – strongly separate). Since the operationalized key activities contain two elements that would lead into double-barreled questions they are separated into two measures each.

**Table 7: Measures of change in key activities**

| Item | Please indicate the expected change in the following processes. |
|---|---|
| | (strongly standardize) – (strongly diversify) |
| KA_1A | Development of products and services |
| KA_1B | Management of products and services |
| KA_2A | Marketing of products and services |
| KA_2B | Selling of products and services |
| KA_3 | Delivery of products and services |
| KA_4 | Customer service |
| KA_5 | Management processes |
| KA_6 | Support processes |
| | (strongly integrate) – (strongly separate) |
| KA_7A | Development of products and services |
| KA_7B | Management of products and services |
| KA_8A | Marketing of products and services |
| KA_8B | Selling of products and services |
| KA_9 | Delivery of products and services |
| KA_10 | Customer service |
| KA_11 | Management processes |
| KA_12 | Support processes |

Key resources represent the required assets within an organization. The respondents were asked to indicate how the usage of resources would change due to digital transformation. This change was measured on a 7 point Likert-scale (strongly decrease – strongly increase).

**Table 8: Measures of change in key resources**

| Item | Please indicate the expected change in usage of the following resources |
|---|---|
| KR_1 | Usage of physical resources |
| KR_2 | Usage of intellectual resources |
| KR_3 | Usage of human resources |

Key partnerships represent the network of suppliers and partners that allow an organization to operate. The respondents were asked to indicate if the number of and the relation of key partnerships will change due to digital transformation. This change was measured on a 7 point Likert-scale (strongly decrease – strongly increase).

**Table 9: Measures of change in key partnerships**

| Item | Please indicate the expected change in the following elements. |
|---|---|
| KP_1 | Number of suppliers |
| KP_2 | Number of channel intermediaries |
| KP_3 | Number of complementary vendors |
| KP_4 | Shared responsibility between key partners |
| KP_5 | Cooperation between key partners |

The revenue streams represent the way a company generates cash from its customers. The respondents were asked to indicate for each form of revenue generation if they will occur more often or less due to digital transformation. This change was measured on a 7 point Likert-scale (strongly decrease – strongly increase).

**Table 10: Measures of change in revenue streams**

| Item | Please indicate the expected change in the following elements. |
|---|---|
| RS_1 | Usage of asset sale |
| RS_2 | Usage of usage fees |
| RS_3 | Usage of subscription fees |
| RS_4 | Usage of lending/renting/leasing |
| RS_5 | Usage of licensing |
| RS_6 | Usage of brokerage fees |
| Rs_7 | Usage of advertising |

The cost structure represents the incurred costs of an organization. The respondents were asked to indicate how fixed, variable and total costs will change due to digital transformation. These changes were measured on a 7 point Likert-scale (strongly decrease – strongly increase).

**Table 11: Measures of change in cost structure**

| Item | Please indicate the expected change in the following elements. |
|---|---|
| **Cost_1** | Fixed costs |
| **Cost_2** | Variable costs |
| **Cost_3** | Total costs |

### 5.1.3. Data preparation

Out of the 93 cases, 1 case provided consistent outliers for more than half of the measures. The cause of this abnormality is unknown but highly affects the data set. To avoid this effect the case is removed. Furthermore most measures did not contain outliers. Only four outliers were removed; VP_7 (2), CH_2 (1) and KP_5 (1). The outliers were removed and labeled as missing to improve data accuracy and consistency.

Thirteen of the 92 respondents reported a level of knowledge lower than four of which three reported 2 out of 7 and nine 3 out of 7. Using an independent sample t-test data between the thirteen respondents and other responders were compared. Six out of 59 measures significantly differed between the two groups, which is relatively low. Due the low difference, data of the respondents that reported to have a lower level of knowledge was not removed from the sample.

In total eleven measures were deemed non-normally distributed on both Kurtosis and Skewness, eleven cases solely on Kurtosis, and five cases solely on Skewness. These observations of data distribution differ substantially from the Kolmogorov-Smirnoff and Shapiro-Wilk normality tests. The normality test of Kolmogorov-Smirnoff and Shapiro-Wilk indicated that all measure where non-normally distributed. The measure for which the outcome differed between the normality test and the tests of Kurtosis and Skewness were evaluated based on histograms with normality lines and q-q normality plots. Based on this analysis and additional eleven measures were deemed non-normally distributed. The results of the performed analysis and the assumed normality can be found in appendix 3 at page 87.

Due the doubled barreled nature of the development and management of products and services, and the marketing and selling of products they were split into two measures each; KA_1A and KA_1B, and KA_2A and KA_2B. If the split measures both measure the same type of activity, which they should, they can be combined into one scale. The combined split measures have a Cronbach's alpha between 0.80 and 0.90 which indicates combining them into one scale would result into a reliable measure.

## 5.2. Results

In this section the results of the survey are presented. In the first paragraph the expected change for each measure is described and the hypotheses of chapter five are tested. The second paragraph describes the correlations between different constructs, identifying which changes occur simultaneously.

### 5.2.1. Organizational effects

Using a one-sample t-test and/or one-sample Wilcoxon rank test the hypotheses formulated in paragraph 5.3 are tested to determine whether they are supported by the survey data. A one-sample t-test is performed under the assumption that data is normally distributed, which is not the case for all measures. Therefore the non-parametric Wilcoxon rank test, which does not assume normally distributed data, is also performed. Both test results are presented parallel to each other. If the test results differ, the test that fits the data distribution is decisive. For normally distributed data this is the one-sample t-test, for non-normally distributed data this is the Wilcoxon rank test. Under the normality column, the assumed normality of the data is presented.

Since the t-test uses the mean and the Wilcoxon test uses the median both statistics, along with the number of cases, standard deviation, and the minimum, maximum and assumed normality are presented. For one measure the mean is non-discrete because the mean fell in between to different discrete values.

All measures are tested against a mean and median of “4”, which is the no change option of the survey. If a measure statistically significantly ($p < 0.05$) different from “4”, it means that the organizational aspect of that mean will change due to digital transformation. The hypothesized change is presented in the tables along with the descriptive statistics. For measures of which a direction of change was hypothesized, the one-tailed p-value is presented. For the other measure the two-sided p-value is presented.

In order to describe the magnitude of change the mean values of the measures are used in line with the ordinal scales of the survey. Based on Meilgaard, Carr, and Civille (2006, p. 56) the following scale is used:

- a value between 1.00 and 1.49 is considered a strong decrease,
- a value between 1.50 and 1.99 is considered a moderate-strong decrease,
- a value between 2.00 and 2.49 is considered a moderate decrease,
- a value between 2.50 and 2.99 is considered a slight-moderate decrease,
- a value between 3.00 and 3.49 is considered a slight decrease,
- a value between 3.50 and 3.99 is considered a very slight decrease,
- a value between 4.00 and 4.49 is considered a very slight increase,
- a value between 4.50 and 4.99 is considered a slight increase,
- a value between 5.00 and 5.49 is considered a slight-moderate increase,
- a value between 5.50 and 5.99 is considered a moderate increase,
- a value between 6.00 and 6.49 is considered a moderate-strong increase,
- a value between 6.50 and 7.00 is considered a strong increase.

**Value proposition**

A moderate-strong increase is expected in the creation of new offerings, the customization of products and services as well as the perceived convenience of those products and services which supports hypotheses VP1, VP4, VP6, and VP7.

Moderate increases are expected in the combination of products and services as well as the performance and accessibility which supports VP3 and VP6. Furthermore the prices of products and services are expected to drop slightly.

**Table 12: effects on value proposition**

| | N | Mean | Std. | Min. | Max. | Median | Normality | Hypothesized change | T-test p<0.05 | Wilcoxon p<0.05 |
|---|---|---|---|---|---|---|---|---|---|---|
| **VP_1** | 92 | 6.14 | 0.806 | 4 | 7 | 6 | No | Increase | .000 | .000 |
| **VP_2** | 92 | 5.54 | 1.226 | 1 | 7 | 6 | No | Unknown | .000 | .000 |
| **VP_3** | 92 | 5.80 | 0.917 | 2 | 7 | 6 | No | Increase | .000 | .000 |
| **VP_4** | 92 | 6.08 | 1.019 | 2 | 7 | 6 | No | Increase | .000 | .000 |
| **VP_5** | 92 | 3.29 | 1.125 | 1 | 7 | 3 | Yes | Unknown | .000 | .000 |
| **VP_6** | 92 | 5.92 | 1.179 | 1 | 7 | 6 | No | Increase | .000 | .000 |
| **VP_7** | 90 | 6.16 | 0.847 | 4 | 7 | 6 | Yes | Increase | .000 | .000 |

**Customer segment**

A moderate-strong increase is expected in the identification of customer needs, attributes, and behavior which leads to a moderate increase in the accommodation to these aspects which supports hypotheses CS1, CS2, CS3, CS5, CS6, and CS7. Overall a moderate increase is expected in market segmentation which supports Hypothesis CS4.

**Table 13: effects on customer segments**

| | N | Mean | Std. | Min. | Max. | Median | Normality | Hypothesized change | T-test p<0.05 | Wilcoxon p<05 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CS_1** | 91 | 6.10 | 0.920 | 3 | 7 | 6 | No | Increase | .000 | .000 |
| **CS_2** | 91 | 6.14 | 0.914 | 4 | 7 | 6 | No | Increase | .000 | .000 |
| **CS_3** | 91 | 6.27 | 0.817 | 4 | 7 | 6 | No | Increase | .000 | .000 |
| **CS_4** | 91 | 5.69 | 1.244 | 2 | 7 | 6 | No | Increase | .000 | .000 |
| **CS_5** | 91 | 5.80 | 0.897 | 3 | 7 | 6 | Yes | Increase | .000 | .000 |
| **CS_6** | 91 | 5.81 | 0.829 | 3 | 7 | 6 | Yes | Increase | .000 | .000 |
| **CS_7** | 91 | 5.88 | 0.867 | 3 | 7 | 6 | Yes | Increase | .000 | .000 |

**Channels**

Across all five channel phases a moderate increase is expected. Customers will become more aware of products and services offered with more possibilities to evaluate them which support hypotheses CH1 and CH2.

Furthermore the ways and means to purchase and deliver products and services, and provide post-purchase customer support are expected to grow which support hypotheses CH3, CH4, and CH5.

**Table 14: effects on channels**

| | N | Mean | Std. | Min. | Max. | Median | Normality | Hypothesized change | T-test p<0.05 | Wilcoxon p<0.05 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CH_1** | 86 | 5.72 | 0.978 | 3 | 7 | 6 | Yes | Increase | .000 | .000 |
| **CH_2** | 88 | 5.58 | 1.014 | 1 | 7 | 6 | No | Increase | .000 | .000 |
| **CH_3** | 88 | 5.99 | 0.916 | 3 | 7 | 6 | Yes | Increase | .000 | .000 |
| **CH_4** | 88 | 5.94 | 0.975 | 3 | 7 | 6 | Yes | Increase | .000 | .000 |
| **CH_5** | 88 | 5.90 | 0.923 | 3 | 7 | 6 | Yes | Increase | .000 | .000 |

### Customer relationships

No change in the usage of personal assistance and dedicated personal assistance is expected as the p-value is not significant. Communities and co-creation as means of interaction are expected to increase moderately and the expected change in self-service and automated services is even larger with a moderate-strong increase which supports hypotheses CR3, CR4, CR5, and CR6.

**Table 15: effects on customer relationships**

| | N | Mean | Std. | Min. | Max. | Median | Normality | Hypothesized change | T-test p<0.05 | Wilcoxon p<0.05 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CR_1** | 84 | 4.23 | 1.689 | 1 | 7 | 4 | Yes | Unknown | .223 | .246 |
| **CR_2** | 84 | 4.06 | 1.710 | 1 | 7 | 4 | Yes | Unknown | .751 | .742 |
| **CR_3** | 84 | 6.19 | 0.871 | 4 | 7 | 6 | No | Increase | .000 | .000 |
| **CR_4** | 84 | 6.24 | 0.859 | 3 | 7 | 6 | No | Increase | .000 | .000 |
| **CR_5** | 84 | 5.89 | 1.018 | 2 | 7 | 6 | No | Increase | .000 | .000 |
| **CR_6** | 84 | 5.71 | 1.001 | 2 | 7 | 6 | No | Increase | .000 | .000 |

### Key Activities

When looking at the standardization of activities no change is expected in the development and management of products and services, customer service, management processes and support processes as the p-value is not significant. The level of standardization for these processes is likely to stay the same. As such the hypotheses KA1, KA4, KA5, and KA6 are rejected.

A slight increase of standardization is expected in the delivery of products and services. The largest increase of standardization is expected in the marketing and selling of products and services; the level of standardization is expected to increase moderately. These findings do not support hypotheses KA2 and KA3, as such they are rejected.

From an integration perspective all key activities – expect support processes - are expected to slightly decrease in level of integration indicating that the processes are separated into slightly smaller processes. Support processes are expected to slight-moderately decrease in level of integration. These survey findings support hypotheses KA7A, KA7B, KA8A, KA8B, KA9, and KA10.

**Table 16: effects on key activities**

| | N | Mean | Std. | Min. | Max | Median | Normality | Hypothesized change | T-test p<0.05 | Wilcoxon p<0.05 |
|---|---|---|---|---|---|---|---|---|---|---|
| **KA_1A** | 79 | 4.15 | 1.861 | 1 | 7 | 5 | No | Decrease | .470 | .278 |
| **KA_1B** | 79 | 4.11 | 1.915 | 1 | 7 | 5 | No | Decrease | .598 | .357 |
| **KA_2A** | 79 | 5.23 | 1.860 | 1 | 7 | 6 | No | Decrease | .000 | .000 |
| **KA_2B** | 79 | 5.18 | 1.831 | 1 | 7 | 6 | No | Decrease | .000 | .000 |
| **KA_3** | 79 | 4.67 | 1.920 | 1 | 7 | 5 | No | Decrease | .002 | .002 |
| **KA_4** | 79 | 4.34 | 2.006 | 1 | 7 | 5 | No | Decrease | .067 | .081 |
| **KA_5** | 79 | 4.06 | 1.828 | 1 | 7 | 4 | No | Decrease | .380 | .422 |
| **KA_6** | 79 | 3.90 | 1.991 | 1 | 7 | 5 | No | Decrease | .325 | .206 |
| **KA_7A** | 79 | 3.44 | 1.781 | 1 | 7 | 3 | No | Decrease | .004 | .004 |
| **KA_7B** | 79 | 3.23 | 1.694 | 1 | 7 | 3 | No | Decrease | .002 | .000 |
| **KA_8A** | 79 | 3.47 | 1.954 | 1 | 7 | 3 | No | Decrease | .018 | .009 |
| **KA_8B** | 79 | 3.35 | 1.935 | 1 | 7 | 3 | No | Decrease | .002 | .002 |
| **KA_9** | 79 | 3.38 | 1.734 | 1 | 7 | 3 | No | Decrease | .001 | .002 |
| **KA_10** | 79 | 3.23 | 1.797 | 1 | 7 | 2 | No | Decrease | .000 | .000 |
| **KA_11** | 79 | 3.03 | 1.577 | 1 | 7 | 3 | No | Unknown | .000 | .000 |
| **KA_12** | 79 | 2.94 | 1.659 | 1 | 7 | 2 | No | Unknown | .000 | .000 |

**Key resources**

Within organizations the usage of physical resources is expected to decrease slightly along which supports hypothesis KR1. The use of intellectual resources is expected to increase moderately which supports hypothesis KR2. No change in the usage of human resources is expected as the p-value is not significant.

**Table 17: effects on key resources**

| | N | Mean | Std. | Min. | Max. | Median | Normality | Hypothesized change | T-test p<0.05 | Wilcoxon p<0.05 |
|---|---|---|---|---|---|---|---|---|---|---|
| **KR_1** | 76 | 3.26 | 1.436 | 1 | 7 | 3 | No | Decrease | .000 | .000 |
| **KR_2** | 76 | 5.84 | 1.007 | 2 | 7 | 6 | No | Increase | .000 | .000 |
| **KR_3** | 76 | 3.91 | 1.471 | 1 | 7 | 4 | Yes | Unknown | .587 | .748 |

**Key partnerships**

The number of suppliers of organizations is expected to increase slightly and the number of channel intermediaries is expected to increase very slightly. The number of complementary vendors is not expected to change as the p-value is not significant.

The cooperation within the network is expected to moderately increase along with a moderate-strong increase in shared responsibility which supports hypotheses KP4 and KP5.

**Table 18: effects on key partnerships**

| | N | Mean | Std. | Min. | Max. | Median | Normality | Hypothesized change | T-test p<0.05 | Wilcoxon p<0.05 |
|---|---|---|---|---|---|---|---|---|---|---|
| **KP_1** | 76 | 4.85 | 1.679 | 2 | 7 | 5 | No | Unknown | .000 | .000 |
| **KP_2** | 76 | 4.34 | 1.894 | 1 | 7 | 5 | No | Unknown | .060 | .079 |
| **KP_3** | 76 | 4.95 | 1.450 | 1 | 7 | 5 | Yes | Unknown | .000 | .000 |
| **KP_4** | 76 | 5.57 | 0.984 | 2 | 7 | 6 | No | Increase | .000 | .000 |
| **KP_5** | 75 | 5.85 | 0.954 | 3 | 7 | 6 | No | Increase | .000 | .000 |

**Revenue streams**

The use of asset sales is not expected to change as the p-value is not significant as such hypothesis RS1 is supported. The usage of brokerage fees is expected to decrease very slightly supporting hypotheses RS6.

Slight increases are expected for the usage of advertising, licensing and lending, renting, and leasing which supports hypotheses RS4, RS5, and RS7. The largest changes are expected in usage and subscription fees, where a slight-moderate increase is expected in the usage of subscription fees and a moderate increase is expected in the usage of usage fees which support hypothesis RS2.

**Table 19: effects on revenue streams**

| | N | Mean | Std. | Min. | Max. | Median | Normality | Hypothesized change | T-test p<0.05 | Wilcoxon p<0.05 |
|---|---|---|---|---|---|---|---|---|---|---|
| **RS_1** | 72 | 4.19 | 1.507 | 1 | 7 | 4 | Yes | No change | .139 | .171 |
| **RS_2** | 72 | 5.29 | 1.388 | 2 | 7 | 5 | Yes | Increase | .000 | .000 |
| **RS_3** | 72 | 5.21 | 1.528 | 2 | 7 | 5.50* | Yes | Unknown | .000 | .000 |
| **RS_4** | 72 | 4.81 | 1.460 | 2 | 7 | 5 | Yes | No change | .000 | .000 |
| **RS_5** | 72 | 4.89 | 1.400 | 2 | 7 | 5 | Yes | Increase | .000 | .000 |
| **RS_6** | 72 | 3.60 | 1.329 | 1 | 7 | 3 | Yes | Decrease | .000 | .007 |
| **RS_7** | 72 | 4.81 | 1.450 | 2 | 7 | 5 | Yes | Increase | .000 | .000 |

**Cost structure**

A slight-moderate decrease is expected in the fixed cost of organizations while variable costs are expected to increase very slightly which supports hypotheses Cost1 and Cost2. A slight decrease of total costs is expected within organizations supporting hypothesis Cost3.

**Table 20: effects on cost structure**

| | N | Mean | Std. | Min. | Max. | Median | Normality | Hypothesized change | T-test p<0.05 | Wilcoxon p<0.05 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cost_1** | 72 | 3.01 | 1.250 | 1 | 6 | 3 | Yes | Decrease | .000 | .000 |
| **Cost_2** | 72 | 4.42 | 1.527 | 1 | 7 | 5 | No | Increase | .014 | .014 |
| **Cost_3** | 72 | 3.39 | 1.205 | 1 | 7 | 3 | Yes | Decrease | .000 | .000 |

### 5.2.2. Correlations

The 59 measures form a total of 1741 correlations between the nine different constructs which can be found in appendix 4 at page 89. The correlation are pure statically, no assumptions on causality are made. As such the correlation values only indicate which type of effects generally happen together. The correlation values are used to determine which survey elements vary together and spot patterns between the elements. These correlations could help to build an understanding of underlying causality and mechanisms that influence the elements in the context of digital transformation and potentially provide useful insights.

A correlation of 0.80-1.0 is considered very strong, 0.60-0.80 strong, 0.40-0.60 moderate and below 0.40 is considered weak. Most of the correlations are insignificant or weak, there are approximately 65 moderate correlation, 30 strong correlations and five very strong correlations. In this paragraph only the correlations that classify as moderate or strong are discussed.

There are some significant moderate – no strong or very strong - correlations between measures of different constructs. All moderate correlations are positive, indicating that measures change in the similar direction. The implications for the moderate correlation between measures of different constructs are presented below. The correlations are presented in the first surveyed sections only. For instance the correlation between value proposition and resources is only presented in the value proposition section. * indicates that p <0.05, ** indicates that p <0.01, and *** indicates that p ≤0.001.

**Value proposition**

The value proposition element of convenience correlates with both accommodation to customer attributes, and behavior. This implicates that if the convenience of products and services changes, accommodation to attributes and behavior will do so too, similarly this occurs the other way around as well.

There are some moderate correlations between the elements of value proposition and channels. This implicates that if the value proposition elements of new products and services, performance and convenience change, the channel elements of purchasing and deliver change. This effect will also occur the other way around.

**Table 21: Correlations value proposition**

| Measures | Correlation | Measures | Correlation | Measures | Correlation |
|---|---|---|---|---|---|
| **VP_7 - CS_6** | 0.424*** | **VP_3 - CH_3** | 0.457*** | **VP_7 - CR_3** | 0.415*** |
| **VP_7 - CS_7** | 0.423*** | **VP_3 - CH_4** | 0.494*** | **VP_3 - KR_2** | 0.514*** |
| **VP_1 – CH_3** | 0.424*** | **VP_3 - CH_1** | 0.410*** | **VP_7 - KR_2** | 0.411*** |
| **VP_1 – CH_4** | 0.423*** | **VP_7– CH_3** | 0.452*** | **VP_5 - Cost_3** | 0.427** |
| **VP_1 – CH_3** | 0.424*** | **VP_7– CH_4** | 0.432*** | | |

Convenience of products and services correlates with the level of self-service indicating that changes in both elements together. A change in convenience and performance of products and services occurs together a change in intellectual resources since they correlate moderately. The price of products and services correlates with the total costs of an organization, meaning changes will happen simultaneously.

**Customer segment**

The customer segment elements of identification (needs, attributes and behavior) correlate with the ways and means of purchasing, delivery and, post-purchase customer service. This implicates that those changes will occur together. Additionally the elements of accommodation (needs, attributes and behavior) correlate with the ways and means of delivery.

**Table 22: Correlations customer segment**

| Measures | Correlation | Measures | Correlation | Measures | Correlation |
|---|---|---|---|---|---|
| **CS_1 – CH_3** | 0.489*** | **CS_3 - CH_4** | 0.414*** | **CS_3 - CH_5** | 0.429*** |
| **CS_2 – CH_3** | 0.515*** | **CS_5 - CH_4** | 0.458*** | **CS_4 – KP_1** | 0.434*** |
| **CS_3 – CH_3** | 0.473*** | **CS_6 - CH_4** | 0.508*** | **CS_4 - KP_3** | 0.408*** |
| **CS_1 - CH_4** | 0.452*** | **CS_7 - CH_4** | 0.507*** | **CS_2 - RS_3** | 0.441*** |
| **CS_2 - CH_4** | 0.517*** | **CS_2 - CH_5** | 0.447*** | **CS_3 - RS_3** | 0.413*** |

The accommodation of customer needs correlates moderately with the number of suppliers, and complementary vendors indicating that changes in these elements will occur together.

In addition changes in the identification of attributes and behavior happen together with changes in revenue through lending, renting and leasing.

**Channels**
The ways and means of delivery correlates with the usage of intellectual resources indicating that these changes occur together.

**Table 23: Correlations channels**

| Measures | Correlation |
|---|---|
| **CH_4 - KR_2** | 0.448** |
| **CH_4 - RS_3** | 0.471*** |
| **CH_5 - RS_3** | 0.414*** |

Similarly the elements of delivery and post-purchase customer support correlate with the usage of lending, renting and leasing as a revenue stream meaning these change in these elements occur simultaneously.

**Customer relationships**
The element of co-creation correlates outside the construct with cooperation between key partners. This means that if one of the elements changes the other element will change as well in a similar direction.

**Table 24: Correlations customer relationships**

| Measures | Correlation |
|---|---|
| **CR_6 - KP_4** | 0.492** |

**Key resources**
The usage of physical resources correlates with the fixed costs of organizations, which seems to be a straightforward correlation. This correlation implicated that if either the usage of physical resources or fixed costs change the other element changes in a similar direction.

**Table 25: Correlations key resources**

| Measures | Correlation |
|---|---|
| **KR_1 - Cost_1** | 0.436** |

# 6. Conclusions and Recommendations

In this chapter the main findings of the research are presented along with a discussion of these results. Furthermore the implications for practice, contributions, and limitations of this research are discussed. The last paragraph of this chapter describes the recommendations for further research.

## 6.1. Main findings and Discussion

The aim of this research is to determine the impact of digital transformation on organizations their business model. A study to these effects is needed because there is to date there are no studies that describe the effects of digital transformation for all the elements of an organizations and across industries. Previous research only focused on specific elements, single industries, or the individual underlying technologies. Furthermore the results of this study can be used as a starting point for organizations to substantiate their business cases. Organizations are in need of such input as only half of them create business cases and only one out of four succeed in computing key performance indicators such as return on investment.

### 6.1.1. The concept of Digital Transformation

In order to determine the impact of digital transformation a clear definition of digital transformation is needed. Definitions provided in other research are holistic by nature and do not break down digital transformation in specific technologies and specific changes.

This research contributes to literature and practice by providing a definition of digital transformation that addresses both the technological and transformation aspects of the term. As stated in various studies; Social, Mobile, Analytics, and Cloud are the current digital technologies that are driving digital transformation. Furthermore Lucas et al. (2013) present seven different dimensions with an impact threshold. If three or more of these threshold are passed a technology driven changes classifies as transformational. Combining the technological and transformational aspects results in the following definition:

*Digital transformation is a social, mobile, analytics or cloud induced change that significantly affects three or more dimensions on individual, firm, and/or societal level.*

In the near future there could, and probably will, be new waves of digital technologies that drive digital transformation. As such the digital technologies that fall under the concept of digital transformation will change and the definition of digital transformation should change accordingly. Additionally as Lucas et al. (2013) state there could be potential debate about the dimensions and impact criteria they propose. This definition will undoubtedly develop and change over the coming years if more research is done to classify technological change.

It is surprising to see that there is little research available on quantified classification of technological impact. It stands to wonder whether there is an actual widespread need for such a classification. From a pragmatic perspective it might not be important at all to know whether a change classifies as radical or transformational; the actual effect is far more important. Attaching a label to the change doesn't change the magnitude and implications.

### 6.1.2. Measurement Model and Survey

To measure the impact on organization's their business model a business model framework was selected. The process of operationalizing the business model framework of Osterwalder and Pigneur (2010) was a straightforward process which did not yield any surprising insights as there was an extensive amount of (meta-) research to build upon.

The framework and survey constructed in this research are re-usable artifacts. The framework and subsequent survey cover the full range of business model components and can use used again to determine the impact of other digital technologies and/or other external factors. Additionally application of the framework across multiple organizations and/or technologies allows for easy comparative analysis between organizations and/or technologies.

Surprisingly the answers given by respondents who reported lower than average knowledge of digital transformation only slightly differ from those who reported above average knowledge. Thirteen of the 92 respondents reported a level of knowledge lower than four out of out seven and only six out of 59 measures significantly differed between the two groups, which is relatively low.

One would assume a difference in answers between the above and below average respondents, as the above average respondents would be able to judge the expected impact more accurately. It stands to wonder why this is the case for digital transformation. It could for instance be a matter of coincidence or it could be that any senior IT consultant is able to determine the impacts regardless of level of expertise.

### 6.1.3. Effects of Digital Transformation

Digital Transformation is expected to change organizations across many different fronts as six out of nine business model constructs have at least one element that is expected to change moderately or even stronger.

The greatest impact will be to organizations' their value proposition, the customer segments they can identify and serve, the way organizations reach their customers, and the resources they use. The following paragraphs discuss the finding for each business model construct by stating the findings, their correspondence with previous research and the connection to changes we can observe in practice.

**Table 26: number of moderate or above changes and average change per construct**

| Business model construct | # of elements | # moderate or above changes | Average expected change |
|---|---|---|---|
| Value proposition | 7 | 6 | Moderate |
| Customer segment | 7 | 7 | Moderate |
| Channels | 5 | 5 | Moderate |
| Customer relationships | 6 | 4 | Slight-Moderate |
| Key activities | 12 | 0 | Very slight |
| Key resources | 3 | 1 | Slight |
| Key partnerships | 5 | 2 | Moderate |
| Revenue streams | 7 | 0 | Slight |
| Cost structure | 3 | 0 | Slight |

**Value proposition**

The survey outcomes demonstrate that more new products and services will be introduced to the market for a lower price. This expected increase in new products and services are in line the findings of (Fitzgerald et al., 2013) and (Huang et al., 2012) who state that organizations will create new products and services and will enhance existing ones. The drop in market price can be explained as a result of the expected decrease in total and fixed cost predicted by the survey respondents.

According to the survey findings these products and services will have increased accessibility, performance, customization, and convenience. Again we can explain these findings, as they are with the findings of (Hennig-Thurau et al., 2010; Smith & McKeen, 2008) who state that products and services will become more and more accessible. Furthermore the research of (Fitzgerald et al., 2013) and (Huang et al., 2012) explains the expected increase in performance as they found that organizations will enhance existing products and services. Furthermore the expected increase of customization corresponds with the research of (Li, 2015) who found that products and services are more tailored towards customer preferences. The findings around increased convenience can be explained by the research of (Yoo, 2010) who states that the convenience of products and services will most likely increase.

These survey findings also correspond with changes we are experiencing in our everyday life. More and more products and services we use are fully digital or have a digital component such as smart products. Moreover products and services are becoming increasingly accessible through multiple different channels such physical stores, (mobile) websites and applications. Furthermore more are more as products and services are either digital or have digital components they can be customized by or for you based on your preferences. Combined with the wider range of products and service and increase accessibility it's only logical that the convenience is increasing.

**Customer segment**

The survey outcomes show that the ability to identify customers' needs, attributes, and behavior increases. These findings are similar to the research of Westerman et al. (2011) which states that organizations will become better at analyzing their customers. The survey respondents also expect an increase in market segmentation which corresponds with the findings of Li (2015) who states that organizations will be able to better segments markets. Aside from identifying and segmenting customers finding of this research show that organizations will be able to better accommodate to their customers' needs, attributes, and behavior as well. These findings are similar to the findings of Dutta and Biren (2001).

These survey finding correspond with current trends as organizations are investing in their analytic capabilities on an increasingly growing scale. Together with the explosion of available data from different sources this enables organizations to derive insights about their customers, ultimately reaching a so called segment of one. Furthermore organizations are increasingly able to capitalize on these insights as an increasing number of products and services is either digital or contains re-programmable digital components allowing customization at an individual level.

**Channels**

The outcomes of this research show that customers are expected to become more aware of products and services that organizations offer and will have more opportunities to evaluate them. These findings correspond with the research of Clemons (2008), Kaufmann et al. (2010), and Westerman et. al (2011) who state that customer will know the exact products and services available, their prices and attributes and their capability to evaluate the value of these products and services will increase.

Furthermore this research shows that organizations are expected to provide more ways of purchasing, delivery and post-purchase customer support. These outcomes are in line with the findings of multiple previous studies. For instance Granados and Gupta (2013) state that increased digital competence of customers enables them to increasingly purchase online. Li (2015) found that organizations use various (new) digital channels and Hennig-Thurau et al. (2010) concluded that digital devices and digital channels enable new ways for organizations to deliver their offerings. In addition the expected increased post-purchase support corresponds with Kurniawati et al. (2013) and Li (2015) who state that organizations are able to provide more accurate customer service through new interfaces.

The results for the survey are not surprising as we can observe these changes happening. Increased prevalence of mobile and social applications enable customers to access product and service information through various means when want to which also increases their products and services awareness. Combined with the increased availability of web-based compare and contrast tools this allows for better evaluation of products and services offerings.

The past couple of years we've seen an increase in ways and means to purchase products and service; from PayPal and Ideal to newly introduced services such as Samsung and Apple Pay. Currently there are a lot of FinTechs working on solutions for financials payments that are going to increase the ways and means to purchase products and services. Additionally Products and services are becoming more accessible through digital devices and digital channels that enable distribution and these digital channels are only expanding.

Furthermore Web-based support solutions and social channels such as Twitter and Facebook allow customers to get support through new interfaces when and where they want. More and more organizations are using these tools to provide customers 24/7 support through the channels they prefer, and as such the ways and means of customer support are increasing.

**Customer Relationships**

The findings of this study show an expected increase in the usage of automated and self-service interaction between organizations and customers. These findings correspond with the research of Li (2015) and kurniawati et al. (2013) who state that automated self-service is increasingly enabled by engagement through digitalization and digital channels. Additionally the survey findings show an expected increase of interaction through co-creation and communities which is in line with previous research of Huang et al. (2012) and Leclercq (2015) which lists digitalization as the contributing factor of this increase. Furthermore this research shows that no change is expected in the usage of personal assistance and dedicated personal assistance.

These survey findings correspond with shifts in organizations and customer interaction we are currently experiencing. Through digital channels information can be obtained anywhere, anytime without the intervention of an organization's representative. As customers increasingly expect around the clock seamless service, organizations are enabling self-service and automated services to accommodate this need.

Moreover increased usage of mobile and social technologies enables customers to share their thoughts, knowledge, and experience through communities helping each other. Organizations build upon this feedback and knowledge and actively involve customer through various platforms to improve their products and services, which is often labeled so called co-creation.

**Key activities**

The findings of this study show that the level of standardization of most key activities within organizations will not change. Only the standardization level of management and support processes is expected to decrease. These findings contradict the research of Westerman et al. (2011), Agarwal & Dhar (2014), Bharadwaj (2013), and Markus & Loebbecke (2013) who notice that operational process are becoming more and more standardized due to the digitalization within organizations. As the outcomes are purely survey it's impossible to make a statement on the cause of the difference in findings.

From an integration perspective the research findings show that all key activities are expected to increase in level of integration. These findings correspond with previous findings as Westerman et al. (2011) state that automation of internal processes is driving operational efficiency by integration operational.

**Key resources**

This study shows that a decrease in the usage of physical resources is expected and an increase in the expected usage of intellectual resources. The findings are in line with the research of Armbrust et al. (2010) and Bharadwaj et al. (2013) who showed that the increased usage of digital technologies enables organizations to own less physical resources but increases the usage of intellectual resources. Furthermore the usage of human resources is expected to stay the same.

We can already observe these findings in organizations' their current resource usage. Cloud-based services which are becoming more and more popular decrease the need for fixed in-house IT infrastructure. In addition new and improved mobile and social technologies enable employees to work where and when they want reducing the office space needed. An example of the increase usage of intellectual resources is the amount of data organizations store and own which is growing exponentially.

**Key partnerships**

The outcomes of this research show that within the network of organizations the number of suppliers and complementary vendors is expected to grow whilst the number of channel intermediaries is expected to stay the same. Furthermore the survey shows that the level of shared responsibility and cooperation between partners will continue to increase. The expected increase of shared responsibility and cooperation corresponds with the previous research of Li (2015) and Bharadwaj et al. (2013) who found that new interfaces enable new ways of cooperation and that key partners are increasingly tightening together by sharing and integrating services.

The results of this research substantiate the current shift in organizations' their ecosystem we observe. Digital technologies enable new and enhanced products and services that organizations can – and need to – deliver to their customer. To do so organizations often need additional partners as they either do not have the means or expertise to utilize these technologies. Furthermore ecosystems between organizations need to become more and more closely linked as seamless integration is needed to provide consistent customer experience anytime and anywhere. As such partners must increase their level of cooperation and responsibility to ensure smooth and continuous collaboration.

**Revenue streams**

The research findings show that usage of assets sales as a means of revenue is not expected to change which is in line with Li (2015) who observed no notable change in asset sales. Additionally survey respondents expect an increase usage in usage fees and licensing which corresponds with Li (2015) who stated that licensing as well as new pay per usage models are becoming increasingly more popular. Furthermore this research shows that the usage of brokerage fees is expected to decrease which is in line with Granados and Gupta (2013) who found that there is less need for intermediaries as the competence of consumers is increasing.

The research findings also indicate that the usage of advertising is expected to increase which corresponds with the observation of Li (2015) who noticed that this will increase due to increased online presence. A research finding that does not correspond with (Li, 2015) is the expected increase in renting / renting / leasing. Li (2015) observed no notable changes for this type of revenue. Lastly this research shows that the usage of subscription fees is expected to increase as well.

These survey findings correspond with changes we can observe. New mobile and web applications enable customers to pay for and use products and services when and whenever they want. There is no need to pay for these new products and services upfront as pay per usage models fit these new ways of consumption. With the increased online presence of customers and increased usage of advertising is a logical consequence.

**Cost Structure**

The survey findings show that fixed costs are expected to decrease which is in line with the research of Armbrust et al. (2010) and Huang et al. (2012) who state that fixed cost are expected to drop as a result of fewer owned physical resources. On the other hand the survey findings show that an increase is expected in the variable costs of organizations. This finding is in line with Armbrust et al. (2010) as well. They state that variable costs are expected increase as we're going towards pay per usage models. Overall the survey findings show that the total cost are expected to decrease which corresponds with the research of Bharadwaj et al. who states that due to cheaper and more cost-effective digital solution and benefits from economics of scale total costs are expected to decrease.

These findings correspond with the current trends in IT infrastructure usage within organizations. More and more organizations are exploring and moving towards cloud-based services as this lowers the need of fixed in-house IT infrastructure and accompanied upfront investments and maintenance but increases the variable costs as it is a pay per usage system.

## 6.2. Implications for practice

As this research shows many different changes are expected across different business model elements. Throughout the variety of changes there is a single group that benefits the most; customers. When looking at the research outcomes regarding value proposition customers' their value for money increases a lot. Products and services are expected to increase in customization, performance, accessibility and convenience whilst prices are expected to decrease a little. Customers additionally benefit from the increased numbers of new products and services introduced to the marketplace.

In addition the research outcomes regarding channels and customer relations show that customers' their communication and interaction with organizations is expected to improve. There will be greater awareness of the products and services in the market and it will become easier to evaluate them. Furthermore customers are given more possibilities in purchasing, delivery and customer support and levels of service through self- and automated services will increase. Moreover organizations will empower customers by expanding current mutual beneficial elements such as co-creation and communities.

Organizations seem to have no choice but to embrace the prevalence of new digital technologies and incorporate them in their organization. Failure of doing so could result into significant loss of market shares as competitors have the opportunity provide better products and services with an improved customer experience for lower prices. Therefore organizations should adopt a very strong customer focus and invest in digital capabilities while remaining agile enough to respond to changing social and technological environments to ensure they will not become obsolete in the marketplace.

Organizations can do so by taking the following measures:

- Invest in analytic capabilities to allow “hyper” customization of services and products. This research shows that customization of products and services as well as the ability to identify and accommodate individual customers are expected to increase substantially. To stay relevant organizations must be able to offer products and services that are fully tailored towards customers’ their individual needs, attributes, and behavior. In order to get there organizations need to derive insights through analytics from the wide variety of structured and un-structured information they obtain from their customers through purchase and transaction history, social technologies, online (web) activity, and demographics.
- Invest in a flawless omni-channel customer experience with self and automated services. As this research shows products and services are increasingly purchased, evaluated, and delivered through multiple channels enabled by (new) digital channels. As such customers have an increased number of touch points with organizations through physical stores, mobile and social applications, websites and more. Organizations should ensure that their customer experience is not only similar through all channels but that there is a seamless integration of the different channels that are complementary to each other. Such a strategy is often called an omni-channel approach. Furthermore customers increasingly consume any-where, any-time. Organizations should enable this by focusing on self and automated services, which is expected to increase substantially as shown in this research. This will allow consumer to purchase, obtain, use, and their products and services when and where they want through various channels with constant means of customer support.
- Explore and adopt an enterprise-wide cloud-based strategy. This research shows that fixed and total costs are expected to decrease as a result of a decreased need for physical resources. The cloud is a large factor enabling this drop. With the need for organizations to invest in digital technologies key procurement decision have to be made. Choosing cloud-solutions allows organizations to operate with lower total costs due to pay per usage models without huge upfront investments. This ensures organizations will remain agile enough to react to future changes in their social-technological environment while still making the necessary investment in the current digital technologies.

## 6.3. Contributions

This research contributes to existing literature as it's a unique study that addresses the expected effects of digital transformation across the entire spectrum of organizations' their business models across industries. Not just from the perspective of a single underlying technology but all for underlying technologies combined. As opposed to other studies that focus on specific underlying technologies, industries or business model elements.

The findings of this research regarding increased customer segmentation, increased personalization of products and services, and increased online customer-organizations interaction confirms previous findings of Li (2015), Piccinini et al. (2015), and Westerman et al. (2011). Moreover it takes their research findings one step further by providing quantified expected effects instead of qualitative findings.

Furthermore this research shows that multiple other business model elements are expected to be impacted as well. With the strongest changes in value proposition, channels, and key partnerships followed by lesser changes in revenue streams, resource usage, and cost structure and only minor changes in key activities. It is worth noting the majority of these findings correspond with studies that have focused on these elements with only one underlying technology considered.

Aside from the intended contributions determined in the research problem, this research has provided other contributions as a by-product of the steps taken to answer the research question. This study is the first to provide a definition of digital transformation on a tangible level by stating the underlying digital technologies and impact criteria of transformational change. Whereas previous research such as that of Patel and McCarthy (2000), Stolterman and Croon Forst (2006), and Lankshear and Knobel (2008) provided a broad holistic perspective of digital transformation.

Furthermore future research can benefit from the business-model based survey created in this research as it can be applied to any organization to determine any impact of a technology – or even any external factor - on organizations their business model elements. Additionally the application of the framework across multiple organizations and/or technologies allows for easy comparative analysis between organizations and/or technologies.

The research findings provide unique insights into the expect change of organizations' their business model that can be used to build and substantiate digital transformation business cases. Together with the business model measurement framework this provides a structured approach to determine which elements of organizations' their business model are most likely to be effected by digital transformation along with the expected magnitude of that change. This enables organizations to create businesses cases more efficiently and accurately allowing for more reliable and factual investment decisions.

Furthermore by pinpointing the exact expected changes of digital transformation organizations are given a clear direction in strategic initiatives they should undergo. As shown in the previous paragraphs organizations should;

- Invest in analytic capabilities to allow "hyper" customization of services and products,
- Invest in a flawless omni-channel customer experience with self and automated services and,
- Explore and adopt an enterprise-wide cloud-based strategy.

## 6.4. Limitations

As within any research there are certain limitations; these limitations are discussed in this paragraph. First of all the Respondents to the survey might be biased due to the fact that are able to influence each other's opinion, which is not uncommon in organizations that apply information technology (Guimaraes & McKeen, 1988). This is a possible threat to the independence of measurement since respondents work closely together and can share the same opinion on the impact of digital transformation. 65.2% of the respondents share practice and location with at least one other respondent. In addition to respondents that work in the same practice at the same location there is a chance that respondents are influenced in their opinion by shared leadership vision on digital transformation. Although there is no absolute certainty respondents influence each other's opinion there is a high probability that at least within some groups this is the case, violating the independence of measurement.

Secondly this study is performed with a certain definition in mind; digital transformation is a social, mobile, analytics or cloud induced change that significantly affects three or more dimensions on individual, firm, and/or societal level. Results of this research therefore only apply to digital transformation in this context.

Thirdly as addressed in the survey chapter there is a difference between the definition of digital transformation used in this research and the one used for the survey. The survey definition is the internal organizational definition that does not specify the technologies and the transformational aspect. This potentially dilutes the results by including other digital technologies or changes that are less impactful than the once described in the definition.

Last this research is conducted amongst IT consultants from one company which means that the sample is a convenience sample. The results and conclusions could therefore be only applicable to this group as the sample is potentially not a true representation of the population. As such it's unclear whether the results of this research can be generalized for the entire intended population. In order words, do the results of this study apply outside of cognizant as well?

## 6.5. Recommendations for future research

From the limitations in section above it becomes clear that there is room for improvement which can be done in future research. Additional research should help to validate the contributions of this research. Furthermore future research can build upon observations done and framework created during this research. The last set of recommendation consists of practical advice for similar future research.

When it comes to the validity of the contributions made in this thesis, several aspects could be explored in future research:

- The outcomes of this research are based on the opinions of experienced consultants from cognizant. To validate that the results can be applied outside of this context and thus holds for the generalized population; similar research should be performed amongst other IT consultancy firms.
- The expected effects are based on expert opinions. It's not certain these outcomes will actually occur. Future research – through i.e. comparative case studies could validate whether the expected changes are actually occurring or have occurred.
- Furthermore the concept of digital transformation used in this research consists of four digital technologies that currently drive transformation changes. Future research could help to determine how robust this concept really is, or whether it's prone to constant change and interpretation. Furthermore future research could determine if the removal or addition of a digital technology actually leads to noticeable changed on the effects of organizations. Results of this research could reveal whether digital transformation really is a combination of four distinct technologies or more a general contemporary notion that people have.

This research has provided several contributions and insights that could be re-used or explored in future research:

- Several correlations are found between different elements. Due to the nature of this research these correlations are pure statistical and no causality is assumed. Known causality would provide value insights in what elements influence certain effects. Determining the causality through experimentation or observations would be an excellent way to identify the mechanics behind digital transformation.
- This research is performed in a cross-industry setting. Effects of digital transformation can and probably will differ between industries. Research specifically aimed a certain industries could provide unique insights and results can be compared to this research in order to determine differences in effects.
- The business model-based framework created in this research could be used as a proxy for organizations in future research when determining the effects of other (digital) technologies or for comparative studies on organizations.
- In this research a proposition of Lucas et al. (2013) was used to classify transformational change. Future research could explore what technological changes that have happened classify as transformational. Based on these findings the dimension and criteria could be re-evaluated or validated.

Based on the experience obtained from this research there several aspects worth noting for similar future research:

- The respondents of the survey in research have been in contact with digital transformation extensively and uphold their own view on digital transformation; as such their concept will differ from the concept used in the research. This is a situation that can occur with any topic and research that includes experts. Researchers should be aware of this potential validity issue and design their research to minimize the effect.
- When taking observations from within a single organization, there is a high probability that respondents have influenced each other's opinion because they work closely together. Researchers should be aware of this potential independence of measurement violation and design their research to minimize the effect.
- The survey performed in this research measures the relatively change of certain organizational aspects due to digital transformation without absolute reference point to the current status of organizations. Designing a survey in such a way that respondents can indicate the current level of an organizations elements and the expected level yield more information and still allows to the determine the relative change.

# 7. Reflection

In this chapter I provide a personal reflection on the research and the research process. First of all there were several aspects of the research process I did not expect. After five years of university education, conducting an independent scientific research seemed like just another project that had to be completed, but I was wrong. My master thesis research required different capabilities not previously used in other projects. As a result I had to learn and develop these capabilities during the research.

It was difficult to set the scope of the research and frame the scientific contribution. Although using scientific literature to substantiate your research was very common to me, using a literature review to identify knowledge gaps in literature was not. I could only do so properly after I completed a large part of the research. In hindsight this was something I did not have enough experience with.

Additionally setting the scope was an act of balance between providing both scientific and practical contributions. When you are given the opportunity to conduct your master thesis within a company the latter could prevail quickly. A question I had to continuously ask during the scoping of the project was: "How is my research delivering scientific contribution?"

Aside from the scientific research framing it was difficult to scope the entire research to begin with. The scope of the project was very wide and something I had to determine myself. Instead of a pre-defined question I had to do something with "digital" and the effects on organizations. I needed the first few weeks to define what type of project I wanted to do at Cognizant. Although this took considerable time it did allow me to shape a project that was both interesting for me and valuable to Cognizant.

When it comes to digital transformation there is little academic literature – due to the novelty of the concept - regarding digital transformation and most is spread amongst different academic fields i.e. the specific underlying technologies or applications. Bringing together the literature from different fields and dissection the concept of digital transformation was quite a challenge. A fair share of the literature used was even published just prior or during my research. Due to the broad scope, novelty of the concept and dispersed literature, I was not able to complete the research within the one semester.

Furthermore digital transformation is a continuously evolving term. The concept of digital transformation started out with social, mobile, analytics, and cloud but there are more "digital" technologies that are maturing and in the near future able to transform societies and industries. As such the landscape of digital transformation will change and the results of this research will only hold for the technological snapshot of the current landscape.

Methodology-wise there were no real issues. The selection of a framework and further operationalization was fairly straightforward. The survey design did not pose any problems and I was able to distribute the survey easily to a large group providing me with more than enough respondents. The large amount of respondents is a result of the great internal support I've had through the entire organization, which made me feel that I was providing an appreciated and important contribution to the internal knowledge on digital transformation. The data-analysis,

conclusion and recommendations went fairly smoothly despite the period of time it took to refine and finalize them.

Time-wise completing my Master thesis is not at all what I expected. I completed my bachelor's and master's program in a timely matter, but this was not the case for my Master Thesis. It took me quite some time to go from a broad idea to a narrow scope of research and from a rough draft to my final version. I've touched upon the scoping of the research already but not on the process of going from a draft to a final version.

After completing my draft version for which I got a conditional green-light I started as a graduate at Cognizant. The first months I've had very little to no time for my master thesis due to the overwhelming and time-consuming start of my career. It has proven difficult to spend enough time to maintain a steady flow working towards a final version. Only now – months after I started working – I've finally found the time to complete the last hurdle of my thesis and complete my master's program.

Taking everything into account; I feel that it's been an insightful journey from which I've learned a lot. I belief that I've delivered impactful research that provides valuable insights to digital transformation and the effects it has on organizations.

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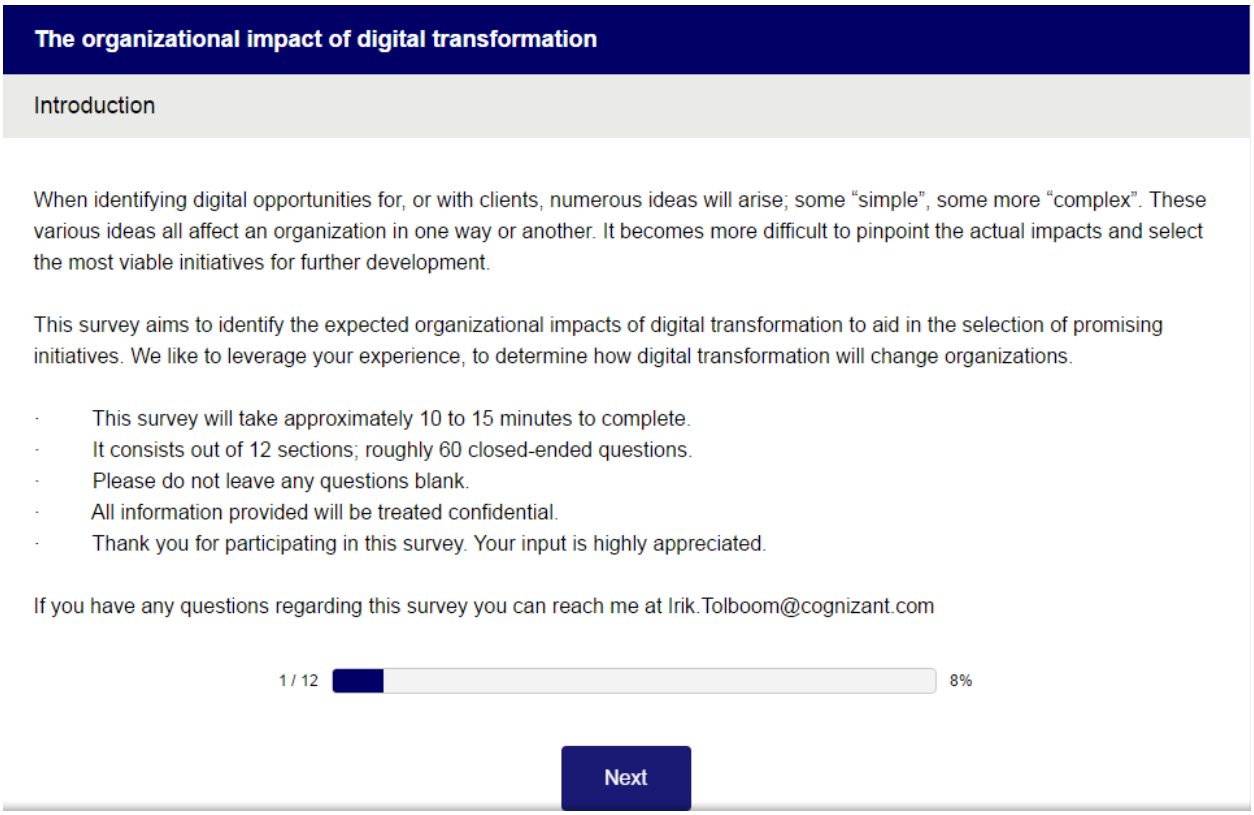
## Appendix 1: Practice abbreviations

| Abbreviation | Practice |
|---|---|
| SS | Strategic Services |
| BFS | Banking Financial Services |
| PMC | Program Management Consulting |
| CIS | Cognizant Infrastructure Services |
| LS | Lifesciences |
| Manlog | Manufacturing and Logistics |
| ComTech | Communication technologies |
| IME | Information, Media, and Entertainment |
| P&R | Products and resources |
| EIM | Enterprise Information Management |
| PQC | Process Quality Consulting |
| QEA | Quality Engineering and Assurance |
| EAS | Enterprise Application Systems |
| GTO | Global Technology Office |

# Appendix 2: Survey



## The organizational impact of digital transformation

### Digital Transformation

For your reference: “Digital Transformation" is a strategic imperative of all forward leaning companies globally in response to a “sea of change” in the expectations of customers, partners, and employees brought about by revolutionary advances in technology. Companies can radically improve their performance by leveraging digital technology across the enterprise.

Note: We request you to answer this survey based on experience and examples from your field of expertise to increase survey validity.

**Knowledge of digital transformation**

| | No knowledge | | | | | | Excellent knowledge |
|---|---|---|---|---|---|---|---|
| How would you rate your level of knowledge on digital transformation? | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

**Please state your department (Horizontal/Vertical)**

**Please state your grade level (Senior Manager, Director etc.)**

**Please state your country of employment**

**Please state your e-mail (if you want to recieve the results of this research and survey).**

2 / 12 17%

Prev Next

## The organizational impact of digital transformation

### Value Proposition

The value proposition of an organization describes the bundle of products and services for a specific customer segment.

**Due to digital transformation ...**

| | strongly decrease | | | not change | | | strongly increase |
|---|---|---|---|---|---|---|---|
| the creation of new products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the combination of existing products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the performance of products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the customization of products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the price of products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the accessibility of products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the convience of products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

Prev Next

## The organizational impact of digital transformation

### Customer segment

The customer segment describes distinct segments of customers based on needs, behavior and/or attributes with the aim to identify profitable customers.

**Due to digital transformation ...**

| | strongly decrease | | | not change | | | strongly increase |
|---|---|---|---|---|---|---|---|
| identification of customer needs will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| identification of customer attributes will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| identification of customer behaviour will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| segmentation of markets will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| accommodation to customer needs will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| accommodation to customer attributes will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| accommodation to customer behaviour will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

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## The organizational impact of digital transformation

Channels

Channels describe the way a company communicates with and reaches its customers to deliver the value proposition.

**Due to digital transformation ...**

| | strongly decrease | | | not change | | | strongly increase |
|---|---|---|---|---|---|---|---|
| the customer awareness of an organization's products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the possibility to evaluate an organization's value proposition for customers will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the ways and means of purchasing products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the ways and means of delivering products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the ways and means to provide post-purchase customer support will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

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## The organizational impact of digital transformation

### Customer relationships

Customer relationships describe the types of relationships a company establishes with specific customer segments. Several types of relationships will often co-exist in an organization.

Types of customer relationships:

- *Personal assistance: direct contact between organizations and customers (e.g. on-site or by telephone / email).*
- *Dedicated personal assistance: personal assistance through a specific assigned representative .*
- *Self-service: no direct relationships with customers. All necessary means are provided to the customers.*
- *Automated services: Self-service with automated processes providing customized services for each customer.*
- *Communities: online platforms used to exchange knowledge and solve problems.*
- *Co-creation: customers co-create value such as content or products designs.*

**Due to digital transformation the usage of ...**

| | strongly decrease | | | not change | | | strongly increase |
|---|---|---|---|---|---|---|---|
| personal assistance will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| dedicated personal assistance will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| self-service will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| automated services | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| communities will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| co-creation will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

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## The organizational impact of digital transformation

### Key activities

Key activities are the activities a company must take to operate successfully; they are required to create and offer a value proposition, reach markets, maintain relationships, and earn revenues. Key activities are the operational processes, supporting processes, and management processes within an organization.

- *Operational processes are the core business processes of an organization.*
- *Supporting processes support the day to day operations of an organization. Supporting processes can be accounting, internal communications, human resource management, and maintenance of infrastructure (including information systems).*
- *Management processes are the processes of setting goals, planning, controlling and organizing operational activities.*

The questions related to key activities are measured on two dimensions:

1) standardisation vs. diversification of processes.
2) intergration vs. separation of processes.

The first set of questions will determine whether processes will standardize or diversify.

**Due to digital transformation ...**

| | standardise strongly | | | not change | | | diversify strongly |
|---|---|---|---|---|---|---|---|
| processes to develop products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| processes to manage products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| processes to market products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| processes to sell products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| processes to deliver products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| processes regarding customer service will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| management processes will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| support processes will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

The second set of questions will determine whether several processes can be integrated into one (larger) process or have to be separated into several (smaller) processes

**Due to digital transformation ...**

| | intergrate strongly | | | not change | | | seperate strongly |
|---|---|---|---|---|---|---|---|
| processes to develop products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| processes to manage products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| processes to market products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| processes to sell products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| processes to deliver products and services will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| processes regarding customer service will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| management processes will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| support processes will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

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## The organizational impact of digital transformation

### Key resources

Key resources describe the assets required to create and offer a value proposition, reach markets, maintain relationships, and earn revenues.

**Due to digital transformation the usage of ...**

| | strongly decrease | | | not change | | | strongly increase |
|---|---|---|---|---|---|---|---|
| physical resources will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| intellectual resources will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| human resources will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

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## The organizational impact of digital transformation

### Key partnerships

The key partnerships describe the network of suppliers and partners that allow an organization to operate.

**Due to digital transformation ...**

| | strongly decrease | | | not change | | | strongly increase |
|---|---|---|---|---|---|---|---|
| the number of suppliers will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the number of channel intermediaries will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the number of complementary vendors will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the shared responsibility between key partners will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| the cooperation between key partners will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

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## The organizational impact of digital transformation

### Revenue streams

The revenue stream represents the way a company generates cash from each customer segment.

Types of revenue streams:

- *Asset sale revenue is derived from selling the ownerships rights of a physical product.*
- *Usage fees are obtained when customers pay based on the amount of service they use.*
- *Subscription fees are obtained through granting continuous access to a service for a certain period of time.*
- *Lending/renting/leasing revenue is derived from granting the temporary exclusive right over an asset.*
- *Licensing revenue is generated by providing permission to use intellectual property.*
- *Brokerage fees are derived from intermediation between two or more parties.*
- *Advertising fees are obtained in exchange of advertisements space for products, services or brands.*

**Due to digital transformation the usage of ...**

| | strongly decrease | | | not change | | | strongly increase |
|---|---|---|---|---|---|---|---|
| asset sales will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| usage fees will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| subscription fees will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| lending/renting/leasing will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| licensing will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| brokerage fees will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| advertising will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

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## The organizational impact of digital transformation

### Cost structure

The cost structure describes all the cost incurred in creating value, maintaining customer relationships, and generating revenue.

**Due to digital transformation ...**

| | strongly decrease | | | not change | | | strongly increase |
|---|---|---|---|---|---|---|---|
| fixed costs will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| variable costs will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| total costs will | ○ | ○ | ○ | ○ | ○ | ○ | ○ |


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**The organizational impact of digital transformation**

Closing remarks

Thank you for completing this survey. Your participation is highly appreciated.
Feel free to leave any comments in the box below.

**Do you have any comments?**

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## Appendix 3: Skewness and Kurtosis

All measures and data were checked on normality using the Kolmogorov-Smirnoff and Shapiro-Wilk tests, which indicated that all data was non-normally distributed. Since these tests are known to bet very stringent, the measures were checked on Kurtosis and Skewness. If the one of the values was greater than 1 or larger than 3 times the standard error the data is assumed non-normally distributed. The outcomes can be found in the table below. Since there is a large difference between the results of the Kolmogorov-Smirnoff, and Shapiro-Wilk and the test of Kurtosis and Skewness, measures that differed were manually checked using a Histogram with normality line and Q-Q plots. If data seemed non-normally distributed using the histogram and Q-Q plot it is considered as such.

**Table 27: Skewness, Kurtosis and assumed normality**

| Measure | Kurtosis > 1 or 3 σ | Skewness > 1 or 3 σ | Histogram + Q-Q plot (additional) | Normal Distribution assumed? |
|---|---|---|---|---|
| **VP_1** | No | No | X | No |
| **VP_2** | Yes | Yes | | No |
| **VP_3** | Yes | Yes | | No |
| **VP_4** | Yes | Yes | | No |
| **VP_5** | No | No | | Yes |
| **VP_6** | Yes | Yes | | No |
| **VP_7** | No | No | | Yes |
| **CS_1** | No | Yes | | No |
| **CS_2** | No | No | X | No |
| **CS_3** | No | Yes | | No |
| **CS_4** | Yes | Yes | | No |
| **CS_5** | No | No | | Yes |
| **CS_6** | No | No | | Yes |
| **CS_7** | No | No | | Yes |
| **CH_1** | No | No | | Yes |
| **CH_2** | Yes | Yes | | No |
| **CH_3** | No | No | | Yes |
| **CH_4** | No | No | | Yes |
| **CH_5** | No | No | | Yes |
| **CR_1** | No | No | | Yes |
| **CR_2** | No | No | | Yes |
| **CR_3** | No | No | X | No |
| **CR_4** | Yes | Yes | | No |
| **CR_5** | Yes | Yes | | No |
| **CR_6** | Yes | Yes | | No |
| **KA_1A** | Yes | No | | No |
| **KA_1B** | Yes | No | | No |
| **KA_2A** | No | Yes | | No |
| **KA_2B** | No | Yes | | No |
| **KA_3** | No | No | X | No |
| **KA_4** | Yes | No | | No |
| **KA_5** | Yes | No | | No |
| **KA_6** | Yes | No | | No |

| | | | | |
|---|---|---|---|---|
| **KA_7A** | Yes | No | | No |
| **KA_7B** | No | No | X | No |
| **KA_8A** | Yes | No | | No |
| **KA_8B** | Yes | No | | No |
| **KA_9** | No | No | X | No |
| **KA_10** | Yes | No | | No |
| **KA_11** | No | No | X | No |
| **KA_12** | No | No | X | No |

| Measure | Kurtosis > 1 or 3 σ | Skewness > 1 or 3 σ | Histogram + Q-Q (additional) | Normal Distribution assumed? |
|---|---|---|---|---|
| **KR_1** | No | No | X | No |
| **KR_2** | Yes | Yes | | No |
| **KR_3** | No | No | | Yes |
| **KP_1** | No | Yes | | No |
| **KP_2** | No | Yes | | No |
| **KP_3** | No | No | | Yes |
| **KP_4** | Yes | Yes | | No |
| **KP_5** | No | Yes | | No |
| **RS_1** | No | No | | Yes |
| **RS_2** | No | No | | Yes |
| **RS_3** | No | No | | Yes |
| **RS_4** | No | No | | Yes |
| **RS_5** | No | No | | Yes |
| **RS_6** | No | No | | Yes |
| **RS_7** | No | No | X | No |
| **Cost_1** | No | No | | Yes |
| **Cost_2** | No | No | X | No |
| **Cost_3** | No | No | | Yes |

## Appendix 4: Correlations

In the tables below the correlations for each measure are presented, * indicates that p <0.05, ** indicates that p <0.01, and ***indicates that p ≤0.001.

**Table 28: Correlations**

| Variables (N=92) | VP_1 | VP_2 | VP_3 | VP_4 | VP_5 | VP_6 | VP_7 |
|---|---|---|---|---|---|---|---|
| **VP_1** | 1 | | | | | | |
| **VP_2** | .077 | 1 | | | | | |
| **VP_3** | ,335*** | ,232* | 1 | | | | |
| **VP_4** | .147 | -.042 | .193 | 1 | | | |
| **VP_5** | -.131 | -.045 | -.061 | -.010 | 1 | | |
| **VP_6** | .150 | .113 | ,311** | .060 | .175 | 1 | |
| **VP_7** | ,264* | .091 | ,447*** | ,247* | .054 | ,576*** | 1 |

| Variables (N=91) | VP_1 | VP_2 | VP_3 | VP_3 | VP_5 | VP_6 | VP_7 |
|---|---|---|---|---|---|---|---|
| **CS_1** | ,368*** | .021 | ,390*** | ,301** | -.103 | .182 | ,288** |
| **CS_2** | ,287** | .020 | ,390*** | .192 | -.006 | ,239* | ,339*** |
| **CS_3** | ,309** | .050 | ,279** | .165 | -.035 | .187 | .139 |
| **CS_4** | ,209* | .124 | ,285** | ,340** | .022 | .178 | .206 |
| **CS_5** | ,284** | .118 | ,288** | ,330*** | -.034 | ,225* | ,335*** |
| **CS_6** | ,272** | .143 | ,329*** | ,264* | .056 | ,222* | ,424*** |
| **CS_7** | ,230* | .082 | ,303** | ,323** | -.069 | ,272** | ,423*** |

| Variables (N=88) | VP_1 | VP_2 | VP_3 | VP_3 | VP_5 | VP_6 | VP_7 |
|---|---|---|---|---|---|---|---|
| **CH_1** | .194 | ,301** | ,410*** | .098 | -.051 | ,372*** | ,243* |
| **CH_2** | .001 | .149 | .159 | .161 | -.031 | .068 | .083 |
| **CH_3** | ,423*** | .077 | ,457*** | .088 | .050 | ,367*** | ,452*** |
| **CH_4** | ,464*** | .064 | ,494*** | ,331** | -.029 | .182 | ,432*** |
| **CH_5** | .189 | ,282** | ,350*** | .121 | -.099 | .126 | ,313** |

| Variables (N=84) | VP_1 | VP_2 | VP_3 | VP_3 | VP_5 | VP_6 | VP_7 |
|---|---|---|---|---|---|---|---|
| **CR_1** | -.083 | .084 | .168 | .070 | ,243* | .070 | .056 |
| **CR_2** | -.049 | .001 | .144 | .162 | .196 | .138 | .119 |
| **CR_3** | .049 | -.106 | .182 | ,289** | .015 | .214 | ,415*** |
| **CR_4** | .109 | -.005 | .167 | ,246* | .016 | ,385*** | ,376** |
| **CR_5** | ,321** | .051 | .193 | .093 | .013 | ,219* | ,374** |
| **CR_6** | .135 | -.023 | .106 | ,279* | -.104 | ,268* | ,376*** |

| Variables (N=79) | VP_1 | VP_2 | VP_3 | VP_3 | VP_5 | VP_6 | VP_7 |
|---|---|---|---|---|---|---|---|
| **KA_1A** | .111 | .093 | .067 | .010 | -.077 | .141 | .121 |
| **KA_1B** | .079 | .100 | .111 | -.028 | -.125 | .037 | .046 |
| **KA_2A** | .028 | ,273* | .133 | -.016 | -.030 | .212 | .198 |
| **KA_2B** | .085 | ,336** | ,226* | .029 | .047 | ,231* | ,226* |
| **KA_3** | .212 | ,319** | .137 | -.078 | -.001 | .080 | .046 |
| **KA_4** | .140 | .049 | .032 | .042 | -.054 | .002 | .020 |
| **KA_5** | .045 | -.079 | -.060 | -.032 | .017 | -,250* | -.084 |
| **KA_6** | .057 | .134 | .072 | -.102 | .042 | .012 | .030 |
| **KA_7A** | -.117 | -.189 | -.212 | .026 | .044 | -.194 | -.009 |
| **KA_7B** | -.099 | -.210 | -.199 | -.002 | .008 | -.133 | -.036 |
| **KA_8A** | -.182 | -.195 | -.073 | -.102 | .175 | .066 | .032 |
| **KA_8B** | -.180 | -.023 | -.070 | -.043 | .161 | .073 | -.031 |
| **KA_9** | -.077 | -.075 | -.107 | .024 | .169 | -.032 | -.154 |
| **KA_10** | -.050 | -.145 | -.051 | -.030 | .106 | -.078 | -.184 |
| **KA_11** | -.063 | -.101 | -.161 | -.002 | .055 | -.145 | -.186 |
| **KA_12** | -.031 | -.040 | -.114 | -.118 | .108 | -.104 | -.134 |

| Variables (N=76) | VP_1 | VP_2 | VP_3 | VP_3 | VP_5 | VP_6 | VP_7 |
|---|---|---|---|---|---|---|---|
| **KR_1** | -.108 | .034 | .065 | -.063 | .203 | -.082 | -.036 |
| **KR_2** | ,362*** | ,292* | ,514*** | ,323** | -.198 | ,243* | ,411*** |
| **KR_3** | .160 | .181 | .150 | .127 | ,271* | ,287* | .137 |

| Variables (N=76) | VP_1 | VP_2 | VP_3 | VP_3 | VP_5 | VP_6 | VP_7 |
|---|---|---|---|---|---|---|---|
| **KP_1** | .137 | .024 | .092 | ,310** | .052 | .102 | .142 |
| **KP_2** | .206 | -.123 | .102 | .019 | .060 | -.041 | -.082 |
| **KP_3** | .190 | -.044 | ,235* | ,318** | -.049 | .078 | .130 |
| **KP_4** | ,296** | -.105 | ,242* | .167 | .031 | ,290* | ,335** |
| **KP_5** | ,249* | -.081 | .076 | ,287* | -.023 | .062 | .140 |

| Variables (N=72) | VP_1 | VP_2 | VP_3 | VP_3 | VP_5 | VP_6 | VP_7 |
|---|---|---|---|---|---|---|---|
| **RS_1** | -.092 | -.173 | .026 | -.157 | .166 | -.056 | .107 |
| **RS_2** | .164 | ,354** | .107 | ,315** | -.128 | .016 | .132 |
| **RS_3** | ,306** | .105 | .206 | ,305** | -.127 | .003 | .165 |
| **RS_4** | ,261* | .107 | .036 | .001 | -.051 | .149 | .090 |
| **RS_5** | .101 | .102 | -.070 | .118 | -.069 | -.070 | .007 |
| **RS_6** | .105 | .032 | -.003 | .038 | .175 | -.082 | .076 |
| **RS_7** | ,287* | .116 | .015 | -.100 | .166 | ,250* | .165 |

| Variables (N=72) | VP_1 | VP_2 | VP_3 | VP_3 | VP_5 | VP_6 | VP_7 |
|---|---|---|---|---|---|---|---|
| **Cost_1** | -.085 | -.023 | -,290* | -.154 | ,269* | -.115 | -.212 |
| **Cost_2** | .044 | .149 | .164 | .206 | .035 | .159 | .204 |
| **Cost_3** | -.042 | .075 | -.227 | .045 | ,427** | -.003 | -.160 |

| Variables (N=91) | CS_1 | CS_2 | CS_3 | CS_4 | CS_5 | CS_6 | CS_7 |
|---|---|---|---|---|---|---|---|
| **CS_1** | 1 | | | | | | |
| **CS_2** | ,697*** | 1 | | | | | |
| **CS_3** | ,703*** | ,661*** | 1 | | | | |
| **CS_4** | ,240* | ,264* | ,270** | 1 | | | |
| **CS_5** | ,495*** | ,577*** | ,423*** | ,413*** | 1 | | |
| **CS_6** | ,506*** | ,652*** | ,421*** | ,342*** | ,831*** | 1 | |
| **CS_7** | ,517*** | ,541*** | ,455** | .202 | ,769*** | ,834*** | 1 |

| Variables (N=88) | CS_1 | CS_2 | CS_3 | CS_4 | CS_5 | CS_6 | CS_7 |
|---|---|---|---|---|---|---|---|
| **CH_1** | ,229* | ,296** | .154 | ,244* | ,328** | ,282** | ,270* |
| **CH_2** | ,296** | ,323** | ,349*** | .132 | .166 | .125 | ,211* |
| **CH_3** | ,489*** | ,515*** | ,473*** | ,345*** | ,372*** | ,387*** | ,387*** |
| **CH_4** | ,452*** | ,517*** | ,404*** | ,247* | ,458*** | ,508*** | ,507*** |
| **CH_5** | ,376*** | ,447*** | ,429*** | .081 | ,267* | ,332** | ,273* |

| Variables (N=84) | CS_1 | CS_2 | CS_3 | CS_4 | CS_5 | CS_6 | CS_7 |
|---|---|---|---|---|---|---|---|
| **CR_1** | .007 | .019 | .005 | -.085 | -.022 | .094 | .084 |
| **CR_2** | .109 | .175 | .098 | .150 | .191 | ,240* | .172 |
| **CR_3** | .212 | ,337** | ,224* | .051 | ,221* | ,288** | ,303** |
| **CR_4** | ,224* | .214 | ,241* | .163 | .174 | .154 | .135 |
| **CR_5** | ,266* | ,354*** | ,251* | ,279* | .213 | .202 | ,221* |
| **CR_6** | .137 | .142 | .099 | ,307** | .197 | .114 | .196 |

| Variables (N=79) | CS_1 | CS_2 | CS_3 | CS_4 | CS_5 | CS_6 | CS_7 |
|---|---|---|---|---|---|---|---|
| **KA_1A** | .123 | .161 | .124 | .054 | ,230* | .113 | .160 |
| **KA_1B** | .021 | .118 | .129 | .016 | .134 | .059 | .114 |
| **KA_2A** | .132 | .220 | .160 | -.055 | .083 | .088 | .123 |
| **KA_2B** | .153 | ,311** | .192 | .012 | .192 | .208 | .221 |
| **KA_3** | .082 | .180 | .142 | -.016 | .118 | .076 | .078 |
| **KA_4** | .025 | .106 | .042 | .032 | .067 | -.019 | .015 |
| **KA_5** | .010 | .031 | .111 | -.078 | -.054 | -.067 | -.079 |
| **KA_6** | -.014 | .105 | .071 | -.035 | .163 | .073 | .070 |
| **KA_7A** | -.027 | -.098 | -.079 | -.087 | -.145 | -.162 | -.179 |
| **KA_7B** | -.076 | -.056 | -.057 | -.115 | -.129 | -.142 | -.173 |
| **KA_8A** | -.147 | -.098 | -.161 | -.220 | -.179 | -.115 | -.093 |
| **KA_8B** | -.126 | -.068 | -.163 | -.169 | -.022 | -.026 | -.038 |
| **KA_9** | -.166 | -.188 | -,255* | -.174 | -.172 | -,269* | -,256* |
| **KA_10** | -.149 | -.121 | -.127 | -.097 | -.014 | -.134 | -.171 |
| **KA_11** | -.116 | -.159 | -.132 | -.128 | -.067 | -.206 | -.216 |
| **KA_12** | -.137 | -.100 | -.162 | -.194 | -.041 | -.098 | -.111 |

| Variables (N=76) | CS_1 | CS_2 | CS_3 | CS_4 | CS_5 | CS_6 | CS_7 |
|---|---|---|---|---|---|---|---|
| **KR_1** | -.131 | -.075 | .023 | -.069 | -.057 | .026 | -.048 |
| **KR_2** | .217 | ,247* | .180 | ,299** | ,346** | ,324** | ,293* |
| **KR_3** | .143 | ,249* | .129 | .160 | .176 | .189 | .142 |

| Variables (N=76) | CS_1 | CS_2 | CS_3 | CS_4 | CS_5 | CS_6 | CS_7 |
|---|---|---|---|---|---|---|---|
| **KP_1** | ,248* | .155 | ,236* | ,434*** | ,331** | .196 | .158 |
| **KP_2** | -.119 | -.040 | -.089 | .127 | .042 | -.054 | -.016 |
| **KP_3** | .192 | .210 | .190 | ,408*** | ,365*** | ,326** | ,285* |
| **KP_4** | .036 | .206 | -.018 | ,238* | ,287* | .164 | .195 |
| **KP_5** | ,229* | ,235* | .221 | .190 | ,289* | .160 | ,252* |

| Variables (N=72) | CS_1 | CS_2 | CS_3 | CS_4 | CS_5 | CS_6 | CS_7 |
|---|---|---|---|---|---|---|---|
| **RS_1** | -.071 | -.049 | -.072 | -.128 | -.159 | -.141 | -.156 |
| **RS_2** | .185 | ,271* | ,317** | .215 | ,270* | ,277* | ,263* |
| **RS_3** | ,319** | ,441*** | ,413*** | .142 | .226 | .220 | ,268* |
| **RS_4** | .206 | ,297* | ,244* | .202 | .164 | .157 | .116 |
| **RS_5** | .092 | .162 | .093 | .116 | .204 | .080 | .113 |
| **RS_6** | -.051 | .057 | -.074 | .076 | .048 | .032 | -.032 |
| **RS_7** | .156 | .093 | .148 | -.062 | -.035 | .101 | .082 |

| Variables (N=72) | CS_1 | CS_2 | CS_3 | CS_4 | CS_5 | CS_6 | CS_7 |
|---|---|---|---|---|---|---|---|
| **Cost_1** | -,239* | -.122 | -.160 | -.206 | -,280* | -.144 | -.184 |
| **Cost_2** | .122 | .097 | .154 | -.028 | .181 | .169 | .180 |
| **Cost_3** | -.165 | -.111 | -.002 | -.199 | -.157 | -.092 | -.102 |

| Variables (N=86) | CH_1 | CH_2 | CH_3 | CH_4 | CH_5 |
|---|---|---|---|---|---|
| **CH_1** | 1 | | | | |
| **CH_2** | ,324** | 1 | | | |
| **CH_3** | ,430*** | ,242* | 1 | | |
| **CH_4** | ,378*** | .173 | ,591*** | 1 | |
| **CH_5** | ,341*** | ,285*** | ,366*** | ,632** | 1 |

| Variables (N=84) | CH_1 | CH_2 | CH_3 | CH_4 | CH_5 |
|---|---|---|---|---|---|
| **CR_1** | .038 | .107 | .112 | .043 | .043 |
| **CR_2** | .066 | .152 | .101 | .052 | -.050 |
| **CR_3** | ,262* | .205 | ,217* | ,420*** | ,257* |
| **CR_4** | .208 | .146 | .191 | .157 | .070 |
| **CR_5** | .184 | .193 | ,345*** | ,297** | .130 |
| **CR_6** | .208 | .176 | ,320** | .207 | .116 |

| Variables (N=79) | CH_1 | CH_2 | CH_3 | CH_4 | CH_5 |
|---|---|---|---|---|---|
| **KA_1A** | .131 | .103 | ,306** | ,230* | .117 |
| **KA_1B** | .122 | .154 | .160 | .156 | .098 |
| **KA_2A** | .111 | .220 | ,240* | .203 | .202 |
| **KA_2B** | .140 | .207 | ,319** | ,255* | ,234* |
| **KA_3** | .100 | .093 | ,279* | ,267* | ,238* |
| **KA_4** | ,266* | -.029 | .202 | .137 | .086 |
| **KA_5** | -.026 | -.003 | .031 | .029 | -.021 |
| **KA_6** | .116 | .081 | .159 | .006 | -.017 |
| **KA_7A** | -,286* | -.123 | -.043 | -.200 | -,268* |
| **KA_7B** | -.214 | -.094 | -.088 | -.204 | -.215 |
| **KA_8A** | -.165 | -.187 | -.089 | -,222* | -,308** |
| **KA_8B** | -.077 | -.068 | -.112 | -.218 | -,293** |
| **KA_9** | -.088 | -.056 | -.109 | -.168 | -.213 |
| **KA_10** | -.192 | -.103 | -.206 | -.207 | -,241* |
| **KA_11** | -.173 | -.077 | -,237* | -,278* | -,335** |
| **KA_12** | -.057 | -.012 | -.117 | -,249* | -,297** |

| Variables (N=76) | CH_1 | CH_2 | CH_3 | CH_4 | CH_5 |
|---|---|---|---|---|---|
| **KR_1** | -.212 | .106 | -.024 | -.081 | .097 |
| **KR_2** | ,384*** | .158 | ,292* | ,448*** | ,303** |
| **KR_3** | .133 | ,257* | .201 | .180 | .142 |

| Variables (N=76) | CH_1 | CH_2 | CH_3 | CH_4 | CH_5 |
|---|---|---|---|---|---|
| **KP_1** | .172 | -.005 | ,269* | ,261* | .174 |
| **KP_2** | -.031 | -.003 | .095 | .045 | -.114 |
| **KP_3** | ,253* | .015 | .224 | ,321** | ,237* |
| **KP_4** | .197 | -.025 | ,262* | ,292* | .021 |
| **KP_5** | .110 | .130 | .285* | .227 | .216 |

| Variables (N=72) | CH_1 | CH_2 | CH_3 | CH_4 | CH_5 |
|---|---|---|---|---|---|
| **RS_1** | -.064 | .069 | .156 | .013 | .085 |
| **RS_2** | ,313** | .176 | .130 | ,369*** | .342** |
| **RS_3** | ,280* | .187 | ,251* | ,471*** | .414*** |
| **RS_4** | .150 | .059 | .216 | .217 | .289* |
| **RS_5** | .129 | ,334** | .208 | .158 | .243* |
| **RS_6** | .059 | -.058 | .150 | .128 | .060 |
| **RS_7** | .036 | .003 | ,299* | .151 | -.046 |

| Variables (N=72) | CH_1 | CH_2 | CH_3 | CH_4 | CH_5 |
|---|---|---|---|---|---|
| **Cost_1** | -.038 | -.116 | -.059 | -.089 | .087 |
| **Cost_2** | .113 | .089 | -.091 | .145 | .079 |
| **Cost_3** | -,243* | -.030 | -.166 | -.107 | -.054 |

| Variables (N=84) | CR_1 | CR_2 | CR_3 | CR_4 | CR_5 | CR_6 |
|---|---|---|---|---|---|---|
| **CR_1** | 1 | | | | | |
| **CR_2** | ,663*** | 1 | | | | |
| **CR_3** | -.021 | -.024 | 1 | | | |
| **CR_4** | -.054 | -.026 | ,631*** | 1 | | |
| **CR_5** | -.182 | .004 | ,309** | ,305** | 1 | |
| **CR_6** | -.047 | .003 | .284** | .318* | .549*** | 1 |

| Variables (N=79) | CR_1 | CR_2 | CR_3 | CR_4 | CR_5 | CR_6 |
|---|---|---|---|---|---|---|
| **KA_1A** | -.007 | -.168 | .068 | .057 | -.002 | .103 |
| **KA_1B** | -.020 | -.090 | .096 | -.018 | -.050 | .075 |
| **KA_2A** | .037 | -.081 | .140 | .102 | .173 | .113 |
| **KA_2B** | .101 | .011 | .108 | .029 | ,229* | .101 |
| **KA_3** | .092 | -.001 | .096 | .036 | .169 | .149 |
| **KA_4** | -.062 | -.087 | -.009 | .009 | .113 | .120 |
| **KA_5** | -.030 | -.081 | -.035 | .031 | .086 | .030 |
| **KA_6** | .108 | .012 | -.149 | -.046 | -.022 | -.071 |
| **KA_7A** | .165 | .113 | -.130 | -.119 | -.120 | .111 |
| **KA_7B** | .173 | .085 | -.147 | -.104 | -.217 | .180 |
| **KA_8A** | .192 | .065 | -.114 | -.097 | -.083 | .030 |
| **KA_8B** | ,247* | .124 | -.202 | -.119 | -.153 | .109 |
| **KA_9** | ,260* | .074 | -,336** | -,331** | -.096 | .125 |
| **KA_10** | .060 | -.010 | -,327** | -,251* | -.091 | .093 |
| **KA_11** | .062 | -.099 | -,308** | -.150 | -.120 | .187 |
| **KA_12** | .201 | -.053 | -,287* | -.219 | -.187 | .269* |

| Variables (N=76) | CR_1 | CR_2 | CR_3 | CR_4 | CR_5 | CR_6 |
|---|---|---|---|---|---|---|
| **KR_1** | .204 | .117 | -.080 | -.118 | -.095 | -.132 |
| **KR_2** | -.150 | -.124 | ,309** | ,326** | ,326** | .205 |
| **KR_3** | .177 | .137 | .005 | .028 | .182 | .045 |

| Variables (N=76) | CR_1 | CR_2 | CR_3 | CR_4 | CR_5 | CR_6 |
|---|---|---|---|---|---|---|
| **KP_1** | -.053 | .098 | .145 | .062 | .024 | .195 |
| **KP_2** | .031 | -.001 | -.105 | -.126 | .035 | -.054 |
| **KP_3** | -.157 | -.115 | ,295** | .141 | .060 | .162 |
| **KP_4** | -.155 | .006 | ,323** | .221 | ,432*** | .492*** |
| **KP_5** | -,239* | -.156 | .191 | .114 | .115 | .399** |

| Variables (N=72) | CR_1 | CR_2 | CR_3 | CR_4 | CR_5 | CR_6 |
|---|---|---|---|---|---|---|
| **RS_1** | .181 | .147 | .003 | -.032 | -.088 | -.014 |
| **RS_2** | -.155 | -.071 | ,364** | .197 | ,258* | .276* |
| **RS_3** | -.112 | -.071 | ,344** | .074 | ,256* | .107 |
| **RS_4** | .037 | .045 | ,263* | .202 | ,251* | .176 |
| **RS_5** | -.182 | -.212 | .152 | .020 | .091 | .103 |
| **RS_6** | .056 | .087 | .021 | -.099 | .147 | .112 |
| **RS_7** | .074 | -.176 | .113 | .204 | ,243* | .110 |

| Variables (N=72) | CR_1 | CR_2 | CR_3 | CR_4 | CR_5 | CR_6 |
|---|---|---|---|---|---|---|
| **Cost_1** | -.015 | -.155 | -.084 | -.227 | -,263* | -.328** |
| **Cost_2** | .130 | .113 | ,290* | .127 | .198 | .117 |
| **Cost_3** | .094 | -.096 | .022 | -.107 | -.037 | -.150 |

| Variables (N=79) | KA_1A | KA_1B | KA_2A | KA_2B | KA_3 | KA_4 | KA_5 | KA_6 |
|---|---|---|---|---|---|---|---|---|
| **KA_1A** | 1 | | | | | | | |
| **KA_1B** | ,776*** | 1 | | | | | | |
| **KA_2A** | ,616*** | ,579*** | 1 | | | | | |
| **KA_2B** | ,515*** | ,502*** | ,850*** | 1 | | | | |
| **KA_3** | ,484*** | ,478*** | ,599*** | ,692*** | 1 | | | |
| **KA_4** | ,429*** | ,511*** | ,415*** | ,420*** | ,519*** | 1 | | |
| **KA_5** | ,340** | ,489*** | ,256* | .196 | ,346** | ,651*** | 1 | |
| **KA_6** | ,489*** | ,615*** | ,411*** | ,448*** | ,494*** | ,705*** | ,632*** | 1 |
| **KA_7A** | .111 | .011 | .205 | .097 | .193 | -.011 | .105 | -.034 |
| **KA_7B** | .180 | .107 | .138 | .057 | .153 | .052 | .219 | .049 |
| **KA_8A** | .030 | -.025 | .154 | .138 | .083 | .008 | -.023 | -.014 |
| **KA_8B** | .109 | .003 | ,227* | .221 | .097 | .021 | -.064 | .083 |
| **KA_9** | .125 | .068 | ,243* | .197 | .219 | .169 | .021 | .086 |
| **KA_10** | .093 | .004 | .191 | .155 | .059 | .213 | .117 | .189 |
| **KA_11** | .187 | .050 | .199 | .083 | .109 | .208 | .195 | ,246* |
| **KA_12** | ,269* | .192 | ,262* | .211 | .211 | ,272* | ,225* | ,363*** |

| Variables (N=76) | KA_1A | KA_1B | KA_2A | KA_2B | KA_3 | KA_4 | KA_5 | KA_6 |
|---|---|---|---|---|---|---|---|---|
| **KR_1** | -.013 | -.012 | .030 | .151 | .156 | -.171 | -,239* | -.081 |
| **KR_2** | .154 | ,237* | ,277* | ,312** | .126 | .163 | .024 | .071 |
| **KR_3** | .053 | -.004 | .040 | .181 | .118 | -.155 | -,318** | -.033 |

| Variables (N=76) | KA_1A | KA_1B | KA_2A | KA_2B | KA_3 | KA_4 | KA_5 | KA_6 |
|---|---|---|---|---|---|---|---|---|
| **KP_1** | .075 | .033 | .051 | .037 | .032 | .096 | -.082 | -.078 |
| **KP_2** | .124 | .176 | .026 | -.018 | .018 | .115 | -.072 | .097 |
| **KP_3** | .003 | -.026 | -.079 | -.042 | .026 | .007 | -.149 | -.155 |
| **KP_4** | .076 | .062 | .040 | .071 | ,282* | .142 | .011 | .053 |
| **KP_5** | .221 | .226 | .106 | .158 | ,241* | ,295* | ,255* | .114 |

| Variables (N=72) | KA_1A | KA_1B | KA_2A | KA_2B | KA_3 | KA_4 | KA_5 | KA_6 |
|---|---|---|---|---|---|---|---|---|
| **RS_1** | .114 | .139 | -.056 | -.016 | .046 | .157 | .203 | .202 |
| **RS_2** | -.059 | -.058 | .149 | .115 | -.029 | -.038 | -.073 | -.180 |
| **RS_3** | .001 | .112 | .167 | .174 | .014 | .041 | .056 | -.097 |
| **RS_4** | .105 | .150 | .219 | .141 | .114 | -.007 | .027 | -.076 |
| **RS_5** | ,243* | ,241* | .107 | .117 | .152 | .092 | .040 | .140 |
| **RS_6** | .091 | .065 | -.060 | .015 | .120 | .217 | .071 | .077 |
| **RS_7** | .212 | .141 | ,278* | .224 | .160 | .120 | .097 | .077 |

| Variables (N=72) | KA_1A | KA_1B | KA_2A | KA_2B | KA_3 | KA_4 | KA_5 | KA_6 |
|---|---|---|---|---|---|---|---|---|
| **Cost_1** | .005 | .011 | .023 | .112 | .117 | .179 | .062 | .069 |
| **Cost_2** | -.171 | -.067 | -.008 | -.034 | -.084 | -.139 | -.037 | -.161 |
| **Cost_3** | -.099 | -.026 | .043 | .084 | .019 | .039 | -.012 | -.025 |

| Variables (N=79) | KA_7A | KA_7B | KA_8A | KA_8B | KA_9 | KA_10 | KA_11 | KA_12 |
|---|---|---|---|---|---|---|---|---|
| **KA_7A** | 1 | | | | | | | |
| **KA_7B** | ,850*** | 1 | | | | | | |
| **KA_8A** | ,632*** | ,696*** | 1 | | | | | |
| **KA_8B** | ,601*** | ,663*** | ,905*** | 1 | | | | |
| **KA_9** | ,571*** | ,533*** | ,617*** | ,651*** | 1 | | | |
| **KA_10** | ,341** | ,471*** | ,521*** | ,607*** | ,671*** | 1 | | |
| **KA_11** | ,430*** | ,526*** | ,537*** | ,602*** | ,690*** | ,830*** | 1 | |
| **KA_12** | ,439*** | ,493*** | ,547*** | ,626*** | ,704*** | ,736*** | ,834*** | 1 |

| Variables (N=76) | KA_7A | KA_7B | KA_8A | KA_8B | KA_9 | KA_10 | KA_11 | KA_12 |
|---|---|---|---|---|---|---|---|---|
| **KR_1** | -.036 | -.079 | .078 | .047 | .109 | .053 | -.006 | .009 |
| **KR_2** | -,392*** | -,360*** | -,235* | -.221 | -.169 | -.161 | -.156 | -,271* |
| **KR_3** | -.165 | -.196 | -.095 | -.032 | .060 | -.100 | -.065 | -.065 |

| Variables (N=76) | KA_7A | KA_7B | KA_8A | KA_8B | KA_9 | KA_10 | KA_11 | KA_12 |
|---|---|---|---|---|---|---|---|---|
| **KP_1** | .105 | .023 | -.135 | -.122 | -.075 | -.129 | -.150 | -.217 |
| **KP_2** | .039 | .059 | .149 | .083 | .218 | .142 | .119 | .162 |
| **KP_3** | -.075 | .015 | -.045 | -.089 | -.196 | -.084 | -.162 | -,231* |
| **KP_4** | -.023 | .018 | .113 | .031 | -.061 | .004 | 0.000 | -.089 |
| **KP_5** | .033 | .117 | -.055 | -.098 | -.173 | -.076 | -.081 | -.085 |

| Variables (N=72) | KA_7A | KA_7B | KA_8A | KA_8B | KA_9 | KA_10 | KA_11 | KA_12 |
|---|---|---|---|---|---|---|---|---|
| **RS_1** | -.091 | -.091 | -.131 | -.225 | -.085 | -.096 | -.155 | -.001 |
| **RS_2** | -.089 | -.118 | -.185 | -.111 | -,272* | -.176 | -,235* | -,273* |
| **RS_3** | -.213 | -.124 | -,250* | -,252* | -.188 | -.117 | -.195 | -,245* |
| **RS_4** | -.017 | .024 | -.107 | -.133 | -.196 | -,242* | -.217 | -,260* |
| **RS_5** | -.129 | -.108 | -,270* | -.203 | -.127 | -.221 | -.180 | -.052 |
| **RS_6** | .135 | .118 | .165 | .128 | .182 | .124 | .091 | .139 |
| **RS_7** | .083 | .001 | .181 | .153 | .094 | .023 | .064 | .204 |

| Variables (N=72) | KA_7A | KA_7B | KA_8A | KA_8B | KA_9 | KA_10 | KA_11 | KA_12 |
|---|---|---|---|---|---|---|---|---|
| **Cost_1** | -.061 | .019 | .072 | .033 | .196 | .131 | .067 | .132 |
| **Cost_2** | .040 | .081 | .105 | .088 | .029 | .025 | .012 | -.098 |
| **Cost_3** | .109 | .076 | .229 | .206 | ,337** | ,252* | .186 | .155 |

| Variables (N=76) | KR_1 | KR_2 | KR_3 |
|---|---|---|---|
| **KR_1** | 1 | | |
| **KR_2** | .038 | 1 | |
| **KR_2** | ,396*** | ,242* | 1 |

| Variables (N=76) | KR_1 | KR_2 | KR_3 |
|---|---|---|---|
| **KP_1** | -.067 | .081 | -.005 |
| **KP_2** | .020 | -.076 | .059 |
| **KP_3** | -.057 | .131 | -.059 |
| **KP_4** | -.126 | .212 | .036 |
| **KP_5** | -.040 | .075 | -.055 |

| Variables (N=76) | KR_1 | KR_2 | KR_3 |
|---|---|---|---|
| **RS_1** | .183 | -.229 | -.037 |
| **RS_2** | -.088 | ,331** | -.025 |
| **RS_3** | -.033 | ,383*** | .093 |
| **RS_4** | .033 | .132 | .119 |
| **RS_5** | -.025 | .057 | ,264* |
| **RS_6** | -.003 | -.004 | .112 |
| **RS_7** | -.009 | .056 | .201 |

| Variables (N=76) | KR_1 | KR_2 | KR_3 |
|---|---|---|---|
| **Cost_1** | ,436*** | -.142 | .080 |
| **Cost_2** | -.211 | ,269* | .000 |
| **Cost_3** | ,248* | -.066 | ,307** |

| Variables (N=76) | KP_1 | KP_2 | KP_3 | KP_4 | KP_5 |
|---|---|---|---|---|---|
| **KP_1** | 1 | | | | |
| **KP_2** | ,381*** | 1 | | | |
| **KP_3** | ,687*** | ,463*** | 1 | | |
| **KP_4** | .212 | ,252* | ,441*** | 1 | |
| **KP_5** | ,306** | .070 | ,368*** | ,500*** | 1 |

| Variables (N=72) | KP_1 | KP_2 | KP_3 | KP_4 | KP_5 |
|---|---|---|---|---|---|
| **RS_1** | .080 | .171 | -.062 | -.048 | .131 |
| **RS_2** | .188 | -,246* | .191 | .042 | ,308** |
| **RS_3** | .075 | -.159 | .094 | .070 | ,371*** |
| **RS_4** | .137 | .025 | .111 | .128 | ,248* |
| **RS_5** | .067 | -.007 | .068 | .026 | ,279* |
| **RS_6** | -.018 | .108 | -.061 | .092 | .159 |
| **RS_7** | .010 | .067 | -.031 | .049 | .039 |

| Variables (N=72) | KP_1 | KP_2 | KP_3 | KP_4 | KP_5 |
|---|---|---|---|---|---|
| **Cost_1** | -.025 | -.026 | -.023 | -.145 | .134 |
| **Cost_2** | -.121 | -,259* | -.005 | .188 | -.042 |
| **Cost_3** | -.024 | .120 | -.040 | -.107 | .013 |

| Variables (N=72) | RS_1 | RS_2 | RS_3 | RS_4 | RS_5 | RS_6 | RS_7 |
|---|---|---|---|---|---|---|---|
| **RS_1** | 1 | | | | | | |
| **RS_2** | -,256* | 1 | | | | | |
| **RS_3** | -.201 | ,714*** | 1 | | | | |
| **RS_4** | -.034 | ,369*** | ,492*** | 1 | | | |
| **RS_5** | .104 | .227 | ,235* | ,237* | 1 | | |
| **RS_6** | .012 | .179 | .146 | .061 | ,248* | 1 | |
| **RS_7** | -.060 | .120 | .050 | .215 | .149 | ,354** | 1 |

| Variables (N=72) | RS_1 | RS_2 | RS_3 | RS_4 | RS_5 | RS_6 | RS_7 |
|---|---|---|---|---|---|---|---|
| **Cost_1** | .193 | -.035 | .131 | .048 | .138 | .088 | .025 |
| **Cost_2** | -,336** | ,341** | ,276* | .056 | -.024 | .091 | .082 |
| **Cost_3** | -.058 | .125 | .124 | -.020 | .084 | .214 | .197 |

| Variables (N=72) | Cost_1 | Cost_2 | Cost_3 |
|---|---|---|---|
| **Cost_1** | 1 | | |
| **Cost_2** | -,350** | 1 | |
| **Cost_3** | ,473*** | ,324** | 1 |