

# MASTER'S THESIS

## Co evolutionary IS Alignment in the public sector

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**Award date:**  
2020

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# Co evolutionary IS Alignment in the public sector

Education: Open Universiteit, faculty Management, Science & Technology  
Master's degree Business Process Management & IT

Degree programme: Open University of the Netherlands, Faculty of Management, Science & Technology  
Business Process Management & IT master's programme

Course: IM0602 BPMIT Graduation Assignment Preparation  
IM9806 Business Process Management and IT Graduation Assignment

Student: A.P.P. Bervoets

Identification number:

Date: Juni-2020

Thesis supervisor P. Walraven

Second reader R. van de Wetering

Version number: 1.0

Status: Final

## Abstract

IS alignment is a much-studied subject; the importance of IS to be in line with the business goals is generally acknowledged. To get the IS of an organization aligned is hard; to keep it aligned is even more difficult due to constantly changing environments. This research is about the co-evolution of IS alignment in organizations in the public sector with a complex adaptive systems view. It provides an insight into the effect of the IS alignment on dynamic capabilities in the public sector on the hand of quantitative research held under Dutch public organizations.

## Key terms

Coevolutionary IS alignment, IT alignment, Dynamic capabilities, complexity science, co-evolution

## Summary

The research focus on Co-evolutionary IS alignment (COISA), which is IS alignment with a complex adaptive systems approach. In a previous study, the effects described in the COISA framework in hospitals were endorsed. This research tested similar effects at organizations in the public sector with a quantitative method.

For this research, a survey was held with a target audience. The most effective way of response collecting proved to be by a direct approach of people in the target audience. In the end, just under 100 responses were reached from which 81 respondents were reliable for the research. The other respondents were either from the private sector or did not fill in the survey completely.

This research examined the effect of COISA on dynamic capabilities in the public sector. For this purpose, the following research question was posited: What is the influence of co-evolutionary IS alignment on the dynamic capabilities of organizations in the public sector?

Three hypotheses were formed to answer the research question:

H1: Alignment competencies of an organization have a positive effect on the dynamic capabilities of that organization.

H2: Interconnections between heterogeneous employees moderates the effect of alignment competencies on dynamic capabilities.

H3: Alignment motivation moderates the effect of alignment competencies on dynamic capabilities.

The first hypothesis (H1) describes the direct effect between an organization's alignment competencies and its dynamic capabilities. This means that organizations in the public sector with better alignment competencies have better dynamical capabilities. Even more, it means that IS alignment not only has a positive effect on the dynamic capabilities of organizations in competitive markets; it has a comparable effect to organizations to the public sector as well. This research endorsed the positive relation between alignment competencies and dynamic capabilities.

For the other two hypotheses, however, there was in this study no significant proof. This implies that the moderating variables in the COISA framework do not apply in organizations in the public sector.

Moreover, interaction between heterogeneous actors has no significant effect on the relationship between alignment competencies and dynamic capabilities in public organizations in this study. This means that intensify or lessen the interaction between actors in public organizations eventually has neither a positive nor a negative effect on the dynamic capabilities of that organization.

This research underlined the effect that an organization's alignment capabilities influence its dynamic capabilities. Thus, for an organization to obtain better dynamic capabilities, it is advisory to pay attention to its alignment capabilities.

In conclusion, for better dynamic capabilities, organizations must firstly have a strategy for the alignment between business and IT. Secondly, the alignment between business must be orchestrated in the organization, and finally, end-users need to be involved in the alignment process.

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# 1. Introduction

## 1.1. Background

Every organization nowadays has a dependency on information technology (IT). Many organizations are highly dependent on IT in their daily work as IT is supporting the business (Van Grembergen, De Haes, & Guldentops, 2004). Therefore, it is essential that IT is in line with the business goals of the organization. Through the years, extensive research is done on the alignment of IT with the business (Aversano, Grasso, & Tortorella, 2012). Part of the conclusions of this researches is that proper alignment of IT with the business goals gives a competitive advantage (Schwarz, Kalika, Kefi, & Schwarz, 2010).

## 1.2. Exploration of the topic

There are many definitions of IT-alignment given (Chan & Reich, 2007). Luftman, Papp, and Brier (1999, p. 3) give the following definition of business IT-alignment: “[...] applying IT in an appropriate and timely way, in harmony with business strategies, goals, and needs”. Walraven, van de Wetering, Helms, Versendaal, and Caniëls (2018) write that this definition shows that alignment between business and IT is continuous. As business goals develop over time through internal and external changes, IT also needs to develop to maintain the harmony between IT and business.

The alignment process of the information systems (IS) in an organization does not stand on itself. Walraven et al. (2018) identified five different alignment processes: strategy formulation, strategy implementation, Enterprise Architecture Management, IT implementation, and IT usage. Walraven et al. (2018) then developed a model that shows the interaction between these five processes and the evolution of these processes. The conceptual model of Walraven et al. (2018) presents the co-evolution of IS alignment (COISA). The alignment process of an organization can be described as the co-evolution of the different IS alignment processes.

The alignment process of organizations is primarily internal. In a fast-changing environment, organizations must be able to change with the environment for a competitive advantage. This phenomenon is called “dynamic capabilities” by Teece and Pisano (1994). According to Schwarz et al. (2010), there is a causality between the Business/IT-alignment and the dynamic capabilities of an organization. Organizations with better IT alignment results in better dynamic capabilities.

## 1.3. Problem statement

Walraven, Van de Wetering, Versendaal, and Caniëls (2019) conducted three case studies to study COISA in the public sector. However, they were limited to the implementation of electronic medical reports (EMR) systems at three different hospitals. Walraven et al. (2019) applied the COISA model of Walraven et al. (2018) in a qualitative case study on implementing an EMR system in a hospital. Until this moment, there is no further research performed on the application of COISA in other organizations in the public sector.

Therefore, this research studies the effect of COISA on dynamic capabilities in more organizations in the public sector. This research gives insights into the effect of COISA on the dynamic capabilities of organizations in the public sector and different cases. The public sector consists, for example, of multiple complex organizations in a complex environment due to changing politics. Because of the continually changing environment of organizations in the public sectors, it is interesting to research the effect of COISA on the dynamic capabilities of those organizations.

## 1.4. Research objective and questions

This research focuses on the alignment of information systems in the public sector and the co-evolutionary characteristics of IS alignment. It examines the effect of COISA on the dynamic capabilities of an organization in the public sector.

The research question is, therefore, as follows: *What is the influence of co-evolutionary IS alignment on the dynamic capabilities of organizations in the public sector?*

Three hypotheses are set up in chapter two and tested in chapter four to answer this research question. The hypotheses are tested in quantitative research among almost a hundred organizations in the public sector.

## 1.5. Motivation/relevance

As mentioned before, until so far, no further research has been performed on the application of COISA in other organizations in the public sector. This research gives insight into COISA through the whole public sector in addition to the qualitative hospital cases. It explains what the COISA framework is and how it is related to the dynamic capabilities of organizations in the public sector. The dynamic capabilities of an organization are, on its turn, linked to the IT alignment: organizations with a better IT alignment results in better dynamic capabilities.

This research is relevant as it investigates the effect of COISA on the dynamic capabilities of an organization and, with that, the effect on the IT alignment of an organization. It gives insight into the influence of COISA and if it results in better dynamic capabilities within an organization. If there is a positive effect, the application of COISA could be beneficial for an organization in terms of dynamic capabilities and the business/IT alignment.

## 1.6. Main lines of approach

Chapter two provides a detailed process of the performed literature study. In this chapter are also the definitions of all the main topics explained. With these definitions, the framework and the conceptual model is built up. With the conceptual model, the different hypotheses are explained and described in chapter two. The process of answering the research question is written down in chapter three. In this chapter, the research methods are described, followed by the design of these research methods. Finally, the validity and ethical aspect of this research are elucidated in chapter three. In chapter four, the results of quantitative research that is performed are extensively explained. In chapter five, the discussion and conclusion of the research are given. Moreover, future recommendations are listed.



## 2. Theoretical framework

### 2.1. Research approach

The framework of the research approach started with literature research. The first analyzed paper was the paper of Walraven et al. (2018). Next, the principle of forward snowballing was applied to find the used literature for this paper. References of the papers were scanned for relevant subjects to use in the framework. This continued until no further relevant references could be found. To determine whether the references were of interest, firstly, only the title in the reference was read. Secondly, the abstract and the conclusion of those references were examined to determine the relevance. Papers with references to Complex adaptive systems theory, Dynamic capabilities theory, Business-IT alignment, and COISA were considered relevant. Finally, when the relevance was approved, the paper was read completely.

An additional method applied to collect literature was searching via google scholar. Google scholar was used because of the fast way of finding literature. The downside of google scholar is that are many results that need to be filtered. The filtering is performed in different ways. First of all, this was done with search queries. The following queries were applied to obtain relevant literature: "Coevolutionary alignment," "Complexity theory," "Business-IT alignment services," "Dynamic capabilities," "Business-IT alignment," "Business-IT alignment dynamic capabilities," "Dynamic capabilities Performance," "IT Governance," "Coevolutionary IS alignment COISA," and "Dynamic capabilities organization performance." These keywords were chosen to fit the concepts of the COISA framework of Walraven et al. (2018) as that paper supports the view on the COISA approach of this research. As said before, the downside of using Google scholar is that it gives a large result. To deal with this problem, three precautions are made: 1) only the first page of the results is used; 2) at least one of the authors is also an author of one of the references in the other papers found by the snowballing procedure; 3) the title and the short text presented in the search result were quickly scanned and verified if it is in the scope of the research. Appendix I shows the different articles used for the framework of this research and the method applied, i.e., forward snowballing or google scholar search.

### 2.2. Implementation

The research approach was implemented by using the forward snowballing procedure and Google scholar, as mentioned above. Forward snowballing leads directly to a broad range of literature (Okoli & Schabram, 2010). In combination with the search queries on Google scholar, it led to 45 articles that could potentially be used as a foundation for the theoretical framework.

The first filtering was applied based on the title and partly on the author. Titles with the keywords "IT alignment," "dynamic capabilities," "Business alignment," and "IS alignment" are on the list to be analyzed. Domain-specific literature like "EMR" was filtered out if none of the keywords mentioned before was in the title or the keywords.

The second filtering was performed by reading the abstract and the conclusion. Filtering was not only done by keywords but also on the relevant frameworks in the paper.

Papers with a relevant framework were researched thoroughly. For this research, relevant frameworks consist of the following theories and frameworks: Complex adaptive systems theory, Dynamic capabilities theory, Business-IT alignment (BITA), and COISA. These theories and frameworks were the most suitable for the dynamic view of this paper. However, classical BITA has a

more static position; it is an excellent addition to the framework due to the basic principles of IT alignment.

After the filtering, 27 papers were read thoroughly and analyzed to set up the scope and the framework of this research. The analyzed papers are placed in the table in appendix i.

### 2.3. Results and conclusions

The literature research results in the following definitions for the main topics, which are dynamic capabilities, IT alignment, and COISA:

#### **Dynamic Capabilities**

Business environments of complex organizations change constantly; therefore, the “[...] the formulation of timely and accurate strategic responses is vital for success” (Karadağ, 2019, p. 11) and brings a competitive advantage. The way an organization reacts to these environmental changes can be described as the dynamic capabilities of an organization. For this research, the definition of dynamic capabilities from Teece, Pisano, and Shuen (1997, p. 516) is used: the “[...] ability to integrate, build, and reconfigure internal and external competencies to address rapidly-changing environments”.

Dynamic capabilities theory is built upon the resource-based-value (RBV) theory (Eisenhardt & Martin, 2000). RBV focuses on the influence of all resources on the competitive advantage of an organization. Reallocating resources of an organization can bring a competitive advantage to an organization.

The dynamic capabilities theory also examines the effect of resources used on the competitive advantage of an organization. However, contrary to the RBV theory, dynamic capabilities theory takes a dynamically changing environment into account (Eisenhardt & Martin, 2000; Winter, 2003). So a continually changing environment causes that organizations continuously need to make changes in the use of their resources.

#### **IT alignment**

The IT of organizations has become crucial for everyday work. The growth of IT expenses is a clear indicator of the importance of IT. IT is supportive to the business goals of an organization and, therefore, to support the business with IT. IT has to be in line with their business goals (Chen, 2008). Furthermore, Chan, Sabherwal, and Thatcher (2006) conclude that IT alignment is positively related to the performance of organizations.

Every organization has some degree of IT alignment: some organizations are more mature in business-IT alignment than others (De Haes & Van Grembergen, 2009). However, as complex organizations change due to their constantly changing environments, their business goals may also change, and this causes IT to be unaligned. Therefore it is necessary for IT to adjust and develop along with the business goals to stay aligned with those business goals. Yeow, Soh, and Hansen (2018, p. 43) describe IT alignment as “... a continual process of aligning to the moving target of emerging strategy.”

Luftman et al. (1999, p. 3) describe IT alignment as “applying IT in an appropriate and timely way, in harmony with business strategies, goals and needs.” It is, therefore, essential to note that the alignment of IT in an organization never in a stable state. According to Luftman and Brier (1999), “Alignment is a dynamic, complex process that takes time to develop and even more to sustain.” IT

alignment cannot be seen as a final phase that an organization either has or has not; it is a constant adjustment of the IS of an organization.

### COISA

The classic point of view of IT or IS alignment in the literature is the adjustment of the IS of an organization to align with the business goals. Amarilli, Van Vliet, and Van Den Hooff (2016) analyzed IS alignment based on complexity science, which implicates that the IS alignment is a co-evolutionary process that occurs on a micro level in an organization. Walraven et al. (2018) developed a framework where the alignment of IS and business occurs co-evolutionary through different parts of an organization. COISA is an aggregation of multiple alignment competencies: Strategy formulation, Strategy implementation, enterprise Architecture Management, IT usage, and IT implementation. These five competencies are combined in three categories that are in the conceptual model of this research: Strategic, Orchestrational, and Operational.

Within the conceptual model of COISA, there are two moderating variables. These are “Interconnections between heterogeneous employees” and “Alignment motivation” (Walraven, 2019). These components control the effect of the alignment competencies on the dynamic capabilities. The first variable, the interaction between heterogeneous employees, means that human actors of different compartments within an organization interact with each other (Walraven, 2019). For example, the interaction between an IT user and someone responsible for the IT strategy. The second variable, the alignment motivation refers to the motivation of an organization and its employees to work to a better alignment between business and IT (Walraven, 2019).

This gives the following conceptual model of the effect of COISA on Dynamic capabilities:

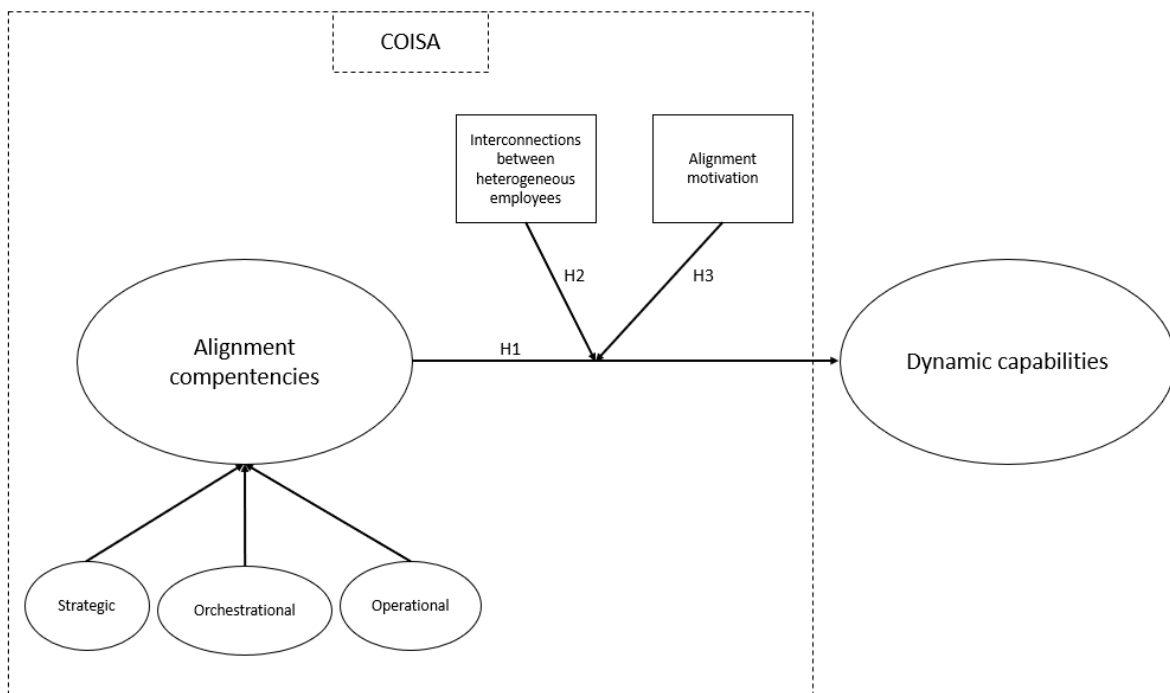


Figure 1 Conceptual model

The conceptual model in figure 1 gives three hypotheses. The first hypothesis is based on the effect of alignment competencies on Dynamic capabilities. Continuous alignment in an organization is needed to sustain dynamic capabilities (Teece, 2007). Defined in a more specific perspective, Schwarz et al. (2010) describe the causality between Business IT alignment and the dynamic

capabilities of an organization. Hence, better alignment between business and IT brings a positive effect on the dynamic capabilities of an organization. Therefore, the first hypothesis is:

**H1:** *Alignment competencies of an organization have a positive effect on the dynamic capabilities of that organization.*

The Complex Adaptive Systems (CAS) theory is at the foundation of COISA (Walraven et al., 2018) and, therefore, the interconnections between heterogeneous employees are an essential part of the COISA framework. Interactions between employees cause changes at these employees (Allen & Varga, 2006). Walraven et al. (2018, p. 5) write: “[...] diverse agents [...] within the organization are continually adapting and co-evolving”. These adaptations cause changes in the organization (Anderson, 1999).

The definition of the dynamic capabilities of an organization by Teece et al. (1997) focusses on the ability to make changes to an organization in a way that they keep a competitive advantage. The ability to change depends on the possibility of employees to make changes as well (Walraven, 2019). In an earlier definition of dynamic capabilities of Teece and Pisano (1994), they refer to the sensing, seizing, and adapting of an organization. The interconnections between human actors allow them to sense the changes that need to be made in an organization (Walraven et al., 2018). Therefore, the second hypothesis is:

**H2:** *Interconnections between heterogeneous employees moderates the effect of alignment competencies on dynamic capabilities.*

Another element that moderates the effect of alignment competencies on dynamic capabilities is the alignment motivation of the actors in an organization.

Changes in the environment lead to the need for changes in the IS of an organization and create an adaptive tension (Benbya & McKelvey, 2006). These tensions cause motivation for organizations to get better aligned to coop with these changes (Benbya & McKelvey, 2006).

Furthermore, Walraven (2019) mentioned that the motivations of human actors that influence the Business-IT alignment are at the fundament of COISA. These human actors all have their motivation for their actions in the system. (Walraven, 2019) state that human actors can have an intrinsic motivation to adapt when they sense misalignments. This motivation to adapt when misalignments are sensed contributes to the dynamic capabilities of the organization. Therefore, the third hypothesis is:

**H3:** *Alignment motivation moderates the effect of alignment competencies on dynamic capabilities.*

## 2.4. The objective of the follow-up research

The objective of the follow-up research is to give more insight into the relationship between alignment capabilities and dynamic capabilities. The objective is to test the hypotheses in this framework at organizations in the public sector. The hypotheses are quantitatively tested with a survey held under organizations in the public sector. In detail, it provides more information on the COISA in organizations in the public sector. It contributes to the existing literature by providing quantitative substantiation to the COISA framework and the effect of COISA on dynamic capabilities.

### 3. Methodology

This chapter explains the methodology used in this research to answer the research question. First, the conceptual design of the study is elaborated. Secondly, the technical design of the study is explained. The technical design explains how the data is obtained. Thirdly, the analysis of the collected data is described, and finally, the validity, reliability, and ethical aspects of the data collation and analysis are explained.

#### 3.1. Conceptual design

For the development of the strategy for this research, the research “onion” (Saunders, Lewis, & Thornhill, 2016) was peeled.

According to Saunders et al. (2016), each research consists of multiple layers around the core of data collection and data analysis. Moreover, Saunders et al. (2016) also describe the management and business research, which consists of five different philosophies, namely: Positivism, Critical Realism, interpretivism, postmodernism, and pragmatism. In this research paper, positivism is used because, for this research, the world is beheld as an observable reality (Saunders et al., 2016). To test the hypothesis of the conceptual model that is built on the theoretical framework, this research has a deductive approach (Saunders et al., 2016). With the deductive approach, the existing COISA framework is applied in this research on different organizations.

Consequently, a quantitative method is used to test the three hypotheses of the conceptual model described in chapter 2.3. A quantitative method is performed to “*examine relationships between variables*” (Saunders et al., 2016, p. 612). For this mono-method quantitative study (Saunders et al., 2016), a survey was held. The survey made it possible to achieve a large number of respondents within a short time. A disadvantage of a survey is that the researcher has limited influence on the correct fulfillment of the questionnaires by respondents. Respondents could interpret questions of the survey in a different way (Saunders et al., 2016). Hence, questions could be misunderstood or socially accepted answers could be given.

#### 3.2. Technical design

As described in chapter 3.1, a survey is held to gather data at various organizations in the public sector. This paragraph explains the technical design of the data gathering for this survey. Respondents were asked to fill in different questions in the survey. The questions in the survey were set up in such a way that the hypotheses from the theoretical framework described in chapter 2.3 could be tested. Therefore, the multiple variables in the framework were operationalized to measure them. The multiple variables consist of dependent, independent, and moderating variables.

The dependent variable, named “dynamic capabilities,” is operationalized with the help of the research of Janssen, Castaldi, and Alexiev (2016). Den Hertog (in Janssen et al., 2016) built further upon the conceptualization of Dynamic capabilities from Teece (2007) (“sensing,” “seizing,” and “reconfiguring”) and created a “*service-based extension*” (Janssen et al., 2016, p. 3). This extension consist of four constructs: “Sensing user needs and (technological) options,” “Conceptualizing,” “Coproducting and orchestrating,” and “Scaling and Stretching” (Janssen et al., 2016, p. 6). For each of those four constructs are underlying statements determined by Janssen et al. (2016, p. 6). These can be found in appendix ii

The independent variable, “Alignment competencies,” and the moderating variables, “Interconnections between heterogeneous employees” and “Alignment motivation,” are within the COISA framework. The variable “alignment competencies” is composed of three variables:

“strategic,” “orchestrational,” and “operational.” For these five independent variables of the COISA framework, multiple statements were composed in the questionnaire of the survey. The statements of all variables create the foundations for the questions in the survey.

The survey was done online for rapid data gathering and to process the data quickly afterward. The respondents got a list of the statements. The statements are based on a Likert-scale, this means that if the respondent thought the statement fits his organization perfectly, he or she gave 7 “points” on the scale. If the statement did not fit the organization according to the respondent, he or she gave 1 “point” on the scale for that question.

The target population of the respondents consists of organizations in the public sector. Therefore the target audience for the survey are respondents that can represent these organizations in the public sector. Respondents that can represent these organizations are described as people that work on the business and IT in a public organization. Examples of these respondents are CIO’s Enterprise Architects and Business consultants.

To retrieve data from the target population, non-probability sampling is applied. The reason is that for a probability sample of the population, a sampling frame is needed (Saunders et al., 2016). A sampling frame is not possible in this population because there is no complete list of all organizations in the public sector. So this research is performed with a non-probability sampling (Saunders et al., 2016). The sampling is done with a combination of techniques described by Saunders et al. (2016): “Volunteer” and “haphazard.”

Respondents were approached directly by the researchers to ensure that the respondents were in the target audience. The organizations were found in the network of the group of researchers. Respondents were asked if they know people in their network to fill in the survey. The researchers were responsible for getting 20 to 25 respondents each, which gave a varied group of around 100 respondents.

This number of 100 respondents is chosen because there have to be at least 30 respondents in total to be able to conduct particular statistical techniques (Baarda & de Goede, 2006). The choice of 100 respondents is made to get a more statistical power, as a larger sample size gives more statistical power (Prajapati, Dunne, & Armstrong, 2010). More than 100 respondents would give even more statistical power, but this was impossible due to limited time. A varied group of respondents is needed due to the heterogeneity of the population (Baarda & de Goede, 2006). The varied sample is achieved by the varied networks of the researchers.

### 3.3. Data analysis

The outcome of the survey held among the different organizations is processed with statistical software called Smart PLS. Smart PLS uses partial least squares path modeling (PLS-SEM). PLS-SEM is a second-generation technique of multivariate analysis (Hair, Hult, Ringle, & Sarstedt, 2016); it enables the researchers to test hypotheses in complex models with multiple latent variables. The conceptual model set up in chapter two is modeled in Smart PLS to perform the analysis of the collected data.

Smart PLS made it possible to draw conclusions on the hypotheses put in chapter two.

### 3.4. Validity and reliability

The validating of the questionnaire is divided into “Dynamic capabilities” and “COISA.” The questions that represent the dependent variable “dynamic capabilities” were extracted from (Janssen et al., 2016). Therefore, these questions are already validated in that particular study.

For the statements of the COISA part, a Q-SORT method is applied for the validation. The questions are validated in different stages to prevent misunderstanding and misinterpreting of the questions. First, the validation of the questions took place with the group researchers. They categorized the different questions in five elements of the conceptual model. Unclear questions were taken out or changed to ensure the answer to the question measures the right element of the conceptual model. The second validation was done with a larger group, yet based on the same principle: categorization of the questions in the survey to validate the questions.

### 3.5. Ethical aspects

Every research needs to be done in an ethically justified manner; for this purpose, the ethical aspects of the research had to be tested. Baarda and de Goede (2006) state that four questions needed to be answered by the researchers for this test: Are the respondents filling in the survey voluntarily? Is the survey not a false representation of the truth? Are the answers respondents anonymous processed? Furthermore, can the outcome of the research have negative consequences for the respondents?

For this research, the survey was filled voluntarily by the respondents. The respondents were informed about the research and the purpose of it, so there could be no false representation. The respondents are known to the researchers. Their personal information and answers are not published in public. Moreover, the outcomes of this research cannot be traced back to the individuals who filled in the survey.

For conducting the survey, LimeSurvey software is used, which stores the data of the respondents on servers of the Open Universiteit in the Netherlands; this ensures that the data is used for this research only.

The outcome of this research also has no direct influence on the organizations the respondents work for and, therefore, it is not affecting the respondents. It can, as a result, be concluded that the four questions of Baarda and de Goede (2006) are answered positively, and the survey was held with respect for the participant and its privacy.



## 4. Results

In this chapter, the data collected via the survey is analyzed to test the three hypotheses. The analysis is performed with partial least squares path modeling (PLS-SEM) with SMART PLS software. PLS-SEM allows conducting a complex analysis with multiple variables and relations.

Prior to the hypothesis testing is the analysis, validating, and verification of the dataset and the model. This is executed in different steps. First, the data examination is performed, in which the raw data is scanned for inconsistencies and irregularities. Secondly, the evaluation of the measurement model is executed for two different parts of the model: the reflective and the formative. Finally, the analysis of the structural model resulted in the significance and predictability of the model that leads to an overall conclusion of this research.

### 4.1. Data examination

For the data examination, the data of the respondents are scanned for inconsistencies and irregularities. Information on the missing data and outliers are also given in this chapter.

#### **Respondents**

The survey link was opened 213 times in total. From these 213 openings, only 86 were filled in completely. Two additional surveys were filled in enough to use for further analysis because its unfilled answers were not used in the final model. Therefore, 88 respondents could potentially be used in further analysis. However, from these 88 potentially useful respondents, seven respondents could not be characterized as (semi)public sector, and thus these were excluded from the dataset. From the remaining 81 respondents, 18 respondents could be marked as redundant, or it was unclear for which organization they worked. For example, they described their employer as a “municipality” or a “local government.” The decision was made to leave these 18 responses in the dataset for multiple reasons. Firstly, because the overall dataset was already small, and more respondents are beneficial for more statistical power. Secondly, some of the respondents were not considered redundant anymore when investigating the organization in more detail. Because when the organization consisted of multiple independently operating departments and the responses came from the different departments, the respondents were left in the dataset. The different independent in that case departments could be considered as different organizations. Thirdly, responses were kept due to the dilemma of which of the two responses should be left in or be left out. Finally, three unclear responses were left in, because it seemed unlikely that these three unspecified respondents already represent one of the other 78 respondents organizations. Therefore, 81 responses were put in the final dataset.

The organizations represented by the respondents are diverse. It consists almost entirely of Dutch organizations. Global subjective grouping is performed to achieve an overview of the sectors the respondents represent. This global grouping, displayed in figure 2, indicates a fairly evenly distribution of the sectors.



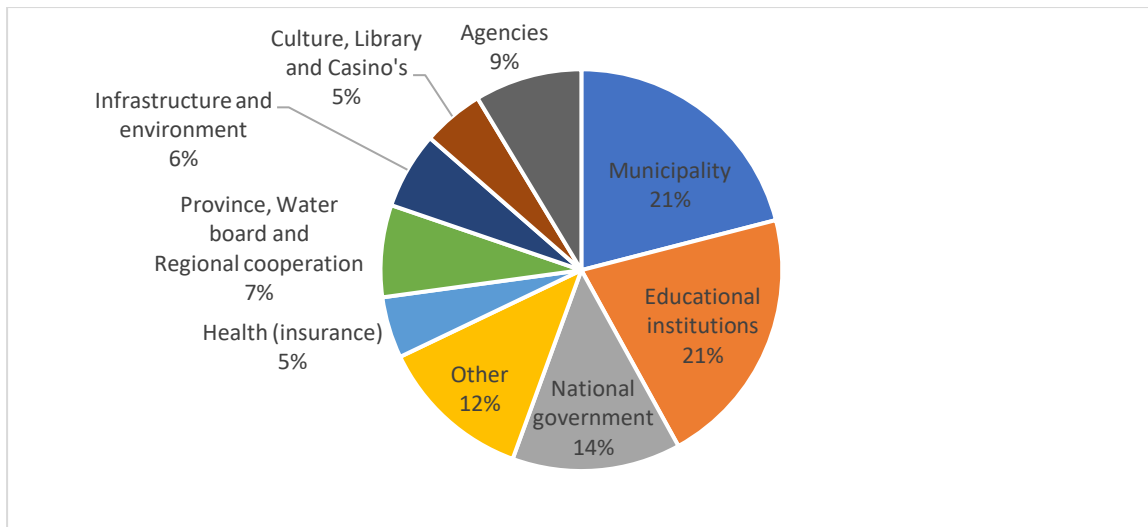


Figure 2 Sector distribution

### Missing values

As mentioned before, there are two respondents in the dataset with some missing values. These missing values do not have a relation with a construct in the final model. Therefore, the dataset used in the analysis could be considered as having no missing values.

### Outliers

Outliers are extreme values in the dataset; these values can occur accidentally and can affect the results. Outliers need to be indicated, analyzed, and possibly even deleted to ensure the results are valid.

No extremely large or small values on individual answers are identified in the dataset since all indicator values were measured with a Likert scale from 1 to 7. However, it would have been possible that a respondent answered all questions with the same value. A respondent with the same answer to all the questions could also be characterized as an extreme value. Reviewing the dataset brings to the conclusion that no respondents answered the same value for every indicator, and therefore, no outliers are indicated in the dataset.

## 4.2. Evaluation of Measurement Model

Before assessing the hypothesis with the PLS-SEM model, the measurement model needs to be validated. The validation of the measurement model takes place in two different stages. In the first stage, the reflective elements of the measurement model will be evaluated. In the second stage, the formative elements will be assessed.

### 4.2.1. Reflective Model

The reflective part of this model consists of latent variables with reflective indicators. Reflective indicators are highly correlated, interchangeable indicators. The reliability and validity of these indicators are examined to ensure that these indicators and variables can be used for further analysis.

Figure 3 shows the second-order model that is built for the validation of the measurement model. “Dynamic capabilities” and “Alignment competencies” are modeled as formative constructs in a second-order model. Consequently, the model in this form cannot be used for evaluating the structural model, but it can be used for evaluating the measurement model.

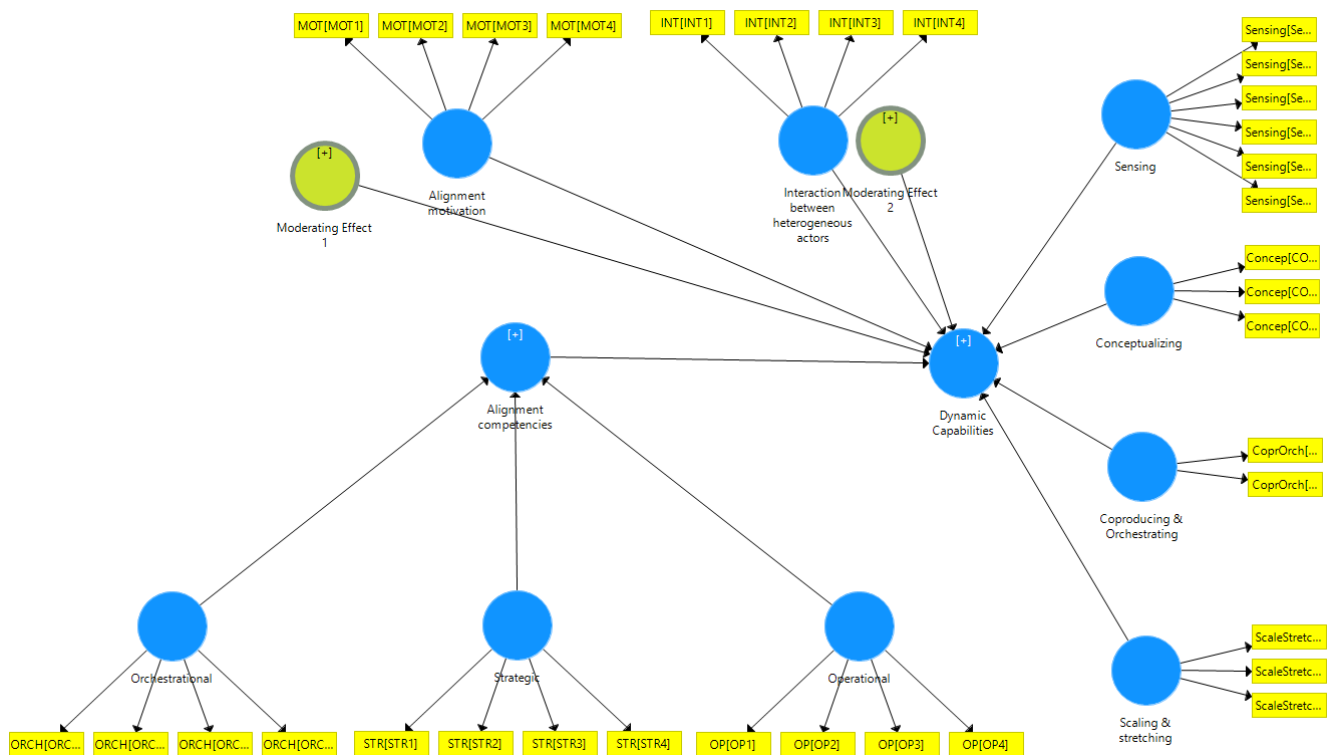


Figure 3 Measurement model in SmartPLS3

For the evaluation of the reflective part in the model, three checks need to be made according to (Hair et al., 2016): first, a check for internal consistency, secondly for convergent validity, and finally for discriminant validity.

#### Internal Consistency Reliability

The first check is for internal consistency reliability. The reliability of the internal consistency is essentially in reflective models because it tells if all interchangeable indicators of a construct represent that construct a similar way.

To measure the internal consistency reliability, traditionally, Cronbach's Alpha is used (Wong, 2013). However, currently, the "composite reliability" is more used. In this research, both are used and, to examine the results, the rules of thumb by (Hair et al., 2016). are applied. The PLS Algorithm in Smart PLS is utilized to calculate the Cronbach's Alpha and composite reliability. After running the PLS algorithm, a stop criterion check is performed to make sure the algorithm stopped due to converged data instead of the maximum iteration (Hair et al., 2016).

For Cronbach's alpha and composite reliability, the measured value theoretically varies between 0 and 1, where 0 means an unreliable internal consistency and 1 means perfectly reliable.

As a rule of thumb, values between 0.60 and 0.70 with both Cronbach's Alpha and the composite reliability are acceptable in exploratory research. While "[...] *in more advanced stages of research, values between 0.70 and 0.90 can be regarded as satisfactory*" (Hair et al., 2016, p. 97).

For the composite reliability, the ideal maximum value is 0.9, and the values above 0.95 are undesirable (Hair et al., 2016). The internal consistency of all reflective constructs in the model is above the minimum value of 0.7, as shown in table 2. Moreover, all reflective constructs in the model are below the undesirable maximum value of 0.95. However, seven of the nine constructs have a composite reliability value above 0.9, which can indicate that indicators measure the same phenomenon and, therefore, are not valid for measuring the construct (Hair et al., 2016). The construct "Alignment motivation" and "Orchestrational" have composite reliability near the critical value of 0.95.

Table 3 shows that removing indicators from the construct resulted in a decrease of the composite reliability, as well as a decrease of the Cronbach's Alpha. This decreasing of the Cronbach's Alpha value can be undesirable when it is decreasing too much. The removal of multiple indicators and the recalculation of the Cronbach's Alpha and Composite Reliability proved that removing [ORCH 4] and [MOT3] were the best indicators to be left out. Table 3 shows that all composite reliabilities are 0.934 or below.

### **Convergent validity**

The second check is for convergent validity. Convergent validity measures the positive correlations between indicators of the same reflective construct. Indicators of a reflective construct should share a high variance (Hair et al., 2016). Convergent validity can be assessed with the outer loadings of the indicators of a construct and with the average variance extracted (AVE). Hair et al. (2016) say that the AVE needs to be above 0.50 to assure convergent validity. As presented in table 2, the AVE values all are above 0.50, which indicates that all reflective indicators in this model are convergently valid.

However, the outer loading and the indicator reliability are below the threshold value of respectively 0.70 and 0.50. Despite these values, the indicators should not be deleted directly, but first, check their effect on the composite reliability, and the AVE are checked (Hair et al., 2016). After deleting Sensing1, Sensing2, and Sensing3, both Composite reliability and the AVE increases even as the outer loadings of the indicators Sensing4, Sensing5, and Sensing6, as shown in table 3. Despite the slightly exceeding of the ideal maximum of 0.9 of the composite reliability (0.903), the other effects to the model are all positive. Therefore, it is decided to delete these three indicators from the model.

### **Discriminant validity**

The third check is for discriminant validity. "*Discriminant validity is the extent to which a construct is truly distinct from other constructs by empirical standards*" (Hair et al., 2016, p. 99). It means that

the different constructs in the model are unique and represent different phenomena in the model. Discriminant validity can be evaluated by using multiple methods. There are three methods that can be used, according to Hair et al. (2016): Cross loadings, Fornell-Larker Criterion, and the Heterotrait-Monotrait Ratio (HTMT). However, Hair et al. (2016, p. 106) consider HTMT as a “... *more reliable criterion* ...” than the other two criteria. HTMT is, therefore, used as the criterium for the discriminant validity of the reflective constructs.

The threshold value where the HTMT of the constructs should be under is 0.9, according to (Hair et al., 2016). Table 1 shows that all the HTMT values are below 0.9; moreover, it is even below the more conservative value of 0.85 (Hair et al., 2016). Therefore it can be concluded that all the constructs are distinct from each other.

	1	2	3	4	5	6	7	8	9
Alignment motivation (1)									
Conceptualizing (2)	0.700								
Coproducing & Orchestrating (3)	0.545	0.688							
Interaction between heterogeneous actors (4)	0.792	0.630	0.676						
Operational (5)	0.555	0.665	0.538	0.670					
Orchestrational (6)	0.524	0.612	0.657	0.685	0.519				
Scaling & stretching(7)	0.266	0.566	0.509	0.453	0.415	0.317			
Sensing (8)	0.620	0.785	0.836	0.731	0.656	0.747	0.541		
Strategic (9)	0.583	0.679	0.726	0.786	0.706	0.813	0.425	0.739	

Table 1 Assessment of Discriminant validity with HTMT criterium

A bootstrapping is performed to ensure that the reflective constructs are also significantly distinct from each other. As presented in table 3, the HTMT 95% confidence interval does not include the value 1 at any of the constructs, which indicates that all the constructs are significantly discriminant valid.

Latent Variable	Indicators	Convergent validity			Internal Consistency reliability		Discriminant validity  HTMT confidence interval does not include 1
		Outer loading	Indicator reliability	AVE	Composite reliability	Cronbach's Alpha	
		>0.70	>0.50	>0.50	0.60-0.90	0.60-0.90	
Alignment motivation	MOT1	0.877	0.769	0.818	0.947	0.926	Yes
	MOT2	0.915	0.837				
	MOT3	0.920	0.846				
	MOT4	0.906	0.821				
Conceptualizing	Concep1	0.895	0.801	0.755	0.902	0.837	Yes
	Concep2	0.879	0.773				
	Concep3	0.832	0.692				
Coproducting & Orchestrating	CoprOrch1	0.898	0.806	0.828	0.906	0.793	Yes
	CoprOrch2	0.922	0.850				
Interaction between heterogeneous actors	INT1	0.876	0.767	0.702	0.904	0.858	Yes
	INT2	0.854	0.729				
	INT3	0.862	0.743				
	INT4	0.753	0.567				
Operational	OP1	0.824	0.679	0.649	0.880	0.819	Yes
	OP2	0.717	0.514				
	OP3	0.871	0.759				
	OP4	0.802	0.643				
Orchestrational	ORCH1	0.888	0.789	0.811	0.945	0.922	Yes
	ORCH2	0.846	0.716				
	ORCH3	0.925	0.856				
	ORCH4	0.940	0.884				
Scaling & stretching	ScaleStretch1	0.847	0.717	0.777	0.912	0.856	Yes
	ScaleStretch2	0.881	0.776				
	ScaleStretch3	0.914	0.835				
Sensing	Sensing1	0.688	0.473	0.525	0.866	0.815	Yes
	Sensing2	0.586	0.343				
	Sensing3	0.601	0.361				
	Sensing4	0.742	0.551				
	Sensing5	0.886	0.785				
	Sensing6	0.797	0.635				
Strategic	STR1	0.895	0.801	0.753	0.924	0.890	Yes
	STR2	0.852	0.726				
	STR3	0.875	0.766				
	STR4	0.847	0.717				

Table 2 Assessment reflective measurement model before removal

Latent Variable	Indicators	Convergent validity			Internal Consistency reliability		Discriminant validity  HTMT confidence interval doe not include 1
		Outer loading	Indicator reliability	AVE	Composite reliability	Cronbach's Alpha	
		>0.70	>0.50	>0.50	0.60-0.90	0.60-0.90	
Alignment motivation	MOT1	0.893	0.797	0.824	0.934	0.895	Yes
	MOT2	0.914	0.835				
	MOT4	0.916	0.839				
Conceptualizing	Concep1	0.895	0.801	0.755	0.902	0.837	Yes
	Concep2	0.881	0.776				
	Concep3	0.830	0.689				
Coproducting & Orchestrating	CoprOrch1	0.899	0.808	0.828	0.906	0.793	Yes
	CoprOrch2	0.921	0.848				
Interaction between heterogeneous actors	INT1	0.876	0.767	0.702	0.904	0.858	Yes
	INT2	0.856	0.733				
	INT3	0.863	0.745				
	INT4	0.748	0.56				
Operational	OP1	0.826	0.682	0.649	0.880	0.819	Yes
	OP2	0.719	0.517				
	OP3	0.870	0.757				
	OP4	0.800	0.640				
Orchestrational	ORCH1	0.888	0.789	0.800	0.923	0.874	Yes
	ORCH2	0.869	0.755				
	ORCH3	0.925	0.856				
Scaling & stretching	ScaleStretch1	0.850	0.723	0.777	0.912	0.856	Yes
	ScaleStretch2	0.880	0.774				
	ScaleStretch3	0.913	0.834				
Sensing	Sensing4	0.834	0.696	0.757	0.903	0.838	Yes
	Sensing5	0.939	0.882				
	Sensing6	0.832	0.692				
Strategic	STR1	0.896	0.803	0.753	0.924	0.890	Yes
	STR2	0.853	0.728				
	STR3	0.874	0.764				
	STR4	0.846	0.716				

Table 3 Assessment reflective measurement model after removal

## 4.2.2. Formative model

The second-order model in figure 3 of the chapter 4.2.1 has two formative constructs: “Alignment Competencies” and Dynamic Capabilities.” Figure 5 and figure 5 show these formative constructs. The construct “Alignment Capabilities” is built up of three indicators: Orchestrational, Strategic, and Operational. “Dynamic Capabilities” is built up of four constructs: Sensing, Conceptualizing, Coproducing & Orchestrating, and Scaling & stretching. The evaluation of the formative model is performed with two assessments: "collinearity" and "significance and relevance."

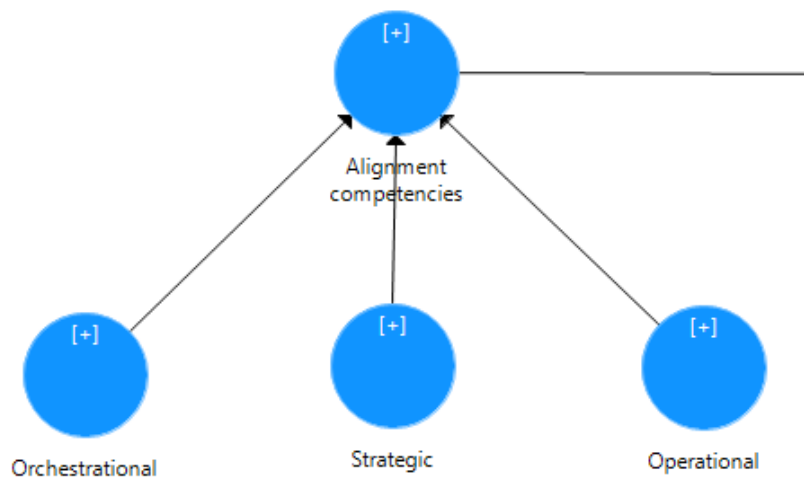


Figure 5 Indicators alignment competencies

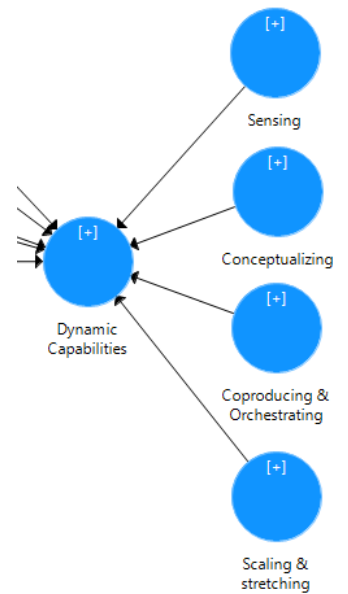


Figure 4 indicators Dynamic capabilities

### Collinearity issues

Formative modeled constructs do not have interchangeable indicators, contrary to the reflective modeled constructs. Therefore, a high correlation between the indicators of the formative construct is not expected and even problematic; this is addressed to as collinearity issues by (Hair et al., 2016).

The inner variance inflation factor (VIF) is analyzed to check for issues with collinearity in the formative model. According to (Hair et al., 2016), the critical collinearity threshold is five and above. Table 4 shows that all the values are below 3, so the collinearity does not reach any critical levels.

	Alignment Competencies	Dynamic Capabilities
Orchestrational	2.060	
Operational	1.595	
Strategic	2.641	
Sensing		2.898
Conceptualizing		2.564
Coproducing & orchestrating		2.248
Scaling & stretching		1.478

Table 4 Collinearity statistics (VIF)

### Significance and relevance

The next step in the evaluation of the formative constructs in the measurement models is the determination of significance and relevance. To determine the relevance of the constructs that form the indicators of the formative constructs, the outer loadings, and outer weights are analyzed. Bootstrapping is performed in Smart PLS 3 to determine the significance.

From the results presented in table 5, it can be concluded that with a confidence interval of 95%, two of the indicators of the formative constructs do not have a significant contribution to that construct. These indicators, “Coproducting & Orchestrating.” and “Scaling & stretching,” do not have a significant contribution to the formative construct “Dynamic Capabilities.” However, their outer loadings are respectively 0.782 and 0.862. Indicators with a non-significant outer weight, but with high outer loading (above 0.5) should be retained (Hair et al., 2016).

Formative Constructs	Formative indicators	Outer Weights (Outer Loadings)	t Value	p Value	Significance (p < 0.05)
Alignment Competencies	Operational	0.449 (0.877)	2.521	0.012	Yes
	Orchestrational	0.239 (0.799)	2.893	0.004	Yes
	Strategic	-0.063 (0.479)	2.322	0.020	Yes
Dynamic Capabilities	Conceptualizing	0.486 (0.917)	3.127	0.002	Yes
	Coproducting & Orchestrating	0.356 (0.782)	1.528	0.127	No
	Scaling & stretching	0.426 (0.862)	0.555	0.579	No
	Sensing	0.389 (0.912)	2.962	0.003	Yes

Table 5 Formative constructs out weights significance testing result



### 4.3. Evaluation of the structural model

After the evaluation of the structural model, the evaluation of the structural model is performed. The evaluation of the structural model assesses the effects and the significance of the relations in the model. It explains in which degree the independent variables in the model predict the dependent variable “Dynamic capabilities.”

For the evaluation of the structural model, it is necessary to use latent value for the construct “Dynamic capabilities” instead of the four different latent variables. In figure 6, four variables, “Sensing,” “Conceptualizing,” “Coproducting & Orchestrating,” and “Scaling & Stretching” are replaced with the latent value “Dynamic capabilities.” With this latent value, the distinction between the previous four formative indicators of dynamic capabilities and the constructs that affect the Dynamic capabilities are made.

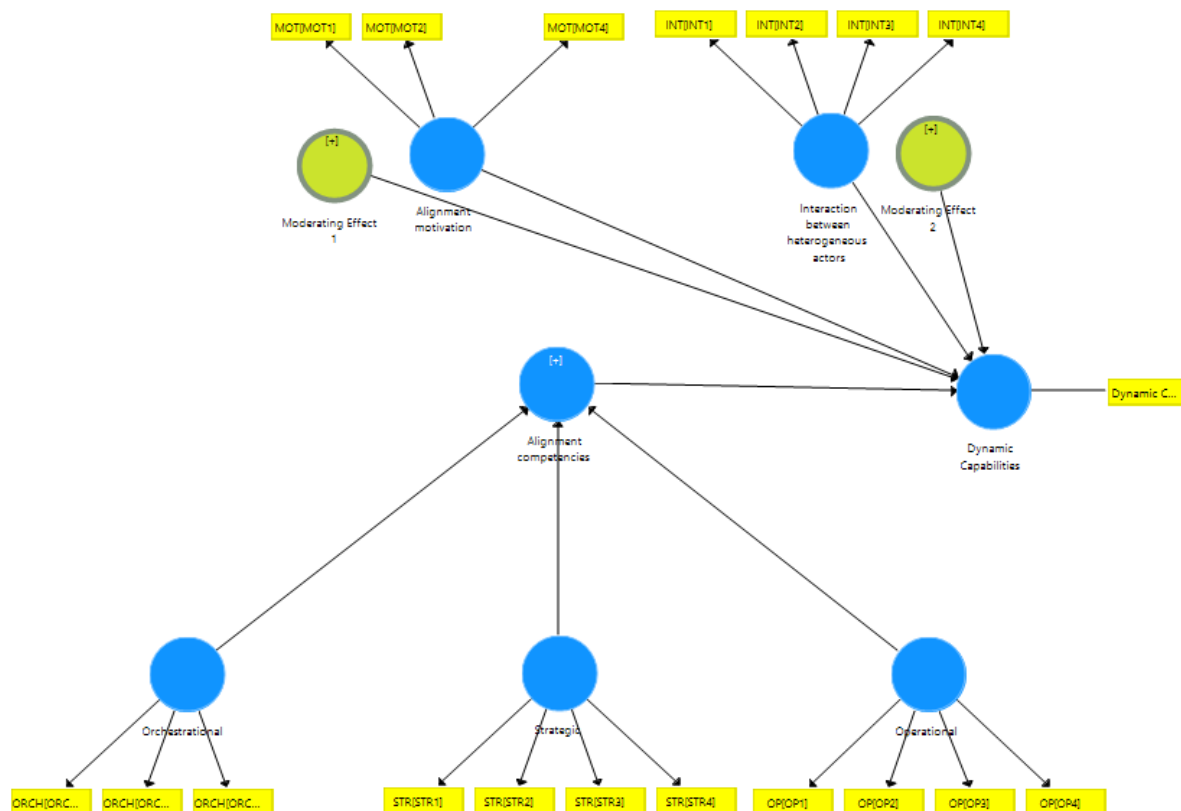


Figure 6 Structural model in SmartPLS3

#### Collinearity issues

The first step in the evaluation of the structural model, according to Hair et al. (2016) is the check for collinearity issues in the structural model. This assessment is performed similarly to the collinearity assessment in the measurement model. Checking the VIF values of the structural model are again all under the threshold of 5, and, therefore, there are no collinearity issues.

#### Predictability

Secondly, the predictability of the model is examined. The predictability of the model is how well the variables in the model predict the dependent variable “Dynamic capabilities.” The predictability of the model is assessed with the  $R^2$  and the  $f^2$ . The  $R^2$  is the total predictability of all the indicators. An  $R^2$  of zero means that “dynamic capabilities” cannot be predicted by the independent variables in the model. An  $R^2$  of 1, on the other hand, means that “dynamic capabilities” can be predicted 100%

perfectly with the independent variables, which is practically impossible. The  $f^2$  value is the relative predictability of a specific exogenous construct. It is determined by Smart PLS 3 by recalculating the  $R^2$  value without the specific construct. In this way, the effect of each independent variable is determined.

The  $R^2$  of dynamic capabilities in this model is 0.607; it can be described as moderately (0.5), according to the rules of thumb of Hair et al. (2016). The  $f^2$  values for the endogenous variable Dynamic capabilities are presented in table 6.

	$f^2$
Alignment Competencies	0.327
Alignment Motivation	0.053
Interaction between heterogeneous actors	0.002
Moderating effect 1 (motivation)	0.007
Moderating effect 2 (interaction)	0.028

Table 6  $f^2$  Values

The rules of thumb of hair et al. state that values of 0.02 are indicated as a small effect, 0.15 as a medium effect, and 0.35 as a large effect. The  $f^2$  results of the analysis indicate that all the constructs, except alignment competencies, have a small effect on the endogenous variable Dynamic capabilities. Alignment competencies (0.190) can be considered as a medium effect.

### Hypothesis testing

By analyzing the path coefficients, an impression can be given that independent variables influence the dependent variable. Table 7 shows a high value of the effect of alignment competencies on dynamic capabilities. The other effects are relatively small.

A bootstrapping with 10 000 samples is performed to test whether the effects of table 7 are significant. The results of this bootstrapping are also presented in table 7. These T-values and P-values indicate that only the direct effect from alignment competencies on dynamic capabilities is significant.

	Path Coeficients	T values	P Values	95% confidence interval	Significantly relevant? ( $p < 0.05$ )
Alignment competencies -> Dynamic Capabilities	0.538	4.914	0.000	[0.324, 0.755]	Yes
Alignment motivation -> Dynamic Capabilities	0.224	2.036	0.042	[0.015, 0.442]	Yes
Interaction between heterogeneous actors -> Dynamic Capabilities	0.057	0.369	0.712	[-0.267, 0.337]	No
Moderating Effect 1 -> Dynamic Capabilities	0.083	0.771	0.441	[-0.119, 0.301]	No
Moderating Effect 2 -> Dynamic Capabilities	-0.148	1.666	0.096	[-0.330, 0.021]	No

Table 7 Path coefficient statistics

Based on the above statistics, the following conclusions are made for the hypotheses:

	Hypothesis	Accepted
H1	Alignment competencies -> Dynamic Capabilities	Yes
H2	Moderating Effect of Alignment motivation -> Dynamic Capabilities	No
H3	Moderating Effect Interaction between heterogeneous actors -> Dynamic Capabilities	No

Table 8 Acceptation of hypothesis

### Predictive relevance $Q^2$ and effect size $q^2$

$Q^2$  measures the "... out-of-sample predictive power or predictive relevance." (Hair et al., 2016, p. 145). The  $Q^2$  from Dynamic capabilities was evaluated to assess how well the model can predict the endogenous variable. The  $q^2$  measures the relative effect size of a specific construct. To determine the  $q^2$  of a specific construct, the  $Q^2$  is recalculated without that specific construct.

The  $Q^2$  value of Dynamic capabilities (0.353) is above zero, which means that the path model has a predictive relevance (Hair et al., 2016).

q2 Assessment	
q2 Alignment competencies -> Dynamic capabilities	0.183
q2 Alignment Motivation (and moderator)-> Dynamic capabilities	-0.017
q2 Interaction between heterogeneous actors (and moderator)-> Dynamic capabilities	-0.040

Table 9  $q^2$  values

The rules of thumb of hair et al. are that  $q^2$  values can be assessed in the same way as  $f^2$  values: 0.02 can be interpreted as a small effect, 0.15 as a medium, and 0.35 as a large. Hence, based on the results in table 9, it can be concluded that the  $q^2$  value from Alignment competencies on Dynamic capabilities is medium. The other two effects are negative and, therefore, judged as negligible.

## 5. Discussion, conclusions, and recommendations

A preliminary study of (Walraven et al., 2018) described Co-evolutionary IS alignment (COISA) with a complex adaptive systems approach. In the follow-up qualitative study by (Walraven et al., 2019), the effects described in the COISA framework in hospitals were endorsed. This research tested the same effects at organizations in the public sector with a quantitative method.

### 5.1. Discussion – reflection

The collection of the responses was done via multiple methods. At first, people of the target audience in the researcher's networks were asked directly. Secondly, the targets were approached via a LinkedIn post, and the target audience was alerted to that post. Thirdly, snowballing was used by approaching people in the researcher's networks to ask their network to fill in the online survey. Lastly, the targets were approached by placing articles with calls to the survey in professional journals.

The most effective way of response collecting proved to be by a direct approach of people in the target audience. Data collecting took more time and effort than calculated in the beginning. In four weeks, only fifty respondents filled in the complete online survey. Fifty respondents do exceed the minimum of thirty that Baarda and de Goede (2006) prescribes, but a bigger sample size ensures more statistical power (Hair et al., 2016). Therefore, the period for data collection was extended with a few weeks. This extension resulted in just under 100 responses.

Not all respondents filled in the survey completely; this resulted in the exclusion of a few data points. Analyzing all the responses and the feedback that was given by people who prematurely stopped the online survey brought up two possible reasons for incomplete surveys. One reason could be the difficulty of the survey for it was not in the native language of most responders. The second reason could be that responders could not identify their organization with the financial questions. Some data points could still be used due since they only left out the financial questions. Unfortunately, at least one respondent said that he deleted his partly filled in survey when he ran into the financial part. When this survey is repeated, it should be taken into consideration to leave some financial questions out and to change the languages into the native languages of the responders.

Seven responses were kept out of the analyzed data because they were from organizations in the private sector. There is no further examination done with these responses because the research question was explicitly about organizations in the public sector.

Due to the diverse characteristics of the public sector, a lot of different types of organizations are among the results. The survey had no question about the size of the organization; hence there could be no filtering on that variable. Therefore, the dataset holds a lot of different data of organizations that differ in size between organizations with less than 50 people to organizations with around 10 000 people. The difference in size in the organization may also indicate a difference in complexity.

CAS is at the foundation of the COISA framework, and therefore, the diversity in the complexity of the organizations represented in the dataset could lead to wrong measurements. A respondent working for a small and relative non-complex organization would respond differently than a respondent in a large complex organization. Variety in the complexity possibly leads to different results. When the complexity of the organizations would be taken into account, this may alter the final conclusions of this research.

## 5.2. Conclusions

This research examined the effect of COISA on dynamic capabilities in the public sector. Consequently, the following research question was posited: What is the influence of co-evolutionary IS alignment on the dynamic capabilities of organizations in the public sector?

Three hypotheses were formed to answer the research question:

H1: Alignment competencies of an organization have a positive effect on the dynamic capabilities of that organization.

H2: Interconnections between heterogeneous employees moderates the effect of alignment competencies on dynamic capabilities.

H3: Alignment motivation moderates the effect of alignment competencies on dynamic capabilities.

The first hypothesis (H1) describes the direct effect between an organization's alignment competencies and its dynamic capabilities. Statistical analysis in this research endorses this hypothesis. This means that organizations in the public sector with better alignment competencies have more dynamical capabilities. Even more, it means that IS alignment not only has a positive effect on the dynamic capabilities of organizations in a competitive market; it has a comparable effect to organizations in the public sector as well.

Multiple researchers already studied this effect without the moderating effects. The effect is tested in different countries at different types of organizations. Hence this research endorses the positive relation between alignment competencies and dynamic capabilities.

For the other two hypotheses, however, there was in this study no significant proof. This means that the effect between alignment competencies and dynamic capabilities is not moderated by the two moderator variables, "alignment motivation" and "interaction between heterogeneous employees." Consequently, there is no proof for the significance of these variables as a moderator within COISA. This implies that the moderating variables in the COISA framework do not apply in organizations to the public sector.

The framework that is researched builds upon a co-evolutionary and complex systems approach of IT Alignment (Allen & Varga, 2006; Amarilli et al., 2016; Amarilli, Van Vliet, & Van den Hooff, 2017; Anderson, 1999). Rejecting the hypothesis with the moderating effects implies that the role of these effects as a moderator between alignment competencies and dynamic capabilities of organizations in the public sector is negligible.

Interaction between heterogeneous actors has no significant effect on the relationship between alignment competencies and dynamic capabilities in public organizations in this study. This means that intensify or lessen the interaction between actors in public organizations eventually has neither a positive nor a negative effect on the dynamic capabilities of that organization.

## 5.3. Recommendations for practice

There are recommendations for using this research in practice. The main question is: What do these conclusions mean for public organizations? As all organizations are unique in, for example, size and complexity, there is no blueprint for success.

The preliminary research described that dynamic capabilities give a competitive advantage and enable organizations to coop with fast-changing environments. While organizations in the public

organization may not act in a competitive market, one can also state that dynamic capabilities give an organization a better performance (Schwarz et al., 2010).

This research underlined the effect that an organization's alignment capabilities influence its dynamic capabilities. Thus, for an organization to obtain better dynamic capabilities, it is advisory to pay attention to its alignment capabilities. In this research, the alignment capabilities are divided into strategic, orchestrational, and operational. Those three factors are all three parts of the alignment capabilities of the organization.

In conclusion, for better dynamic capabilities, organizations must firstly have a strategy for the alignment between business and IT. Secondly, the alignment between business must be orchestrated in the organization and finally, end-users need to be involved in the alignment process.

While the moderating effects could not be proven, it should still be taken into consideration that interaction between employees can still affect the IS alignment, and therefore, the dynamic capabilities of an organization. Allen and Varga (2006) conclude that human actors are a crucial part of the IS in an organization and, therefore, can not be ignored. Therefore also the motivation should be taken into account in IS alignment in an organization.

#### 5.4. Recommendations for further research

There are recommendations for further research. The main question is: How can this study be positioned within the existing research? Compared to the study of Walraven et al., this research could not strengthen the moderating effect of alignment motivation and interconnections between employees. However, it could verify the relation between alignment competencies and dynamic capabilities.

In this research, the moderating effects could not be verified. A possible explanation is that the variance of organization size and complexity in the used dataset. The COISA framework has a complex adaptive systems approach that considers primarily medium to large complex organizations. Further research could focus on only those organizations which could be characterized as medium to large by introducing a minimum employee size.

Since "alignment motivation" and "interaction between heterogeneous employees" do not have a significant effect on the relationship between alignment competencies and dynamic capabilities, further research could focus on other causalities. It is imaginable that these two factors do affect certain factors within the COISA framework. For example, they could directly affect alignment competencies or indirectly via one or more of the formative constructs of alignment competencies.

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## Appendix I – Analyzed Papers

Author(s)	Title	Key words	Found by
<b>Amarilli, F., Van Vliet, M., &amp; Van Den Hooff, B. (2016)</b>	Business IT alignment through the lens of complexity science.	Business IT alignment, Strategic alignment, Complexity Science, Co-evolution	Snowballing
<b>Amarilli, F., Van Vliet, M., &amp; Van den Hooff, B. (2017)</b>	An explanatory study on the co-evolutionary mechanisms of business IT alignment.	Business-IT Alignment, Complexity theory, Co-evolution	Snowballing
<b>Allen, P. M., &amp; Varga, L. (2006)</b>	A co-Evolutionary Complex Systems Perspective on Information Systems.	complexity science, information systems, ontology, epistemology, axiology, agent-based modelling	Snowballing
<b>Anderson, P. (1999)</b>	Perspective: Complexity theory and organization science.	Complexity Theory, Organizational Evolution, Strategic Management	Snowballing
<b>Aversano, L., Grasso, C., &amp; Tortorella, M. (2012)</b>	A literature review of Business/IT Alignment Strategies.	measurement framework, evaluation and analysis, enterprise evolution, modelling, alignment	Snowballing
<b>Baker, J., Jones D., Cao Q &amp; Song J. (2011)</b>	Conceptualizing the dynamic strategic alignment competency	Dynamic Capabilities Framework, Strategic Alignment, Dynamic Capabilities, Competitive Advantage, Strategic IS Management, Fit.	Snowballing
<b>Benbya, H., &amp; McKelvey, B. (2006)</b>	Using coevolutionary and complexity theories to improve IS alignment: a multi-level approach.	information systems alignment, coevolution, complexity	Snowballing
<b>Chan, Y. E., &amp; Reich, B. H. (2007)</b>	IT alignment: what have we learned?	IT alignment, Alignment process	Snowballing
<b>Chan, Y.E., Sabherwal, R and Thatcher, J.B.</b>	Antecedents and Outcomes of Strategic IS Alignment: An Empirical Investigation	Academic institutions, antecedents of alignment, business strategy, information systems strategy, organizational characteristics, organizational performance, strategic alignment.	Snowballing
<b>Chen, H.-M. (2008)</b>	Towards service engineering: service orientation and business-IT alignment.	Business IT alignment management	Google Scholar: "Business-IT alignment dynamic capabilities"
<b>De Haes, S., &amp; Van Grembergen, W. (2009)</b>	An exploratory study into IT governance implementations and its impact on business/IT alignment.	IT governance, business/IT alignment, exploratory research	Snowballing
<b>Eisenhardt, K. M., &amp; Martin, J. A. (2000)</b>	Dynamic capabilities: what are they?	dynamic capabilities, competitive advantage, resource-based view, dynamic markets, resources, high-velocity markets, organization theory, organizational change	Snowballing

<b>Karadağ, H. (2019)</b>	Dynamic capabilities and entrepreneurial management: A review of selected works of David J. Teece.	Dynamic capabilities, Entrepreneurial management, Competitive advantage.	Snowballing
<b>Luftman, J., &amp; Brier, T. (1999)</b>	Achieving and sustaining business-IT alignment.	Business IT alignment, dynamic capabilities	Snowballing
<b>Luftman, J., Papp, R., &amp; Brier, T. (1999)</b>	Enablers and inhibitors of business-IT alignment.	Alignment of IT plans with business plans, IT strategic planning, IT management, information technology impact, organizational strategies, enabling and inhibiting activities.	Snowballing
<b>Schwarz, A., Kalika, M., Kefi, H., &amp; Schwarz, C. (2010)</b>	A dynamic capabilities approach to understanding the impact of IT-enabled businesses processes and IT-business alignment on the strategic and operational performance of the firm.	Alignment, IT-enabled business process, Resource-Based View, Dynamic Capabilities Theory	Scholar: “ Business-IT alignment dynamic capabilities”
<b>Sledgianowski D. and Luftman J. (2005)</b>	IT-business strategic alignment maturity: A case study	Strategic Alignment Maturity , IT Alignment, IT-business alignment	Snowballing
<b>Teece, D. J. (2007)</b>	Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance.	Cospecialization, intangible assets, innovation, business ecosystems, entrepreneurship, managerial capitalism, global competitiveness	Scholar: “ Dyanmic capabilities Performance”
<b>Teece, D. J., Pisano, G., &amp; Shuen, A. (1997)</b>	Dynamic capabilities and strategic management.	competences, capabilities, innovation, strategy, path dependency, knowledge assets	Snowballing
<b>Teece, D., &amp; Pisano, G. (1994)</b>	The Dynamic Capabilities of Firms: an Introduction.	Dynamic capabilities	
<b>Van Grembergen, W., De Haes, S., &amp; Guldentops, E. (2004)</b>	Structures, processes and relational mechanisms for IT governance.	IT Governance, strategic alignment, Business/IT Alignment	Scholar: “IT Governance”
<b>Walraven, P. (2019)</b>	Toward Assessment of Efficacious Dynamics in Co-evolutionary IS-alignment processes: The case of Electronic Medical Records.	COISA, Complex Adaptive Systems, IS alignment	Snowballing
<b>Walraven, P., van de Wetering, R., Helms, R., Versendaal, J., &amp; Caniëls, M. (2018)</b>	Co-evolutionary IS-alignment: a complex adaptive systems perspective.	Business-IT alignment, Complex Adaptive Systems, Co-evolutionary IS-alignment, Alignment processes	Snowballing
<b>Walraven, P., Van de Wetering, R., Versendaal, J., &amp; Caniëls, M. (2019)</b>	Using a co-evolutionary is-alignment approach to understand emr implementations.	Co-evolutionary IS-alignment (COISA), complexity science, Electronic medical records (EMR), hospitals.	Snowballing

<b>Wilden, R., Gudergan, S. P., Nielsen, B. B., &amp; Lings, I. (2013)</b>	Dynamic capabilities and performance: strategy, structure and environment.	dynamic capability, performance, competition, organizational structure, partial least square modeling, confirmatory tetrad analysis, contingency theory	Scholar: "Dynamic capabilities organization performance"
<b>Winter, S. G. (2003)</b>	Understanding dynamic capabilities.	dynamic capabilities, change, cost-benefit, problem solving	Scholar: "Dynamic capabilities"
<b>Yeow, A., Soh, C., &amp; Hansen, R. (2018)</b>	Aligning with new digital strategy: A dynamic capabilities approach.	Aligning, Dynamic capabilities, Digital strategy, Tension, B2C, ecommerce, IT Alignment	Snowballing

## Appendix II – Survey

### **Outcomes of Alignment Capabilities in the Public Sector**

First of all we would like to thank you for participating in this survey!

This survey is meant to assess alignment in the public sector, including for example governmental organizations and educational institutes.

In this survey, you will be asked to answer 17 closed ended questions. Completing the survey will take approximately 15 minutes of your time.

This survey is carried out as a part of a research from graduate students of the Open Universiteit. There are no right or wrong answers, we aim to assess your own views.

Participation is completely voluntary and results will be processed anonymously. If you have any questions or remarks in relation to this survey or our research generally, please contact the student that invited you to this survey.

There are 17 questions in this survey.

(\*mandatory)

1. \*Which organisation do you work for?
2. Please specify the business unit / department you work for.
3. \*What is your job title?
4. How long have you been working at your current organization? Please specify in months or

5. Please choose the appropriate response for each item:

- (1) Never
- (2) Way too infrequently
- (3) Too infrequently
- (4) Somewhat in line with frequencies of changes
- (5) Moderately in line with frequencies of changes
- (6) Mostly in line with frequencies of changes
- (7) Completely in line with frequencies of changes

- Our organization periodically performs strategic IT planning processes (e.g., prioritizing IT projects).
- Our organization frequently adjusts strategic goals to better adapt to changing conditions.
- Our organization continuously works on creating the right conditions to enable implementation of strategic goals in relation to IT (e.g., setting up program structures and creating roadmaps).
- When making strategic IT investment decisions, our organization actively considers strategic goals from different departments, roles, and perspectives.

6. Please choose the appropriate response for each item:

- (1) Never
- (2) Way too infrequently
- (3) Too infrequently
- (4) Somewhat in line with frequencies of changes
- (5) Moderately in line with frequencies of changes
- (6) Mostly in line with frequencies of changes
- (7) Completely in line with frequencies of changes

- Our organization continuously works on maintaining architectural principles and standards to guide systems development and maintenance projects.
- Our organization continuously works on maintaining overall coherence between different processes, roles, and IT components.
- When making architectural decisions, our organization actively considers coherence with strategic principles and goals.
- Our organization actively works on ensuring relevance and topicality of architectural practices, principles and standards and makes changes accordingly.

**Architectural principles**

*Architectural principles of the organization can be seen as the general rules and guidelines for IT within the organization.*

7. Please choose the appropriate response for each item:

(1) Never

(2) Way too infrequently to leverage any opportunities for improvement

(3) To the degree that we leverage some opportunities for improvement

(4) To the degree that we leverage a moderate amount of opportunities for improvement

(5) To the degree that we leverage a moderate amount of opportunities for improvement

(6) To the degree that we leverage a considerable amount of opportunities for improvement

(7) To the degree that we leverage (almost) all opportunities for improvement

- Overall, end users spend efforts in recommending changes to IT in use to better fit their works. Overall, end users spend efforts on changing their tasks so that these better fit the IT in use.
- Our organization continuously works on implementing and improving IT systems in operational settings to the degree that we leverage (almost) all opportunities for improvement.
- Our organization continuously evaluates implemented IT systems for alignment with business processes and working routines.

8. Please choose the appropriate response for each item:

- (1) Strongly disagree
- (2) Disagree
- (3) Somewhat disagree
- (4) Neither agree nor disagree
- (5) Somewhat agree
- (6) Agree
- (7) Strongly agree

- Our organization ensures adequate stakeholder participation in IT development and - improvement efforts.
- In our organization, IS/IT people and line people from various departments periodically attend cross-functional meetings.
- Our organization takes conscious action to improve informal connections across functions and departments.
- We have a dedicated platform where we share information across functions and departments, related to IT alignment efforts.

**IS/IT Alignment**

*To apply IT in an appropriate and timely way, in harmony with business strategies, goals and needs.*



9. Please choose the appropriate response for each item:

(1) Strongly disagree

(2) Disagree

(3) Somewhat disagree

(4) Neither agree nor disagree

(5) Somewhat agree

(6) Agree

(7) Strongly agree

- Our employees are intrinsically motivated to continuously leverage and improve IT initiatives.
- Generally, our employees are enthusiastic to contribute to IT initiatives.
- Our employees generally feel stimulated to engage in dialogues related to IT initiatives.
- Our employees have clear reasons to actively collaborate with other stakeholders on leveraging and improving IT initiatives.

10. Please choose the appropriate response for each item:

- (1) Very strongly disagree
- (2) Strongly disagree
- (3) Disagree
- (4) Neither agree nor disagree
- (5) Agree
- (6) Strongly agree
- (7) Very strongly agree

- We systematically observe and evaluate the needs of our customers.
- We analyze the actual use of our services.
- Our organization is strong in distinguishing different groups of users and market segments.
- Staying up-to-date with promising new services and technologies is important for our organization.
- In order to identify possibilities for new services, we use different information sources.
- We follow which technologies our competitors use.

**Customers**

*The group of people or entities where the organization does their activities for.*

**Services**

*A valuable action, deed, or effort performed to satisfy a need or to fulfill a demand.*

**Competitors**

*Comparable public organizations.*

11. Please choose the appropriate response for each item:

(1) Very strongly disagree

(2) Strongly disagree

(3) Disagree

(4) Neither agree nor disagree

(5) Agree

(6) Strongly agree

(7) Very strongly agree

- We are innovative in coming up with ideas for new service concepts.
- Our organization experiments with new service concepts.
- We align new service offerings with our current business and processes

**Services**

*A valuable action, deed, or effort performed to satisfy a need or to fulfill a demand.*

12. Please choose the appropriate response for each item:

- (1) Very strongly disagree
- (2) Strongly disagree
- (3) Disagree
- (4) Neither agree nor disagree
- (5) Agree
- (6) Strongly agree
- (7) Very strongly agree

- Collaboration with other organizations helps us in improving or introducing new services.
- Our organization is strong in coordinating service innovation activities involving several parties.

**Services**

*A valuable action, deed, or effort performed to satisfy a need or to fulfill a demand.*

13. Please choose the appropriate response for each item:

- (1) Very strongly disagree
- (2) Strongly disagree
- (3) Disagree
- (4) Neither agree nor disagree
- (5) Agree
- (6) Strongly agree
- (7) Very strongly agree

- In the development of new services, we take into account our branding strategy.
- Our organization is actively engaged in promoting its new services.
- We introduce new services by following our marketing plan.

**Services**

*A valuable action, deed, or effort performed to satisfy a need or to fulfill a demand.*

**Branding (strategy)**

*The process involved in creating a unique name and image for a product in the consumers' mind, mainly through advertising campaigns with a consistent theme. Branding aims to establish a significant and differentiated presence in the market that attracts and retains loyal customers.*

**Marketing plan**

*Product specific, market specific, or company-wide plan that describes activities involved in achieving specific marketing objectives within a set timeframe. A market plan begins with the identification (through market research) of specific customer needs and how the firm intends to fulfill them while generating an acceptable level of return. It generally includes analysis of the current market situation (opportunities and trends) and detailed action programs, budgets, sales forecasts, strategies, and projected (proforma) financial statements.*

14. Please choose the appropriate response for each item:

- (1) Very strongly disagree
- (2) Strongly disagree
- (3) Disagree
- (4) Neither agree nor disagree
- (5) Agree
- (6) Strongly agree
- (7) Very strongly agree

- Over the past 3 years, our financial performance has been outstanding.
- Over the past 3 years, our financial performance has exceeded comparable organizations.
- Over the past 3 years, we have been more profitable than comparable organizations.

*Profitable can also be read as cost efficient.*

15. Please choose the appropriate response for each item:

(1) Very strongly disagree

(2) Strongly disagree

(3) Disagree

(4) Neither agree nor disagree

(5) Agree

(6) Strongly agree

(7) Very strongly agree

- Customers perceive our organization's quality of services is better compared to other organizations in the same industry.
- Our organization has higher customer satisfaction compared to other organizations in the same industry.
- Our organization has better firm image compared to other organizations in the same industry.

**Customers**

*The group of people or entities where the organization does their activities for.*

16. Please choose the appropriate response for each item:

(1) Very strongly disagree

(2) Strongly disagree

(3) Disagree

(4) Neither agree nor disagree

(5) Agree

(6) Strongly agree

(7) Very strongly agree

- Our organization has better productivity improvements compared to other organizations in the same industry.
- Our organization has better timeline of customer service compared to other organizations in the same industry.
- Our organization has better production cycle time compared to other organizations in the same industry.



17. Please choose the appropriate response for each item:

- (1) Very strongly disagree
- (2) Strongly disagree
- (3) Disagree
- (4) Neither agree nor disagree
- (5) Agree
- (6) Strongly agree
- (7) Very strongly agree

- We use our Enterprise Architecture to identify new business and IT opportunities or potential threats.
- We use our EA to mobilize resources in line with a potential solution when we sense business and IT opportunities or potential threats.
- We successfully use our EA to adjust our business processes and the technology landscape in response to competitive strategic moves or market opportunities.
- Overall, we use EA in the process of proactively addressing the rapidly changing internal and external business environment.

**Enterprise Architecture**

*Design or 'blueprint' of a business that depicts the components of a firm employed in its operations, interrelationships of those components, information flows, and how each component supports the objectives or the strategy of the enterprise.*

**Resources**

*An economic or productive factor required to accomplish an activity, or as means to undertake an enterprise and achieve desired outcome. Three most basic resources are land, labor, and capital; other resources include energy, entrepreneurship, information, expertise, management, and time. (www.Businessdictionary.com)*

We thank you for participating in this survey. We appreciate the information that you provided. The data will contribute to the analysis in our research.

Many thanks.