LOW POWER SENSING AND TRACKING

SODAQ

MASTER THESIS

Digital Transformation

in conditions of pandemic

DARIA YAKUSHKINA

MSc Business Information Technology - IT Management and Enterprise Architecture
Faculty of Electrical Engineering, Mathematics & Computer Science (EEMCS)

SUPERVISORS

Dr. Ir. A. A. M. Spil, BMS, University of Twente
Dr. Maya Daneva, EEMCS, University of Twente

O. Smeenk, CEO, SODAQ B.V.

Yakushkina Daria

Student number: s1612956
E-mail: d.yakushkina@student.utwente.nl / daria.yakushkina@sodaq.com
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Supervisors
Dr. Ir. A. A. M. Spil - University of Twente
Dr. Maya Daneva - University of Twente
O. Smeenk, CEO - SODAQ B.V.

University of Twente

Business Information Technology
Faculty of Electrical Engineering, Mathematics and Computer Science
Drienerlolaan 5 7522 NB Enschede, The Netherlands

Abstract

In March 2020, the COVID-19 pandemic forced the Netherlands to apply a smart lockdown. In turn, businesses had to accelerate the transition to digital technology significantly. Despite the tremendous efforts and significant achievements of many enterprises, the pandemic exposed the many ways in which companies are vulnerable in the crisis situation. For many firms, the most important option to stimulate their businesses turned out to be the digital transformation. This means moving from active experimentation to active scale-up. Despite the enormous challenges that businesses face today, they realize that it is high time to act and focus on new strategies and principles to adapt to a changing environment.

This thesis is dedicated to the phenomenon of digital transformation in the time of pandemic. The goal of the thesis is to develop a model for a Dutch company, namely SODAQ B.V., to perform a digital transformation initiative in conditions of pandemic. This model is supposed to help SODAQ and other companies comparable to SODAQ, to go through the digital transformation process during a pandemic while openly facing some pandemic-context-specific challenges.

The digital transformation model has been developed based on literature sources and the author's professional experience in the context of the company SODAQ B.V. The usefulness and the usability of the model has then been evaluated by experts in the sector of Digital Transformation and the SODAQ management team. Based on the provided practitioners' feedback, a final revised version of the model has been presented in the thesis.

From the literature study the most significant result is a list of performance criterias consisting of 6 attributes as factors of pandemic: *speed (1), agility (2), efficiency (3), reliability (4), capability (5)* and *resilience (6)* that influence the digital transformation process in conditions of crisis. These six characteristics have been chosen based on how frequently they were mentioned in literature, how compelling the arguments for each attribute in the literature were and their relevance in the specific context of the company SODAQ B.V.

The main objective of this research is to design and evaluate a Transformational Model that can help companies to develop a strategy for digital transformation in conditions of pandemic and to perform it. To structure the research a Design Science Research Methodology (DSRM) is applied. Based on the results from performing a five-stage literature review and examination of a case study, the Model for Digital Transformation is assembled and validated in the context of the Data and Systems case at SODAQ B.V. Furthermore, two expert interviews carried out as part of the evaluation process corroborated that the effects produced by the artifact satisfy the main research objective of this thesis. At the same time, a series of improvements are suggested for the presented framework. Finally, conclusions are drawn, limitations are outlined and implications for practice and research are discussed.

Acknowledgements

"There is nothing more difficult to take in hand,
more perilous to conduct, or more uncertain in its success,
than to take the lead in the introduction of a new order of things."

– Niccolo Machiavelli

This thesis has been a once in a lifetime challenging experience of hard work within six months, including a lot of steep learning and intense preoccupation with new subjects at the intersection of the business world and the University of Twente.

There is a strong belief among fellow BIT master students suggesting that: during the first two months of the final project you have no idea what you are doing, during the third and the fourth months it becomes more and more clear and during the fifth and the sixth months you wish you had known from the very start what you should do, because now you know, but there is not enough time anymore to do everything you want to do. Now, looking back I absolutely agree with this understanding of my fellows. If I could have known from the beginning what the final result would be, the thesis path would have been more straight and easier to follow. Though, it is different from how the World works.

I thought about quitting this BIT thesis in the beginning of this year, after already successfully accomplishing another Master degree and taking into consideration all pros and cons of pandemics' influence on my education plan and the timeline.

I was almost certain that there was no way that I could graduate this year, or ever for that matter. I have started several dead-end projects within one company, and most of my data was inconsistent and did not support most of my hypotheses in the way I wanted them to be.

I felt stuck and trapped in my own life.

The irony was that I actually created this life for myself because I thought that getting two Master degrees was the road to a better life and a career that I would be passionate about. I finally summoned the courage to have "the talk" with my supervisors and clarify once and for all what I needed to do to graduate before the stated deadline. Whatever the cost.

I like to challenge myself and this is the reason why after graduating with a bachelor degree at a Russian University I made the decision to finalize my specialisation at University of Twente, here in the Netherlands.

Throughout the thesis writing process, I experienced a crisis of confidence. Suddenly, for a variety of different reasons, I lost faith in myself and had moments

when I felt I was simply not up to the task; it's beyond me. I almost believed that I had messed it up at this point, and I had convinced myself that I was not capable or worthy of the degree which I was working on. I am incredibly thankful to my supervisors Ton Spil and Maya Daneva for times of support and reassurance that were crucial and all I needed to get back on track and into the right mindset.

I also appreciate the UTwente counselling services for helping with visa extension, regulating financial support in conditions of pandemic and whatever problems I faced. I am thankful to my university psychologist - Caroline de Koning for stabilizing my mental health, my study advisor - Bibian Rosink for all the talks and advice she provided me with.

I'm endlessly thankful to my parents - Vladimir and Ekaterina - for providing me the opportunity of getting my degrees and their support with my education initiatives through the long way; and to my beloved little brother Fedor - for being my pure motivation to be the best version of myself.

My most sincere appreciation to my partner Simon for believing in me and motivating, providing comfort and safe space when I needed it the most, helping to overcome stress and anxiety and pushing me over my limits.

I would like to express my gratitude to Ollie Smeenk from SODAQ B.V. for considering my candidature to be a perfect match for account manager position and inspiring me to be one. I certainly enjoyed my time being a part of a big and innovative company and hope to be a great employee as well.

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List of Acronyms

DEMIN	Digitally-Enabled Multinational Inner Network
DS	Design Science
DSP	Digital Service Platform
DSRM	Design Science Methodology
DT	Digital Transformation
EA	Enterprise Architecture
IS	Information System
IT	Information Technology
TAR	Technical Action Research
TM	Transformation Model

1 Introduction

1.1 Problem Statement

The Covid-19 outbreak reminded us how fragile our societies, businesses, and lives are. It turned things upside down in a matter of weeks. It required governments to provide dramatic emergency support. It forced people to enter self-isolation to protect themselves and others. It pushed organizations to reimagine how they do business and how they would survive. There are many lessons learned from this global pandemic. Several will require you and your organization to go through significant and, possibly, lasting changes. (Vargas, 2020)

Examples of crisis-driven innovation are happening all over the world, not just in labs but also in homes and offices. Children have shifted to homeschooling and adults to remote working. Fashion brands have produced medical clothes, and car companies have built hospital ventilators. These feats of imagination and effort show us what we are capable of in times of hardship. (Callesen, 2020)

The economic shock of the coronavirus pandemic has accelerated several pre existing trends while also giving rise to entirely new ones. In the face of such rapid change, executives are piecing together the future landscape of value and the new rules of competitive advantage. New value shifts are being driven by shifting customer needs and behaviours on the demand side, increased value chain uncertainty on the supply side, and a reversal of many of the trends that have defined pre-pandemic globalization. Competitive positions, likewise, are more vulnerable during such shifts, spelling out both promise and peril for executives. Variously referred to as “the new normal,” “the big reset,” and with other such elaborate monikers, the emerging landscape will be characterized by the emergence of new value pools and the erosion of existing ones. (Choudary, 2020)

The pandemic is like a stress test to past digital transformation efforts and bears learnings on how well companies have digitally transformed. (Frankenberger et al., 2020)

At the onset of the global pandemic, there was a sudden and accelerated need for organizations to transform and respond to an unprecedented change in their business and customer behaviours. Many businesses had to be completely rewired to enable employees to work from home and largely support online-only channels for their customers. This new wave of change required even further digitization of supply chains, business processes, workforce collaboration, and customer service. (Palermo, 2020)

1.2 Research Context and Motivation

Digital Transformation (DT) is a concept we hear often these days. Generally, DT is about adopting disruptive technologies to increase productivity, value creation, and social welfare (Ebert and Duarte, 2018). Leaders across industries are adopting DT strategies and innovative solutions to improve the way companies work and develop. As an enabler DT combines strategy and smart technologies to enable companies to remain competitive in this rapidly changing marketplace. Firms that have undergone digital transformation are likely to have a better chance of performing better amidst the pandemic as they are more capable of maintaining some degree of operation and revenue stream for their businesses (Ding et al., 2020).

The digital challenge we face now is *how to transform business in the midst of a crisis*. The crisis mentioned here is the crisis caused by global pandemics. The business has to adjust to new environments and regulations. The Coronavirus (COVID-19) pandemic is a living case to prove how technology can make substantial improvements (AlHinai, 2020).

Digital technologies are creating transparency into what does and does not work inside companies. It is not possible to survive on hard work and some combination of hope or life, you have to design a seamless company that learns and responds to the constantly changing customer domain.

It was unknown to what extent the global pandemic would accelerate the emergence. Addressing the opportunities and challenges of DT has become truly urgent. The particular challenge that needs to be explored in this master thesis project is what is happening as a result of digital transformation in conditions of the pandemic.

1.3 Research Objectives

The high-level goal of this research is to provide a transformation model framework. In general, this framework's concepts comprise organizational design elements - people, processes, and technology as aspects of strategy. In line with this, the high-level goal of our research is translated into the following central research question that we will answer:

How can organizations achieve successful Digital Transformation in conditions of the pandemic?

The main research objective we set out for this thesis is:

To deliver a transformation model that helps companies to perform Digital Transformation in conditions of pandemic

Furthermore, the central research question is further decomposed into the following objectives/sub-research questions:

Research Objective 1 (RO1):

- to investigate the suitability and the feasibility of Digital Transformation as an approach for business adaptation during a pandemic, according to published literature;

RQ 1: What are the challenges for digital transformation caused by pandemics?
RQ2: Which model to follow if an organization wants to proceed with digital transformation in conditions of the pandemic?

Research Objective 2 (RO2):

- to compare existing methods for Digital Transformation by analyzing their weak and strong sides;

RQ3: What existing methods are there for Digital Transformation, according to published literature?
RQ4: What are the strong and weak sides of these proposed solutions, according to published literature?

Research Objective 3 (RO3):

- to design a transformational method/model to perform Digital Transformation for SODAQ in conditions of the pandemic;

RQ5: What are the components of a model that can guide SODAQ in the DT process?
RQ6: Is the proposed model useful to its users at SODAQ?
RQ7: Is the proposed model usable by the SODAQ Employees involved in DT?

We make the note that RQ1,RQ2,RQ3 and RQ4 are knowledge questions and will be answered by using secondary sources (publications by other authors), while RQ5, RQ6 and RQ7 are empirical questions and will be answered by designing an artefact that fits the context of a Dutch company (SODAQ) and the empirical evaluation of this artefact regarding its usefulness and usability (Wieringa, 2014).

1.4 Research Methodology

This research adheres to the Design Science Research Methodology (DSRM) for research in the Information System (IS) field as defined by Peffers et al. (2007). Figure 1 depicts the general process prescribed by the method to present and evaluate design science research in IS. In line with the intentions of this research, the process is composed of the following six steps:

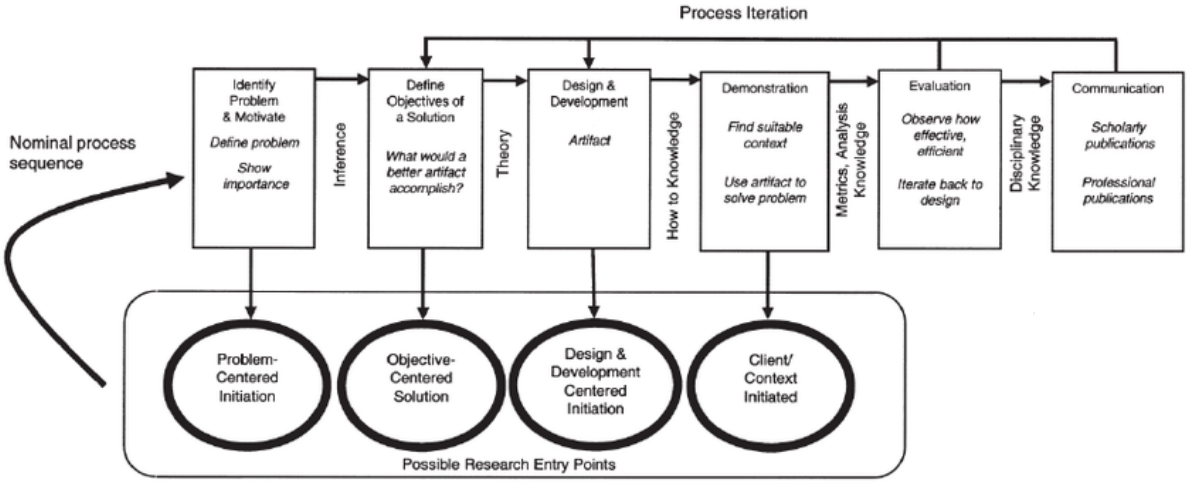

Figure 1. Design science research methodology process model (Peffers et al., 2007)

1. **Problem identification and motivation:** The main problem is identified and the motivation to develop the research is justified. A literature review is performed at this stage, focused not just to aggregate all the existing content for the research question and objectives, but to support the development of evidence-based guidelines for practitioners (Kitchenham et al. 2009).

2. **Define the objectives for a solution:** The main research objectives are defined to provide an artifact that treats the problem identified in the first phase. This refers to the definition of requirements and expectations to be met by the artifact to be assembled.

3. **Design and development:** The activity includes the development of the Transformation Model reference for successful Digital Transformations. Findings from the SLR as well as the analysis of a case study contribute to the formation of requirements to be considered in the artifact design.

4. **Demonstration and Evaluation**: A Digital Transformation at SODAQ B.V. sets a practical environment in which the model is applied. Under those circumstances, a Technical Action Research methodology (TAR) is employed. As part of the evaluation section, semi-structured interviews are carried out through an expert opinion process to evaluate the designed artifact.

5. **Communication:** This thesis report serves as a vehicle of communication of the conclusions from designing, demonstrating, and evaluating the proposed framework in a real-world scenario.

1.5 Thesis structure

The remaining chapters of the thesis are structured as follows: in the next chapters, we review the literature to understand the state of the problem (problem identification), we identify the objectives of a solution, we explicate the

design of a design science research process, we demonstrate the use of the process in a validation case in which we develop a model for digital transformation, where the case study is also structured following the design science research process (demonstration), and lastly, we evaluate the process in terms of the objectives of our study (evaluation) and conclude (Peffers, 2007).

The structure of the thesis document is presented in Table 1. The first column represents the thesis chapters. The second column shows the design science phase to which the information of each chapter corresponds. For each DSRM phase, the respective research methods are given. The research questions that were already stated in section 1.3, are distributed among the chapters (see the rightmost column of Table 1).

Table 1. Thesis structure

Thesis chapter	DSRM phase	Research Method	Research Questions
1. Introduction	Problem identification & motivation	-	-
2. Background & context	Problem identification & motivation	Peffers (2007)	-
3. Literature review	Problem identification & motivation	Wolfswinkel (2013)	RQ1, RQ2, RQ3, RQ4
4. Artifact Design	Objectives for a solution	Novilus framework (Archimate)	RQ5, RQ6
		SL-07 requirements	
		Framework for IS/IT strategy formulation & planning	
5. Evaluation	Evaluation	TAR	RQ7
6. Conclusions & Recommandations	Communication	-	-

1.6 Practical and Scientific Relevance

The research is relevant from two perspectives: practitioners' and researchers' perspectives. This is described more in detail in the next subsections.

1.6.1 Practical relevance

Industry-leading research and surveys have shown that organizations that have adopted best practices to embark on Digital Transformation initiatives are more likely to succeed than those who did not (McKinsey & Company, 2018). The digital transformation model and development method, as presented in this research,

are meant to assist organizations to perform Digital Transformation in conditions of pandemic. With the model proposed in this thesis, practitioners would have a map that would inform them about what to consider in their DT initiative. Practitioners might adopt or adapt this map based on their own context. Clearly, the decision on how much of our proposal model to adapt is contingent on the similarity of contexts between SODAQ, the company for which the model is originally developed, and the context of any other organization. As we will see later in this thesis, the proposed model could possibly be a good candidate for adoption in any other Dutch organization that is different yet similar to SODAQ in terms of contextual settings.

1.6.2 Scientific relevance

Due to its high value in conditions of crisis, several IS research schools and individual scholars were focused on providing a more effective and comprehensive model to organizations with different sets of essential elements for successful digital transformation. However, to the best of our knowledge there has not been much progress in updating traditional approaches. This research analyzes, compiles, and integrates methodologies from selected publications and proposes a new set of attributes for Digital Transformation and validates their suitability and usefulness on a case. To sum up, the thesis makes two contributions of scientific relevance: first, we contribute to knowledge by proposing a framework that includes elements combined in a way that evaded so far the attention of scholars. This new framework was evaluated by means of experts' opinions regarding its usefulness and usability. Second, we contribute a case of a real-world organization and a demonstration of how the framework and the model actually work. This increases the realism of our proposed artefact. Of course, we openly make the note that follow-up research would be needed to increase its generalizability to other similar but different contexts.

2 Background and Context

This section provides background information about the case study company SODAQ B.V. and its motivation for digital transformation. SODAQ provides the context in which this master research project takes place.

2.1 Case Study Company

From The Netherlands to Australia, and from Peru to Sri Lanka, SODAQ's scalable electronic solutions are used all over the world. The company specializes in the environmental Internet of Things. That means they design and create solutions to connect things outdoors by harnessing the power of the sun. They aim to create a smarter environment that can sense what's going on and tell us how to make better decisions.

- **SODAQ design** and build solutions in projects for large corporate Internet of Things departments and manufacture products for companies who want to deploy tracking and sensing devices in their logistics chain.

- **SODAQ aims** to serve as the extension of the IoT departments of individual corporations. The company works with corporations who actively engage with IoT technology throughout their chain of logistics and operational processes.

- **SODAQ has experience** in a wide range of industries and is able to offer individualised solutions and support for the development of IoT hardware and software: subcontract the development process, realisation of ideas into feasible projects and support functions.

2.2 SODAQ Motivation

Currently, SODAQ has an extended IT landscape (see Figure 2) with many internal systems supporting different business processes within the company. Many data objects are created at different stages of one process and some information valuable as input is cross-correlated between these different stages. Systems are not directly connected and file transfer is hardly possible.

Brown and blue boxes represent systems that should be included in an integrated IT landscape. Brown boxes stay for existing systems and blue boxes are systems needed to be implemented. Arrows between systems are interactions: it might be data created or an operation made. The direction of an arrow shows the flow.

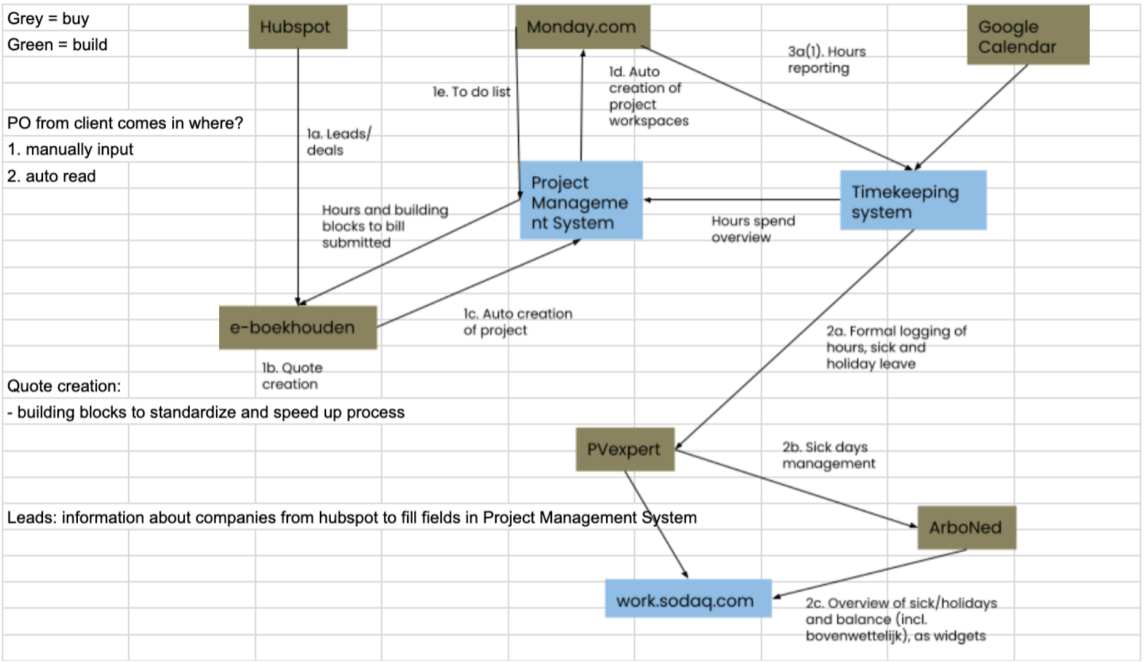

Figure 2. SODAQ IT landscape

These internal systems have been developed by different vendors and at different times. In turn, they do not share the data used in the support of the business processes. Many systems have unique data formatting requirements, which makes the transfer of information between systems hard. There are manual interfaces between several systems, which keeps employees busy in assuring the correct flow of data from one system to another. Some of these systems form "islands of technology" which makes it hard to establish fully integrated business processes across the company.

To reduce the diversity of applications in support of its business processes, SODAQ considers implementing an Enterprise Resource Planning (ERP) solution and in particular, the Project Management System of a leading ERP vendor. To this end, the company started an Enterprise Application Integration exercise which included:

1. documenting their business processes and their data objects;
2. established a mapping between the components of the business processes and the supporting systems as well as a mapping between the data objects and the systems that create, receive, update or delete data pieces of each data object.

3 Literature Review

3.1 Literature Review Methodology

To explore the concepts "Digital transformation" AND "Pandemic" AND "Business agility" the five-stage grounded-theory method for reviewing the literature of Wolfswinkel, Furtmueller, and Wilderom (2013) is used as the first stage. The method consists of five stages: define, search, select, analyze, and present. Results of applying this technique provided a list of articles relevant to the research topics represented in table 1 and table 2.

To provide a complete report, additional literature sources were added based on different factors. One of them is including recommendations of experienced researchers to fulfill a theoretical framework with a traditional approach and earlier published articles. Annual reports made by leading consulting professionals were included on behalf of data collection and analysis of current situations. Extra articles were found through references of basis search as authors did not include all required keywords.

Define & Search

The scope of this paper is confined to the concepts of "Digital transformation" AND "Pandemic", which were also the search terms in Scopus and Scholar (See figure 1: Flowchart of the selection process).

First search in Scopus: "Digital transformation" AND "Pandemic" AND "Business Agility". The second search in Scopus: "Digital transformation" AND "Pandemic" AND "Crisis".

Existing literature was selected within the domains of business, management, and accounting; computer science; social sciences; decision sciences; engineering; economics, econometrics, and finance. The concepts and domains were defined and found, as a result of the iterative process.

Select

The articles were selected based on the sample iteration process according to Wolfwinkel et al. (2013). This process includes double iteration with different keywords mentioned in the previous part.

Analyze

After a profound analysis, related concepts were discovered and refined into sub-categories, either called axial coding (Wolfswinkel et al., 2013). Literature was analyzed until the saturation of value propositions, properties, or interesting links arose. Saturation is requisite for a convincing, representative, theory-based, and forward-looking review (Wolfswinkel et al., 2013).

Table 2. Result of basis analysis of the selected literature sources V1

Author(s)	Title	Year of publication	Publisher
Ding, D., Guan, C., Chan, C.M.L., Liu, W.	Building stock market resilience through digital transformation: using Google trends to analyze the impact of COVID-19 pandemic	2020	Frontiers of Business Research in China
Carvalhaes, T., Markolf, S., Helmrich, A., Kim, Y., Li, R., Natarajan, M., Bondank, E., Ahmad, N., Chester, M.	COVID-19 as a Harbinger of Transforming Infrastructure Resilience	2020	Frontiers in Built Environment
Hamilton, J.	The strategic change matrix and business sustainability across COVID-19	2020	Sustainability (Switzerland)
Rapaccini, M., Saccani, N., Kowalkowski, C., Paiola, M., Adrodegari, F.	Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms	2020	Industrial Marketing Management
Ivanov, D.	Viable supply chain model: integrating agility, resilience & sustainability perspectives — lessons from and thinking beyond the COVID-19 pandemic	2020	Annals of Operations Research
Kamal, M.M.	The triple-edged sword of COVID-19: understanding the use of digital technologies and the impact of productive, disruptive, and destructive nature of the pandemic	2020	Information Systems Management
Doyle, R., Conboy, K.	The role of IS in the covid-19 pandemic: A liquid-modern perspective	2020	International Journal of Information Management
Chowdhury, M.T., Sarkar, A., Paul, S.K., Moktadir, M.A.	A case study on strategies to deal with the impacts of COVID-19 pandemic in the food and beverage industry	2020	Operations Management Research

Table 3. Result of basis analysis of the selected literature sources V2

Author(s)	Title	Year of publication	Publisher
van Fenema, P.C., Romme, A.G.L.	Latent organizing for responding to emergencies: foundations for research	2020	Journal of Organization Design
Fonseca, L.M., Azevedo, A.L.	COVID-19: Outcomes for Global Supply Chains	2020	Management and Marketing
Ahmed, R.R., Streimikiene, D., Rolle, J.-A., Duc, P.A.	The COVID-19 pandemic and the antecedents for the impulse buying behaviour of US citizens	2020	Journal of Competitiveness
Juergensen, J., Guimón, J., Narula, R.	European SMEs amidst the COVID-19 crisis: assessing impact and policy responses	2020	Journal of Industrial and Business Economics
Kim, R.Y.	The Impact of COVID-19 on Consumers: Preparing for Digital Sales	2020	IEEE Engineering Management Review
Quayson, M., Bai, C., Osei, V.	Digital Inclusion for Resilient Post-COVID-19 Supply Chains: Smallholder Farmer Perspectives	2020	IEEE Engineering Management Review
Rapaccini, M., Saccani, N., Kowalkowski, C., Paiola, M., Adrodegari, F.	Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms	2020	Industrial Marketing Management
Gurbuz, I.B., Ozkan, G.	Transform or Perish: Preparing the Business for a Post Pandemic Future	2020	IEEE Engineering Management Review
Amadi-Echendu, J., Thopil, G.A.	Resilience Is Paramount for Managing Socio-Technological Systems during and Post-Covid-19	2020	IEEE Engineering Management Review
van Barneveld, K., Quinlan, M., Kriesler, P., Junor, A., Baum, F.	The COVID-19 pandemic: Lessons on building more equal and sustainable societies	2020	Economic and Labour Relations Review
Fisch, F., Fleury, A.	Towards the digitally-enabled multinational inner network (DEMIN)	2020	Gestao e Producao
Akpan, I.J., Udoh, E.A.P., Adebisi, B.	Small business awareness and adoption of state-of-the-art technologies in emerging and developing markets, and lessons from the COVID-19 pandemic	2020	Journal of Small Business and Entrepreneurship

3.2 Problem identification and motivation

Digital Transformation is a phrase we hear often these days. Leaders across industries are adopting DT strategies and innovative solutions to improve the way companies work and develop. As an enabler digital transformation combines strategy and smart technologies to enable companies to remain competitive in this rapidly changing marketplace. Firms that have undergone digital transformation are likely to have a better chance of performing better amidst the pandemic as they are more capable of maintaining some degree of operation and revenue stream for their businesses (Ding et al., 2020).

The digital challenge - *how to transform business in a crisis*. The crisis mentioned here is the crisis caused by global pandemics. The business has to adjust to new environments and regulations. The Coronavirus (COVID-19) pandemic is a living case to prove how technology can make substantial improvements (AlHinai, 2020).

Digital technologies are creating transparency into what does and does not work inside companies. It is not possible to survive on hard work and some combination of hope or life, you have to design a seamless company that learns and responds to the constantly changing customer domain.

It was not known the extent to which the global pandemic would accelerate the emergence. Addressing the opportunities and challenges of digital has become truly urgent. The particular challenge that needs to be explored here is what is happening as a result of digital transformation in conditions of the pandemic.

3.3 Performance criteria for Digital Transformation

Digital transformation is the integration of digital technology into all areas of business, fundamentally changing how organizations operate and deliver value to customers. It can be seen as an accelerating transformation concerning models, processes, competencies, and business activities, to gain competitive advantages (Ilter, 2019).

Digital transformation is defined as the changes a firm goes through as it starts to use digital technologies to develop a new digitally-enabled business model to create and appropriate more value for the firm (Kane et al. 2019; Liu et al. 2011; Schallmo et al. 2017). Thus, firms that have undergone digital transformation are likely to have a better chance of performing better amidst the pandemic as they are more capable of maintaining some degree of operation and revenue stream for their businesses (Ding et al., 2020).

Two digital strategies provide direction for managing digital transformation: customer engagement and digitized solutions. Operational backbone and digital

service platform are two technology-enabled assets that are essential for executing those strategies (Sebastian et al., 2017).

Digital strategy - a business strategy inspired by the capabilities of powerful, readily accessible technologies (like SMACIT), intent on delivering unique, integrated business capabilities in ways that are responsive to constantly changing market conditions (Sebastian et al., 2017).

In May 2020, AppDynamics conducted a survey, in which 1000 IT professionals took part. According to the results of the study, the "Report on Transformation Agents" was presented, which provides such data:

- 81% of respondents consider the pandemic to be the cause of the highest technical load in the history of their companies;
- 64% perform tasks that they have not previously encountered.

These numbers explain the dramatic acceleration in digitalization. In 74% of organizations, transformational projects were approved (and in 71% of cases even implemented) in a matter of weeks, versus the usual months or years.

The research finds that technologists are experiencing pressures from all sides, accelerating digital transformation projects, mobilizing huge sections of the workforce to operate from home, while at the same time needing to manage their network and maintain security throughout the technology stack (Slade, 2020).

Both structures and processes have changed and priorities have radically shifted, with individual roles and responsibilities having to adapt to meet them. These are conditions for digital transformation in conditions of the pandemic, in "new normality", where urgency is a key factor for adaptation.

The digital part is not new, but the acceleration part is crucial. This is about the urgent adoption of established patterns, many of them digital, but also patterns of psychology, organization, and governance (Howard, 2020).

The COVID-19 pandemic has presented a new set of challenges to fight the pandemic with digital transformation (Rabello, 2020). To build a correct multifunctional e-strategy, factors for change implementation and enterprise adaptation were defined based on literature findings. They are represented in table 4 answering the R1 of this research.

Table 4. Challenges for digital transformation in conditions of pandemic

Speed	Organizations are urgently having to adapt their go-to-market strategies, as well as create and launch new digital services and applications in the current environment. As a result, technologists are being asked to deliver major transformation projects in previously unthinkable timeframes – all the while ensuring flawless customer experience. Preparing for speed is not so much a methodology or a process. It's a mindset (Brayan, 2020).
	A pandemic is a crisis where the speed of response is justifiably vital. It may also be the catalyst for 'an even faster adoption of activities relying on digital' (Arner et al., 2020).
	From the viewpoint of Covid-19's disruptive nature, its impact has compelled rapid transformation in business processes and operational practices have now significantly grown in speed, as compared to the glacial implementation during the pre-Covid-19 era (Bartik et al., 2020; Watermeyer et al., 2020).
Mobilizing a Remote Workforce	Large sections of the workforce have suddenly found themselves working at home, without the connectivity, devices, and software to be effective, and often lacking the skills and knowledge to resolve simple issues. And it has fallen to the IT department to tackle this problem (Kamal, 2020).
	Developing and managing remote business operations and activities, in situations where direct contact is difficult or restricted, such as during the community lockdown to curtail the spread of COVID-19 (Akpan et al., 2020).
	Implementation of a remote workforce approach during COVID-19 to ensure its essential top-tier employees remained to maintain its rapid-response brand image (Hamilton, 2020).
Weak Productivity	Consider how an increased proportion of remote working will affect overall productivity. The cost of operating in a socially distanced world will increase costs, requiring significant reengineering to return to pre-COVID productivity (Panetta, 2020).
	The current pandemic has drastically altered the course of productivity across many different sectors and businesses (Kamal, 2020).
The Urgent Need for Agents of Transformation	As organizations prioritize digital experiences for both internal users and external customers, they must recognize the critical role of technologists in responding to the current crisis. (Doyle, 2020).
Resilience	Governments and businesses can confront the challenges imposed by the pandemic by learning about resilience (Howell, 2020).
	The principles of resilience are paramount for sustainable management of socio-technological systems, and more so in a post-Covid-19 world (Amadi-Echendu et al., 2020).

Enterprises need to remain competitive in a changing business environment, be able to tackle current economic, technological, political, regulatory, and social challenges caused by the pandemic, and make use of new opportunities for future growth.

The pandemic as a phenomenon is a crisis in this context. Researchers have highlighted the overall characteristics of a crisis (Runyan, 2006). These include:

- surprising changes in a system or to its parts (Greiner, 1989);
- a threat to the organizations' existence (Witte, 1981);
- a large number of involved stakeholders (Elliott and McGuinness, 2002);
- low probability of occurrence and great influence and little time for decision-making (Hills, 1998; Pearson and Clair, 1998).

These characteristics contribute to the described challenges and define factors of crisis.

To deliver new digital services, a company needs two technology-enabled assets: an operational backbone and a digital services platform. The operational backbone supports efficiency and operational excellence, while the digital services platform supports business agility and rapid innovation. (Sebastian et al, 2017)

These assets are needed to deliver the following attributes for digital transformation: *efficiency (1)*, *reliability (2)*, *speed (3),* and *agility (4)*. Reliability and efficiency are essential requirements for an operational backbone — a set of integrated and shared systems, processes, and data. Reliability allows management to focus on strategic issues. Moreover, companies with operational backbones can automate repetitive processes, thus enhancing the speed of these processes. Speed and agility are factors that the competitive environment demands from digital platforms — a repository of business, technology, and data components facilitating rapid innovation of new offerings and enhancements (Sebastian et al, 2017).

These attributes were described in the paper of Sebastian and compared to described in table 4 challenges of the pandemic from the proposed model. This was made to prove that the digital transformation approach described by Sebastian et al sufficiently triggers a changing environment of crisis. Although these models do not completely match and have several differences in the value range. For instance, both models include speed, in case of the speed being a part of the challenge model, it describes a factor of urgency, while speed from DT attributes stands for the ability to increasingly automate repetitive processes within the operational backbone. These differences in compared models show how digital transformation in conditions of pandemic differs from the standard approach and which particular factors influence the whole process.

From the comparison table, it is seen that some attributes do not have the challenge to tackle. For instance, the urgent need for agents of transformation is

not included in the model described in the paper of Sebastian (2017). For these reasons, the third column combines attributes and challenges for making a list of performance criteria. The result of the comparison of the two chosen models is represented in table 5:

Table 5. Comparison of models

Proposed model Challenges	Sebastian et al (2017) DT attributes	Performance criteria
Speed	Speed	Speed
Mobilizing a Remote Workforce	Agility	Agility
Weak Productivity	Efficiency	Efficiency
—	Reliability	Reliability
The Urgent Need for Agents of Transformation	—	Capability
Resilience	—	Resilience

As it is seen - not every challenge caused by a pandemic is equally triggered by the attribute of the chosen digital transformation approach. The described assets refer to different management objectives. Based on the paper of Sebastian (2017) the applicable architecture principles, key processes, and delivery method are presented in table 6:

Table 6. Assets in DT approach

Management Objective	Operational Backbone	Digital Services Platform	Strategy
Architecture Principles	Business efficiency and technology reliability	Business agility	Implementation speed and transformation capability
Data	Standardized end-to-end business processes; transparency into systems; data access	Plug-and-play business and technology components	Concrete business goals
Key Processes	Single source of truth for transactional data	Massive repositories of sensor / social media / purchased data	Communication
Delivery Method	Roadmaps; architecture reviews	Agile and DevOps; use of MVP (minimum viable product) concepts and constant enhancement	Change management

As it is seen in table 6, new performance criteria are distributed among three assets of digital transformation: strategy, operational backbone and digital service platform. In case of this logical distribution speed and capability refers to the strategy column as they characterise the implementation vector and transformation direction. Business agility stands for the digital service platform as it is stated in the paper of Sebastian, and as it refers to an ability of the digital service platform to quickly respond to the crisis environment of pandemics. Efficiency and reliability are parts of operational backbone as they refer to processes and operations characteristics (Sebastian, 2017). In this list resilience is the only attribute that directly represents the cause of pandemic and crisis situations. This element stands out of the mentioned three assets.The described model fits into approaching DT in conditions of pandemics from the theoretical side. The essential steps for building a successful DT strategy are determined to be the following:

1. definition of **strategy**;
2. creation of **operational backbone**;
3. architecture a **digital service platform**;

In this part of the research, proposed challenges of digital transformation in conditions of pandemics correlates with characteristics of a crisis. To overcome them and adjust to caused changes, a model was built as a result of the literature review. The list of performance criteria was created and correlated with essentials of digital conditions in conditions of pandemic.

3.4 Digital Transformation Frameworks

Before designing or implementing a solution, it is vital to understand digital transformation frameworks. After literature analysis in the previous chapters, it is clear that the digital transformation is not necessarily about technology. It is about how we lead organizations, it is a way of thinking, it is a way of being able to progress innovations quickly and rapidly in order to add competitive advantage or change to an organization. In other words, digital transformation is a strategy to create a competitive advantage. How do you inspire a workforce? How do you bring all of the challenges together? How do you stop yourself defaulting to the tactics? You do it using digital transformation frameworks.

Before proposing a Digital Transformation model, existing solutions were analysed and reviewed from the top consulting companies: PwC, McKinsey, Accenture, EY, Gartner, CapGemini, MIT, Cognizant, Altimeter and Ionology. Digital transformation frameworks, like any kind of framework, give decision-makers a starting point. Frameworks offer checklists of what needs to get done, and sequence to order what needs doing. Digital transformation frameworks show people at different levels of the organization how to cooperate to make digital change possible (Coundouris, 2020).

According to the review made and published by Coundouris in 2020, MIT framework leads the chart together with Capgemini and DXC with the rate of 3.5. This rate was calculated by Coundouris based upon four dimensions: customer-centricity, opportunity and constraints, company culture, simplicity. The results of his work are presented on the figure 3:

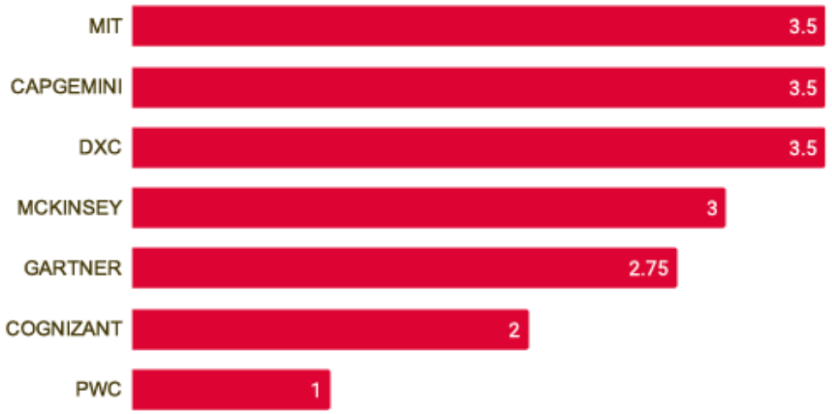

Figure 3. Rating of Digital Transformation Framework (Coundouris, 2020)

Among the reviewed frameworks, the MIT framework requires more attention of this research as it includes chosen from the literature (section 3.3) assets: operational backbone and digital platform. The framework itself is presented on the figure 4:

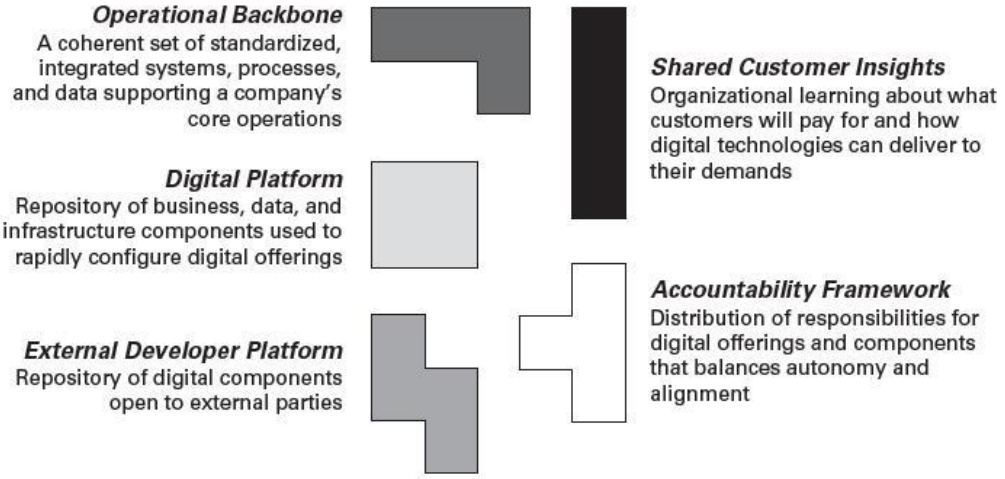

Figure 4. Digital Transformation framework (MIT, 2019)

With the highest rate from comparison review, strong theoretical basis extracted from Sebastian (2017) paper, the current framework designed by MIT and described in the book "Designed for Digital" is chosen as the basis for designed artifact. Based on Coundouris' analysis, MIT's five building blocks are more like a stack of building blocks and it is considered to be a strong point of the chosen model. While its weakness is considered to be an emphasis on operations instead of customers.

3.5 The Newly-proposed Digital Transformation Model

This chapter presents the artifact that was created by using the design science research method. This chapter describes the use of six attributes that are an essential set of guidelines to serve their intended purposes of digital transformation in conditions of a pandemic. These attributes are ideal performance criteria to which real transformation models are likely to conform fully either now or in the future. As already stated, successful digital transformation requires a wide-ranging digital change approach that encompasses organizational, personal, and technological aspects in new normality - pandemic.

To proceed through the digital transformation process, a transformational model should be chosen from a practical perspective. While the theoretical framework is based on literature sources, apart from practical implications it should be taken from real case experiences. For this reason, presented in figure 5 models are based on another transformational approach developed by a consulting company - Deloitte (Appendix A). It was taken into consideration for further implementation in this thesis. This model includes different aspects of an organization and has more impact compared to the theoretical one. This comparison was made in section 3.4 of the current chapter.

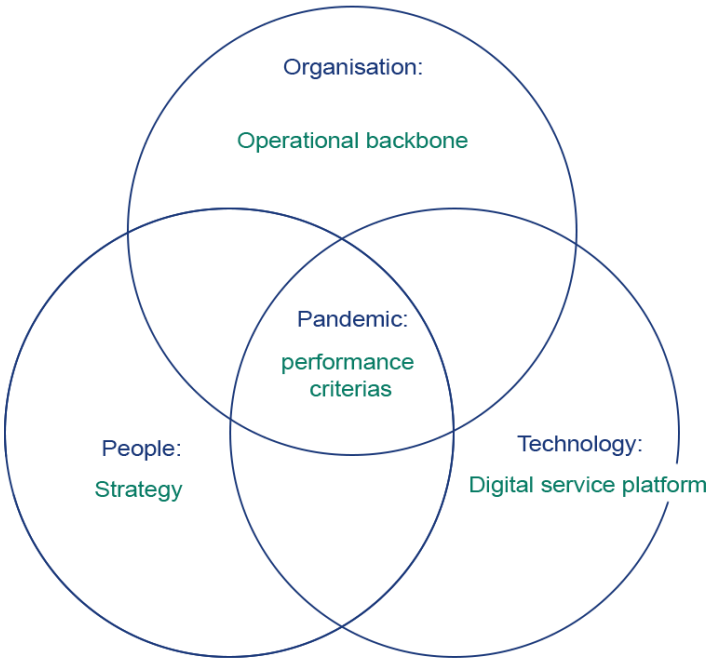

Figure 5. Adopted transformation Model

Figure 5 shows the attributes that emerged in our systematic literature review (Section 3.3). These attributes play a central role in the diagram. The sector "Pandemic" is located at an intersection of three circles representing the interplay between those criteria and operational backbone, digital service platform, and strategy.

From the literature review, we can extract relatedness of performance criteria to parts (circles of the model):

- People - Strategy: *speed (1)* and *capability (2)*;
- Organisation - Operational Backbone: *efficiency (3)* and *reliability (4)*;
- Technology - Digital Service Platform: *agility (5)*;
- Pandemic: *resilience (6)*.

4 Artifact Design

In the following chapter three key assets of digital transformation are analyzed and correlated: *strategy* (4.1), *operational backbone* (section 4.2) and *digital service platform* (section 4.3). This analysis is performed based on the company case SODAQ B.V. in order to extend input for the final design of the artifact.

4.1 Strategy

Before describing primarily assets such as the operational backbone and digital service platform, this section is describing the strategy factor for the designed artifact. A digital transformation strategy is a plan of action describing how a business must strategically reposition itself in the digital environment (Ionology, 2020).

According to an Ionology consultancy report, operational effectiveness, although necessary to superior performance, is not sufficient, because its techniques are easy to imitate (Porter, 1996). In this condition, a smart strategy is needed to support operational excellence. Richard Rumelt (2011) described by McKinsey as "Strategy's Strategist' reinforces that a strategy is not a goal or objectives. It is the battle plan for action that is designed upon a unique set of attributes or conditions that sets an organization apart from its competitors and results in exceptional and sustainable profits (Rumelt, 2011). A proposed DT model should have a set of actions in order to reflect strategy assets.

It is important to have and translate a clear vision of the company. Despite challenging conditions, SODAQ stated an ultimate concept of low powering and sensing (figure 6). For SODAQ, moving from an engineering company to a products and engineering company is the strategic approach.

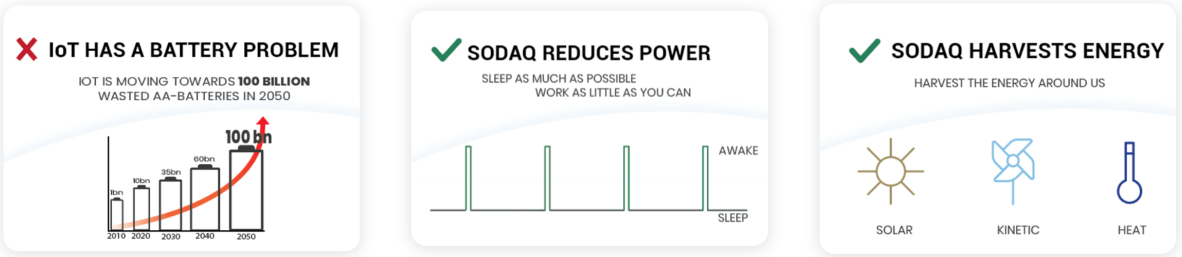

Figure 6. SODAQ vision

To be aligned with the company's Business Strategy is illustrated in Figure 12 in archimate notation and refers to a strategic and motivation layer of enterprise architecture. Business Goals typically represent a company's larger purpose and work to establish an end-goal for employees to work toward. Business goals do not have to be specific or have clearly defined actions. Instead, business goals are broad outcomes that the company wishes to achieve.

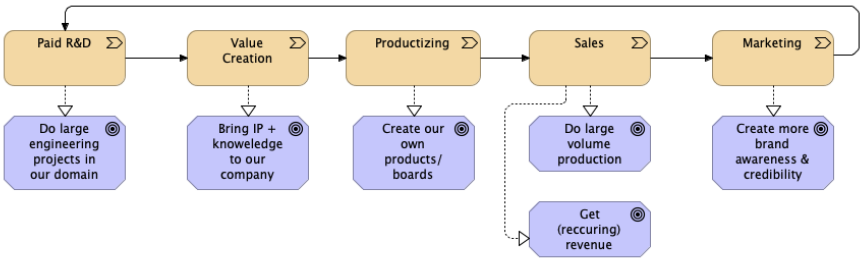

Figure 7. SODAQ business goals

As the vision and business goals were defined for the SODAQ case, several directions for strategy development were specified. These directions are *sales*, *marketing*, *productizing*, *paid research and development (R&D)* and *value creation*. According to the MIT digital transformation framework, the goal of building a DT strategy is to enable companies to rapidly deliver innovative digital offerings. There are three interacting elements that are needed to be developed in order to make a strategy for successful transformation (Ross et al, 2019):

(1) **people** who understand what needs to be done and how to do it;
(2) **processes** that guide a company from idea through delivery to support;
(3) **technology** that supports both efficient and effective organizational processes and innovative digital offerings.

These key elements are crucial for successful digital transformation as they are vectors for the company's business goals. According to this, chosen directions were divided by supported systems that process related data. The separation between strategy sectors and system support is presented in figure 8:

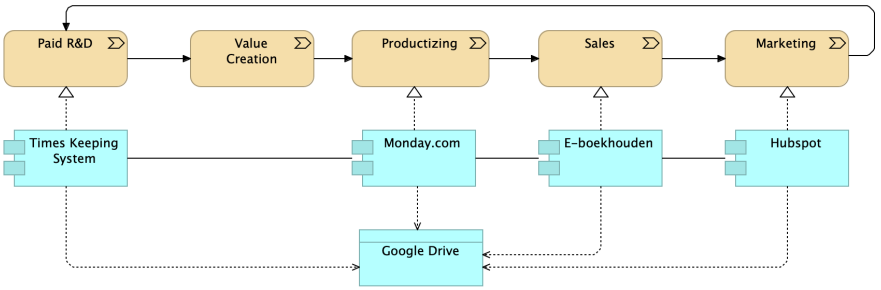

Figure 8. SODAQ data driven transformation

To increase the speed and agility of the DT initiative by creating efficient and reliable processes supported by a digital platform, valuable data is integrated within mapped systems. As it is seen from figure 8, four out of five business divisions have their own system which stores and processes data. In order to transfer data between systems, a cloud solution such as Google Drive is used. The goal of data driven digital transformation is to reduce the number of data objects and their transfer from software to software. This means that an integrated solution is needed in order to centralize data storage.

Introducing new technology and processes provides an opportunity to redesign roles and change habits. As the basic sets of steps for filling in a strategy sector for the designed DT model the following should be taken into consideration:

- motivate the change;
- formulate a vision;
- identify short term wins;
- monitor the transformation process.

In the following subchapters, two key digital assets are identified. For SODAQ case both elements are described:
(4.2) operational backbone - configuring people, processes, and technology to ensure reliable, efficient core processes to support stable operations (SODAQ's core enterprise system, referred to as SODAQ integrated IT landscape, which support standardized processes);
(4.3) digital service platform - configuring people, processes, and technology to design, architect and use software components.

4.2 Operational Backbone

According to MIT, the definition of operational backbone as an element of a digital transformation framework is a coherent set of standardized, integrated systems, processes and data supporting a company's core operations. The backbone replaces the messy legacy systems, processes, and data generated by siloed business units with standardized and shared systems, processes and data. An operational backbone contributes to business success by ensuring reliable, stable, secure operations (Ross et al, 2019).

Architects describe the existing and desired design of organizations based on many aspects. By looking at an organization from different angles, choices can be made and the structure of the organization is made clear to decision-makers. Relationships between business, information provision, and technology can be used to determine the consequences of a change to clarify the business or the information provision. To give more insight and structure we use an architectural framework for all aspects portrayed by architects.

Initially, a SODAQ processes whiteboard was built in order to structure business process creation. The outcome is presented in figure 9:

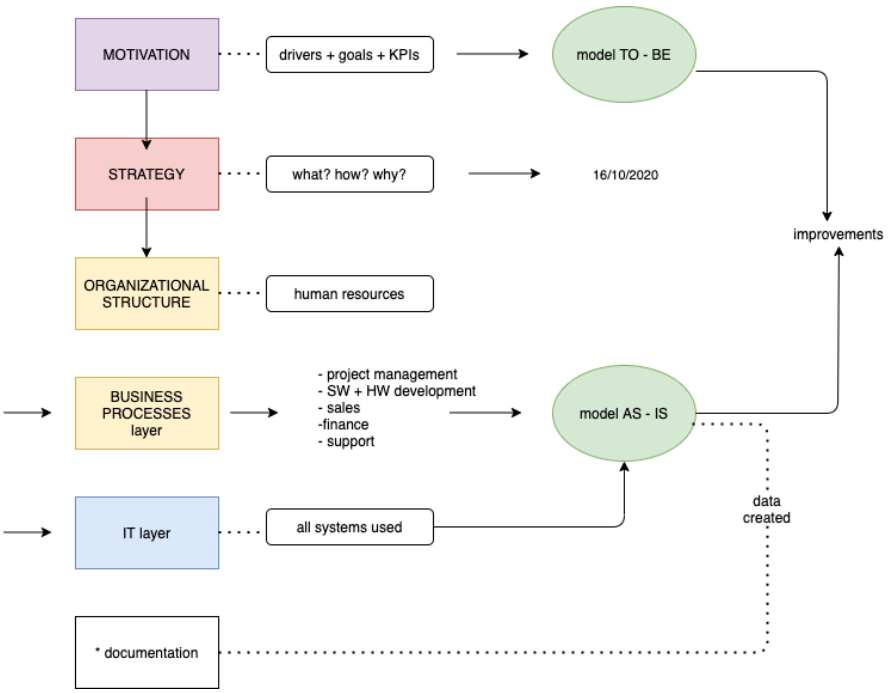

Figure 9. SODAQ processes white board

Based on the primarily analysis of the white board, a group of processes to optimize was defined:

- Managing - business processes that are included in the strategic management & management of the organization.
- Operational - a set of processes that make up the main activities of the company(production, development, marketing, sales, support, etc.)

According to these groups, key processes were defined for the case organization. They are: *project management*, *hardware* and *software development*, *sales*, *finance* and *support*.

A general process flow was captured according to Archimate business process notation and Novilus architecture framework (figure 10). In order to create operational excellence all defined processes were notated (Appendix B). On the IT layer of enterprise architecture of SODAQ all systems were mapped as parts of the integrated IT landscape.

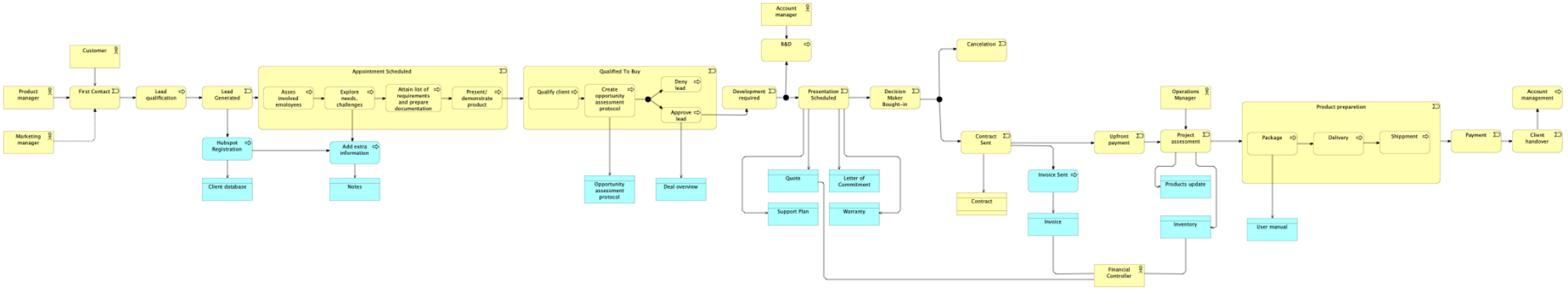

Figure 10. SODAQ process flow

Building an operational backbone invariably requires unlearning entrenched organizational habits, distributing existing power structures, and installing disciplined business processes that capture critical master and transaction data (Ross et al, 2019). As the guidance for creating an operations backbone for the DT the following steps should be taken into consideration:

- define key processes;
- create operational excellence;
- integrate an IT landscape

4.3 Digital Service Platform

Based on the previous Section 4.2, where an architecture approach was described and applied to the main organizational processes, the need for a Digital Service Platform was defined. Having operational excellence in the operational backbone is not enough for success of digital transformation, especially in conditions of pandemic. According to MIT, the definition of a digital platform is a repository of business, data, and infrastructure components used to rapidly configure digital offerings (Ross et al, 2019).

Modeling of business processes was carried out in order to improve the efficiency of SODAQ work, primarily to put things in order in the current processes (examine and describe the AS-IS process model), and then to make changes in business processes in order to perform DT in conditions of the pandemic (generate a TO-BE model).

The AS-IS model made it possible to reflect the current situation and to systematize the processes occurring in the organization and information flows within the framework of these processes. On the basis of this model, problem areas were identified and interaction of processes, as well as the need for changes was determined. In this case, it is optimization of the IT landscape consisting of different information systems involved in the process. Figure 1 represents the AS-IS model which was built based on interviewing SODAQ employees (Appendix E):

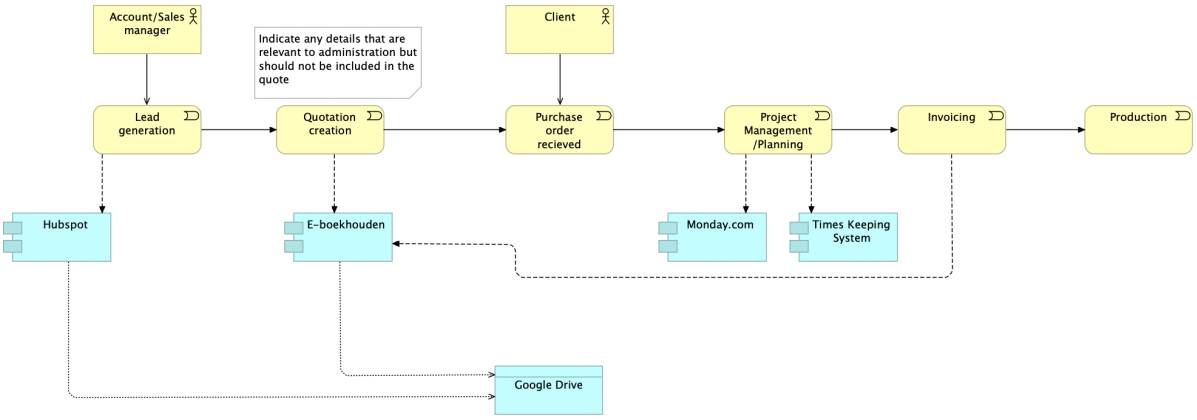

Figure 11. SODAQ process AS-IS

The detailing of the processes according to the AS-IS model made it possible to identify shortcomings in the investigated area of activity, which were taken into account when creating the TO-BE model.

The TO-BE process model is generated from the analysis of the AS-IS process model. This model describes the future state of processes, in a particular case under consideration - the implementation of the ERP system. Figure 2 represents the TO-BE model:

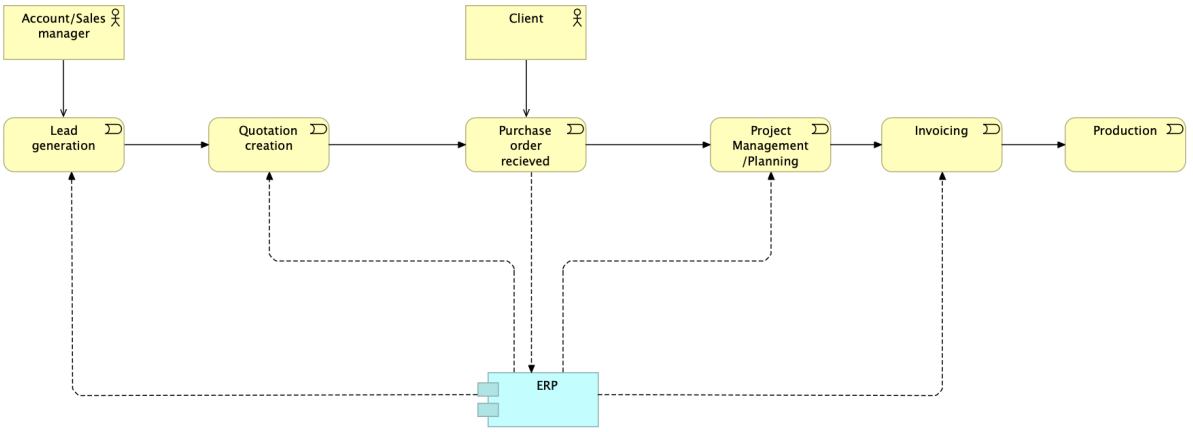

Figure 12. SODAQ process TO-BE

Operational backbone and digital service platform have very different design requirements. After defining the need for implementing an ERP system, requirements for this Digital Service Platform should be set up for the case company. The primary analysis of the current tool used and its limitations, together with ERP details are described according to the following process presented in Figure 3. The results are presented in the Appendix F.

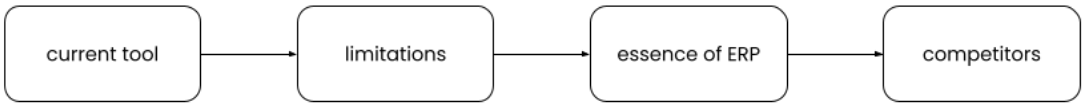

Figure 13. Primary ERP analysis

According to the illustrated procedure functional requirements for the system were written (Appendix E). As the guidance for designing a digital service platform for the DT the following steps should be taken into consideration:

- set up requirements;
- architecture a DSP.

4.4 Analysis of DT as performed in SODAQ

The proposed transformational model was filled in with designed action points that were particular steps of the DT performed in SODAQ and performance criteria were mapped as key factors determining crisis conditions.

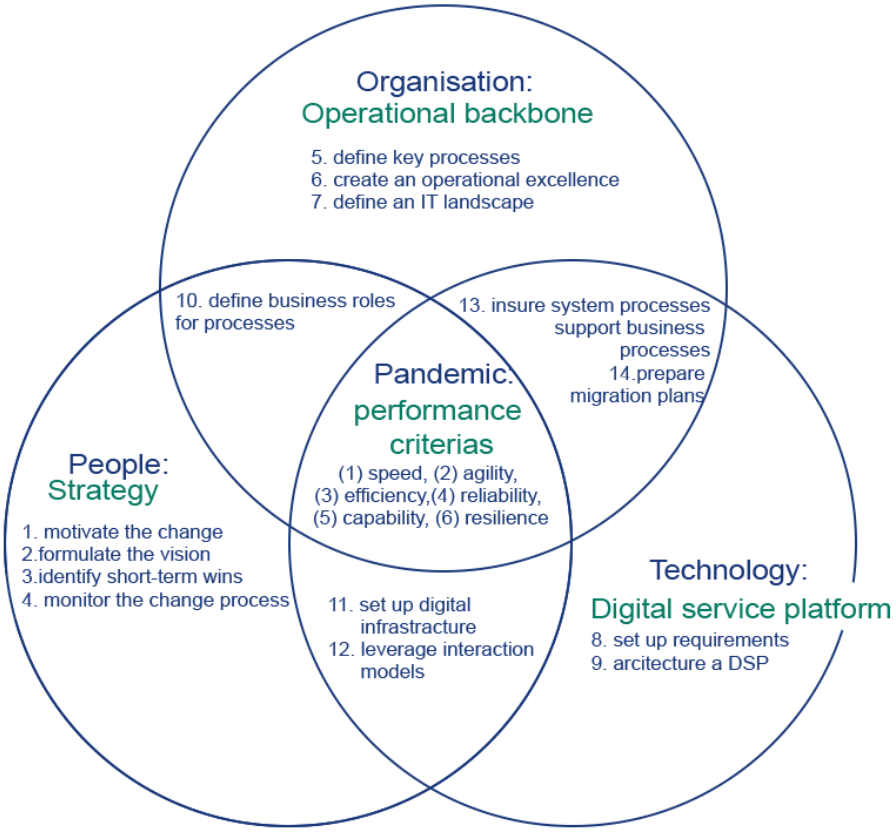

Figure 14. Final Transformation Model

The presented transformation model is described in Table 9. Column "Circles of the model" shows which particular circle is related to the action point or which intersections. The numbers mentioned in the table are the same numbers that are mapped in the figure and show the sequence of the steps. The "Description" column is made in order to provide descriptive information regarding the influence of the step on the DT process and connection with performance criteria. Information presented in the last column is synthesized by an additional literature review in order to support statements extracted from the interviews.

Table 7. Description of the Transformation Model

Circle of the Model	#	Step	Description
People - Strategy	1	Motivate the change	In a constantly changing and competitive environment caused by pandemic, it is vitally important for organisations to engage and motivate their employees. Those who are motivated and engaged use their talents and abilities to the full and make the best contribution they can to the work of the organisation (CMI, 2021).
	2	Formulate the vision	Vision has been critical to growth and survival of organizations in conditions of a crisis. Its role is very significant in improving and sustaining organizational performances (Suranga, 2014).
	3	Identify short-terms wins	Generating short-term wins is necessary to prevent the loss of momentum and keep your organization engaged. Short-term wins can also derail cynics and self interested resistors of change in your organization. This occurs because your short-term wins provide real evidence about the validity of your change vision (Tanner, 2021).
	4	Monitor the change process	Much of what will happen during a transformation in a pandemic is uncertain. One way to address this question is to review each task which is part of the implementation schedule looking for elements of uncertainty. If any uncertainties do not have serious constraints then they do not need to be flagged as a risk (Durham University, 2020).
Organization - Operational Backbone	5	Define key processes	A quick and effective approach to documenting a process is to prepare an initial draft and then conduct an interview with a knowledgeable process user to verify and populate the draft. The draft is an assumptive view of how a process works, presented as a rough model. A process definition, usually a combination of graphics and text, facilitates analysis and execution of the process (Allen et al, 2011).
	6	Create an operational excellence	Operational excellence is considered a philosophy of leadership, teamwork and problem solving resulting in continuous improvement throughout the organization by focusing on the needs of the customer, empowering employees and optimizing existing activities in the process (Liker, 2004).

	7	Define an IT landscape	Define a set of hardware, software and facility elements, arranged in a specific configuration, which serves as a fabric to support the business operation of an enterprise involved in the DT.
Technology - Digital Service Platform	8	Set up requirements	A good requirement states something that is necessary, verifiable, and attainable (Hooks, 1993).
	9	Architect a DSP	To facilitate innovation of value-enabling IT services in a service ecosystem, digital service platforms are needed (Gobel & Cronholm, 2016).
People x Organisation - Strategy x Operational Backbone	10	Define business roles for processes	There are multiple viewpoints. It commonly begins with the question of ownership and responsibility as an organization begins to understand the value of process and implement actions to manage those processes. Assignment of process ownership is one of the indicators of an increasing level of process maturity (Long, 2019).
People x Technology - Strategy x Digital Service Platform	11	Set up digital infrastructure	Adapt existing IT infrastructure and introduce new ones. Different processes and systems need to be networked for the future and have to be taught to communicate with each other (Deloitte, 2017).
	12	Leverage interaction models	Incorporate customer preferences and needs into development and production processes, facilitate customized solutions and individualized mass production (Deloitte, 2017).
Organization x Technology - Operational Backbone x Digital Service Platform	13	Ensure system processes support business processes	It is a necessity to maintain up-to-date, complete and accurate information to stay competitive in the changing world, especially in conditions of pandemic. An organization should look for processes that are essential to the functioning of the business and those that may be used to bring a competitive advantage (Bourgeois, 2014).
	14	Prepare migration plans	A detailed data migration plan is an essential step in a digital transformation project to select, prepare, extract, transform and transfer data of the correct form and quality.

5 Evaluation

For the purpose of validating our proposed artifact, we chose our very first evaluation case to be the Transformational Model for SODAQ. In this chapter our applied evaluation method is described, our proposed evaluation plan is presented and our evaluated transformational model is shown as an outcome of evaluation interviews with experts.

Following the Design Science methodology, after developing a solution it must then be validated, before its implementation (Wieringa, 2014). To do so, a panel of experts is assembled to whom the method is shown. After walking them through the respective models, these same experts are then asked to partake in a questionnaire.

5.1 Evaluation Plan

A Digital Transformation at SODAQ B.V. sets a practical environment in which the proposed model is applied. Under those circumstances, a Technical Action Research (TAR) methodology (Wieringa, 2014) is employed. As part of the evaluation section, semi-structured interviews are carried out through an expert opinion process to evaluate the designed artifact.

A TAR study is a way to validate the artifact in the field.

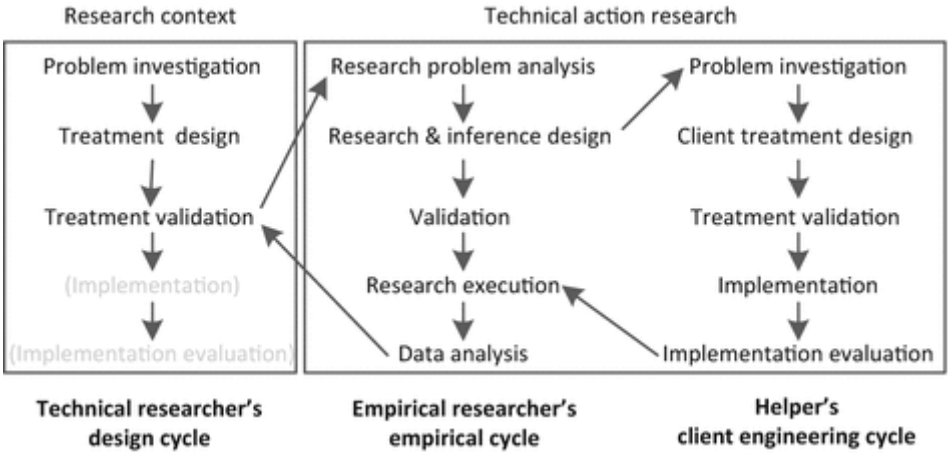

Figure 15. The three-level structure of TAR

Primarily the evaluation plan consists of the following steps:

1. Validate the model for the SODAQ case.
2. Ask experts in the field of interest to validate the developed model.
3. Reflection on the designed artifact.

Stakeholder analysis is one of the steps in the evaluation process. The following stakeholders' list includes people who have an impact on the digital transformation model, or who could influence the outcome. They can be internal (SODAQ) or external (an expert from Ramboll). The stakeholder table is presented below:

Table 8. Evaluation Stakeholders Analysis

Stakeholder Name	Contact Person	Impact	What is important to the stakeholder
SODAQ	CEO - Ollie Smeenk	High	Digital Transformation outcomes
SODAQ	Executive Coach - Frederik Engelmans	Medium	Digital Transformation Model - Practical Approach
SODAQ	Daria Yakushkina - Business Analyst	Medium	Connection of results with the proposed Digital Transformation Model - Theoretical Approach + Practical implications
Ramboll	Automation Manager - Alejandro Mata	Low	Digital Transformation Model - Future Approach for Industry

A primary set of evaluation questions was defined for outcome evaluation or impact evaluation. These questions aim to get feedback from stakeholders to improve and critically revise the model proposed in previous chapters:

Table 9. Question for Outcome evaluation

Outcome evaluation (impact evaluation)	How well did the model manage/serve the DT?
	Did the model match the intended DT results/stated goals in the short, medium, and long term?
	What are the positive and negative parts of the model?
	To what extent can changes be attributed to the model?
	What were the particular parts of the Model and context that made a difference?
	What was the influence of pandemic factors on DT and the Model?

5.2 Evaluation Interviews

The evaluation interviews were performed as a live face-to-face session and as an online video call due to COVID-19 measurements. Together with the Interviewees, we went through a digital transformation process that was made in SODAQ for the last 6 months and analyzed the following steps from real case to theoretical research.

The designed transformational model was presented using a set of Prezi slides for each expert (Appendix G). For each expert, the methodology was explained using this set of Prezi slides. The overall developing process was explained as well as the methodology itself. Afterward, an unstructured discussion session took place according to the proposed interview protocol (Table 2). It is important to note that expert C (Alejandro Mata) was not available for the interview, and consequently the evaluation sessions were performed with expert A and B only.

5.3 Expert Panel

Two experts agreed to take part in the validation and evaluation:
1. The head of the validation company SODAQ with more than 5 years of experience in leading the company transformation and strategy, and with more than 10 years of experience in business and management (expert A).
2. The executive coach of the validation company with more than 30 years of experience in change management, consultancy, and human resources (expert B).

During the evaluation session, a proposed list of questions was answered. Results are represented in the next sub-chapter.

Expert A

As the head of the company,expert A knows all aspects influenced throughout the DT procedure: people, organization, technology, and influence of pandemic as a key catalyst.

He is a great leader and changemaker himself capable of performing and supporting any kind of transformation, he plays a strategic role in rewriting processes and setting operational goals. For a successful digital transformation strategy to be achieved, the head of the company will need to define the roles and responsibilities of managers. An ERP system is a good business management tool for a CEO to have a birds-eye view of what is going on in the company and identify the gaps in the business where exponential value can be added.

Expert B

Expert B himself categorized his experience into three pillars: leadership and team development, executive and personal coaching, and business training and consultancy. In SODAQ, he guides individuals and teams to get clear about the change the company desires and how to perform the change.

He shares a deep passion for people development, performance impact, and business development. He has extensive experience in leadership development and has built an excellent Team Development Program. He is currently involved in strategic business development within the company.

5.4 Evaluation Outcomes

After conducting an evaluation interview with the stakeholder who according to the stakeholders' analysis had the highest impact, an analysis of performance criteria was made as key factors determining crisis conditions. The results are presented down below (figure 15.1-6). Red color indicates low performance of a particular attribute in terms of the case, when green color stands for the highest impact. The colored grades were given based on the interviews' outcomes.

1. Speed

The speed of digital transformation in SODAQ was fast but not fast enough to accomplish the implementation in the period of the crisis conditions. This attribute has a direct impact on the implementation and development process. It's very relevant to be quick but to also give this process time. So the speed is not just high speed, but it's selecting the right speed (interview 1). It is graded as: Medium.

2. Agility

The agility in the current case means that there is space for incremental change. But if this process is repeated every so many months or years, then there can be a switch to a new process again, which is healthy for the company as well (interview 1, 2). This criteria is graded: Medium.

3. Efficiency

The efficiency of the performed DT in SODAQ was evaluated as not an essential element as it can be covered by the combination of the rest four criteria. Efficiency is harder to measure (interview 1). This criteria was graded: Low.

4. Reliability

The reliability as a performance criteria of the DT was also evaluated as one of four most essential elements for the same reasons as the previous attribute was not. This criteria was graded: High.

5. Capability

The capability of the digital transformation in SODAQ is an important criteria because people need to understand the different parts of the process, and need to understand why. They need to understand the tools of the DT (interview 1). This attribute has an extreme impact as it is necessary to get everybody involved in the transformation process and use all resources especially in conditions of pandemic. It is graded as: High.

6. Resilience

The resilience criteria has an immense impact because there should be planning for where the organization is in three years after the DT. This is a management level change and management should always be looking in the future. it is graded: High.

5.5 Reflection

As the final step of the evaluation process, a reflection was made using the SWOT analysis method in order to critically review the designed artifact. The results are presented in the following table:

Table 10. Reflection results using SWOT

Strengths	Weaknesses	Opportunities	Threats
4 circles covers all necessary aspects for the DT	it is a high level of description approach	the model can be used in practice by any company	presents digital transformation in conditions of pandemic
the model can be easily transferred in a 14 steps plan	the model does not show iterative processes		
it is based both on a practical case and supported by the theory			

5.6 Limitations and Evaluation of Validity Threats

This section reflects on the possible limitations (Peffers, 2007) of our very first evaluation study. First, we acknowledge a threat due to the fact that our study includes only 2 practitioners. This poses a threat to generalizability of the findings and therefore we acknowledge that it would have been much more beneficial if we had included more stakeholders. However, our participants are selected because of there deep expertise of SODAQ and also because they share some commonalities, specifically:

(1) profound knowledge of the organization,
(2) expert knowledge of its business processes,
(3) expert knowledge of the organization's support systems.

Following Peffers (2007), and Seddon and Scheepers (2011), we think that it might well be likely that the perceptions and the experiences of these two experts would be similar to the experiences with other SODAQ practitioners who share the same expert level of familiarity with the SODAQ context. This is possible because, as Seddon and Scheepers indicate, similar work contexts may create similar organizational mechanisms which, in turn, could lead to similar observations of

the working in the field. Clearly, it will be ideal to replicate our evaluation with more participants, which forms a line of research for the future.
To sum up, our very first evaluation of the proposed artifact gave a convincing indication that the artefact is useful for SODAQ. The SODAQ leadership team considers it usable for their company's context and it is their plan to continue employing it in the remaining components of their digital transformation initiative. In SODAQ, this artefact is considered as only the beginning of their transformation journey. Following the Design Science principle of iterative improvement of any proposed artefact based on repetitive use in follow-up contexts in the same organization (Wierenga, 2014), the company remains positive about the artifact's gradual refinement and possible extensions as new information and lessons learned from the artifact' use becomes available.

Second, a threat common for qualitative evaluation studies of design science artifacts in general, is the personal bias on the researcher's side. However, in our particular research context, we think that this threat is minimal, because the researcher fully transcribed the conversations with the experts and her analytical procedures included the establishment of explicit traceability links between the collected qualitative data (namely the experts' observations) and the analytical codes and the elements of the SWOT analysis (Table 10).

Furthermore, the author has shown her analysis to the two practitioners to assure that she captured all the information and that it is correctly traced to her conclusions. This step however did not lead to changes in the author's findings, which strengthens the understanding that the personal researcher's bias is kept to a minimum.

Third, an interesting question in Design Science research is about the extent to which the proposed artefact could be used beyond the context for which it was originally created. Of course, to collect evidence in order to answer this question, some empirical research in other organizations would be needed. We however think that our model might well be suitable to contexts similar to the one of SODAQ. This position is grounded on the methodological reasoning of Peffers (2007) who suggests that organizations having similar goals, similar initiatives and similar needs might well find useful to consider for implementation artefacts that were created in other similar but different organizational settings. If an artefact created for one organization worked well for its original context (SODAQ), this artefact could serve as a starting point in other organizations who want to start a DT initiative and have similar goals.

6 Conclusions and Recommendations

The impact of COVID-19 will be long-lasting, far beyond the steps to ease up the current restrictions on how people work and interact. Things will not simply go 'back to normal' – the way we expect to use digital services and applications will be changed forever. Organizations will still need to pursue DT goals and will need models to support their efforts in DT projects. This thesis provided a model and an approach in response to this need.

The proposed digital transformation model consists of four sectors that are needed to be included for a successful digital transformation: *People - Strategy* (1), *Organization - Operational Backbone* (2), *Technology - Digital Service Platform* (3), and *Pandemic - Performance Criteria* (4). The model also includes a list of performance criterias consisting of 6 attributes as factors of pandemic: *speed (1), agility (2), efficiency (3), reliability (4), capability (5)* and *resilience (6)* that influence the digital transformation process in conditions of crisis. The final artifact was tested during a case study and evaluated by experts.

This model was adopted to the described assets of digital transformation - *operational backbone* and *digital service platform*. These practical outcomes properly correlate with the results of the literature review.

This research presents one way for organizations to achieve successful Digital Transformation in conditions of the pandemic. It delivers a transformation model that helps companies to perform Digital Transformation in conditions of pandemic. The proposed approach is not without limitations, but nevertheless, it is found to be useful in practice. The developed model, aiming to implement the concepts of DT in the pandemic, contributes to both practice and theory and could serve both designers and researchers in their future activities. On the basis of our empirical evaluation, we could conclude that practitioners could take the model as a candidate framework to consider in their future digital transformation projects. To researchers, the framework could serve as a theoretical foundation for the possible creation of other approaches and their empirical evaluation.

6.1 Summary of the work

As stated in the Introduction, the main objective of this research was to deliver a transformation model that helps companies to perform the digital transformation in conditions of the pandemic. The central research question to be answered was: *how can organizations achieve successful Digital Transformation in conditions of the pandemic?*

Using design science as our chosen research methodology, we proposed an artifact - a framework and a model for digital transformation. This artifact is our answer to the central research question. More in detail, in the next paragraphs, we

summarize the work done towards this end. First, our literature review (Chapter 3) was necessary to gain theoretical knowledge and get other researchers' perspectives regarding the current corona crisis situation and the challenges it posed to digital transformation. We compared the reviewed pandemics characteristics with a traditional DT approach. The outcome of this comparative analysis is a new model of performance criteria consisting of six attributes: *speed (1), agility (2), efficiency (3), reliability (4), capability (5)* and *resilience (6).* We note that the last two - capability and resilience, are newly added. The proposed model has an impact on performing DT in new conditions and aims to support organizations in their transformation journeys.

We also analyzed existing digital transformation frameworks in terms of their strengths and weaknesses (Chapter 3). This led us to choose the MIT framework with its building blocks including key assets - *operational backbone* and *digital service platform*, as the foundation for the proposal developed in this thesis. Using a design science cycle (Peffers et al, 2007), we proposed a framework and a model consisting of four components instrumental for a successful DT: *People - Strategy (1), Organization - Operational Backbone (2), Technology - Digital Service Platform (3), and Pandemic - Performance Criteria (4).*

Chapter 4 reveals how the proposed model is used in case study of SODAQ. The company case admits that the model is applicable for performing digital transformation in conditions of pandemic. It is assumed that the chosen approach of visualizing a digital transformation plan via a model clarifies how the digital transformation should be handled in a crisis.

In order to evaluate the usefulness and the usability of the newly proposed model and to generate possible improvement options, an expert panel was used (Chapter 5). Interested readers could find the questions discussed with the experts in Appendix D and Appendix F. Whereas the opinions of the experts varied, their overall evaluation demonstrated that the model led the case company through the DT process and was practical, useful and usable for implementing a new system in conditions of the crisis. In the perceptions of the involved experts, the model was found to be compatible with the organizational and technical infrastructure in the tested environment. As the result of the evaluation, a final transformation model was presented as the final artifact of this thesis.

6.2 Contributions

Considering the practical and scientific relevance of this research, and the obtained evaluation results, this thesis made three main contributions. First, from a theoretical standpoint, this thesis contributes to the body of knowledge in the Business and Information Technology discipline by introducing a novel approach to develop a model for Digital Transformation. The artifact assembles the fundamental building blocks to embrace modular, agile, and evolutionary architectures based on the results of a systematic literature review and the examination of a case study in an innovative organization. Additionally, this study

has conducted Technical Action Research to provide significant insights into how the proposed artifact contributes to Digital Transformation initiatives in conditions of the pandemic.

Secondly, university researchers could employ the proposed artifact as a theoretical lense for analyzing the pandemic impact on the business of aligning strategic, operational, and technological elements critical for delivering Digital Transformations into organizations.

Finally, from a practical perspective, this research has evaluated the suggested model and its core methodologies in a real-world Digital Transformation project. The implementation for SODAQ provided the appropriate environment to assess the usefulness of absorbed concepts from other architecture frameworks or methods that were either presented only at a theoretical level or were recently published where no real-world implementation cases existed. Therefore, this study has served as a point of reference for the validation of such approaches with their particular benefits and drawbacks in relation to practice.

6.3 Limitations and Future Research

6.3.1 Limitations

Despite the fact that the study has addressed the main research question and associated research objectives as well as contributing to both scientific and practitioner communities, it has several limitations. First, as the conditions of the current pandemic are comparably new to the world, the literature review was performed with only the latest literature sources on the date of October 2020. This limits the number of scientific publications based on which we investigated the known challenges. Also, retrieving articles focused on the challenges of the crisis is rather complicated due to the fact that most papers refer to pandemic crises but barely discuss how to complete DT.

Second, the lack of scientific literature on guidelines and strategies for DT limits the development of the final artifact. As Chapter 4 indicates, the method was developed by combining various ideas from several sources which might possibly be limited by these sources' authors' mindset. In addition to this, our very first evaluation exercise itself has some limitations, because of the involvement of only two experts. Further improvements for our method could be discovered if the method is applied to companies from different areas and business sectors but with the same aim to perform digital transformation during a pandemic when all researched challenges are still relevant.

6.3.2 Recommendations for Future Research

As a line for future research, we recommend validating the proposed model with different case scenarios and perform digital transformation for different sectors. Similarly, a much bigger case with a more complex IT landscape would bring more insights. These empirical research efforts could also reveal some needs to

adapt our designed model, to refine or extend it, and to propose ways to improve it. The aspect that can be looked into further, is the usage of the model. Is the model suitable and sufficient for different types of companies? To what extent does this model of DT help the decision-maker?

Another suggestion for future work is to implement quantitative analysis in order to test and validate outcomes. The present research does not propose quantitative metrics which could be used in further studies and bring more results..

6.4 Recommendations for practitioners

The designed model can become a basic method for digital transformation applications as a digital transformation tool. We think this is possible, as it includes all necessary aspects for designing a fully functional prototype. This innovative product can be competitive from a marketing perspective and helpful for all types of businesses.

The proposed plan can be adopted by practitioners for system implementation in order to attain digital transformation and go through the change. The final DT model and described components are still relevant for other system renewal initiatives within the case company.

Based on the artifact is it possible to build a checklist or a new canvas for digital transformation. This might make the model more practical, constructive and businesslike.

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Appendices

Appendix A - Case Study - Processes meeting 12/10/2020

- **Key processes defined:**
  - Project Management
  - HW + SW
  - Support
  - Financial processes
  - Customer Journey
  - Sales

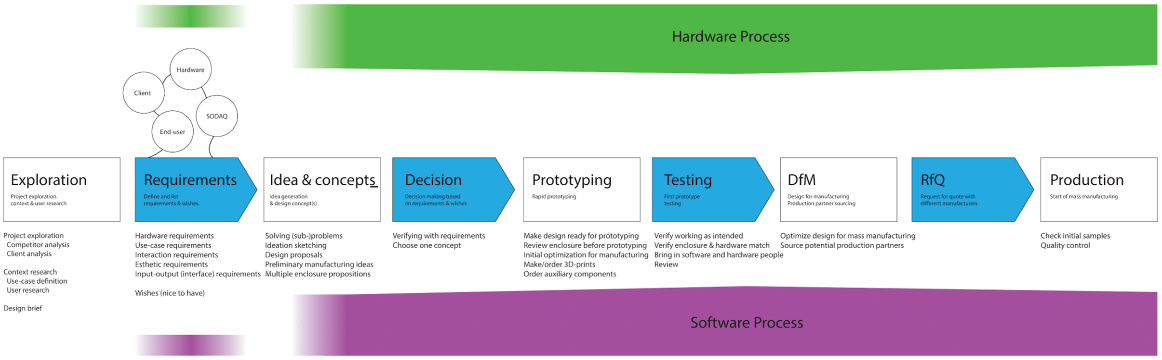


Figure 15. Hardware and Software development processes - Initial

- Is there a tool that makes processes digital/clickable? Once all processes are made, to have a view-only format and be able to click from one process to the next

  Archi

- When is support part of engineering and when is it part of products/operations?
- Make a presentation with a plan.
- Schedule a meeting with whoever needs to see our presentation. Maybe record so whoever can't join can watch it and provide feedback.

  16/10/2020 - 3.30-4.00 - Support Processes

- Plan a role-playing game for processes. Who should be part of which role-playing and when?

  Found an article for a business process role play - insert later

Updates regarding SODAQ EA:

- define the goal of building business processes & further optimization:
  - Requirements for possible ERP
  - Integration of current IT landscape
  - Documentation + data flow
  - Optimization
  - Minimize the variation
  - Reduce confusion

- strategy & KPIs
- motivation layer development

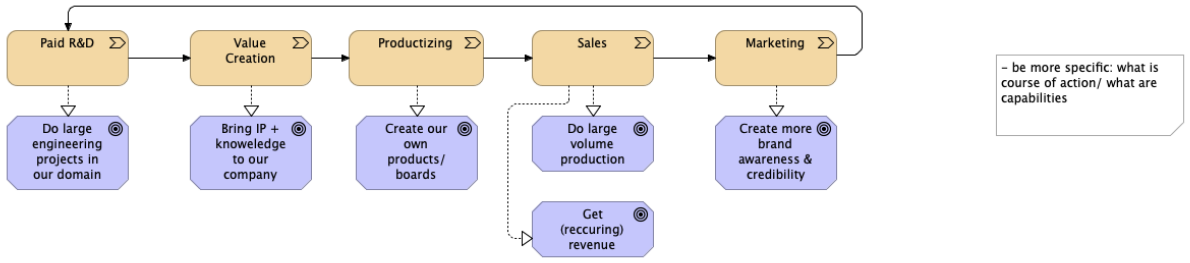


Figure 16. SODAQ motivation

- issues with input data from employees - set up a format - BPMN
- showcase of a particular example - ***Certification***
- action plan - Define the target group for the process with employees
  1. Present motivation & strategy for BP optimization & documentation
  2. Share the goal of making BP
  3. Theory: to-be VS as-is
  4. Define processes (based on the goal)
  5. Workshop for employees about BPMN - input data

Additional questions:

- *How to make a purchase order? Examples*
- *What is the difference between quotation VS offer*

Updated organogram in processes June 2019

Updates regarding SODAQ EA:

Processes presentation - https://prezi.com/view/fCTWUr4ZNM8kfwrJN5uX/

Added processes and layers:
- Organizational structure
- Strategy
- Project development
- Customer journey
- Certification

Q&A:
- Ask for a HubSpot access

To-do:
- Share slides (link above)
- Share pics of processes (available on the drive)
- Share archi file

Interviews are done:
- Customer support (process to be added)
- Customer Journey
- Project development

Interviews to go:
- Operations
- Financial
- Employees

Hubspot improvements:
- Quotations database for overview (avoid different prices for same products - particular case - sniffer bikes for Utrecht university)
- Notes form (add primarily info with requirements, needs, motivation, etc)

Meeting 09/12/2020

-with Consultant X.

3 important points to keep in mind for building operational excellence:

1. Business functions;
2. Cross-correlation between different systems (employees roles in this case);
3. Data objects on different stages (amount of similar files);

TOGAF - correctly chosen architectural framework - *keep focused on a high level*

ArchiMate - modelling language & EA standard - correctly chosen

Archi - ArchiMate modelling tool

Recommendations from Novius:

- Style Guide for architecture models (Novius architecture framework)
- E-book (to be sent)

Representation:

- Cut big BP in small pieces to show the exact point

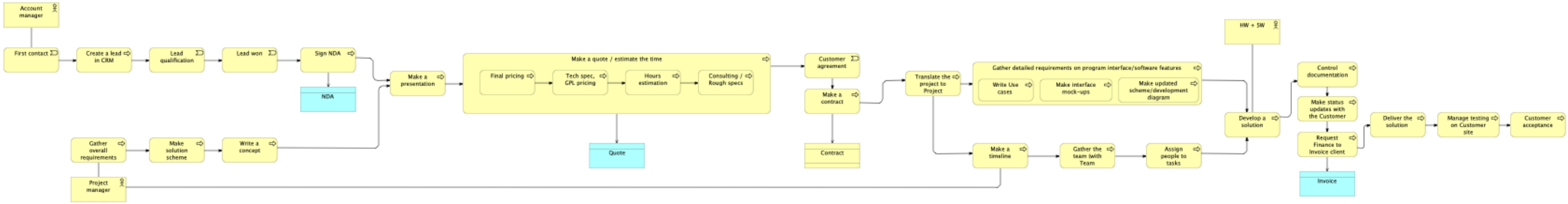


Figure 17. Project development process at SODAQ

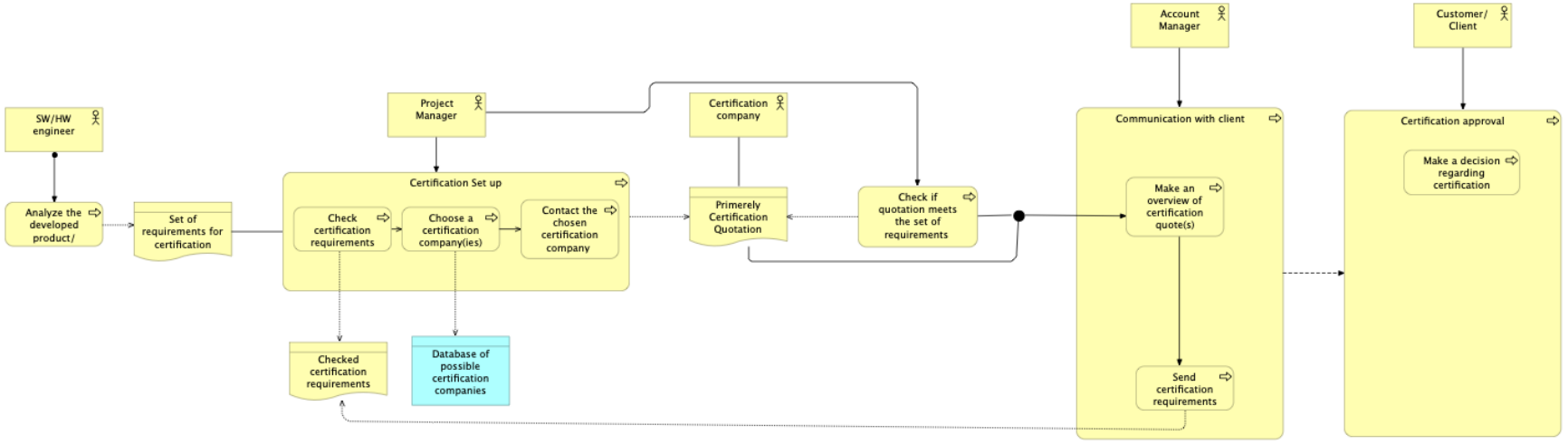


Figure 18. Certification process at SODAQ

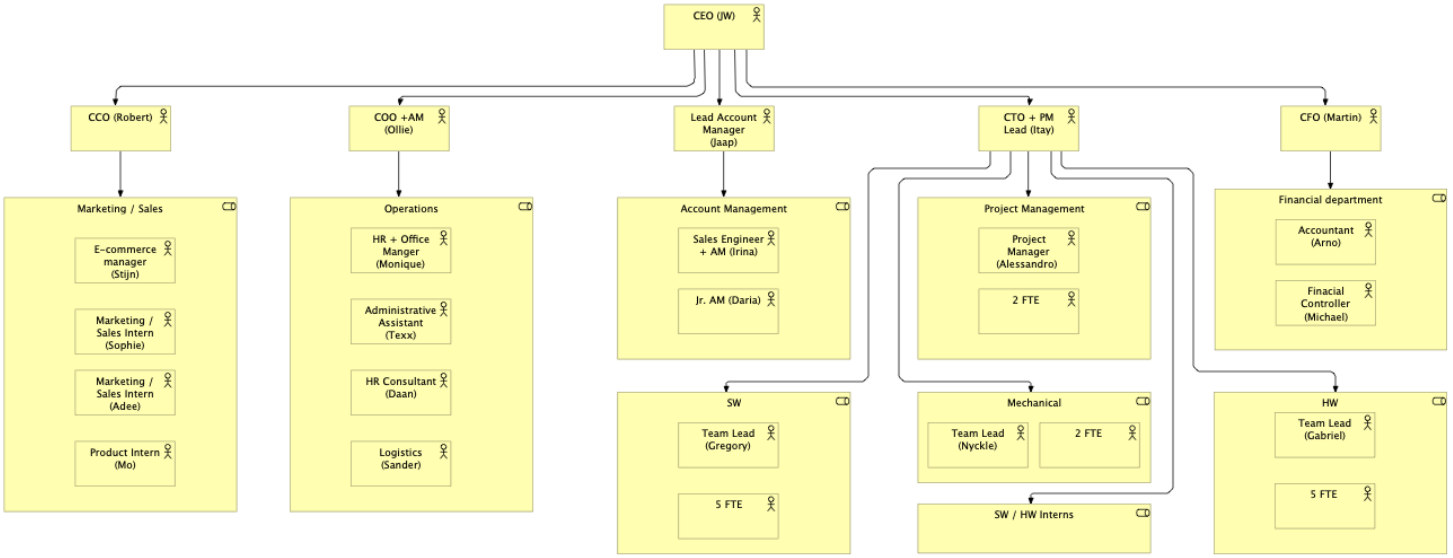


Figure 19. Organogram

Process in system:

1. Lead generation in hubspot;
2. Creating a quotation in e-boekhouden (consideration: making quote in 'project planning tool');
3. Indication of any details that are relevant to administration but should not be included in the quote (to make it easier for client to approve quote - e.g. risk margin);
4. Receiving purchase orders from clients (optional: if clients don't do this we don't need to force them to). It does make a deal more binding so it is preferred. If a quote must be changed, it is key that the account manager or salesperson changes it in the system, as it will need to match the invoices sent;
5. Project added to timekeeping only once a purchase order is received:
    a. Some projects have 1 timekeeping row, some have multiple (expand and collapse project);
    b. Timekeeping only allows hours to be filled if hours allocated aren't exceeded (AM can increase hours allocated, making a new row in summary overview: allocated but not quoted hours).

Plan:

- Make separate section within same login of timekeeping system
- Link APIs:
    - Hubspot:
        - Read client information to fill automatically in project planning tool
        - Create (fill) cell to link client to historic information from sales process and the new quotation/PO/invoice numbers *(optional - may be redundant as work.sodaq.com is leading)*
    - E-boekhouden
        - Create quotation (in e-boekhouden the data is auditable)
        - Read created quotations (content in E-boekhouden is used/leading)
        - Create invoice
        - Read invoices *(now manually splitting management and engineering hours)*
        - Read payment status
        - Michael:
            - P&L (reading grootboek nummer to match to a project). Missing now which purchase order is linked to that
            - Read material costs: only if there is material cost budget available can engineer or admin order materials
- Purchase orders:
    - purchaseorder@sodaq.com or uploading and automatically reading or manually inputting PO value
    - *Look at how other companies / systems do this*
- Link to timekeeping:
    - Read hours spent per project by different employees, *per purchase order (not available, manual)*, per time unit
        - Currently we need to manually link hours to categories.
- Show project statuses

Pages needed:

1. Project status overview (per project the following columns)
    a. Total budget
    b. Materials budget, requested, invoiced
        i. Standard markup

    c. Hourly rates (can be multiple different - *decide up to how many*)
    d. Per different rate:
        i. Hours budget
        ii. Hours invoiced
        iii. Hours remaining
        iv. Hours allocated but not budgeted
    e. Work in progress
    f. Outstanding payments
2. Individual project status
    a. Materials and hours
        i. Available per PO
        ii. Spent per month
        iii. Per different rate
    b. Totals
    c. Links between quotes and Purchase orders
    d. Work in progress
3. Quotations page (purpose is for sales team to see if there is any opportunity still open)
    a. Quotation date
    b. Link to hubspot client details
    c. Status (Quote created, quote sent, PO received, invoice #/# sent, project completed)
4. Invoice approval page
    a. For finance: approve and send invoice
    b. Quick access to relevant data from other sources
    c. *Stock keeping*
    d. *Purchase request form*
        i. Add to materials list
        ii. Now material purchasing is done via monday.com which is suboptimal
    e. *Incoming goods (stock)*
        i. Multiple warehouses
        ii. Quantity in/out
    f. *Link via API to e-boekhouden stock-keeping*
    g. *Link via API to lightspeed*
    h. *Engineers should be able to search in stock keeping system which components we have already (before ordering on farnell)*
    i. *Purchase request made in stock keeping*
        i. Item should be searched and if it exists the stock should show up
        ii. Make item in system if not already there
        iii. Once made can be approved and ordered
        iv. Once in should be marked as arrived
        v. Requester is notified of arrival of goods
        vi. Once sold stock should go down
        vii. Item can only be in shop, stock, or sold to project, or to client

Future ideas:

- Forecasts of income per project (based on averages)
    - Could be manual fields
- Notifications
    - Account managers to follow up/upsell to client/remind of payment/create a new invoice
    - Finance to send invoices
- Link to pipeline:
    - Clear link between hubspot and project planning tool to give clarity on sales opportunities and pipeline
- Hours split per department:
    - Improve quotation creation by knowing overspend/underspend of hours per project
- Resource planning:
    - Duration of project + allocated resources to project to make gantt chart of staff availability
    - Estimates for future available capacity for projects
    - Estimates for when hours can be billed: cash flow for
    - Ecasting
- TKS improvements:
    - Make reporting clearer: overview of hours per person per month (also per role per month). Especially useful for summary creation

Current tool used:

- Project master list (Excel Sheet)
- Similar setup can be used, but should be automated

Limitations of the current tool:

- Easy to make mistakes
- Complex to create overviews
- Different people work on it in different ways
- Too easy to manipulate in ways that are not preferred for the aimed format
- All inputs are manual

Essence of having an enterprise resource planning:

1. Account managers: visibility in PO remaining hours, billed hours, unbilled hours, paid/unpaid hours (priority # for new system)
2. Accounting: sending invoices that are auto-created, no need for manually filling PML
3. Financial control: all necessary analyses can be automated

Table 11. Competitor tools available and costs

Tool	Cost	Features	Limitations
ionbiz	€ 40/user per month ion biz + €100 per month for tools timesheets, projects, resources, relations Total = c.a. € 500 per month (10 users)	Elaborate	Can't be linked to monday.com We will need to replace e-boekhouden, TKS, hubspot
odoo.com	€ 18/user per month Odoo + € 8-16 per added tool per month (16 for project planning). Total = c.a. € 200 per month (10 users)	Unsure	
SAP	Robbert states a setup cost 20k + annual 25k	More elaborate	
AFAS	Michael to investigate		

00:00:00

Daria: I am interviewing you as an expert in DT (Digital Transformation) and the main SODAQ stakeholder and now we're going to make a final outcome of the model through the evaluation process. So, I have a list of questions and I'm going to grade the whole model based on your answers. The main approach that I took is that I have analyzed different consultancy frameworks in order to see how to perform DT. There are different factors such as people that connect to strategy (organization) which goes to the operational backbone (these are all processes within one company) and technology (which actually supports digital transformation). Because it's pandemic, many things are working differently and it's in the middle of the model. There are different performance criteria, six of them. Going from step to step, there are 14 steps of this process on how to make this digital transformation happen. Everything starts with the people when you **motivate the change** (1), then you **create the vision** (2), for example, why SODAQ needs an ERP system: why do we want to implement it? Why do we want to upgrade the TKS (timekeeping systems)? Then you **state short-term wins** (3). For example, in the beginning, we want to have just extra hours and then want to have a full process where everything is automated. And then you have to manage your process. So this is what is, according to the people, to the strategy. After this, we go to the operational backbone when we **define key processes** (5) that influence the digital transformation itself, then we **create operational excellence** (6) (that's why we define the process) and we put them together and then we have to **define an IT-landscape** (7). This is what you have done when you want to replace different IT systems. After this, we go directly to technology - a Digital Service Platform (DSP), which supports all this transformation. We have to **set up requirements** (8) and we have to **architect this platform** (9). After we made these, we have to make a connection between different circles of the model, so we can go to people and organizations first. We have to **define business roles for the processes** (10), who from employees and from the SODAQ team is a keyholder for the process and how they interact with the system. Secondly, we go to people and technology and we **set up the digital infrastructure** (11). And then we just have an interaction model: which interfaces users have and which processes are covered by the technology. For the last point, we have processes and technology. We have to ensure that the implemented **system supports all the processes in the company** (13) and that we **prepare a migration plan** (14). This framework is the final artefact of the thesis project. An ideal thing is to use it as a consultancy framework that everybody chooses to perform DT in the pandemic. My first question to you is how well do you think this model manages or serves the digital transformation? if all the key aspects are included?

00:03:33

Expert A: So, the first thing I think about when I see this model is something that

came back more than previous models that you showed: what is the business goal. For example, what does the company want to achieve by digitizing processes whether it is growth? For SODAQ, moving from an engineering company to a products & engineering company. And I think that comes maybe in strategy. So I would have added another aspect.

00:04:14
Daria: Yeah, it's just a step of the strategy.

00:04:16
Expert A: Exactly. It's really important because then you can always relate back to that point.

00:04:22
Daria: Yeah, that's true.

00:04:24
Expert A: But I'm really, really like this. It's very holistic. And so it covers a lot of aspects. And then again, what's the end? The end goal is to make things simpler, right? So, although the process of this is complex, the outcome should make things simpler. And I think that it would be valuable to add to this - what is the input and what is the output.

00:05:11
Daria: I'll go for other questions step by step. The second question is exactly what you were talking about. Do you think that the model matches the intended digital transformation results or stated goals? And you can check in short, medium and long term. You mentioned that you have to set up goals. Do you think this model really tracks them in short, medium and long term? Like if you can use this model to follow the whole process of the DT.

00:05:41
Expert A: I think what you should add, what you can use it for, and I think it does as well, is say this is a process. How often do you do the process? Just because you do the process doesn't mean you have to change anything. That should be the intention. Also, as you can say, we do all the interviewing of the people, see what's going on, and then maybe realize, OK, in six months we come back to this because the company is not ready for making the change. You know, a regular interval repeating the process...

00:06:15
Daria: that iteration

00:06:17
Expert A: iteration.

00:06:18
Daria: That's what my supervisor told me.

00:06:20
Expert A: Yeah. Yeah. But then you don't have to change the model. You just have to mention that it is a requirement of the model.

00:06:31
Daria: And a very standard question, what do you like about the model and what are the positive aspects and what are the negative? Maybe it's too complex or if it does not have coverage of all the things. So, maybe something is not clear...

00:06:48
Expert A: So what is very positive for me is that there's an order to it. And you cover other aspects and you sort of like to deepen into the combination of the aspects as you go through it. I think it's really well structured. And I want to see this as part of your role within the company as well in the future, as you have a way of thinking about things that make it structured and clear. So that's really valuable here. Then, I think also what is great is that the pilot turns the idea of a pandemic crisis into an opportunity to improve. Which is like getting out of it better rather than seeing pandemic as like making ends meet. Yeah. But I think...

00:07:42
Daria: negative things? You can also go to the different parts. So, for example, if you can take only the people or the organization or the technology and the pandemics or if you can also give comments about the intersection between loops. If something negative is there, or if you need more interaction and so on...

00:08:06
Expert A: So I think of the link between all three. In the middle now you only have performance criteria. But what I think should be there is training or like the people need to understand why and they need to understand how they use the tools. And for you to evaluate it is one thing and to convey it to people understanding and wanting to work with the tools, the motivational aspect. It's there for people.

00:08:43
Daria: Yeah, OK.

00:08:44
Expert A: But that's the change. So, the tool is really important in this.

00:08:50
Daria: OK, what I'm thinking right now is an immediate answer to what you're talking about to adjust this model. If there will be, for example, step 15 when we already make migration plans and everything. This step is coming back to people. And then you have this, as you said, **training: how to use a system**. Will it fulfil what you asked?g

00:09:15
Expert A: Yes. And evaluate. Evaluating.

00:09:18
Daria: OK, yeah. I will put it on. That's a very good thing.

00:09:22
Expert A: Yeah. Training and evaluation makes it circular as well.

00:09:26
Daria: Yes, that's right. Yeah. And then the next question, to what extent can changes be attributed to the model? I was just thinking, this is a question: how do these attributes speed, agility, efficiency, reliability, capability and resilience, influence parts? How do you think they can be extended?

00:09:52
Expert A: How to add more criteria?

00:09:54
Daria: No, how these criteria, for example, speed or agility can influence the DT process? This is a kind of brainstorm question, do you think these criteria influence parts of the models?

00:10:17
Expert A: OK, I think the model is the first step. Then you start to plan with the model when to have sessions with people. You create timelines. I think the capability is an important one, because people need to understand the different parts of the process, and need to understand why. You need to understand the tools. I think you need to actually go in because you want to get everybody involved. Kind of all the key stakeholders. But at the end of the day, there should be the consultant, which in this case is you - should actually make a recommendation and you can actually look at the organization, do the research, and then just advise like this is the way you should go. Because you're working with a company that doesn't have the tool. So if the company would know everything that they needed, they would probably have it. Do you see what I mean? Maybe you want to know something more about how the criteria affect the different steps... Um, I think it's very relevant to be quick but to also give this process time. So the speed is not just high speed, but it's selecting the right speed...

00:12:06
Daria: right priorities

00:12:08
Expert A: And also to say that maybe the company needs a year to change then not to try to do it in two months because people won't accept it or the technology integration or migration is not possible in that short amount of time. And then resilience, I like a lot as criteria because we should be planning for where the organization is in three years. This is a management level change and

management should always be looking at least three years in the future - what do we want to look like.

00:12:47
Daria: OK.

00:12:48
Expert A: And that's also the difference with interviewing the individual team members is they're not thinking, per se, about three years in advance. So let's find the balance

00:12:59
Daria: My motivation besides this question was that this criteria list came from the literature review, and I was writing the same patterns, which issues were challenges for digital transformation in pandemic like different cases. And there were six of them. And I was thinking that after interviewing you, I can also get an idea, maybe some of them are not really relevant. They can be from specific cases, but maybe for one particular company such as SODAQ, something can be not relevant. So, for example, if you can take one or two criterias out of this list, what will you take off?

00:13:57
Expert A: I think I keep speed as it is very important. I wouldn't stay focused too much on agility, because you have to also accept that every so many months or years, you need not be incremental but like a radical change. So agility more means that there is space for incremental change. But if you repeat this process every so many months or years, then you can just completely switch to a new process again, which is healthy for the company as well. So, therefore, efficiency is important. Um, capability. Is that more related to the people?

00:14:50
Daria: Yes. It's for people who are going to make this implementation.

00:14:55
Expert A: Yeah.

00:14:56
Daria: If you have enough resources, if they can support the change, if they can make the change.

00:15:04
Expert A: OK. So I think the criteria can be reduced simply for the fact that if you cover speed, uh, reliability, capability and resilience, you basically cover in the combination of those four criteria. You cover the others as well. Because agility and efficiency will come with the other four. I think, especially agility and efficiency are harder to measure.

00:15:42
Daria: Um, that's true. That's true. I think we can go to the next question, it's

regarding what were the particular parts of these models and the content that made a difference like which are more relevant? Is it people? Is it technology? Is it an organization? Or is it pandemic? Or again, if it's intersection cross-collaboration between people and technology, people and organizations, etc...

00:16:11
Expert A: Which ones are in order the most relevant? Right?

00:16:16
Daria: Yeah, like what do you think? Like we are making this transformation. Who are the most important people, technology itself, organization or when people use technology? These things.

00:16:30
Expert A: To be honest, I think the number one, the most and the highest priority for me is the link between the organization and the technology. Especially because that's a high level and there's a lot of people involved. Overall, there are people who better fit it and some people will not. You will need to do training in some cases, but what's always going to be necessary is the link between the technology and that the organization can use it. So, the process and the technology both, then I would say the people by themselves are the second-highest priority because you need to get them to use the new structure. To be completely honest, I think this is always important. Pandemic is a nice example because we right now are put under pressure to perform with fewer resources or with more challenging contact. And so it's more of a situational effect. But even if there's no pandemic, the model is still equally important. I would say that the pandemic part has a lower priority, but it's still very, very valuable. Then I think about the people and the technology - the less. So I would say if we start with organization technology that links number one priority, then the people themselves and then the people and the link to the processes - the third. And then, I would say, lastly, the people in technology.

00:18:31
Daria: Thank you very much. Do you have any additional comments that may be that I did not include or did not ask? Or maybe you have some questions? Something is not clear?

00:18:44
Expert A: Oh. I think it's very clear, I think the main thing I really like is the application of it. I would love to see simplified examples if you'd make a copy-paste of this diagram and you would just show how this would be applied in the real setting. Yeah, for example, technology, what kind of digital service platform? What does that contain?

00:19:24
Daria: This is exactly why I would like to have SODAQ as a validation case. In the case of the digital service platform, I would write requirements for the ERP system,

which is going to replace the landscapes of many, many, many systems. This is one of the examples in general. This digital service platform is a unique component that depends on the case. So it can be for internal and for external use also.

00:19:54
Expert A: OK, so that's it. Perfect. And, uh. No other questions for me.

00:00:00
Expert B: Hello.

00:00:02
Daria: Hi, Frederick. How are you doing?

00:00:07
Expert B: Good. A little bit busy.

00:00:09
Daria: Thank you very much for your time.

00:00:13
Expert B: How are you? Also good?

00:00:17
Daria: Yes, yeah. I really appreciate that you agreed to take part in the evaluation. I will give you a short introduction. I am finalizing my thesis. My specialization is business information technology and the topic of my thesis is digital transformation in conditions of the pandemic. The main idea is that based on the literature and different cases, I developed the model, which you can see on the screen, which can help companies to perform...

00:00:46
Expert B: Sorry, Daria. This is so bad... I cannot hear you. There's a very big echo.

00:00:51
Daria: OK, I will try to rejoin then... maybe.

00:00:56
Expert B: OK, maybe.

00:01:08
Daria: Hey, is it better now?

00:01:11
Expert B: Yeah.

00:01:18
Daria: The topic of my thesis is digital transformation in the pandemic. And based on the literature and different cases, I developed a model that can help companies to go through this transformation. And as a part of this final project is an evaluation of the designed artefact when I ask the opinion of professional experts to look critically at the model and give me some proposal or advice on what can work, what might not work. The validation case for my thesis is SODAQ and the validation case is a possible implementation of an ERP system. So, I have already had my interview with Ollie and I'm going to take approximately a 20

minutes interview with you. I'm going to guide you through the model. I have a list of questions. I will explain more about different parts and I would appreciate your opinion and your expert comments on the model.

00:02:30
Expert B: What kind of discussion did you have with Ollie? About what system? ERP?

00:02:33
Daria: Yes. Enterprise resource planning system.

00:02:37
Expert B: OK. ERP.

00:02:42
Daria: Do you mind if I record this session for my research?

00:02:46
Expert B: No. No problem.

00:02:47
Daria: Thank you. OK, so you can see three circles on the screen. A circle (1) is people. It contains a strategy circle. Then comes organization (2), which means operational backbone and the whole process is within the company. The third circle is technology (3) is a digital service platform. This is a possible ERP system. In the middle of this, this is a crisis situation. It's pandemic and it includes six performance criteria. This model was made and developed based on other models developed by consultancy companies and with input from the literature. Each and every circle has steps on how to perform the DT. The main goal of, for example, the validation case in SODAQ, is to implement an ERP system. So do you think that in this model we are the three mentioned aspects people, organization and technology manage the digital transformation possible?

00:04:02
Expert B: I think it looks very comprehensive, so I agree that it does include key elements. So the part of motivation and how to make sure that people are involved and they start to support the change from the organizational part as well. Aligning are the key processes and understanding milestones and deadlines and technology part. It's interesting that you think that the middle circle goes with the crisis so that even makes it more complete. So, the first impression, I would say it's complete.

00:04:43
Daria: Thank you. Then we're going to go to the next question. One of the questions that I prepared is what do you think are the negative and positive parts of the model? What do you think? Maybe it is the people, maybe the digital service platform or maybe something is not included or maybe you have any other ideas?

00:05:16
Expert B: Yeah, well, positive is definitely that it's comprehensive. It looks like it includes, you know, the multiple factors that are needed to look at it, to work on. When you look at people, there is room for improvement, which we would call a change committee. So the small number of people are actually guiding the rest of the organization towards the change. So with maybe small interventions, workshops, you know, making sure that you have quick ways that people see progress. And because, of course, the most unpredictable part of change is people and how they deal with the change, which is called more transition, so change is happening all the time and it's external, but how I do or how the people deal with change is internal, also called transition. You've got William Bridges. He wrote a nice book around it and Kotterr has "8 The Steps of Change".

00:06:28
Daria: Eight steps?

00:06:31
Expert B: Yeah, it is also interesting to look at how he lays out that process in there. He also talks about a change committee. That's the part where I see some room to consider.

00:06:46
Daria: Yeah, I was expecting that you will be giving more comments about the people part.

00:06:52
Expert B: OK, everybody has their expertise, right?

00:06:56
Daria: Yeah. That's actually true.

00:07:06
Daria: I also would like to lead you through this plan and to explain more. We can also look into parts. So first, as you said, people are important and when we create a change, especially if it's a technology change and also in a crisis situation when it's pandemic and we have to make it very fast and we have to make it agile, we have to motivate the change (1) for the people, for the employees. So it's step number one. Step number two is to formulate the vision (2). Why do we have this transformation and why do we need this implementation? Then we, of course, have to identify short term wins (3) to build a kind of strategic approach and of course, we need to monitor how the change is going (4). Then when we can cooperate with the people, we go to the next phase - it is an organization where we build an operational backbone. Step number five, we have to define key processes (5) that are going in the company - business processes. Based on these will have to create operational excellence (6) to be sure that all the processes are working. Step number seven, we define an IT landscape (7) that is covered by these processes. After we set people and operations, we go to technology. We have to set up requirements (8), it's step number eight and we

have to make an architecture of these service platforms (9), how it's going to support processes. These are key elements of the three circles. Then we have intersections when we have to connect people with the organization. It's step number ten. We have to define business roles for processes (10). After this, we go to people and technology. Step number 11, how we can set up digital infrastructure (11) around the users because users are employees. And then the following step, we have to leverage interactions, interaction models (12) - how our employees/users are going to interact with the system, how many data objects they create and how they transfer data. Then we have to look into operational backbone and technology altogether. Step number 13, we have to ensure that system processes support business processes (13) so that our system really fulfills all the needs of the company. And then the final step is to prepare an immigration plan (14). After I gave you this brief introduction into the whole model, I would like to go deeper into this and to ask you, what were the particular parts of the model and the context that made a difference for your perspective?

00:10:14
Expert B: You make a difference.

00:10:15
Daria: Something that really shows you that it's a new model, I would say.

00:10:30
Expert B: Well, I think because you define that people, organization and technology, and then you include, let's say, where the touching point is on an organization or research technology and people and technology. I think that is new. Right. I mean, there is innovation in that approach. It's well-considered that the fact is on the pandemic criteria, this is, of course, depending on the project because an ERP project is so big, you would probably ask yourself, do I need to work according to the pandemic performance criteria and include speed and everything that's there? Because ERP is so big that even though we are in a crisis, we still might take the usual path. Right, without stressing too much on those criteria. So I guess for me, the pandemic criteria or the crisis criteria are interesting, but only if the change is relevant towards the crisis. So if change is needed in order to navigate the crisis better. Wouldn't be a project I would challenge you to say. Well, you know the complexity of that for SODAQ is so large that I don't want the pandemic to influence that process. Do you know what I mean?

00:11:56
Daria: Yes. Yes. That was my biggest concern regarding the validation case for the test model. OK, I agree with you. Thank you. And then my following last section of the interview goes deeper into these small circles: regarding the organization and the operational backbone, which role does this element play in the overall model? Which priority can you give to it? Low, high or medium?

00:12:44
Expert B: High. High!

00:12:47
Daria: If it comes to people and strategy, which priority will you give to this element in the overall model?

00:13:02
Expert B: From my perspective, there would be number one. It's a little bit higher than the operational backbone. So it's a complete strategy then. Operational backbone and then technology.

00:13:21
Daria: Am I right that for a validation case as ERP then we are avoiding, according to your opinion, performance criteria. But if it's a different technology, which we implement because of the pandemic, then pandemic will have higher priority.

00:13:39
Expert B: Yeah, if it's business-critical.

00:13:42
Expert B: Yeah, sure. Can I give you an example?

00:13:47
Daria: That would be great!

00:13:50
Expert B: In my business where 80 percent of our work was face to face in terms of consulting. All the business, all the performance criteria were essential to transform to virtual deliveries. Zoom, Teams, you know, and much more in digitised accounts. And if you look at my partner company, they have worked extremely hard on those performance criteria to change and not to procrastinate and not to wait, you know, or to take longer because it was truly business-critical to survive.

00:14:27
Daria: I understand. That was the point when I was working on these performance criteria because this information has its own path. But when it's caused by a corona situation crisis, we have to adjust and we have to make the change when we have to understand how we change the whole implementation strategy. So, for example, as you mentioned, Kotter has eight steps of change. It can really transfer during pandemics because some steps will have to do faster, some steps will have to split. That's how I also came up with this model. And yeah... these actually were all the questions that I prepared for today for you. Maybe you have some brainstorming ideas. What can be added to the model, what can be adjusted or changed according to your experience?

00:15:39
Expert B: Well, setting up a change committee could be one of the steps on the

people and strategy. So, you know, validating people's strategy against Kotter is what I would do. And there is something like this in the ERP example. There's something like you talk about support, right? So there needs to be some kind of a support function when the ERP or when the system is rolled out. Where do people go if they're struggling with the new system, who will support them? Yeah, that's the second point. I'm just brainstorming.

00:16:21
Daria: Yeah. Yeah, yeah. That's exactly what I ask you for.

00:16:24
Expert B: Yeah. So, something like an evaluation session and when the system is rolled out, what is the support, where is the support. Where can people go if they can't utilize the new ERP system or you know when they struggle with the process. So somewhere that needs to be a support team or something like that. How are the procedures documented? Where can people go, let's say Z happens, where do I go?

00:17:39
Daria: It's a good point. You are talking about the overall process or how you interact with the system or just about the ordinary employee who wants to work with the system. Where do they go?

00:18:06
Expert B: So, the pilot is being transformed to fly from a Boeing to a new Airbus, right? When something happens in the system, there's a strange light starting to bleed orange. He can go and he finds out what this orange means.

00:18:34
Daria: Yes, yes, yes, yes. I understand.

00:18:39
Expert B: It is not the same as support that he's not going to be a computer programmer or he's not going to call the system engineer saying: "hey, I've got an orange light flashing". No, he's not going to do that. He knows where to digitally go on his computer or, you know, to take out a manual or whatever. And it's orange, like, I need to press this and then I need a taxi. I need to, you know, whatever, do something with the breaks and then I need to move forward again. I'm just, you know, blah, blah, blah...

00:19:39
Daria: I agree.

00:19:40
Expert B: OK, and what about the training of people...

00:19:45
Daria: This is a very good point. Ollie also said that it's very important to train people how to use the system. Yeah. It's missing.

00:19:57
Expert B: And so you've got role definitions, key users, and they need to train the users, right? And users are trained by the system implementor or a consulting company, whatever.

00:20:14
Daria: OK, yeah, this is also a very important thing to add. I will keep it in mind. Thank you. Hmm. Yes. So, actually, that was the whole evaluation session. I really appreciate your time and your critical viewpoint that you shared. I can also adjust the model up to your comments. Do you have any suggestions after we have this interview and maybe you come up with anything extra that I missed some questions that I did not ask?

00:20:56
Expert B: No, you're very straightforward and to the point and are you managing time well. I mean, it's less than 20 minutes or so. I think that's very good. And sometimes you're quite fast. You talk fast. So, I mean, you need to leave a pause or to slow down a little bit in other interviews. That is my suggestion that you can make it clearer or better. I honestly think it's. Yeah. What I already said before. For a lot of transformations, it's a complex process for companies, organizations to go through and this shows the complexity of it. So I think it's good. It's inclusive and comprehensive.

00:21:49
Daria: OK, thank you very much.

00:21:52
Expert B: I hope it was of value to you as well.

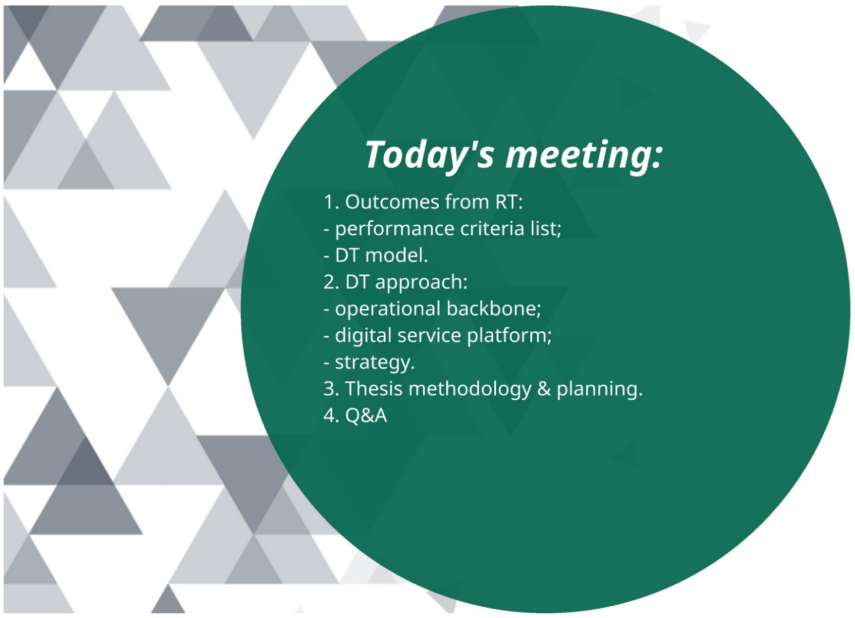
00:21:56
Daria: Yes, it was extremely.

Final BIT Project:
evaluation session

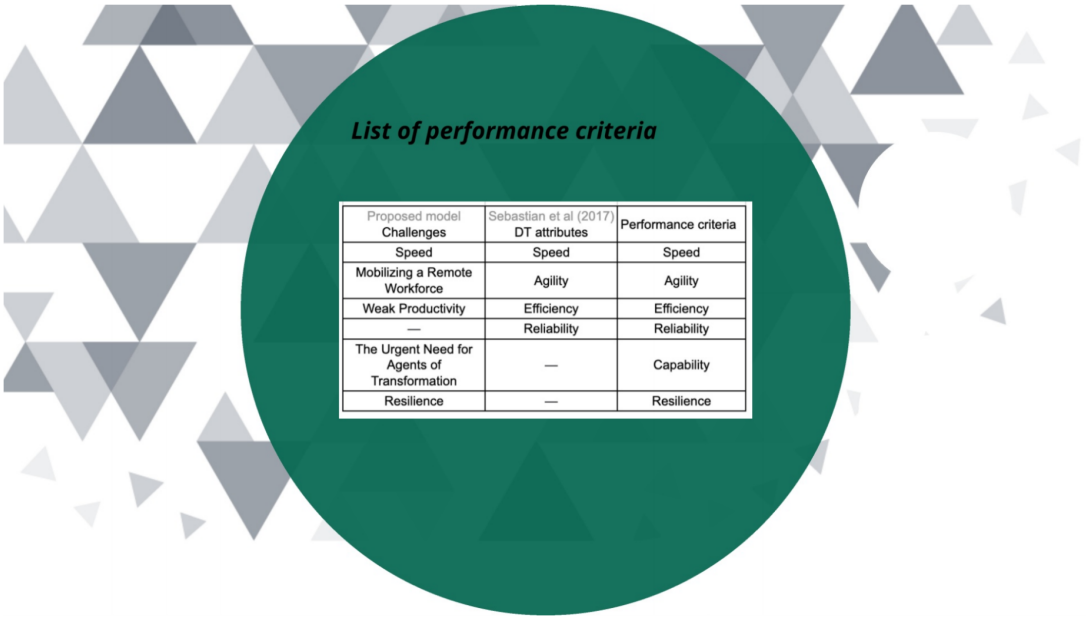
Student: Daria Yakushkina

Supervisors: Dr. ir A. A. M. Spil
Dr. M. Daneva

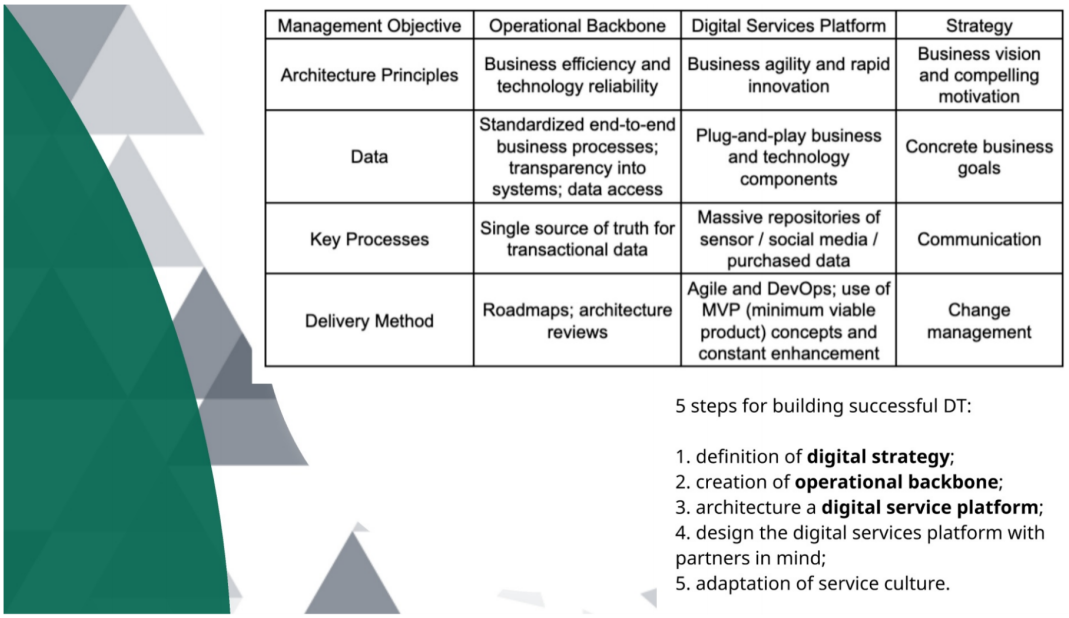
Slide 1: Introduction



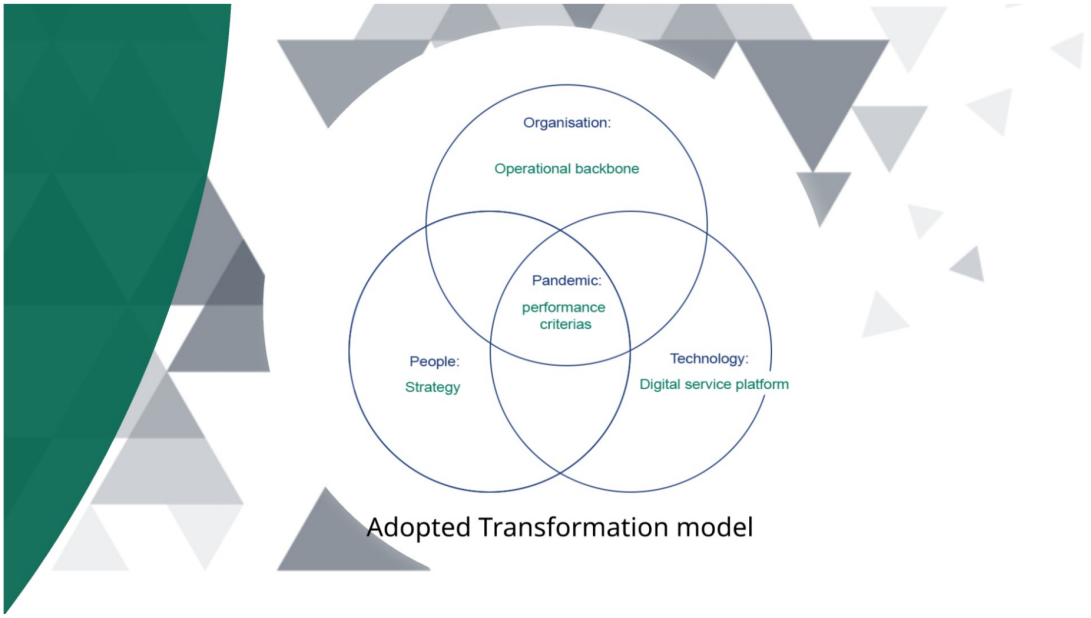
Slide 2: Agenda



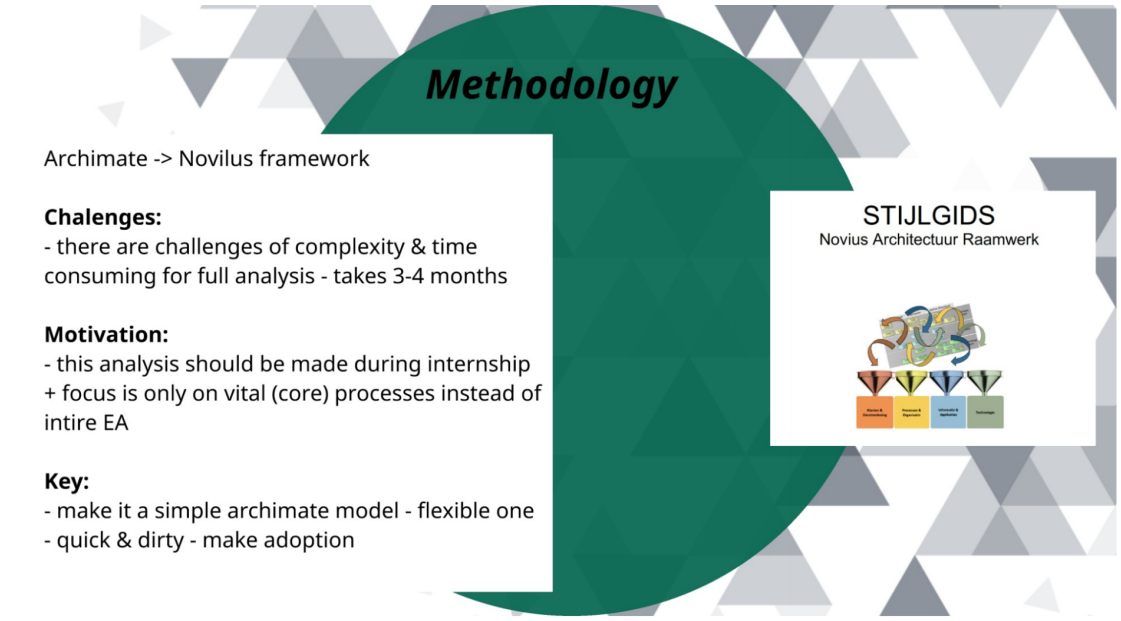
Slide 3: Outcomes from the RT - List of Performance Criteria



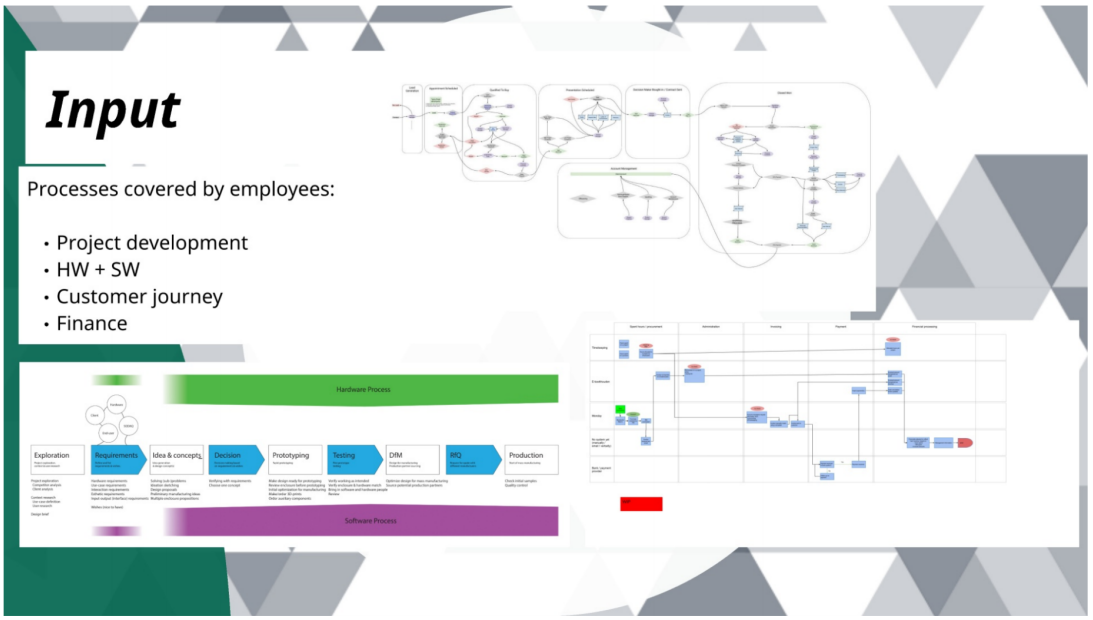
Slide 4: Outcomes from the RT - Management Objectives



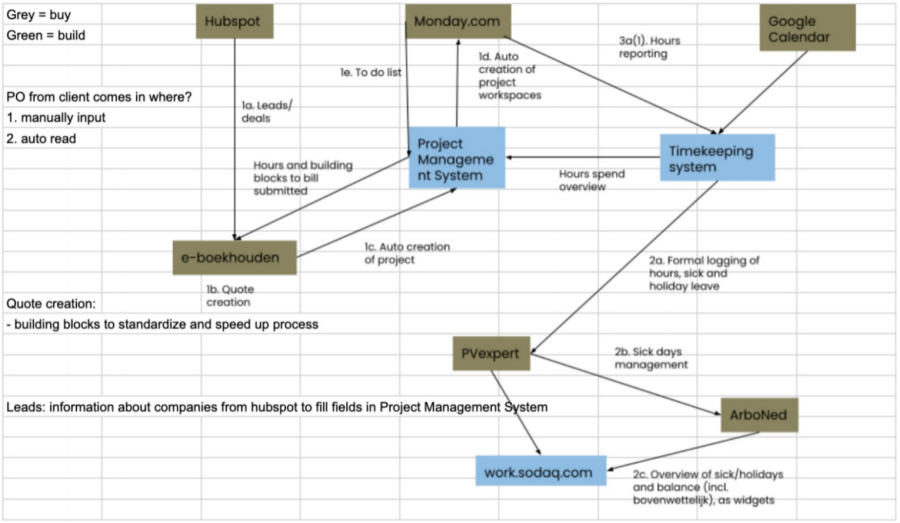
Slide 5: Digital Transformation Model



Slide 6: Architecture Methodology



Slide 7: SODAQ Process - Input from the Employees



Slide 8: SODAQ Integrated IT-Landscape

Slide 9: Introduction to Digital Design

Slide 10: Design Science Process

Slide 11: Evaluation Interview