Professional MBA
Entrepreneurship & Innovation

IT Reeingeneering for Growing Organizations. Exploiting the Full Potential of Digitalization in Developing and Manufacturing Companys.

A Master's Thesis submitted for the degree of
“Master of Business Administration”

supervised by
Univ.-Prof. Mag. Dr. Sabine Theresia Köszegi

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Affidavit

I, **DI THOMAS KUEGERL, BSC**, hereby declare

1. that I am the sole author of the present Master's Thesis, "IT REEINGENEERING FOR GROWING ORGANIZATIONS. EXPLOITING THE FULL POTENTIAL OF DIGITALIZATION IN DEVELOPING AND MANUFACTURING COMPANYS.", 108 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted the topic of this Master's Thesis or parts of it in any form for assessment as an examination paper, either in Austria or abroad.

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_____
Signature

Preface

This master thesis is an original, unpublished work by the author. All content and intellectual development was created by the author. The evaluation was done on the basis of case study companies' data and, therefore, it is presented in relations only.

The problem subject to this thesis arose at my workplace, a medium-sized company that develops and manufactures mechatronic products. I am convinced that the developed organizational redesign represents organizational transformation any IT department must take into account for future use. I am a member of the IT department in the case study and, therefore, I can assist in bringing my environment to a next level.

Interested decision-makers, and managers of IT departments in particular are given a comprehensive overview on how to design an organization in a way that allows utilizing the full potential inherent in digitalization. With the help of organizational design, first steps on the way to a modern IT department being well prepared for the future are provided, and an outlook is given how next development stages could look like.

Organizations that adapt are ready to jump on the digitalization bandwagon and can act and react to external environments and remain competitive on the global market.

I would like to thank the management of the WU Executive Academy and Vienna University of Technology for the organization of all modules that where held in Austria and abroad. In addition, I would like to thank my fellow students within the PMBA Entrepreneurship & Innovation 2018-2020 program for many great inspiring discussions. Finally, I would like to thank my supervisor for valuable guidance, my superior for challenging, my wife and family for their patience, my proof-readers for their efforts and my friends for their silent support.

The knowledge I have gathered during this program is reflected in parts of this thesis.

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Abstract

Organizations today must face the challenges and potentials of digital transformation globally. The increasing speed at which newer and better still digital technologies are emerging is forcing managers to design organizations accordingly. On the one hand, new business models must be created to meet customer demands while on the other hand, internal processes and areas using information technologies need to be rethought. To be successful in a volatile environment, flexible organizational designs are a basis to remain competitive and develop competitive advantages.

This thesis shows traditional and modern methods, processes, and also structures which allow small and medium-sized organizations to reorganize their rigid hierarchical and proven procedures when it comes to information technology. The first step in a multi-phase reorganization of IT departments using the most appropriate methods and tools was developed throughout this thesis. The applied structure, processes, and tools shall benefit LOGICDATA's first steps on their way to become a digitalization champion in process digitalization and IT. The model is designed to meet the requirements of both traditional and modern IT environments. Modern, less hierarchical structures are combined with traditional forms. Finally, an outlook on structureless organizational designs is provided to make the purpose of the department a top priority where talents, experience and personal attitudes of the team specify the future journey.

The first phase of the developed organizational design has been introduced in the case of LOGICDATA and evaluated by the author. The new approaches to structure, tools and processes have been compared to positive and negative aspects of the status quo before the organizational redesign. The results provide improvements and limitations the model has in its evaluated environment.

The thesis was written in times of the global pandemic crisis due to coronavirus disease (COVID-19). In this paper, less hierarchical structures show the likelihood to adapt faster to such environmental changes compared to others.

Keywords: IT, Digital Transformation, Digitalization, Organization, Reorganization, Bimodal, Structureless Organization, Process, Agile, Scalability, Structure, DevOps, Lean, Optimization

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Table of Contents

Affidavit i
Preface ii
Abstract iii
1 Introduction 1
1.1 Initial Situation and Problem 1
1.2 Objectives and Research Questions 3
1.3 Research Methodology 4
1.4 Course of Investigation 5
2 Digitalization and Organizational Design 6
2.1 Digital Transformation 7
2.1.1 General Discussion, Definitions and Terms 7
2.1.2 Drivers and Effects of Digitalization 8
2.1.3 Use of Digitalization 10
2.1.4 Benefits and Risks 13
2.1.5 Digitalization and Organizations 15
2.2 Organizational Solutions 17
2.2.1 General Discussion, Change and Culture 17
2.2.1.1 Organizational Change 17
2.2.1.2 Organizational Culture 18
2.2.2 Traditional Structures Influenced by Digitalization 20
2.2.2.1 Challenges in Traditional Structured Organizations 21
2.2.2.2 Organizational Processes 22
2.2.3 Modern Structures Influenced by Digitalization 24
2.2.4 Trends in IT Organizations Influenced by Digitalization 27
2.2.4.1 Bimodal Organizations 27
2.2.4.2 Development and Operations - Lean Principles in IT Operations 28
3 Organizational Model 30
3.1 Organizations and Its Environment 31
3.1.1 LOGICDATA's Environment 31
3.1.2 IT Environment Roles, Tasks, and Interfaces 33
3.1.3 The Need for Transformation in IT 36
3.2 Model Development Phases 38
3.3 Phase 1: Transform IT Evolutionary 40
3.3.1 General Focus and Objectives 40
3.3.2 Management 41
3.3.3 Structure 42
3.3.3.1 Jour Fixe 44
3.3.3.2 Systems Committee 45
3.3.4 Processes and Tools 45
3.3.4.1 Digitalization Roadmap, Assessment Logic and Technology Radar 46
3.3.4.2 Task Management - Principles of Flow 48
3.3.4.3 Adapt Cloud Usage by Cloud Adoption Frameworks 50
3.3.4.4 Digitalization Project 53
3.3.4.5 Product and Service Development Project 54

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3.3.5 Resources ... 54
3.3.6 Organization's Readiness for Further Transformation ... 56
3.4 Phase 2: Bimodal, Less-structured IT ... 58
3.4.1 Management ... 58
3.4.2 Structure ... 59
3.4.2.1 Internal-, Macro- and Micro-Environments ... 60
3.4.2.2 Operational Units and Steering Committee ... 61
3.4.3 Processes and Tools ... 61
3.4.3.1 Self-management Processes ... 62
3.4.3.2 DevOps - Next Step in the Principle of Flow ... 63
3.4.3.3 Bimodal Principles ... 64
3.4.4 Resources ... 64
3.5 Phase 3: Strategic Self-organized Staff Units ... 65
4 Evaluation ... 67
4.1 Criteria 1: Focused, Agile, and Sustainable Management of System Landscape ... 67
4.1.1 Criteria Relevance ... 68
4.1.2 Impacts on the Organization (Department and Company) ... 68
4.1.3 Phase 1 Approach ... 69
4.1.4 Conclusion ... 70
4.2 Criteria 2: Lean Operation through Transparent Task Management and Improved Core System Handling ... 72
4.2.1 Criteria Relevance ... 72
4.2.2 Impacts on the Organization (Department and Company) ... 72
4.2.3 Phase 1 Approach ... 73
4.2.4 Conclusion ... 76
4.3 Criteria 3: Structure Design Evaluation through Expert Interviews ... 77
4.3.1 Criteria Relevance ... 77
4.3.2 Summary ... 77
4.3.3 Conclusion ... 79
5 Discussion and Conclusion ... 81
5.1 Summary ... 81
5.2 Conclusion ... 82
5.3 Outlook ... 83
References ... 84
Appendix 1: Role Description Examples ... 89
Appendix 2: Fact Sheet from Technology Radar ... 93
Appendix 3: Interview Questions ... 94
Appendix 4: Survey Questions ... 97

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List of Figures

Figure 1: Changing role of IT in organizations. Based on data from (Urbach/Ahlemann 2019) ... 2

Figure 2: Research methodology. Source: Adapted from (Kleindienst/Biedermann 2017, 9) 4

Figure 3: Course of investigation. Source: Own illustration 5

Figure 4: Relationship of digital transformation and organizational design. Source: Own illustration 6

Figure 5: Various drivers of digitalization affecting various levels. Source: Based on data from (Abolhassan 2017; Parviainen/Tihinen 2017) 9

Figure 6: Stages digitalization changes economy. Source: Based on data from (Abolhassan 2017, 15) 11

Figure 7: Benefits of Digitalization. Based on data from (Parviainen/Tihinen 2017, 10; Urbach/Ahlemann 2019, 8) 13

Figure 8: Risks of digitalization. Based on data from (Urbach/Ahlemann 2019, 11) 14

Figure 9: IT-Risk management process. Source: Adapted from (Knoll 2017, 13) 15

Figure 10: Levels of consciousness with organizational models. Adapted from (Gerndt 2014) . 18

Figure 11: The Lily Pond as a metaphor for levels of culture. Source (Schein 2016, 33) 19

Figure 12: Organizational processes. Source: Own illustration 22

Figure 13: Modern structures. Source: Own illustration 24

Figure 14: Viable System Model. Source: (Hoverstadt 2008, 44) 26

Figure 15: A wall of confusion - DevOps opponents. Source: (König/Kugel 2019, 291) 28

Figure 16: The principle of flow. Source: (Kim et al. 2016, 15) 29

Figure 17: Elements in the organizational design. Source: Own illustration 30

Figure 18: Macro- and micro-environment of organizations. Based on data from (Jones 2013, 82; Oliveira 2012, 67) 31

Figure 19: IT environment status quo at LOGICDATA. Source: Own illustration 34

Figure 20: Digital Innovation Quotient LOGICDATA. Based on data from (Werkl 2020, 3) 36

Figure 21: Software tools analysis. Source: Own illustration 37

Figure 22: Phases to transform IT. Adapted from (Urbach/Ahlemann 2019, 105) 38

Figure 23: Digitalization & IT phase 1 organizational structure. Source: Own illustration 42

Figure 24: Mission and goals of transformed IT. Source: Own illustration 44

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Figure 25: Jour Fixe agenda and members. Source: Own illustration 45

Figure 26: Goals systems committee. Source: Own illustration 45

Figure 27: Digitalization Roadmap. Source: Own illustration 46

Figure 28: Technology radar process. Source: Own illustration 47

Figure 29: Technology radar. Source: Own illustration 47

Figure 30: Digitalization cube. Source: Own illustration 48

Figure 31: Types of task in a task management. Source: Own illustration 49

Figure 32:Statuses of work in task management. Source: Own illustration 50

Figure 33: Cloud adoption frameworks. Adapted from (Blanchard 2020, O.V. 2019) 51

Figure 34: Digitalization project process. Based on data from (Groß/Pfennig 2019) 53

Figure 35: Digitalization project process details. Based on data from (Groß/Pfennig 2019) 53

Figure 36: Resources in the transformation. Source: Own illustration 55

Figure 37: Examples of qualitative readiness measures. Based on data from (Laloux 2014).... 56

Figure 38: Managerial change of thinking. Source: (Juncu 2015) 58

Figure 39: Digitalization & IT phase 2 organizational structure. Source: Own illustration 59

Figure 40: Self-management (processes). Based on data from (Laloux 2014, 209)..... 62

Figure 41: DevOps - Phase 2 steps in principle of flow. Source: (Kim et al. 2016, 15) 63

Figure 42: Skills and attributes in a steering committee. Source: Own illustration 65

Figure 43: Phase 3 overview. Based on data from (Urbach/Ahlemann 2019, 106) 65

Figure 44: Evaluation scenarios and indicators. Source: Own illustration 67

Figure 45: Systems landscape survey LOGICDATA. Source (Kügerl 2020) 70

Figure 46: Request process LOGICDATA. Source: Own illustration 73

Figure 47: KANBAN board concept for task management. Source: Own illustration 74

Figure 48: Task management survey LOGICDATA. Source: (Kügerl 2020)..... 75

Figure 49: Ratio of workload for support and improvements over time for ERP activities. Source: Own illustration 75

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List of Tables

Table 1: Specialization and coordination in organizational structures. Based on data from (Jones 2013, 170; Laloux 2014, 116) 20

Table 2: Traditional-Agile. The iron triangle of agile. Adapted from (Vieweg 2019, 80) 23

Table 3: Overview of teal organizations structures, practices, and processes. Based on data from (Laloux 2014, 327) 25

Table 4: Bimodal IT. Source: (Barton et al. 2018, 260) 27

Table 5: KPIs in task management. Based on data from (Abel 2020) 76

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List of Abbreviations

In this list, the explanation of common abbreviations is omitted. Specific abbreviations for information technology, digitalization and organizations are described.

BA	Business Applications
B2B	Business to Business
B2C	Business to Customer
BMDW	Austrian Federal Ministry for Digital and Economic Affairs
BPM	Business Process Modeling
BPMA	Business Process Management and Analytics
CAD	Computer Aided Design
CAF	Cloud Adoption Framework
CAPEX	Capital Expenditure
CDO	Chief Digitalization Officer
COO	Chief Operating Officer
CPI	Continuous Process Improvements
Dev	Development
DWH	Data Warehouse
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
GDPR	General Data Protection Regulation
HR	Human Resources
IaaS	Infrastructure as a Service
IT	Information Technology
ITC	Information Technology and Communication
I&S	Infrastructure & Security
KPI	Key Performance Indicator
Ops	Operation
OPEX	Operational Expenditure
OU	Operational Units

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ROD	Return on Digitalization
SaaS	Software as a Service
SMEs	Small and Medium-sized Enterprises
SOE	Systems of Engagement
SOR	Systems of Records
TCO	Total Costs of Ownership
UX	User Experience
VSM	Viable System Model
WIP	Work in Progress
WKO	Austrian Federal Economic Chamber

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1 Introduction

In the last decade, organizations have faced the challenges of increasing speed, enhanced transparency, and new technologies inherent in digital transformation. Moreover, small, and medium-sized enterprises (SMEs) change and adapt to stay competitive and leverage their specifics e.g. strong niche expertise, shorter decision-making processes, and lower budgets. The existence of a digital transformation strategy for SMEs as a basis to introduce new technologies inherent in digitalization in a structured and sustainable way is essential for the survival of any organization. (Lindner/Leyh 2019)

The question arises who within an organization should track, introduce and maintain digitalization initiatives. (Adeyeri et al. 2019, 173) discusses the increase of information technology through digitalization in production related organizations and the issues of internal IT growth as far as process know-how and expertise are concerned. Moreover, (Geschwill 2016, 17) depicts the changing role of IT within an organization over the last decades. Starting from a supporting service in hardware via the use of IT as software provider to enable e.g. communication to finally being part of product- or service development projects in the role of an enabler having expertise with regard to new digital technologies.

The goal of this thesis is not to set up a digitalization or digitization strategy nor to investigate new digital business models in an organization but to design an IT organization which is able to cope with the existing infrastructure and tools on the one hand and, on the other hand, with rapidly changing requirements for IT departments due to new digital technologies.

1.1 Initial Situation and Problem

In organizations of a size where information technology is handed over to designated teams (>100 employees), it was common practice that these roles where designed to build up a secure, and modern high-performance infrastructure. The focus was put on hardware and less on software as IT staff was trained and educated in this respect. With this intention in mind, IT departments found their responsibility in providing hardware with operating systems and further office tools, e.g. text processing, calculation tools, e-mail tools, etc. As functional departments have additional needs, IT personnel struggles to provide suitable software solutions due to a lack of expertise in processes and value creation. (Andenmatten 2017, 262; Groß/Pfennig 2019, 46; Urbach/Ahlemann 2019, 101)

With the third industrial revolution beginning in 2000, IT spread out into various areas of an organization (Geschwill 2016, 12). Because of digital possibilities due to technological innovations such as intranets for sharing information or electronic mails supplementing paper mail, IT got a central mainstay inside an organization. Nevertheless, the environment and solutions were

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changing rapidly. IT operators were adapting too slowly, not fulfilling the needs of a modern, agile, matrix structured organization. In fact, corporate IT was not standing still in the past decades. There were constant further developments. However, the big difference today is that many technologies such as big data, social media, mobile computing, etc. start spreading quickly at an unprecedented speed. (Urbach/Ahlemann 2019, vii)

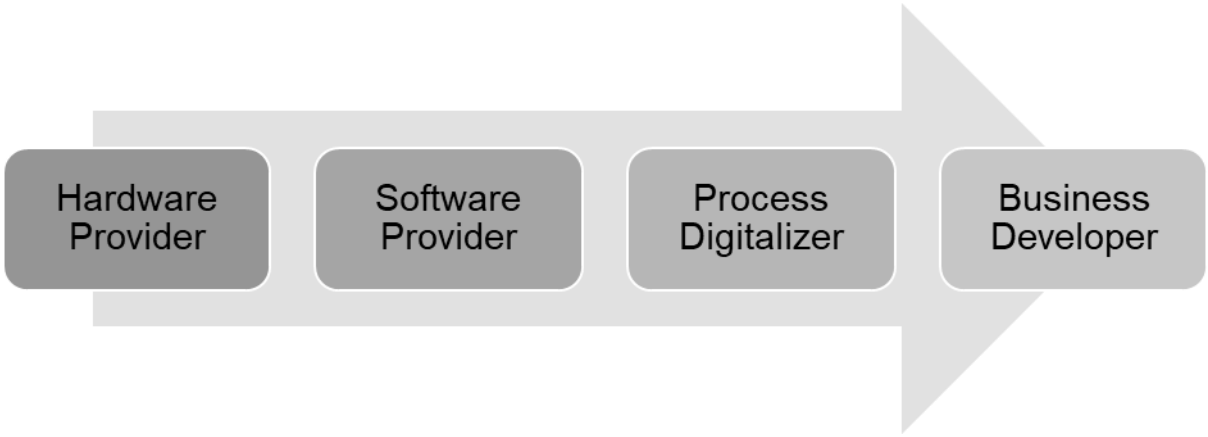

Figure 1: Changing role of IT in organizations. Based on data from (Urbach/Ahlemann 2019)

Digitalization radically changed working environments of all roles within enterprises. The more technologically innovative their tasks, the more they were in need of tools that support them. Under these circumstances, functional departments launched IT initiatives, missing a holistic view on the organization's operation on the whole (Urbach/Ahlemann 2019, 49). Most functional departments, therefore, started to create their own tool administration teams unlinked to the organization-wide IT infrastructure operation. Additionally, any IT driven maintenance or re-engineering followed difficulties as the so-called "shadow IT" was not targeted in alignment communication by IT. In fact, IT was not aware of all the tools that were used all over the firm (Urbach/Ahlemann 2019, 50).

Nowadays further technological innovations are affecting IT organizations, cloud services and software as a service provider to name just two of them. This change from a hardware maintenance to a consulting and interface department for a public cloud provider, for example, needs to be considered in any organizational context in the setup of a modern IT team. Similarly, traditional teams are used to work with milestones and tasks to achieve pre-defined goals which does not suit an unclear move forward during an innovation project where a goal is rather a vague idea what could happen. (Urbach/Ahlemann 2019, vii)

To sum up, the need for a flexible and transformable setup arises for the organization of IT departments on the one hand and for the technologies and services used to deliver service to the business on the other hand. The transformation begins in realizing a shift from being a support group to becoming part of any business creation, business fulfillment or service fulfillment process (Urbach/Ahlemann 2019, 11).

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1.2 Objectives and Research Questions

Various experts are elaborating on the implications of digitalization for the organizational structure of companies. Similarly, different stages in digital transformation are discussed in detail and consultancy is delivered for companies that recognize the need for change. Nevertheless, there is a lack of theoretical and practical guidance as far as the organizational re-engineering of IT departments is concerned. The author's professional experience is that there are numerous partners to guide companies through the possibilities that the first stage of digitalization provides for improving the question "how" work is done. No matter how the company's organizational structure is prepared to leverage the potential, initiatives are started. On the one hand by the push of external consultants and on the other hand, company-internal stakeholders push IT do integrate modern solutions.

This paper is intended to provide a guideline how small and mid-size firms being active in development and manufacturing can prepare themselves to exploit the full potential of digitalization in the first stage. Moreover, an outlook is provided how IT departments need to be structured and seen as future-proof to allow changes of the environment without the need of re-organization. For this reason, a scalable organizational model is worked out that is verified with LOGICDATA's operations as this case fits the described problems from the previous chapter. Of course, organizational re-engineering comes along with both, an underlying culture equally important as processes of change, yet these will not have a broad focus in this paper.

As a provider of mechatronic products, the trend to connect any device to the internet affects LOGICDATA and pushes the company into the internet of things category as it is no longer a sole hardware provider anymore. When looking ahead, IT operations are in the process of becoming an essential part in a product value chain for providing cloud services to the end customer for collecting data from devices. In addition, operating infrastructure as a service (IaaS) is needed for data processing for B2B customers. For this reason, the role of IT is radically shifting from being just an internal hardware service provider to an organizational core department providing hardware, business application, process consulting as well as product and manufacturing application services.

Research Questions:

1. What adequate organizational structures, methods, and processes fit for the different situations an IT department is confronted with when it comes to challenges and potential benefits inherent in digitalization?
2. How can these model and organizational methods be combined to form an organizational model for the IT department in a defined selected environment in order to cope with structural, process, and digitalization challenges?

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1.3 Research Methodology

(Ulrich 1982) refers to the understanding of application-oriented science, which should also form an appropriate basis for this work. The goal is to find a solution to the known problem that can be applied in practice, using the rules, models and procedures currently discussed in theoretical sciences as well as methods from basic sciences. Accordingly, the applicability of the findings to a specific case is to be discussed and evaluated in its execution.

In this thesis we strive for a deductive-explorative research approach which is first characterized by a systematic literature analysis as a basis for the derivation of a first model design from the general (Bortz/Döring 2009, 300). The model and the tools developed from the model will be applied exploratively in sub-areas by means of a case study. In this context, action-based research will be used to gain scientific insights from the observation of reality at work (Bortz/Döring 2009, 342).

The cooperation between scientist, practitioner and persons involved in the project forms the basis for findings that the researcher takes into account to achieve his practical and scientific goals (Kirsch et al. 2007, 230). In the concrete case, the author acts as a researcher, and in some areas, he takes on the role of an actor in the overall project due to his organizational position and commitment. The motivation of the author to choose action-based research is built on the direct and indirect relation to the outcomes of decisions made in concept creation, practical evaluation, and practical relevance. In other words, researcher, and researched groups cooperate on an equal footing. Furthermore, the research process is a repeating series of learning and changing steps until both the researcher and the researched are aligned in terms of the results (Bortz/Döring 2009, 342).

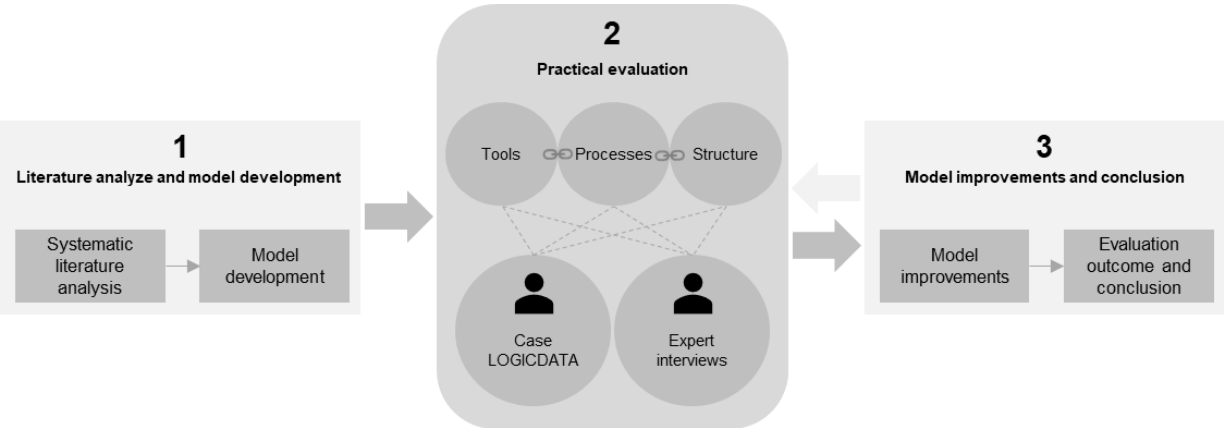

Figure 2: Research methodology. Source: Adapted from (Kleindienst/Biedermann 2017, 9)

As shown in Figure 2, the deductive approach forms the basis for model development **(1)**, which is subsequently evaluated by the introduction and use of the model in its first phase. This is also true for specific tools that are part of the model and their application in the case study of LOGICDATA. The basis for evaluation is a status-quo of the IT department within the whole

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organizational context gathered through workshops and strategic inputs identifying, discussing, and documenting the pain points of the situation. The practical evaluation **(2)** considers first the reasons for implementation, second the feedback from internal and external experts and third from practitioners. As tools are used within the IT organization specific feedback questionnaires allow a detailed evaluation and deliver valid input for adaption and further improvements **(3)** of the model. These improvements are documented to make sure that the further use of the model deals with it. To conclude the overall evaluation outcome, conclusion and outlook is provided.

1.4 Course of Investigation

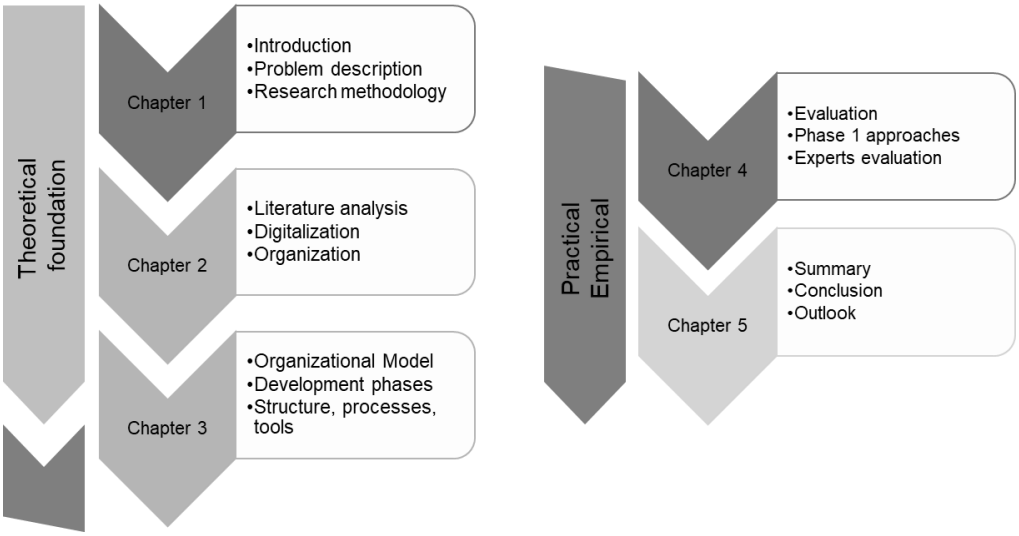

Figure 3: Course of investigation. Source: Own illustration

Chapter 1 gives a first insight in the changing role of IT departments over the last half of the century. It provides the objectives and research questions and an explanation of the research methodology and summarizes the course of investigation.

Chapter 2 is the documentation of a diverse literature analysis on various criteria due to digitalization and organizational solutions. Focus is put on drivers and effects, use and benefits of digital movements as well as on traditional specific organizational designs from a conventional and modern perspective.

Chapter 3 describes the case studies organizational environment from a company's and department's perspective, which is the foundation of the following multi-phase transformation model for IT departments. In detail, structure, processes, tools, and resources are described.

Chapter 4 covers the qualitative and quantitative evaluation of the previously developed model. Specifically, two relevant criteria for the first phase in transformation are documented, followed by the evaluation of the structure through expert interviews.

Chapter 5 sums up the thesis, outlines the evaluation conclusions and gives an outlook on possible further investigation and research topics.

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2 Digitalization and Organizational Design

The digitalization explained in its basics coupled with inherent organizational challenges that are solved by possible organizational solutions are described in this chapter. In particular, digitalization will be summarized on the basis of discussions of various experts with regard to its drivers, effects, use, challenges, and risks in the first part. Correspondingly, organizational solutions from the past are likely to be improved by modern processes, but also new organizational solutions start to grow on the basis of digital possibilities, which is the core of the debate in the second part.

Digitization and digitalization as parts of digital transformation are terms that have been introduced over the last years in various contexts referred to as the digital age. Today they are part of our standard language as far as re-engineering of products, services, processes and business models are concerned. (Kreutzer 2017, 1) points out that a digital transition requires companies of any size to evaluate their current operation and define the implications this transformation process may have for the organization. Due to their organizational inertia to adapt and change, most companies, especially mid-size to big firms, struggle with the implementation of modern approaches how work needs to be done.

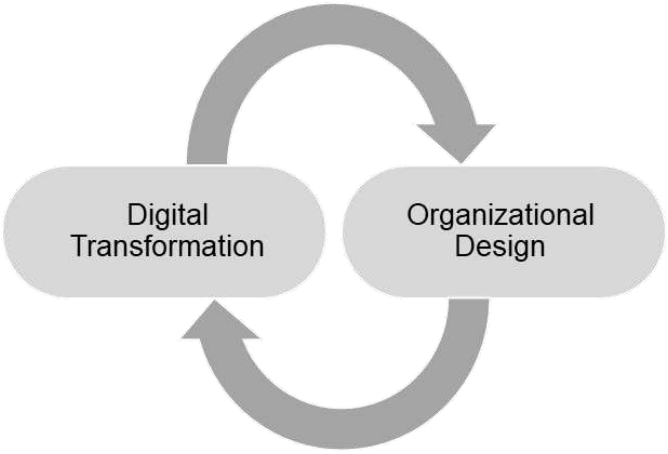

Figure 4: Relationship of digital transformation and organizational design. Source: Own illustration

As digitalization apparently affects every single area of social life also an impact on the organization might be assumed in general, as illustrated in Figure 4. In her article (Büchner 2018) is examining the relationship between digitalization and organization and describes that digitalization is influencing organizations in their expectations and decisions whereas organizations are changing digitalization in an un-unique and structural specific way. She argues that digitalization is not happening organization-neutral and elaborates that organizations as social systems are playing a central role in the process of digitalization.

In the same sense, (Price/Dafydd 2018) is discussing digital maturity of teams. In short, with the use of maturity levels they evaluate a link between the digital maturity and the structure of the

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team itself. The more mature the team with respect to digitalization, the more holistic the structure tends to be. Also (Jabil 2017) considers organization structure as one of the top four challenges organizations have to overcome for digital transformation.

2.1 Digital Transformation

Ongoing technological innovations in terms of digitization are reducing the possible time improvements can be implemented and used before they are outdated again (Parviainen/Tihinen 2017). Established tech-companies have in-house resources and knowledge that could leverage value out of creative ideas and digital technologies. Not to forget to include collaborative networks in any additional development as this is, compared to past decades, a vital source of knowledge and creativity (Kreutzer 2017, 1).

2.1.1 General Discussion, Definitions and Terms

(Hapon 2018) explains *"Digitisation [sic!] is the process of converting information from a physical format to a digital one"*, and *"Digitalisation [sic!] is the process of leveraging digitization [sic!] to improve business processes"*. (Groß/Pfennig 2019, 38 own translation) define *"Digitization is the optimization of existing processes or the creation of new processes and products through the use of modern information technology"*. Finally (Urbach/Ahlemann 2019, 7 emphasis added) provide an overall description that shall be basis for further discussion in this thesis:

> *"Digitalization is the **use of technological innovations in the business context** with a significant influence on products, services, business processes, sales channels, and supply channels. … Thereby, **digitalization has disruptive consequences for many companies and industries**, to the extent that it is often not an option to continue an analogous business."*

The current competitive environment of companies based in Europe and within the European Union having focus on research and development along with production in- or outside Europe is volatile and characterized by uncertainties. Those are on the one hand predictable with investments in research on competitors and markets but, on the other hand, they are unforeseeable due to political hostilities of macro environments the companies are depending on. This supports any initiative to increase the ability of organizations to react faster to pre-defined scenarios that could occur. Firms being able to react fast will survive and benefit from new technologies, whereas firms that are slow and characterized by laziness will hardly survive. Furthermore, this battle of survival is described as *"Digital Darwinism"* by arguing that

> *"Digital Darwinism is the selection process that is automatically started, if companies, industry segments or nations are not able to adapt to the changed requirements fast enough and get therefore sorted out" (Kreutzer 2017, 3).*

To create a link, Darwin's central work discussed the concept that

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"In a partly evolutionary changing environment nor the fittest either the most intelligent will survive, it is the most adaptable one that withstands the implicit radical impacts of the change" (Desmond 2019).

With that in mind it is important to realize the underlying change in digitalization that covers a dematerialization of physical goods. (Kreutzer 2017, 3) defines this term because of digitization of any information we were used to handle physically, like music, photo, text, etc. in the past. Correspondingly any information-containing good is moved to digital and follows handling by various software solutions offered. In general, this software replaces the physical handling of information. Moreover, it improves efficiency by additional features and reduces dependency on hardware, where, for example, cloud-based storage meant to be mentioned. Hence, in future a currently ongoing shift from hardware- to software focused goods will continue and extend. (Kreutzer 2017, 3)

2.1.2 Drivers and Effects of Digitalization

The changes digital transformation brings about have their origin in the first computers introduced in the late 1950's. From those days on, exponential growth started in the area of information technologies or, as it was called in those times, electronic data processing or in German "Elektronische Datenverarbeitung (EDV)" (Groß/Pfennig 2019, 37).

As an example of technological development, Moore's Law described the dynamics of the industry. Based on empirical observations, Moore suggested in 1965 that the number of components per circuit would regularly double over a predictable period of time which follows an exponentiality increase (Kreutzer 2017, 8). Until now, Moore's law still seems to be valid. However, several views on the basic argumentation differ in the technology community nowadays as not only the number of components but also performance is considered in the valuation (Hruska 2019). Nevertheless, it is one valid argument that describes technological development which is further discussed as one of the key drivers of digital transformation.

Similarly, digitalization is covering more areas of value creation. For example, a look into processes of producing companies shows in general that procurement, production, sales, distribution, and service are core processes. Whereas two decades ago most processes were handled without any information technology aids, nowadays most of them are flanked by the usage of software or at least an input device that provides data to a software system in the background. Hence the stakeholders of a firm's value chain as part of an organizational network are more interlinked which is today common in exchanging e.g. stock levels or orders in an automatic, digital way. (Kreutzer 2017, 25)

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(Abolhassan 2017, 14) provides technological drivers of digitalization as a summary of following technological developments that go viral by their interaction – shown in Figure 5:

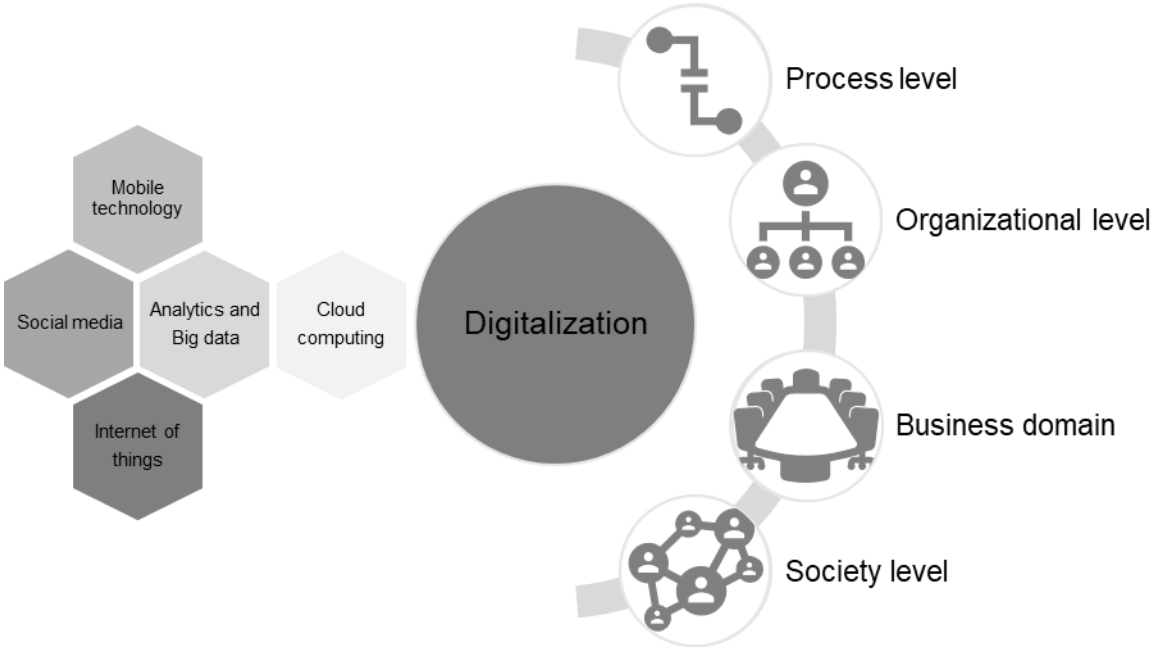

Figure 5: Various drivers of digitalization affecting various levels. Source: Based on data from (Abolhassan 2017; Parviainen/Tihinen 2017)

- Mobile technologies enable a location- and time independent use of platforms
- Social media are changing communication not only in private but also between companies' networks
- Analytics and big data are an on-time basis for decisions and provide new possibilities of value creation.
- Cloud computing technologies support the location-independent use of information at reasonable costs and outsourcing the on-premise reliability service on hardware
- Internet of things supports analytics and big data by installing connectivity in any device of daily use

Besides technological drivers also nontechnological drivers must be considered:

- Globalization is affecting operation of SMEs all over which follows the need of technologies that enable communication, collaboration, and customer experience exchange
- Demographic shifts in workforce put the baby boomers in retirement and set the generations X and Y in focus that now must provide a modern environment to the next generation that was grown up with new technologies

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To describe the effects inherent in digital transformation, (Parviainen/Tihinen 2017) documented several levels where consequences are becoming visual – shown in Figure 5. First, the **process level** where due to the use of digital tools an efficiency increase in processes is possible and manual steps are reduced. Most organizations started this increase by continuous process improvements (CPI) originated in quality systems management. Today, however, the borders between process improvements and use of digital tools are overlapping and sometimes they are even replacing human interaction in processes completely. This does not mean that there is no human interaction anymore. The way how work is done is changing continuously. For example, let us take a post officer who is responsible for distributing letters within an organization. This type of work is replaced by a scanning (digitization) work and a verification if automatic content recognition has assigned the correct target person and metadata.

Second, the **organizational level**, that describes new services that are created and replace existing offerings in different ways. Field application engineering has been an on-call request from customers in the past, and by guiding a technician through a pre-defined way of problem-solving steps the company provided this service. In case it was not successful, a technician traveled to the customer to solve it. Today, connectivity of devices follows the direct and on-time interaction with the device that is not working properly. This type of work, called remote access working, saves travel costs, accelerates problem solving processes and reduces downtimes in operations.

Third, the **business domain** level that considers changing roles and value chains in ecosystems of organizations. Where in the past value chains in the network of a firm have been clearly separated, e.g. supplier – production – customer, today interaction happens permanently between all stakeholders. The value chain drifts in many areas from products to services that create value for the company.

Fourth, the **society level**, where the way how people interact and which type of work they are fulfilling is changing rapidly according to the changes evoked by the technological developments discussed above. (Peters et al. 2019, 1) are writing about the technological unemployment that is becoming important for governments and world policy agencies: *"Governments are scrambling to think outside the square, realizing that this is potentially a moment unlike any other in history."* Further they describe three trends, where the most extreme points out that jobs will disappear due to the technological development e.g. bookkeeping.

2.1.3 Use of Digitalization

According to various effects described, several areas are identified by (Groß/Pfennig 2019, 38) where consequences could be transferred into operational use in an organization environment and how companies need to consider them to be ready for leveraging the potential of digitalization. (Abolhassan 2017, 15) uses three stages where digitalization in use can change

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the economy, starting from changing internally the way people operate to final creation of digital business models as shown in Figure 6.

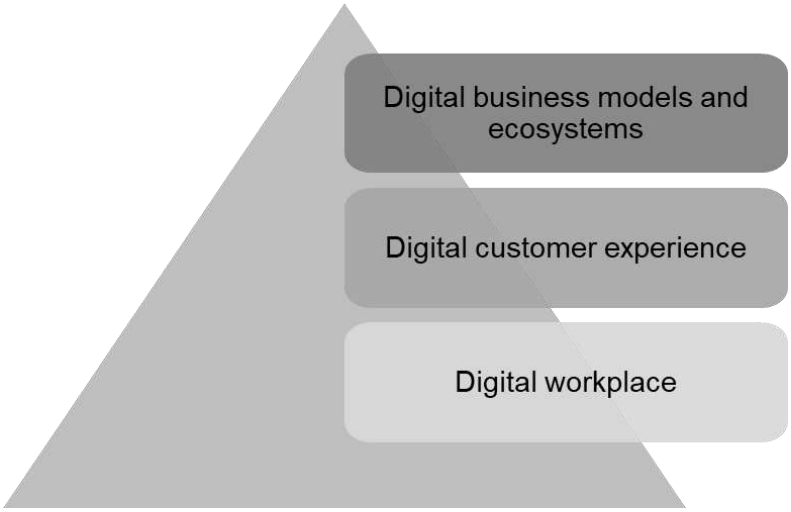

Figure 6: Stages digitalization changes economy. Source: Based on data from (Abolhassan 2017, 15)

The Digital Workplace

"The workplace of the future is no longer a physical place where we go, it is a time- and place independent area that is in operation under preconditions like a device is connected to the internet and the user has access to business data" (Jain 2019).

In several cases, users from generation Y and Z in traditional SMEs are, as far as the IT landscape is concerned, ahead due to their educational background. The reason is found in educational institutions which are maintained by an IT infrastructure that supports modern ways of working without any restrictions, e.g. video conferencing, co-editing, chats, cloud services, etc. On the contrary, they feel thrown back for years when they join an organization environment which is not leveraging the potential of a modern, central workplace equipped with an up-to-date tool landscape. (Abolhassan 2017, 16) presumes an influence on IT landscapes:

"growing penetration of technologies … originally designed for private users which are miles ahead of the old IT landscape in terms of their ease of use"

As a matter of fact, a digital workplace environment is a first step to provide users with a set of tools that enables them to work for the reason they are hired rather than loosing time in inefficient interfaces, media gaps and information search. It is important to understand that it is not only about the tools that characterize a digital workplace. Moreover, (Jain 2019) explores possibilities like combining collaboration and communication with team members, improving overall employee commitment, integrating different business tools together, incorporating agile work strategies and finally automation of repetitive tasks allowing employees to focus on more complex and creative processes.

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The Digital Customer Experiences

The second stage shifts the focus from a company's IT user to a customer or stakeholder who is influenced by speed and quality of information that comes with a product or service provided by the company. In general, the interaction between customers has changed rapidly with the rise of networks. Correspondingly, organizations have the obligation to include user experience-oriented thinking already in the definition of requirements for the product- or service development, not to be finally confronted with a competitive disadvantage. All in all, it must be the customer who is in the center of every process. On the one hand, this could be a competitive advantage, if, for example, customer order processing is done with a high reliability and high speed in interaction. On the other hand, however, if dissatisfaction occurs only in one customer interaction, customers are more likely to switch when there is no physical product obligation anymore. At this stage we need to omit that companies that find the possibility to increase change costs for customers, are more likely to withstand short-term disappointment than companies which offer a product or service that could be easily exchanged. Overall, organizations must leverage digital transformation also to the external stakeholders involved, and especially targeted customers require a complete package of integrated customer-focused digital operations.

Digital Business Models and Ecosystems

The most mature stage in digital transformation deals with the creation of new and the change of existing value chains that are referring often to new sales models, new products, or even new business models where companies act nowadays more in a way of collaboration beyond organizational borders. The reason for that can be found in the increasing complexity of digital solutions that lead to the creation of digital ecosystems. This digital ecosystem includes various areas of expertise and knowledge which single companies often do not have. To build them up, alliances are established to produce a competitive solution on the one hand and to enable the potential of further services by using the digitalization potential on the other hand. For example, car manufacturers that collaborate with platform providers to integrate e.g. media solutions into cars or house automation products that interact with a platform provider to create a central home automation console can be mentioned. (Abolhassan 2017, 16) describes this as a collaborative network of stakeholders from different sectors that work together and develop collaborative business models. As an important source of future income, that is not yet spoken out loudly and, in most products, not yet visible, is the collection of data. Various experts are using the phrase *"data is the new gold"* supporting arguments that value data higher than any physical product like sensors that collect it.

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2.1.4 Benefits and Risks

Benefits

Various benefits could be derived from digital transformation and the use of new technologies. A broader categorization is shown in Figure 7 and discussed as follows.

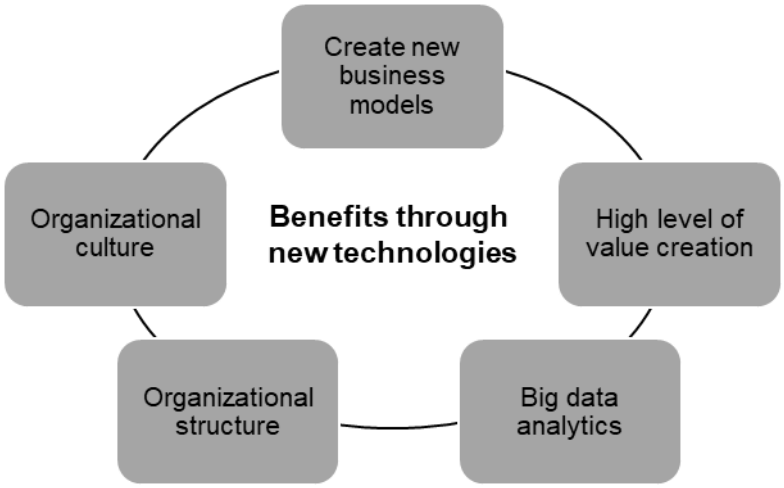

Figure 7: Benefits of Digitalization. Based on data from (Parviainen/Tihinen 2017, 10; Urbach/Ahlemann 2019, 8)

(Parviainen/Tihinen 2017) present in their paper a clear statement about potential benefits digital transformation will create. This includes *"improved business process efficiency, quality, and consistency via eliminating manual steps and gaining better accuracy"* promoting the value creation improvements. Additionally, operational effects as big data analytics are considered like

> *"Digitalization can also enable a better real time view on operation and results, by integrating structured and unstructured data, providing better views on organization data, and integrating data from other sources" (Parviainen/Tihinen 2017).*

Another important benefit that is often given not much attention because of the non-technological field, is the aspect of every single person that needs to understand digitalization as an enabler and not as an enemy that makes work transparent to the management which would backfire to their personal performance. Even so, the value that an efficiency increase brings about, needs to be considered and this increase goes hand in hand with allowing employees to use this time for further development, new tasks, etc.

> *"Digitalization also improves compliance via standardization of records and improves recovery via easier backups and distribution of storage"*

(Parviainen/Tihinen 2017) elaborates to not forget the influence of changing from on-premise services to cloud services as part of a digital transformation.

As described in the chapter above, digitalization enables creation of revolutionary business models, a next level of value creation wherever production processes are used in business

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operations. Futuristic pictures of the production facility of the future picture self-organizing entities, interfaces between machines, components, humans and also external stakeholders such as customers and suppliers, all operated via blockchain technologies. (O.V. 2018)

(Urbach/Ahlemann 2019, 10) emphasize, that digitalization will lead to positive changes in organizational structures of companies. New technologies create new ways of communication and strive for less structured architectures, as they allow a more horizontal collaboration instead of the developed vertical reporting channels, e.g. group- and team leaders, head of department, etc. As the amount of data is increasing, the basis for decision making is getting valuable and time needed for it will decrease through better data. The faster decisions are taken, the higher the speed in innovations (e.g. hypothesis testing) is.

Risks

Digital transformation and the increase of transparency leads to various risks that could harm businesses in their operation. Figure 8 provides a broad categorization of discussed risks described in the following paragraphs.

Figure 8: Risks of digitalization. Based on data from (Urbach/Ahlemann 2019, 11)

With a strong focus on new technologies and innovative use of such, the risk that operations are exposed to must be considered, evaluated, and reacted to. For example, in case IT operations get deeper involved in customer processes, failure of implemented technologies put damage on the business and reputation of the company (Urbach/Ahlemann 2019, 11). It is important to realize that short downtimes of tools, systems or services are becoming a threat to a company's existence in case users are not able to order, to use a service or to review datasets just to name a few possible threats of operating system failures. Not to mention any reputational disadvantages for the brand of the company due to a data leak, wrong calculations, etc.

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Every company today is exposed to the dangers of cybercrime and espionage as there is no company left operating without any IT penetration. Surely disciplines and expertise for processing of data, either business or private in a secure and protected way, are necessary at least since the European Union (EU) has introduced the General Data Protection Regulation (GDPR) in 2018. (Urbach/Ahlemann 2019, 11)

A transparency increase inherited from technological innovations also increases the likelihood of copied business models and new competitors globally. Last but not least the risk of recruiting and retaining employees that are skilled to perform consulting or technological tasks, is under threat as the amount of well-educated, experienced and creative persons is increasing too slowly (Urbach/Ahlemann 2019, 11).

(Knoll 2017) discusses the IT risk management in the age of digitalization that puts increased awareness to an interdisciplinary focus all over an organization to cope with the potential threats examined above. It is further distinguished between threats and weak points in the IT landscape that are put against technical and organizational activities. A risk cube for systematization of risks is modelled and a process as shown in Figure 9 is designed for a systematic approach.

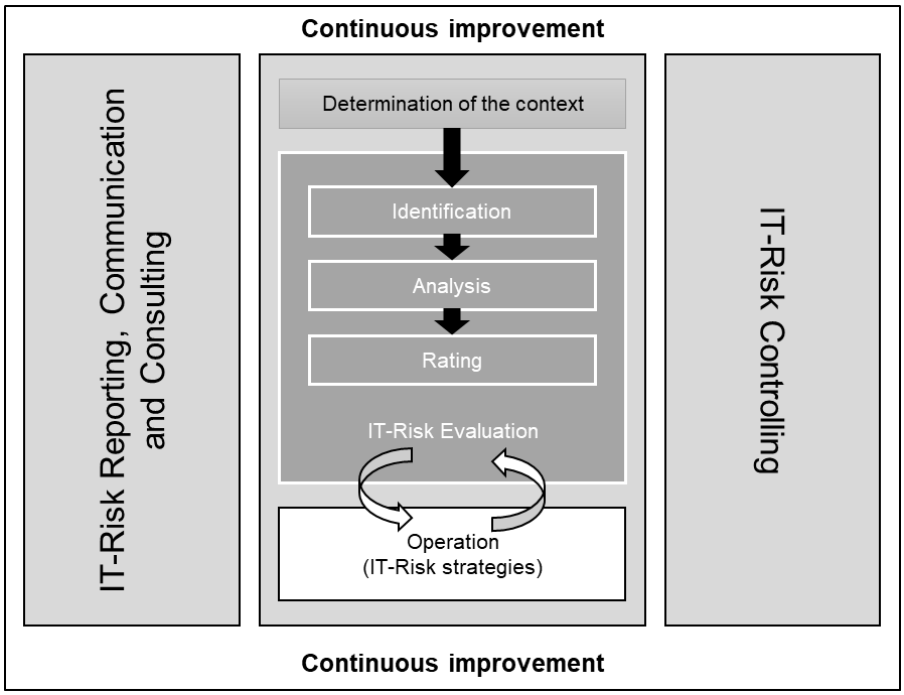

Figure 9: IT-Risk management process. Source: Adapted from (Knoll 2017, 13)

2.1.5 Digitalization and Organizations

The influence of digitalization on organizational structures creates a large field of investigation in research and industry. (Barton et al. 2018; Geschwill 2016; Oliveira 2012; Puranam et al. 2014) to name some, are discussing in general how organizations have developed structures, bureaucracy and hierarchies to be competitive in a static environment in the past while the speed of change driven by technology has become a vital source of influence on the performance of

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these organizations today. (Oliveira 2012) argues that the unique and universal forms of an organization like the one discussed by F.W Taylor, Max Weber or Henry Ford, have been questioned by other studies in the following periods that summarized the trend of Adhocracy. According to (Oliveira 2012, 1), "*Adhocracy would be an appropriate structure for innovation…for dynamic and complex environments*". However, changed environments in the past show that organizations have been forced to change to survive by allowing more flexible forms but not the strict following of Adhocracy. Given these points, (Oliveira 2012, 2) described automated bureaucracy as a kind of organizational structure where re-engineering and downsizing of organizations is discussed as one of the possibilities. As a special emphasis, (Oliveira 2012, 41) puts focus on automation and its consequences for organizations where information technology is specifically mentioned in relation to its use in production processes and their impact on the structure of the organization.

The key question is, how IT organization in companies is challenged by digitalization to create an environment of quick, transparent, and sustainable work. The point the author wishes to make is that motion and further on the speed of this motion (as far as potentials of digital transformation are discussed) are a challenge for IT organizations in companies. (van der Meulen/Rivera 2014, 2 emphasis added) underlines that *"while IT has been **like rocks in a river – resisting change**, the digital world is in continuous flow"*. Equally important is to understand service providers and their concept of security and trust. IT function is reinvented in particular because of the amount of data collected due to digitization and the shift from in-house server landscapes to an outsourced cloud service provider. Frequently the term bimodal IT is used to combine the two sides needed in a modern organization, i.e. Traditional slow operational systems, and the new, modern, and quick development. This involves the stepwise organizational re-engineering of IT, where first digital solutions are implemented in parallel to transform the business not in one big step (Abolhassan 2017, 6).

(Abolhassan 2017, 75) argues that IT in its current form is working as plumbing business to maintain existing systems and not as being an enabler for the rest of the business by providing innovative applications. Another important argument is that for a local IT organization it is not necessary to invent the wheel again as software as a service (SaaS) providers are taking care of providing the latest functions on time and with an amazing availability performance that most organizations are not able to achieve by themselves. If they are, the costs of labor involved must be considered in a TCO calculation when it comes to a valuable comparison of in-house services and SaaS providers. In contrast to technological aspects, social aspect digitalization puts the focus on the persons involved. The described shift of service providers takes into account that IT has to coordinate outsourced partners and internal business demands. (Abolhassan 2017, 78) describes it as the change of the role of IT employees from an internal supplier to a colleague and

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partner of outsourcing providers, who are often establishing more strategic relations to better understand each other's long-term goals.

2.2 Organizational Solutions

The following chapter provides organizational basics as discussed by experts. It shows current organizational systems that are commonly used in organizations. A focus is put on organizational solutions that are supporting various aspects that digitalization affects. Also, social parts not anymore only in the private life of employees. In detail, a two-sided approach shall discuss on the one hand how traditional structures can be adapted to fit digitalization while on the other hand it is examined which structures are running because of new technologies or because they are significantly supported by them.

2.2.1 General Discussion, Change and Culture

Over the years, various general definitions of an organization have been discussed by experts based on (Puranam et al. 2014), where all have provided some things in common. First, a multiagent system is considered as basis which significantly leaves single-agent organizations out of the definition scope. However the networks and partnerships a firm like that could create again led to a horizontal or modular organization as described by (Anand/Daft 2007). Second, identifiable boundaries which are explained by a detailed definition of considered agents within or outside the company. These boundaries are not following a closed system. Moreover, they are providing a flexible line between the micro and macro environment of a firm. Third, the ability to ascribe a defined goal, defined as organizational purpose, is a common conceptional basis in the definition of an organization. Firms often use common goals and break them down to the agents of the system so that they contribute to an overall purpose. This is followed by definition number four, discussed by (Puranam et al. 2014) where each agent is expected to contribute with their work to the successful fulfillment of the common goal.

2.2.1.1 Organizational Change

As organizations change due to various reasons like environmental changes, technological development, or regional authorities, an organization could be described as a living creature. It is an evolutionary or even revolutionary organism that on the one hand needs for its survival inputs like strategy, environment, etc. and, on the other hand, that releases agents or assets from the organizational boundaries to shed ballast. As organizations evolve over time on the basis of their inputs several organizational structures, organizational processes and organizational cultures emerge. (Galbraith 2012, 2010) provides various shapers of organization design like overwhelming complexity due to organizational growth, huge variety of relevant entities (agents) that need a managerial basis to operate or enabling technologies that completely shift the stakeholder relationships as far as connectivity and supply chain is concerned. This permanent

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adding of strategic dimensions leads to a movement of new or modern organizational structures and processes as they are introduced by (Hambach 2017; Kirchherr/Holotiuk 2017; Laloux 2014; Puranam et al. 2014) to name some experts dealing with them.

(Laloux 2014) in specific compares the evolvement of an organization model with respect to the human consciousness development which has emerged in several stages, one following the former and taking the positive and negative outcomes into consideration. Each of these stages have followed several specific organizational models that corresponded to the human consciousness stage society is able to handle. (Laloux 2014, 15) introduces colors respecting stages as shown in Figure 10 below. It does not mean that throughout the course of history organizational models were created which are not used anymore. Moreover, it describes different societies still using all the emerged organizational models.

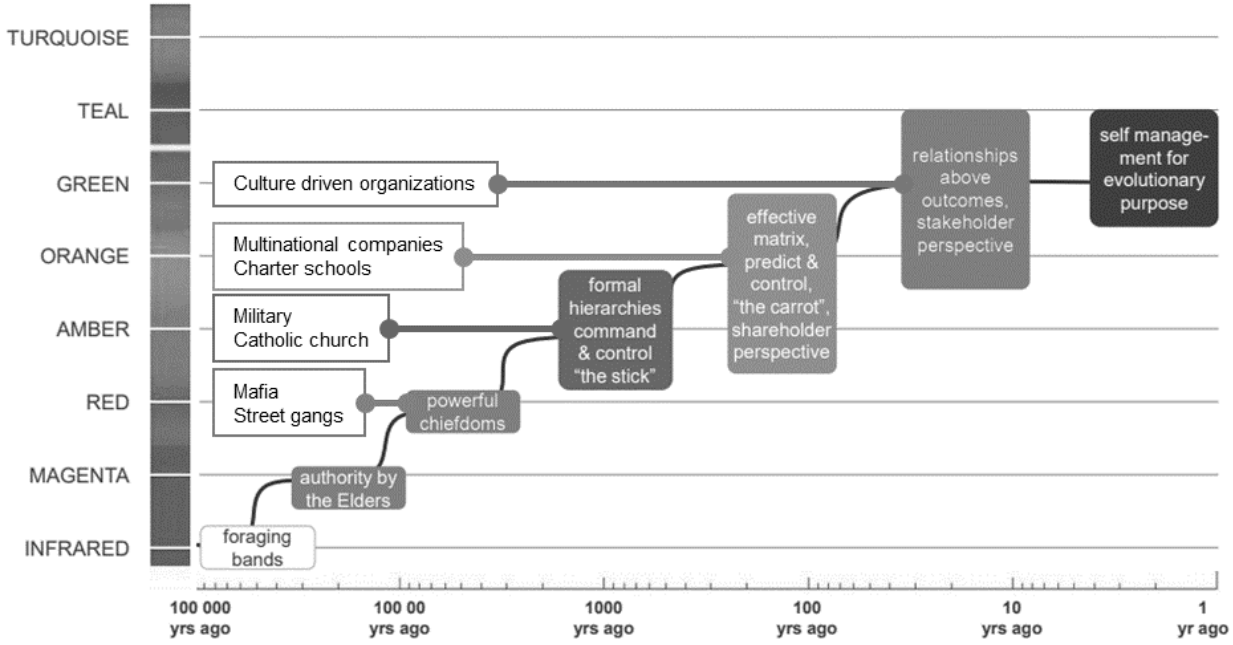

Figure 10: Levels of consciousness with organizational models. Adapted from (Gerndt 2014)

The point the author wishes to stress is that with digitalization new ways emerge, for example regarding the way how we as humans communicate with each other. Therefore, new organizational models will emerge so that organizations change in their structure, process, and culture to reflect and respect the evolving human consciousness.

2.2.1.2 Organizational Culture

According to (Schein 2016, 20), the term of culture in relation to organizations has undergone a long history as far as studies, models and definitions are concerned. Nevertheless, he introduced in his current edition, based on several cultural elements (e.g. climate, formal rituals, and celebrations, observed behavior regularities when people interact), a dynamic definition of culture:

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"the accumulated shared learning of that group as it solves its problems of external adaptation and internal integration; which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, feel, and behave in relation to those problems.

This accumulated learning is a pattern or system of beliefs, values, and behavioral norms that come to be taken for granted as basic assumptions and eventually drop out of awareness."

In whatever way we want to look on culture we need to differentiate the past happenings, the so-called artifacts, the values the group is referring to and the basic underlying assumptions as (Schein 2016, 33) refers to the metaphoric lily pond as illustrated in Figure 11 for the three levels of culture. The metaphor provides leaves and blossoms as the artifacts that can be seen and evaluated no matter how the seeds put in by a farmer (leader) grew to yield these results as long as the beliefs and values are matching the result. If the result does not fit and should be changed its not enough to recolor the blossoms or leaves, nor to change the seed only. In this case, it is necessary to analyze the system starting from the type of seed up to water quality, fertilizer – the invisible deoxyribonucleic acid (DNA) of the pond (corporation) – and change some of that.

Figure 11: The Lily Pond as a metaphor for levels of culture. Source (Schein 2016, 33)

The interesting matter with respect to digitalization is, how organizational culture is adapting to the technological developments' inherent in digitalization. For example, let us take the rise of worktime outside the firm's physical boundaries which directly influences basic assumptions Schein is stating as cultural elements. Such elements are climate or formal rituals and celebrations. Culture and digital technology need to be oriented to in the same direction in a way to solve the need of permanent, connected, transparent and interactive groups.

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Another important element is trust in or mistrust of digital technologies such as cloud services. In fact, with outsourcing services we create trustful relationships with software providers like we did with banks in the last century. The question here is, if those vendors can provide this trustful relationship and how far are organizations and users open to move sensitive data into a public cloud because of increased efficiency and reduced TCO. History has shown various data breaches that drive vendors to heavy investing to build up a culture of trust that needs to be distributed in all organizational levels inside a firm and beyond.

2.2.2 Traditional Structures Influenced by Digitalization

When speaking of traditional, we mean formal systems widely used in organizations of today that on the one hand have been established with the rise of huge corporations at the beginning of the 19th century and, on the other hand, they have developed and adapted to environments till today. In a first step, we want to focus on the solutions to the design challenge of specialization and coordination based on (Jones 2013, 170). The main categories with respect to how organizations create a division of labor that increases efficiency and effectiveness are described as functional, divisional, matrix or network structures, illustrated in Table 1.

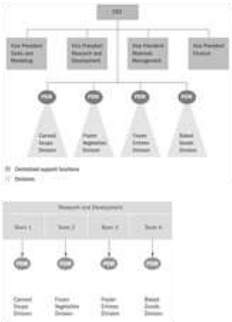
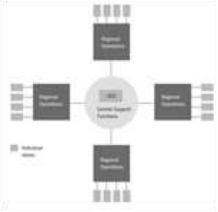
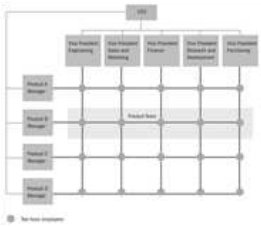
Functional structure			
Divisional structure I	Product division structure	Geographic structure	Market structure
			
Matrix structure			
Network structure and boundaryless organization			

Table 1: Specialization and coordination in organizational structures. Based on data from (Jones 2013, 170; Laloux 2014, 116)

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Boundaryless structures are not common compared to the previously mentioned forms and are often referenced to as *"new"* or *"modern"* solutions. Moreover, every company is choosing to adapt its solution on the basis of several arguments such as industry, environment, size, age, etc. that are affected by permanent change.

The selection of the matching organizational structure is a challenging task, as each of them has its specific advantages and disadvantages. Therefore, the management in traditional organizations has the task to detect any coordination problem, adapt the organizational structure to obtain the advantages and reduce negative elements of the structures to create an organization that is in control of its structure. Firms not adapting the structure to changing environments and growth stages expose themselves to the risk of losing their competitive position. (Jones 2013, 196)

2.2.2.1 Challenges in Traditional Structured Organizations

General Challenges

In the last decade discussions arose on the widely used existing organizational designs, specifically on how we handle critical situations, how we increase team spirit, how we could improve decision making processes and how we could spread information to name some. (Laloux 2014, 2) uses the human belief system of our times by stating

> *"in a hierarchical worldview, there can be only one brain in command, just as there must be a single boss at the head of every organization."*

to start the discussion that much progress humankind achieved did not come from individuals alone but from collaborating persons. We are now questioning structures that have provided us with an unprecedented prosperity at an incredible speed in the last decades due to the fact that those structures and work in general have no correlation with passion and purpose anymore.

> *At both the top and bottom, organizations are more often than not playfields for unfulfilling pursuits of our egos, inhospitable to the deeper yearnings of our souls.*

(Laloux 2014, 4) is describing with his statement both from an employee's and from management perspective the soulless organizations that we have created to achieve profit, ego, and personal wealth, which is, besides profit, even true for nonprofit organizations. Even in case organizations try to improve by centralizations, decentralizations, new mission statements, etc. it shows that we are not solving the situation, yet we are starting a tryout of another recipe.

Some of us start to question the way they provide value to an organization in case this value is not suiting their personal belief system even if this is harming their financial income. This exposes organizations to an increasing amount of persons who want to do things they like, have passion for and want to work in a fulfilling environment. (Laloux 2014, 4)

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Challenges due to Digitalization

Digital transformation shows the underlying assumption of a change that directly challenges organizational culture. (Steffen/Schüller 2017) argue that digital competences are not the only competence needed. Moreover, updated organizational structures are necessary. With the increased use of digital and connected technologies collaboration is becoming hierarchy-independent and leaders are changing from supervisors to coaches or experts in temporary networks that arise with their need (Barton et al. 2018, 256). As an example, the way we communicate can be mentioned. The ability to reach out to higher organizational levels was a difficult journey. You may have had to go through several levels and, instead of direct interaction, assistants to managers were your contact persons. Nowadays, C-level managers are reachable instantly on social media platforms like LinkedIn and from personal experience they even answer serious questions in case they come from persons outside their organizations.

With the possibilities on collaboration and information sharing the self-management for employees becomes possible. Networks like coworking groups over team, department and organizational boundaries are enabled by technology and provide performance increase compared to rigidly aligned teams (Barton et al. 2018, 257).

2.2.2.2 Organizational Processes

In Figure 12 different process methods are shown, characterizing traditional-lean, modern-agile and combined approaches to achieve organizational value creation.

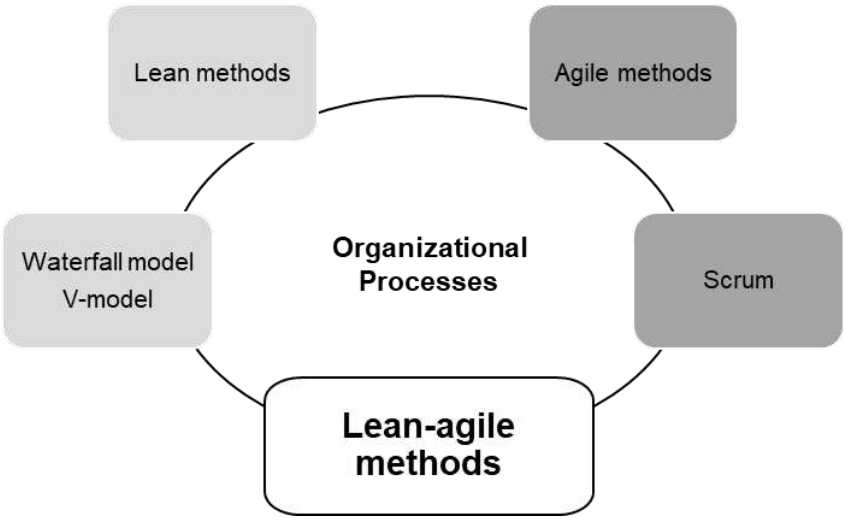

Figure 12: Organizational processes. Source: Own illustration

A classic development process model named waterfall is based on a sequential task fulfilling where one task is done after the previous one has been terminated, and it is always based on requirements defined prior to the start. Consequently, after things have been accomplished changes are linked to either impossibility or huge costs. (Davis/Radford 2014, 145)

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The basis of the V-model, another process definition, is the waterfall model where “V” stands for verification and validation. The difference is that in each phase tests are performed to evaluate the outcome of it compared to the overall goal, which then is used as input for the next phase. (Davis/Radford 2014, 148)

As described in the introduction, speed of change in today’s digital growing environments challenges organizations on the whole. (Davis/Radford 2014, xi) states that scope in projects is something that must change as conditions of environment changes. Therefore, (Davis/Radford 2014, 127) explain the need for an agile process design adapting to business requirements. Agile methods such as scrum provide thus an iterative, incremental approach that allows deliverables to be split up in defined blocks, called sprints. This means a reduced time need for first results delivered to a customer compared to the waterfall model.

(Davis/Radford 2014, 157) argue that there is no either / or in process model use. Instead, a mix of sequential and agile approaches combines advantages of both and eliminates some disadvantages of each. For explanation, the prior requirement and definition to a development shall provide “*a good degree”* of certainty to the outcome not to have *“too many early requirements*” which in the end have been misleading the result. The agile methods solve uncertain topics during construction with e.g. *“learning by doing”*.

Also (Vieweg 2019, 74) elaborates the need for joined solutions, i.e. the combination of traditional over years used lean approaches with agile principles. The advantage is to generate continuous output (lean) with adaptable statuses (agile). Decisions are made where they are handled to provide the following advantages:

- Faster time to market – less delay
- True problems – no fogging
- Better quality
- Minimized overhead
- Purpose - Wholeness

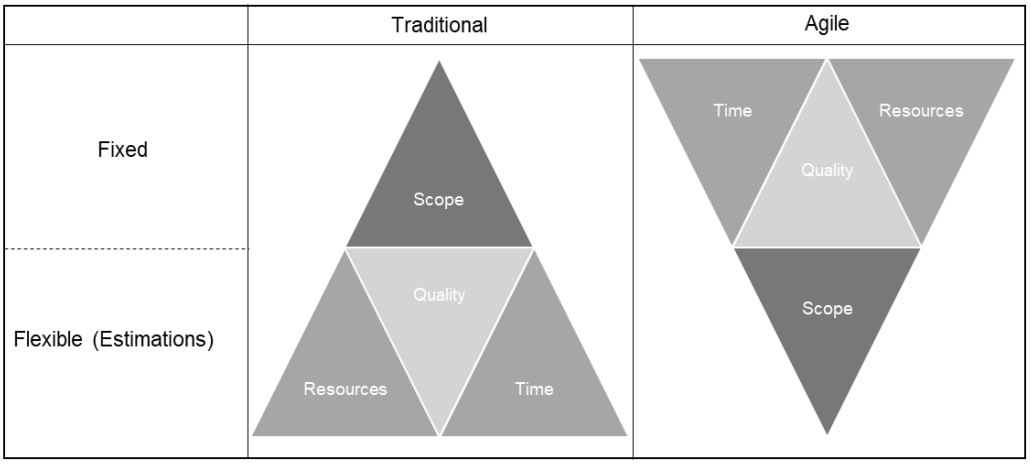

Table 2: Traditional-Agile. The iron triangle of agile. Adapted from (Vieweg 2019, 80)

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As shown in Table 2 (Vieweg 2019, 80) uses "*the iron triangle to agile*" to explain the main difference. We change from traditional fixed scope to flexible scope thinking and use fixed resource and time dimensions to achieve the results.

With agile it is not meant to act randomly and in anarchy, which is often communicated. In specific it means to have a framework within resources are allowed to work on tasks agile (Hatahet 2020). This framework needs clear communication.

2.2.3 Modern Structures Influenced by Digitalization

Experts such as (Fjeldstad et al. 2012; Laloux 2014; Robertson 2015) are providing various names for the following structures or models how organizations could be managed. Figure 13 illustrates the definitions that are described below.

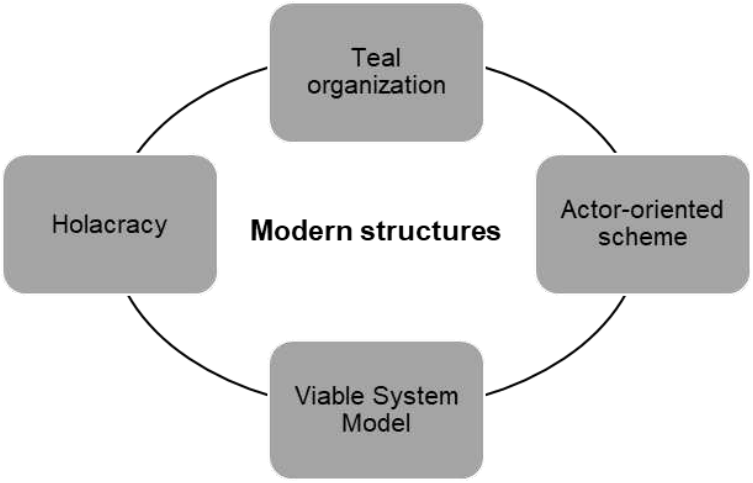

Figure 13: Modern structures. Source: Own illustration

(Laloux 2014, 55) is documenting from his research on pioneer organizations three breakthroughs for the visionary non-structured ("teal") firm: self-management, striving for wholeness and listening to evolutionary purpose. In teal organizations self-management is key, as people work on peer relationships only. Wholeness means being ourselves during the worktime and not to leave non-professional parts at the front door as we are used to in our "professional" life. Organizations see themselves as living systems that have their own soul, not focusing on prediction and control anymore but on sense and response.(Laloux 2014, 209)

Holacracy is a defined approach for operating a teal organization described by (Robertson 2015, 12). Robertson went through transformation processes within companies and documents the structures and processes of Holacracy. The four key elements in the definition are:

- a constitution that defines the rules and redistributes authority
- a new way of role definition as authorities' areas, as well
- a unique decision-making process for updating those roles
- a defined meeting process for keeping teams in sync

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Teal organizations are also structured, have practices and processes which is shown in Table 3 below. The listing is not providing a total scope of contrasts as provided by (Laloux 2014, 327) but it provides an overview of some of the differences from teal organizations to a traditional hierarchic structure.

Category	Type	Traditional practices	Teal practices
Structure	Organization structure	• Hierarchical pyramid	• Self-organizing teams • When needed, coaches (no P&L responsibility, no management authority) cover several teams
	Staff functions	• Plethora of central staff functions for HR, IT, purchasing, finance etc.	• Most such functions performed by teams themselves, or by voluntary task forces • Few staff remaining have only advisory role
Human Resources	Job title and description	• Every job has job title and job description	• No job titles • Fluid and granular roles instead of fixed job descriptions
	Recruitment	• Interviews by trained HR personnel, focus is on fit with job description	• Interviews by future colleagues, focus is on fit with organization and with purpose
Daily life	Office spaces	• Standardized, soulless professional buildings • Abundant status markers	• Self-decorated, warm spaces, open to children, animals, nature • No status markers
	Meetings	• (Many meetings, but few meeting practices)	• Specific meeting practices to keep ego in check and ensure everybody's voice is heard
Organizational processes	Strategy	• Strategic course charted by top leadership	• Strategy emerges organically from the collective intelligence of self-managing people
	Sales & Marketing	• Brands positioned to fit consumer segmentation (outside in) • Sales force driven by targets and incentives	• Marketing as a simple proposition: this is our offer to the world (inside out) • No sales targets

Table 3: Overview of teal organizations structures, practices, and processes. Based on data from (Laloux 2014, 327)

(Fjeldstad et al. 2012, 739) describes modern organizations common in their ability to provide a large group of people ("actors") a wide set of resources that self-organizes projects dynamically and in a collaborative manner. The basic elements of this actor-oriented scheme are actors with the capability to self-organize, common where actors accumulate and share resources, and enablers of multi-actor collaboration. New technologies due to digitalization provide systems that connect actors, allow them to communicate easily and access same information instantly.

"SAOS – self adaptive organizations system" is a European theory on Holacracy with the target to reduce hierarchical structures. (Lange o. J.) is using the metaphor of cells and honeycombs where a cell builds the collaborative and cooperative working connection. A honeycomb is combining cells of equal issues or goals to be solved or achieved. Cells splitter if they get too big and the two cells then are creating a honeycomb.

The Viable System Model (VSM) first introduced by Stafford Beer provides an alternative to common hierarchical organizational models that can be used for diagnosing and designing organizations. "*VSM models the structures of the organization and the relationships between*

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them" (Hoverstadt 2008, 43). The VSM uses the same systematic approach to analyze each fractal level of an organization and describes elements, functions and control relationships for the survival of the system (Hoverstadt 2008, 43). It consists of three main elements (operation, management and environment) where operation and management are split into the six subsystems (Hoverstadt 2008, 44) described below and illustrated in Figure 14:

1. The environment, which represents the world outside the system, e.g. stakeholders
2. Subsystem 1: Operations
3. Subsystem 2: Coordination
4. Subsystem 3 / 3*: Delivery management / monitoring
5. Subsystem 4: Development management
6. Subsystem 5: Policy

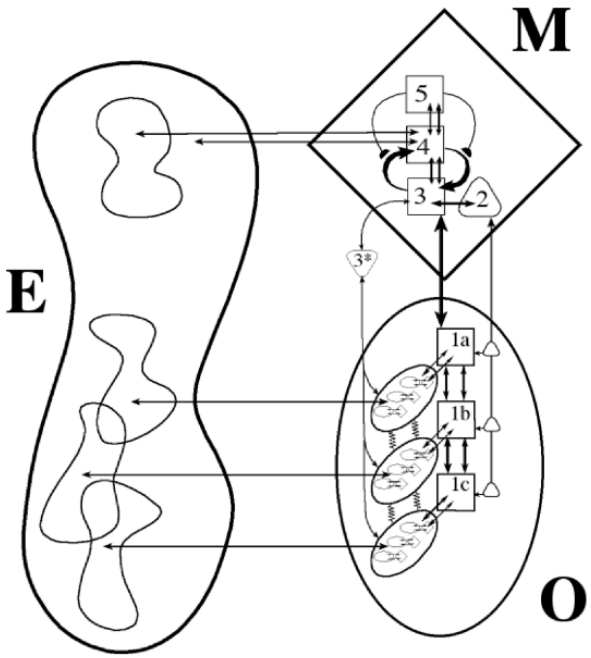

Figure 14: Viable System Model. Source: (Hoverstadt 2008, 44)

As organizations using the models discussed above have been existing since several decades, digitalization is seen as an enabler and assistant for horizontal communication inside those organizations. As an example (Laloux 2014, 249) provides the intranet of an organization called "Buurtzorg" where a social network platform is used as a leadership instrument for the owner to get instant feedback on posts that deliver, for example, decisions that he thinks must be taken or directions that he shares to get the votes of the employees. The speed of decision-making is increased enormously when using a device-, time-, and place-independent platform. While in traditional SMEs decisions from the C-level may take days, teal organizations are able to achieve that in hours with the help of technology. (Laloux 2014, 250)

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2.2.4 Trends in IT Organizations Influenced by Digitalization

This chapter summarizes current trends in the design of IT organizations. To start with, the concept of bimodal IT is described. Further lean aspects in IT operations are illustrated and finally DevOps as the marriage of development and operation in software development is mentioned.

2.2.4.1 Bimodal Organizations

Traditional IT organizations struggle in following the fast train of digitalization in their existing structures. (Abolhassan 2017, 6) arguments that a pre-requisite to focus on new technologies is a stable landscape likely to have both of them operating beside each other.

First, traditional tasks and existing core systems must run securely and reliably in known environments, requiring existing skillsets and the given culture. Second, innovative, and agile assignments need an organization that copes with higher uncertainty and less clear requirements. As with digital business models, the role of IT brings corporations closer to customers for both traditional and innovative tasks. Therefore, it's important to find the right speed for accomplishing them. (Abolhassan 2017, 6; Barton et al. 2018, 259; Loos/Hofmann 2016; van der Meulen/Rivera 2014)

(Loos/Hofmann 2016) describe the bimodal IT organizations as a two-speed entity that requires new specific skills, fitting organizational principles and cultural rethinking. Together with the IT landscape they form four fields of activity in the transformation of IT.

(Barton et al. 2018, 260) defines bimodal IT as a mode that can operate two systems of unequal dynamics. Table 4 provides an overview for simultaneous and synced design of a traditional ("marathon") mode as managing the systems of record (SOR) and the new ("sprint") mode as managing the systems of engagement (SOE). Systems of record are core systems, e.g. enterprise resource planning (ERP), whereas systems of engagement mirror social and mobile systems, e.g. Apps. They are also described as systems of innovation.

Managing systems of record (SOR)	Managing systems of engagement (SOE)
• Reliability	• Speed
• Standardization and Integration	• Continuous function increase
• Strategy- and architecture conform	• Ad-hoc decisions
• Mid-term	• Long-term
• Low mis investments	• Uncertainty, high risk
• Value through performance of IT	• Value trough customer satisfaction
• Development based on traditional methods	• Development based on agile methods
• Robustness	• Short life-cycles
• Security and permanence	• Customer centric availability
• Continuity of contracts	• On-demand cooperation
• Fixed teams and established processes	• Self-organized teams, networks

Table 4: Bimodal IT. Source: (Barton et al. 2018, 260)

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2.2.4.2 Development and Operations - Lean Principles in IT Operations

In the previous chapter the principles of agile and lean have already been discussed with respect to the general organizational process design. In more detail, as far as IT is concerned, lean principles, theory of constraints, etc. applied to technology value creation processes are nowadays more commonly named DevOps, meaning the marriage of development and operations. (Kim et al. 2016, 3)

> *"DevOps is the outcome of applying the most trusted principles from the domain of physical manufacturing and leadership to the IT value stream" (Kim et al. 2016, 4).*

Controversially (König/Kugel 2019) mentions the infinite discussion around this topic, as development stuff is sometimes wishing a NoOps movement instead of a DevOps one. The reason is simple, as developers do not want to focus also on the input of operations professionals. However, with modern development methods releases are possible in shorter intervals that improve the systems that follow impact on operations if those releases are not fitting the operating environment. (König/Kugel 2019, 291) visualize as shown in Figure 15 this conflict as a wall where on one side development focuses on agility and on the other side operations on stability. DevOps is therefore providing methods, processes, etc. to reduce the wall as an obstacle.

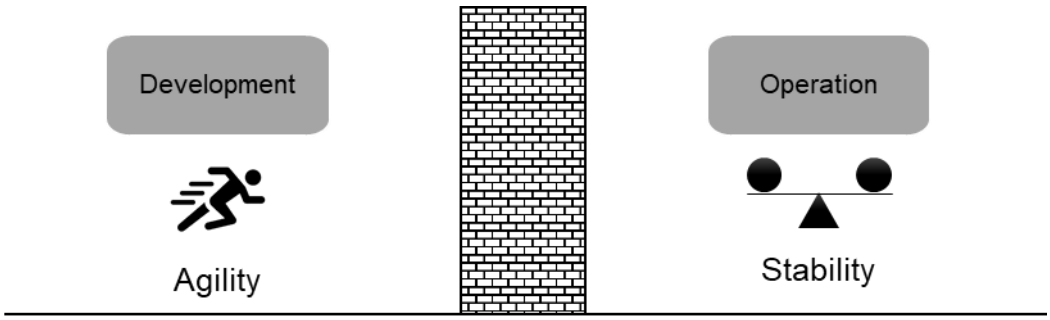

Figure 15: A wall of confusion - DevOps opponents. Source: (König/Kugel 2019, 291)

(Kim et al. 2016) provide details of DevOps based on three principles. First the principle of flow, second the principles of feedback and third the principles of continual learning and experimentation. As the aim of this thesis is not to install a software development department following DevOps at this point the author wants to put focus on the first principle – the principle of flow – as this provides a valuable definition for the continuous flow of work in general. This becomes an essential part of managing tasks, tickets, and targets within an IT operation throughout this thesis.

Within the principle of flow, (Kim et al. 2016, 15) define six metaphors, Figure 16 provides, for establishing a lean flow from development to operations to deliver value quickly to customers and reduce lead times.

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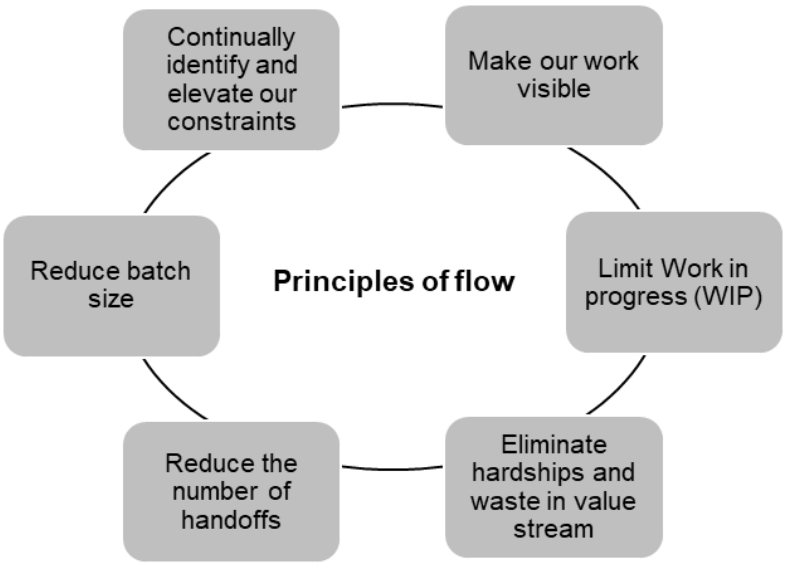

Figure 16: The principle of flow. Source: (Kim et al. 2016, 15)

The six metaphors are also described shortly below (Kim et al. 2016, 15):

Make our work visible is focusing on the visualization of tasks as this is compared to physical streams different in technology value. Often this is achieved by putting tasks on physical or electronic cards in software tools that are then moved between work centers such as to-do, development or done.

The reduction of tasks that one resource is working on is the scope of **limit work in progress**. Due to dynamics, interruptions are occurring. As a result, finishing tasks takes longer the more tasks are in progress at the same time. Therefore, WIP limits are useful to detect limitations or, on the contrary, they find work centers that are underutilized.

As WIP is increasing with large batch sizes **reduce batch sizes** provides continuous flow of deployment and results. Large batches risk large failures or downtimes in operation and provide results much slower than smaller ones.

Reduce the number of handoffs is avoiding interfaces between work centers or resources of any kind. Handoffs are potential queues and add non-value-added time to the task which could be solved by reorganizing teams so that they can deliver to customers themselves.

Constraints in the system weaken the performance and, therefore, they must be identified and exploited. Anything else is to be subordinated to the first two points and elevated. If a team is not able to eliminate constraints performance will not increase. One of the reasons is often that wrong constraints are identified, which increase the performance in the wrong value stream position.

Eliminate hardships and waste in value stream is based on lean principle of eliminating any physical waste. In technology value streams it suggests reducing e.g. work done partially, extra features, non-standard or manual work to name some.

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3 Organizational Model

Based on the described forms of organizational solutions to digitalization in chapter 2.2 this chapter provides the draft of an organizational model which shall cover the needs of IT departments at SMEs. The considered elements are visualized in Figure 17 and described below.

Figure 17: Elements in the organizational design. Source: Own illustration

To start with, the company's environment followed by the IT department's organizational design in its status quo is described. This description funds the specific requirements for the updated organizational model, processes and activities which are discussed afterwards.

The model shall be scalable and suited to SMEs operating in the field of research and development for mechatronic products, including technological development in any direction. Further manufacturing in two possible ways shall be considered, i.e. on the one hand inhouse production facilities and on the other hand contract manufacturing of products. In the specific case study, test equipment and test data collection for outsourced production is provided at any time by the customer of the contract manufacturer.

The bimodal organization design from chapter 2.2.4.1 serves as a basis as this seems to be the more suitable solution to a transformation process to cope with the digitalization challenges described in chapter 2.1. This is extended by and combined with DevOps principles as well as arguments discussed in modern organizational structures e.g. self-management, wholeness. All things considered, a new approach to an IT department's organizational structure and interface within an SMEs organizational environment shall be formed and tailored to the specific environmental conditions of the case study.

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Any process designed is being influenced by lean-agile elements, nevertheless traditional process structures like waterfall and V-model are also considered. As mentioned in the introduction, organizational culture and change are not given a focus in this thesis. However, the author wants to emphasize within the organizational proposal when there is a specific need to consider those elements for a successful introduction.

3.1 Organizations and Its Environment

"The environment is the set of pressures and forces surrounding an organization that have the potential to affect the way it operates and its ability to acquire scarce resources" (Jones 2013, 81).

Organizations put a lot of effort into control, plan, and react to its environment as this is the primary source of uncertainty. In the following analysis of environments on the case of LOGICDATA and its IT department we distinguish between micro- and macro-environment as shown in Figure 18. Micro-environments directly affect the organization, whereas macro-environment affects all organizations. (Oliveira 2012, 66)

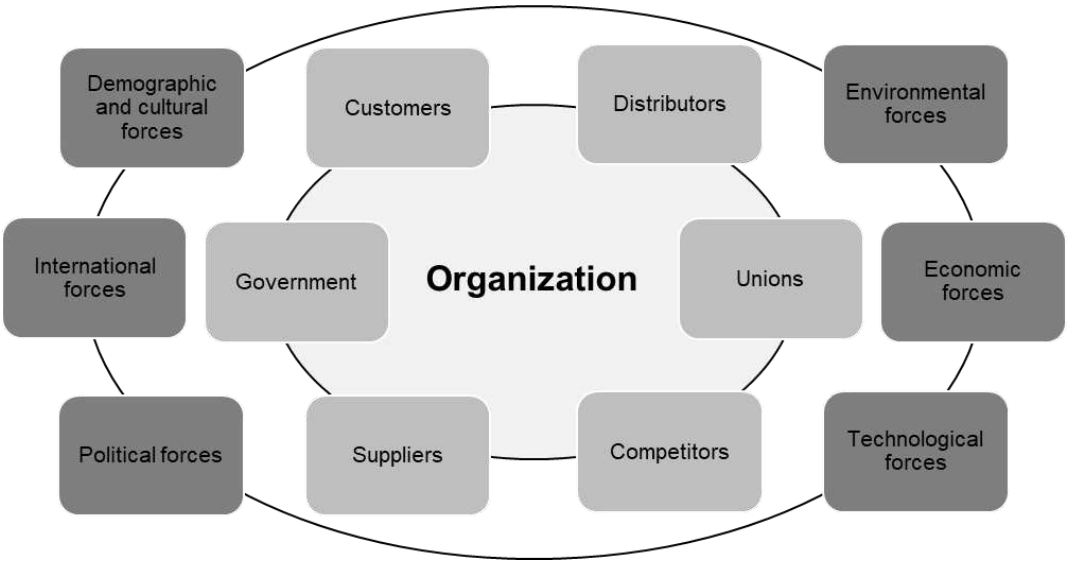

Figure 18: Macro- and micro-environment of organizations. Based on data from (Jones 2013, 82; Oliveira 2012, 67)

3.1.1 LOGICDATA's Environment

Like all others, the macro- and micro-environment of LOGICDATA is complex and, to a certain degree, instable and coupled with continuous changes. The following overview shall first provide the specifics in both environments shown above and, second, it mentions changes going on in them.

Demographic and cultural forces: Regional differences must be considered in this respect. Generation Y in well-educated areas looks for healthy lifestyle in work and in private area. Back

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problems due to less movement at desk work are becoming prominent as studies suggest sitting as the new smoking (Gartlehner 2015).

International forces: Globalization has a major impact on all forces described, as organizations need to scan the developments abroad to avoid competitive disadvantages (Jones 2013, 86).

Political, ethical, and environmental forces: National regulations with regard to healthy office workplaces are in a general process of change. However, European countries, for example, are starting to regulate the use of height-adjustable office tables in firms with computer workplaces. Furthermore, the European Union is elaborating on healthy workplace conditions in general which could have a future impact on demand (Bock 2016). From an environmental point of view the variance in regulations is affecting product design, as with cheap components and cheap production in countries with less strict regulations (e.g. Asian countries) a two-sided strategy-focus either on cost or quality is needed (Times 2019).

Economic forces: With several locations where LOGICDATA has operations around the world, there is a better chance to react to changing conditions in this respect. This includes interest rates, unemployment rates, exchange rates and wage levels. On the other hand, there is a higher chance to get affected by global conflicts such as trade conflicts between the US and China.

Technological forces: First, developed products are influenced by new technologies and market demands like connectivity. Digital affine consumers push firms to innovate and design digital solutions. This needs additional focus on customer data handling and security. Second, new production techniques and supply chain automation influence operational activities. Third, the way employees interact and collaborate is changing with new information-processing tools. A big impact on all dimensions can be traced back to the technological effects inherent in digital transformation.

As presented in the inner circle of Figure 18 micro-environment includes elements that have direct influence on the ability of organizations to obtain resources and offer products (Oliveira 2012, 66).

Distributors: With the first consumer products developed, distributors start to have significant influence on LOGICDATA's operation. Three years ago, components have been delivered B2B only without activities from distributors. Nowadays adjustable furniture is delivered B2C for business expansion and deeper integrated value creation. As the firm is not having the brand value to achieve results in B2C markets distributors take on an important role in sales strategies.

Unions: LOGICDATA does not have an employee's work council and installs elected trust persons that represent the local work force in management circles. As far as unions for products

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and standards are concerned the different requirements based on countries are influencing new product designs. By taking part in furniture manufacturers' and suppliers' forums new technological inventions can be lobbied and have a chance to lead to a competitive advantage when they get introduced into standards. While standards reflect regulations of governments, e.g. product safety, unions often consider the situation in various other countries and have still room to maneuver within the limits provided by the government's regulation.

Competitors: Increasing competition both from Asian manufacturers with increased price pressure, and from American and European producers with increased innovative solutions is influencing LOGICDATA's organization in various aspects. First, a high degree of innovation is needed to avoid falling behind and to keep the competitive advantage. Second, operation needs to reduce costs by increased efficiency and productivity and, third, competitors start to integrate vertical. All facts need attention and general or specific reactions.

Customers: The source of value creation or in short, the source where the money comes from has the biggest influence on the firm. LOGICDATA's has a global, broad customer portfolio that requires specific solutions due to their position in the vertical integration as far as the final product is concerned. Due to its development the company provides customers of all sizes with products and service. That said there is a huge intention to hear on the customers wish and create strong relationships that provide both values.

Government: As described at macro-environment, governments start to have huge impact when it comes to preventive health care in the workplace.

Suppliers: The global supply chain LOGICDATA uses for creating its products is challenging. Incoming goods affect all areas of the organization, starting from purchasing, development, quality to finance and others. Supply chain evaluations are needed to make the TOC of specific components public and to allow changes in the supplier selection for price reductions. Also, here LOGICDATA follows a strong and honest partnership where suppliers shall assist first and grow together with the firm's sales volume increase.

Both macro-environment and micro-environment are changing permanently, and organizations must adapt their organizational design to that. Organizations face the challenges to constantly change their corporate structure and strategies based on elements of VUCA environments. Managements refusing to adjust will lose their competitive advantage sooner or later. It is not the question if but when.

3.1.2 IT Environment Roles, Tasks, and Interfaces

This chapter describes the status quo of LOGICDATA's approach to IT in its landscape within the company. The focus is put on roles, tasks, interfaces, and stakeholders rather than the structure of the IT department itself. Specifically, the department is organized in a strong

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hierarchical functional structure. Traditional structures are described in chapter 2.2.2, whereas at this point the department's organizational context and various IT functions distributed in the organization are documented.

Figure 19 shows the integration of the IT department (1) and IT relevant units (2)-(7) in the organization, which are described below. The IT department **(1)** reports to the Chief Operations Officer (COO). Its focus areas are:

- Maintaining the IT related hardware infrastructure and achieve an up-to-date portfolio of devices
- Ensuring highest security standards with respect to information systems and devices used in the organizational environment
- Servicing any requests on operating systems and generally used tools like text processing, calculation, information display, etc. and ensuring their trouble-free operation

Historically originated, surely influenced by enormous company growth, lack of resources, less knowledge of business operations and the traditional approach of responsibilities of IT departments: the department is hardly able to satisfy the employee's needs. (Murr 2015) in specific points out efficient collaboration tools, digitization initiatives, and efficient user management to name here some of them. From an application point of view, tool development and administration roles are also distributed as follows.

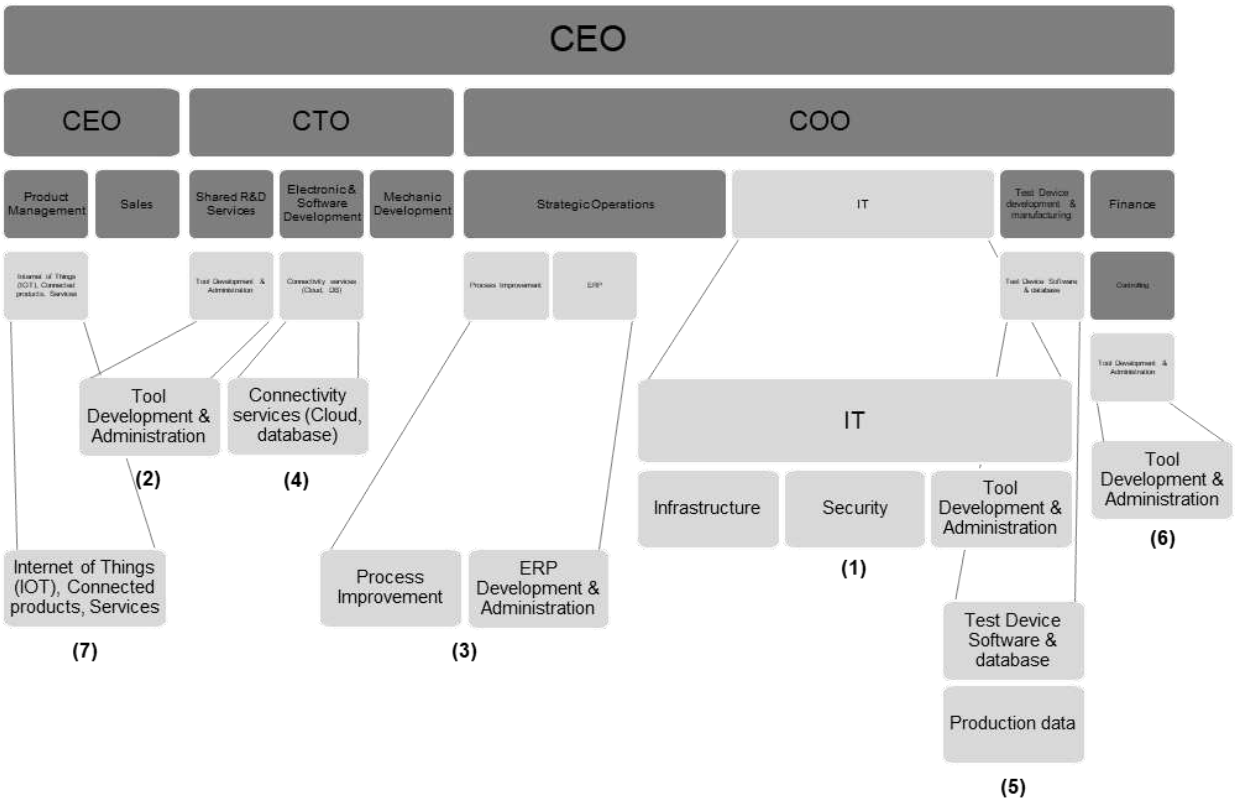

Figure 19: IT environment status quo at LOGICDATA. Source: Own illustration

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For example, computer aided design (CAD), product data management (PDM) and task management systems are administered in the Shared R&D Services team **(2)**.

Business process optimization and ERP system-related tasks are carried out in a separate Strategic Operations team **(3)**. The fact that IT is not linked to any business process knowledge and resource is representing the missing link between the what and why when it comes to software tools that should help in leveraging digitalization effects (Andenmatten 2017, 264).

IT services needed for products that interact and collect data on the final customer, e.g. public cloud services for data collection, are handled by the programmers in the software development department **(4)**. In addition, software development version control tools are administered in this department, while they are also used from the IT department for codes generated in server administration or intranet applications.

For market analysis, consumer needs and product requirements definition **(7)** product management created expertise in IOT products and connectivity together with software development and sales.

For IT hardware and software used in production facilities the test device development **(5)** team is in charge. Not only hardware knowledge is existing and shared with IT department (1), also knowledge about database handling and operation is centered here. In detail, production data exchange is handled from development perspective at this point. On the one hand for providing external manufacturers production data and on the other hand collecting feedback from manufacturers about test results and production data. Additionally, software for test devices is developed, which is used for automation in the testing process of products.

In the area of finance, which is in this case also linked to some HR management tasks like contracting, payroll, etc. tool development and administration are done by a controlling team **(6)**. Here, deep knowledge of business operations and costs is located and used for maintaining HR software tools and for controlling costs on projects and products. Here, a strong interface to any product and project data is necessary which needs collaboration with teams from shared services R&D and Strategic Operations ERP.

Macro- and Micro-Environment

With respect to the environmental analysis of LOGICDATA in chapter 3.1.1, the IT department is influenced in its operation by several topics mentioned there. As a detailed analysis of each area shall not be in the scope of this thesis, the author wants to point out several specific arguments that influence IT departments with respect to digitalization and organization.

Demographic and cultural forces, for example, are putting new generations as the main workforce that *"not only readily accepts digital tech but doesn't understand why it wouldn't be used if it makes life easier" (O.V. 2017).* The workforce is already digitally affine when they start

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their professional experience this improves firms competitive position and puts pressure on management and IT to provide this group with the right toolsets *(O.V. 2017)*.

Political and governmental forces for instance introduced the General Data Protection Regulation (GDPR) in the European Union that

> "sets out rules to make companies more accountable for the data that they lose. This means that your IT department needs to be more aware of hacks and able to respond faster to all forms of cybercrime" *(Redscan 2018)*.

(Subramani 2004) is providing evidence that *"IT use in interfirm relationships*" is key driver to "*create competitive advantages for supply chains.*" This means **Suppliers**, but also other stakeholders like **Customers** and **Distributors** using modern IT solutions push the IT department to adapt in using for example Electronic Data Interchange (EDI) technologies.

Technological forces as digitalization drivers have enormous impact on both IT departments and organizations as a whole as was already described in chapter 2 of this thesis.

3.1.3 The Need for Transformation in IT

A study initiated by the Austrian Federal Economic Chamber (WKO) and executed by Arthur D. Little provides the benefits Austrian SMEs gain by the increased use of information technology. The biggest potential is seen in new customer recruitment, cost reductions and increase of agility and flexibility (WKO 2019, 40). Interestingly the role of IT responsibility in the industrial sector is seen at top level management for 31-70% of responses in 2019 (WKO 2019, 54).

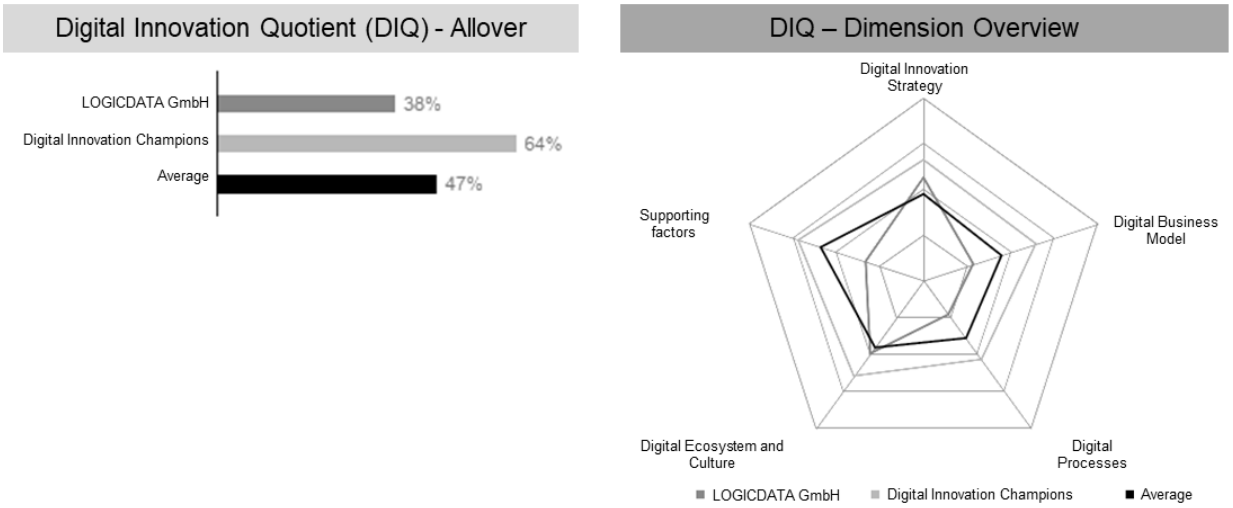

Figure 20: Digital Innovation Quotient LOGICDATA. Based on data from (Werkl 2020, 3)

Austrian federal ministry for digital and economic affairs (BMDW) provides guidelines to find out the status quo of an organization's abilities when it comes to digital transformation. An initial step shall be the digitalization assessment IMP3rove (IMP3rove 2015) which was done for LOGICDATA in 2019 by the European Innovation Management Academy under the execution of

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the human technology Styria cluster (Human.technolgy Syria 2019). The outcome was that the company on a whole is less digital oriented than the average firm in relation to other evaluated SMEs, as shown in Figure 20. This has provided evidence that in specific areas, also illustrated in Figure 20, like process optimization, digitization, and digital workplace improvements the organization has big potential. An unequal distribution in this matter is a sign for methodical weakness and missing systematics in digitalization (Kreutzer 2017, 94).

Another need to change was provided by a survey within LOGICDATA's departments. The goal of the survey was to find out the amount of software tools used and their purpose. The result shows a need for higher transparency in cost allocation for tools used on the one hand and reorganization in tool administration and development on the other hand. The survey was done in two consecutive years and illustrates in Figure 21 the rise in the number of tools by 51% which also explains the rise in one-time costs in the same period of 24%. The biggest increase in number of tools was categorized around organization, like note taking or task management.

Over the last years, the practice emerged to put functionalities and process workflows into tools that provided the easiest and quickest way of implementation, not giving respect to fit from requirements to the tool's possibilities. On the contrary, tools providing much functionalities and even established interfaces were not considered for implementation, the reason being that the execution must be done quick and easy.

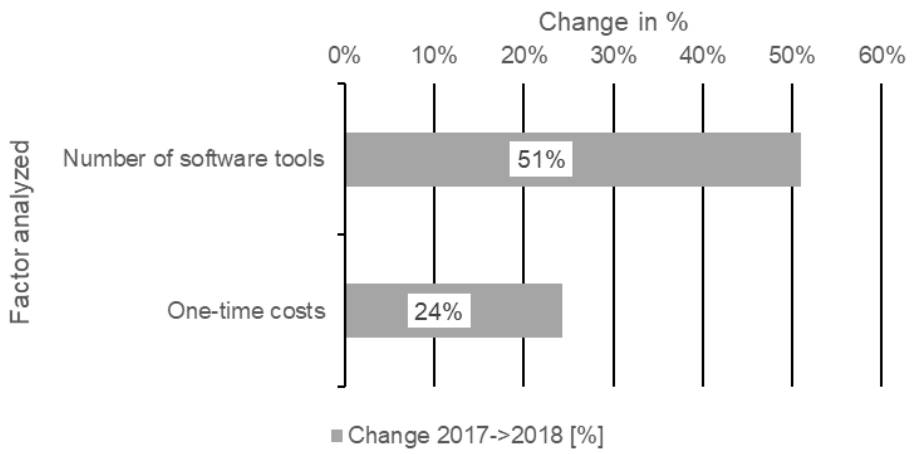

Figure 21: Software tools analysis. Source: Own illustration

The previous chapter provides one of the key reasons in organizational design as the balance of centralization and decentralization is not given any more due to the company's growth and IT department's responsibilities. Further the rigid and un-innovative IT, that only had to function and not to invent something new, is in the current configuration not able to find and provide new ways on how the organization could benefit from new technologies (Ternès 2018, 49).

> *"IT functions are too far away from top-decision-makers in order to help shape necessary innovation and digitalization decisions (Urbach/Ahlemann 2019, 104)."*

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3.2 Model Development Phases

Depending on the current development status of a company's IT department, it makes sense to act in different phases. Based on the work from (Urbach/Ahlemann 2019, 105) three phases in the direction to *"The end of the IT department: IT experts become part of the business departments and are coordinated by a dedicated executive responsibility"* shall be considered in the model development.

As it won't work to transform from a traditional approach, as described in the environmental analysis above, to a high-sophisticated one in a single shot, the model design focus on the transformation illustrated as phase 1 and phase 2 in Figure 22. Phase 3 will be discussed with reduced effort, as the objective of this thesis is fulfilled with implementation of phase 1. Phase 1 will be implemented, evaluated on specific criteria and outcomes are provided as basis for phase 2. Further guidance will be given on exploring organizations readiness for phase 2.

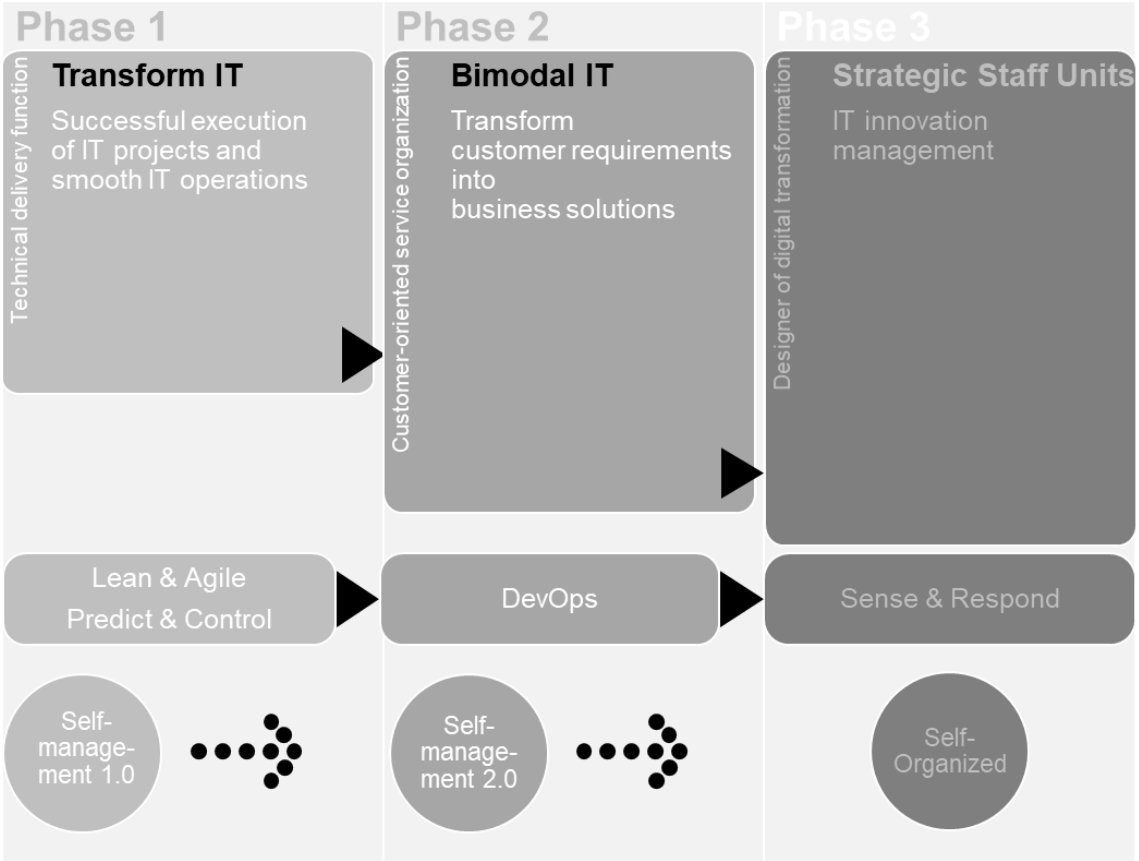

Figure 22: Phases to transform IT. Adapted from (Urbach/Ahlemann 2019, 105)

Phase 1: Transform IT for Aligned Focus

The first step has the purpose to reorganize information technology and business process activities into one function. Still the department fulfills its technical delivery responsibilities and provides fail-free operations. However, any improvement or request with respect to process or tools is documented, analyzed, and executed in a strategic alignment.

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Lean principles are used in general task management. Agile operation is considered for the creation of minimum viable products (MVPs).

Decision-making is starting to emerge where the decision is needed, not by a higher hierarchical level. As an example, a systems-committee and a jour-fixe for the main three operational entities within the team could be mentioned.

Phase 2: Create a Living Environment and Encourage Self-management

The second step shall provide a possible organizational design for a less structured and more customer- and task-oriented department. The ability to provide high reliability in core systems besides quick introduction of new or improved solutions is in the focus. In this phase IT starts taking part in product and service development as specific knowledge has increased or is available.

DevOps principles shall assure a mutual understanding between development and operation environment and launch times shall, therefore, be reduced.

Role descriptions and decision-making is further put into the people's responsibility, and commitments are defined on a one-on-one discussion within the whole team.

Phase 3: Innovate IT in Departments with Central Managerial Coordination

The third step provides self-organized resources that get part of departments when they need any new or improved solution. These resources agree on the organization's and department's goals, coordinate their needs, and design digital solutions within the company. High-skilled labor is a pre-condition to run this setup. Overall coordination by an executive position is necessary. However, this is no hierarchical function in the IT department. It is a role that is taken on by someone who has skills and experience to do that and represents the department within the firm's environment.

Sense and respond in this phase shall replace prediction and control when organizational needs are considered. Free resources work on what the organization needs in fast iterations instead of searching for the "perfect answer" (Laloux 2014, 331)

Roles are only existing for the micro-external environment. Decision-making is done where the decision is affecting others and will be done on purpose, not on profitability, growth or market share (Laloux 2014, 50).

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3.3 Phase 1: Transform IT Evolutionary

The first step in transforming traditional IT departments is to prolong the department's or team name change from "IT" to a phrase that shows a more business and process like connection like, for example, "Digitalization and IT". This makes the underlying need for process optimization and strategic importance as part of digital transformation visual. The change must follow different thinking as IT is no longer "a cost of doing business", instead it is enabling and improving business (Henderson/Venkatraman 1993, 7).

Further implementing and renaming roles in an org-chart must be extended by role descriptions for a transparent visualization of responsibilities within the organization. (Groß/Pfennig 2019, 46; Urbach/Ahlemann 2019, 19)

This chapter provides goals in this transformation phase, evaluation criteria, organizational design, and a final reasoning on how readiness for further transformation of the department could be evaluated.

3.3.1 General Focus and Objectives

Allover, focus must change from technical implementation and operation of solutions to abilities to optimize company-wide processes. Business and IT must be married in this respect as there will be no business without IT in future (Urbach/Ahlemann 2019, 19). Therefore, the following steps need to be defined:

- Analyze status quo and document it
- Design and implement new structure and role descriptions
- Implement lean-agile working principles in processes and work behaviors

Any new structure and role description must be balanced in the organizational design challenges: (Jones 2013, 120)

- Differentiation and integration
- Centralization and decentralization
- Standardization and mutual adjustment

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Scenarios and Indicators to be Evaluated for Comparison to Status quo

As described in chapter 1.3, the model shall be evaluated by referencing to a status quo before the transformation happened. This is achieved by quantitative and qualitative measures listed below. Further explanation on their relevance for successful implementation of this transformation phase are described in chapter 4.

- Implementation of a task management on lean principles and improved performance on core system ERP, verified by a quantitative system measure as also a qualitative survey result
- Assessment logic for decision-making on new systems requests as also maintaining a system landscape, verified by quantitative measures on implementation and qualitative survey results
- Evaluating the fit of the organizational structures (including further phases), verified by qualitative measures by execution of expert interviews

3.3.2 Management

The position and tasks of the department head are subject to basic changes. Traditional IT leaders are often high-skilled technicians that followed management decisions with focus on technical implementation. With a new approach a department leader cannot be the data base administrator or IT security expert anymore. In contrast, it is a consultancy and coaching role of improvements throughout the company and to the specific roles as provided in the next chapters.

It is important to place this role in a leading position within the company's organizational structure. The reasons are:

- C-level must understand and accept the role as consultant and decision-maker on a company-wide level when it comes to information technology in operations and product development
- Strategic targets must be defined in collaboration, as information technology is becoming part in any optimization and product development
- Strategic decisions must be made when it comes to outsourcing. Most applications are out there somewhere as a service.
- Cloud or SaaS commitment is needed throughout the management
- Decisions in Digitalization shall be based on expertise and verified, not on money provision or best friends' opinions

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3.3.3 Structure

This section describes the architecture of the transformed IT department for the case of LOGICDATA. At this point the author focuses on unit's operation, coordination and both operational and strategic management.

Figure 23 shows the organizational structure developed for LOGICDATA's IT department with the main operational units: IT infrastructure & security, business applications and business process modeling (BPM) & analytics. Each of the mid-grey boxes, as shown in the legend, represents a role that was redefined from its previous description and organizational relationship. Some role descriptions are provided in Attachment 1.

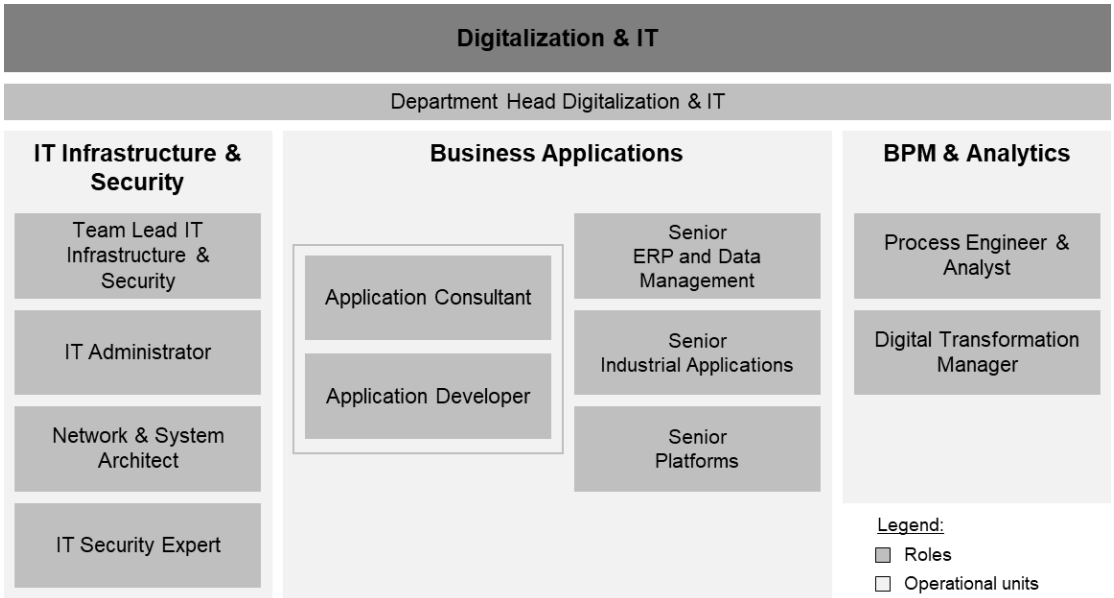

Figure 23: Digitalization & IT phase 1 organizational structure. Source: Own illustration

The model fulfills several aspects of a hierarchical, prediction and control approach, as resources and the rest of the organization need specific roles therefore to satisfy the demand:

- Team leader and senior positions in both IT infrastructure and security (I&S) and business applications (BA)
- Tasks are, depending on their background (ticket, strategic target, etc.) controlled by the chain of commands
- Reporting and escalations are handled from lower levels to higher levels in the structure

IT I&S has the responsibility on smooth operation and availability of hardware used in information technology and communication (ITC). This included in the past all on-premise instances but must be extended to cloud services. As there is no way around cloud solutions to follow technology improvements and provide users with high user experience (UX), a cloud adoption approach in this specific setup is provided in chapter 3.3.4.3. As described in the risks

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of digitalization cyber security must be given high importance to protect companies of this threat. Any tasks linked to IT security are in this area of responsibility.

In the area of BA, a separation is introduced to represent different areas, that were existing distributed in the firm before the transformation. These are:

- **ERP and data management**

  The core system and all its interfaces are maintained and improved within this area. Further data from different systems is used for business analysis via a data warehouse (DWH) solution which is also in this area of responsibility.

- **Industrial applications**

  Any software and database used in production environments is developed and maintained here. Within LOGICDATA's operating model, this area ensures production data collection, and its provision to inhouse departments for analysis.

- **Platforms**

  Any software tool, except two areas before, that is used within LOGICDATA is introduced and maintained in this area. In this area process digitization and process digitalization by the help of software tools, user experience in daily work and harmonization of system landscape are executed.

Regardless of the separation above a pool of resources is available to all the three areas in BA. These resources are split up into the roles of developers and consultants, whereas a specialization matrix provides knowledge areas for the different tasks, e.g. database, or specific programming skills.

BPMA column is assisting process optimization allover and in specific projects it consults BA on process design, efficiency, and lean principles. It is seen as a service to the organization to assist in business process design creation and improvement.

Each of the operational units has missions and goals as defined in Figure 24. This representation is information, communicated to the organization for the explanation of what the transformation and therefore the marriage digitalization & IT means.

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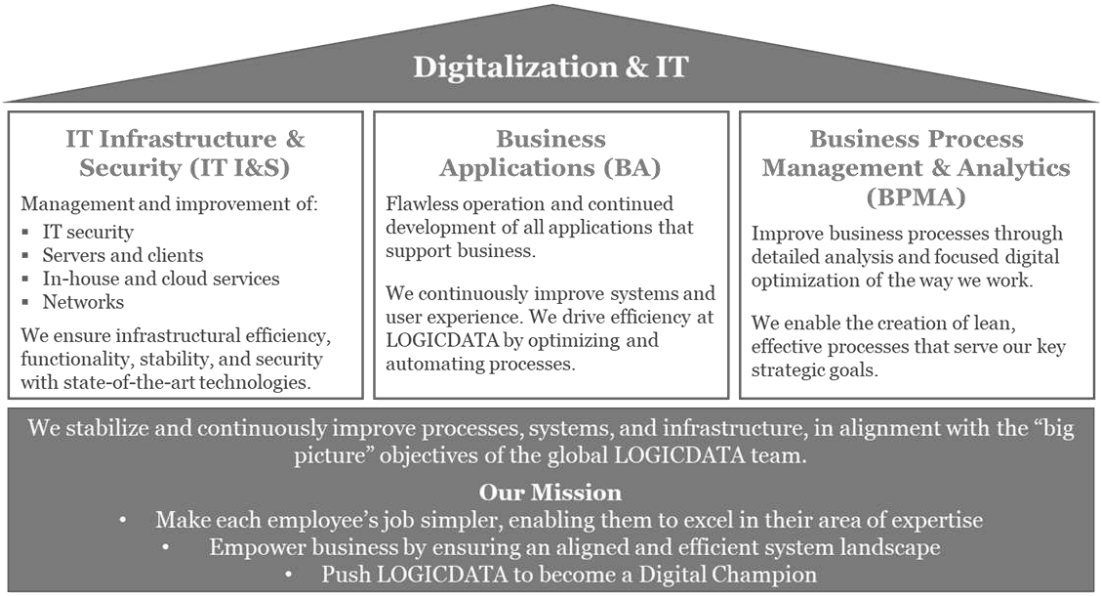

Figure 24: Mission and goals of transformed IT. Source: Own illustration

On balance, in terms of focus there is a need to encourage knowledge and support within the firm in total as far as IT tools are concerned. This needs to be achieved by both, providing users with a platform

- where they find all "how we do" documentation and training materials in the latest version with visible changes
- which is intertwined with other systems
- that ensures a good overview and search functionality

and implementing a key user structure for the main tools in use. These key users are interested in increasing their knowledge with the tool and can help users in a first-level support. They also act in user adoption as success owner or early adopters described in chapter 3.3.4.3. As far as possible, resources in BA are released from support requests with their help.

3.3.3.1 Jour Fixe

The Jour Fixe is an organizational element to align the hierarchical levels of the department. In Figure 25, the fixed agenda items and members are shown. Within the group there is no hierarchy and decisions are made on the basis of teal practices. This means

> *"as long as there is no principled objection, a solution will be adopted, with the understanding, that it can be revisited at any time when new information is available (Laloux 2014, 68)."*

The meeting, therefore, allows everyone to speak up and provides a collective intelligence that makes the decision.

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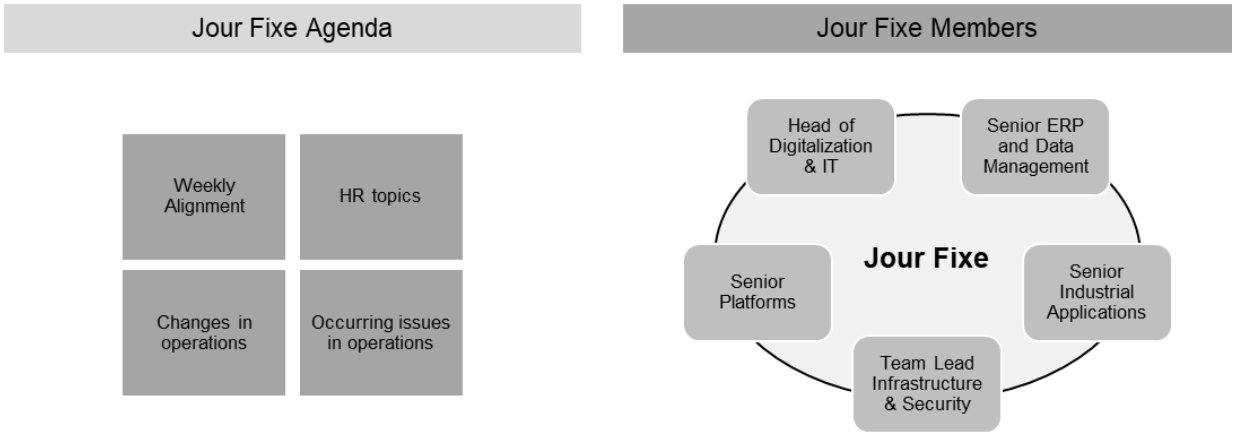

Figure 25: Jour Fixe agenda and members. Source: Own illustration

3.3.3.2 Systems Committee

Just like the jour fixe from the previous chapter, the systems committee is an organizational element that acts on the basis of “teal” principles as far as decision making and meeting rules are considered. To make decisions, the group needs data which are prepared by the tool and process of digitalization assessment (see chapter 3.3.4.1) when it comes to new requests within the company. Specifically, this group must solve the disadvantages the previous setup of decentralized and unstructured software tool management had. Figure 26 illustrates main goals of systems committee.

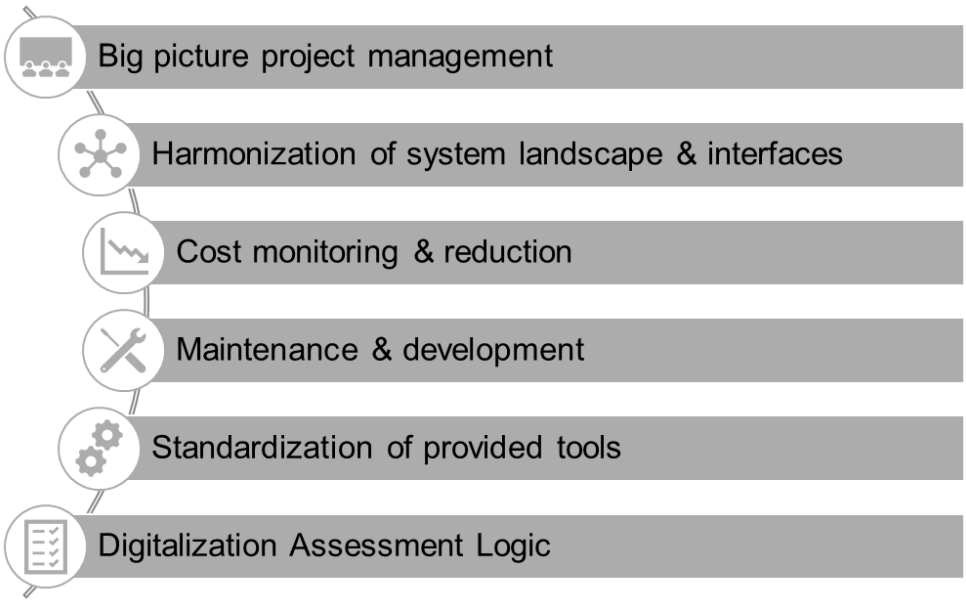

Figure 26: Goals systems committee. Source: Own illustration

3.3.4 Processes and Tools

This chapter describes the major processes and tools the reengineered Digitalization and IT department shall use for controlled and structured operation. First, the Digitalization Assessment Logic is described. Second, lean operation with the help of task management is explained. Third,

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the selection and implementation of tools is illustrated. Fourth, the first steps to adopt cloud solutions in the given setup are provided, and fifth, the role of IT within development projects is discussed.

3.3.4.1 Digitalization Roadmap, Assessment Logic and Technology Radar

Internal digitalization, where focus is put on the first phase of redesign, needs to be compared to traditional practice and the influence of processes. It is all about automation, adaptive processes, etc. to leverage right and now on the market technologies for competitiveness increase and also higher productivity. The described roadmap uses a submission possibility, a digitalization assessment with influence of process mapping, a technology radar and, implementation and controlling. All that to support systems committees' purpose for systematic tool landscape shaping.

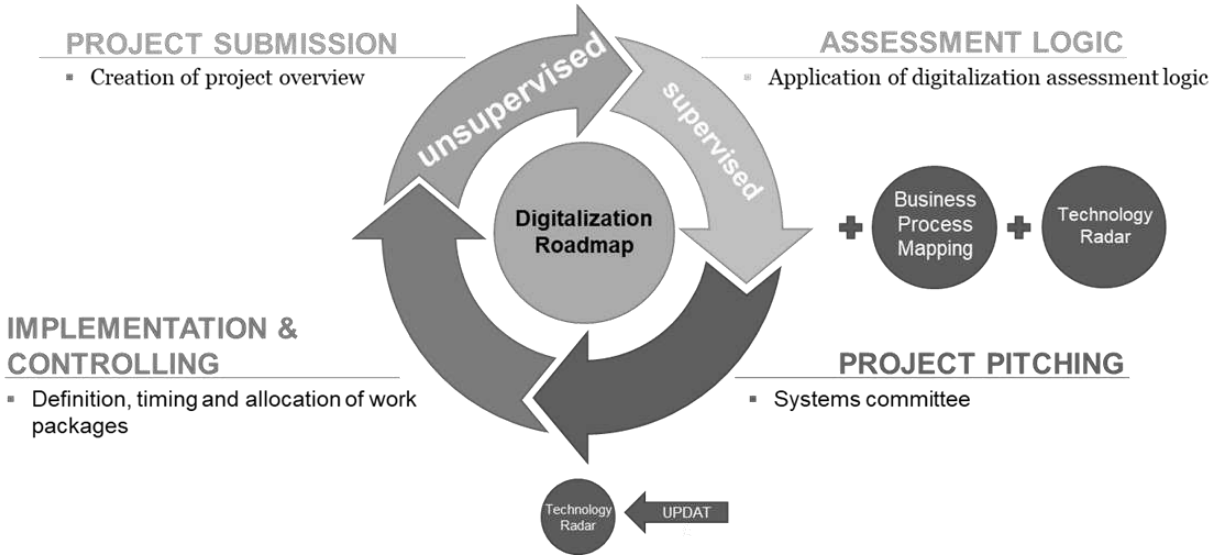

Figure 27: Digitalization Roadmap. Source: Own illustration

Figure 27 shows the digitalization roadmap, that ensures a systematic procedure on any request coming from the organization for tool or process improvements. The first step is the unsupervised submission with a defined request form which is followed by the digitalization assessment logic. A finished assessment is the basis for pitching it in the systems committee where the decision is taken for or against implementation. In case systems committee agrees, the project leader is defined, and the digitalization project (chapter 3.3.4.4) is started.

Identically to the whole organizational model the influence of process modeling on any decision is respected by the link to business process mapping in the assessment logic step. Moreover, technological developments that could be beneficial for a firm in general and for tools in specific are considered and visualized centrally in a technology radar. Within LOGICDATA the presentation and process has been implemented at the beginning of 2019. The process (Figure 28) regulates periodical updates and reviews on the radar.

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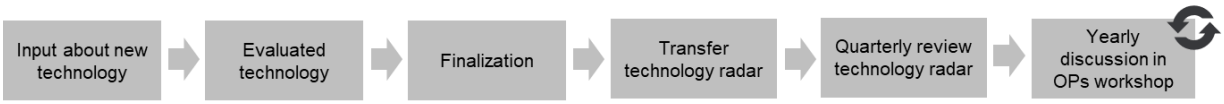

Figure 28: Technology radar process. Source: Own illustration

The radar illustration (Figure 29) provides various information on the classification of the technological trend. In the current context of phase 1 the category of tools / systems must be given highest focus. For example, identifier 110 stands for collaboration hub or 111 for cloud-based ERP where for each identifier a fact sheet is created. An example of a factsheet is shown in Appendix 2 of this thesis. In addition, the arrangement provides on the one hand four general stages (hold, assess, trial, adopt) and on the other hand a quick win's category for fast adoption. For tracking reasons, the status of the item (new or moved, no changes & on hold, no change) is illustrated with shape and color.

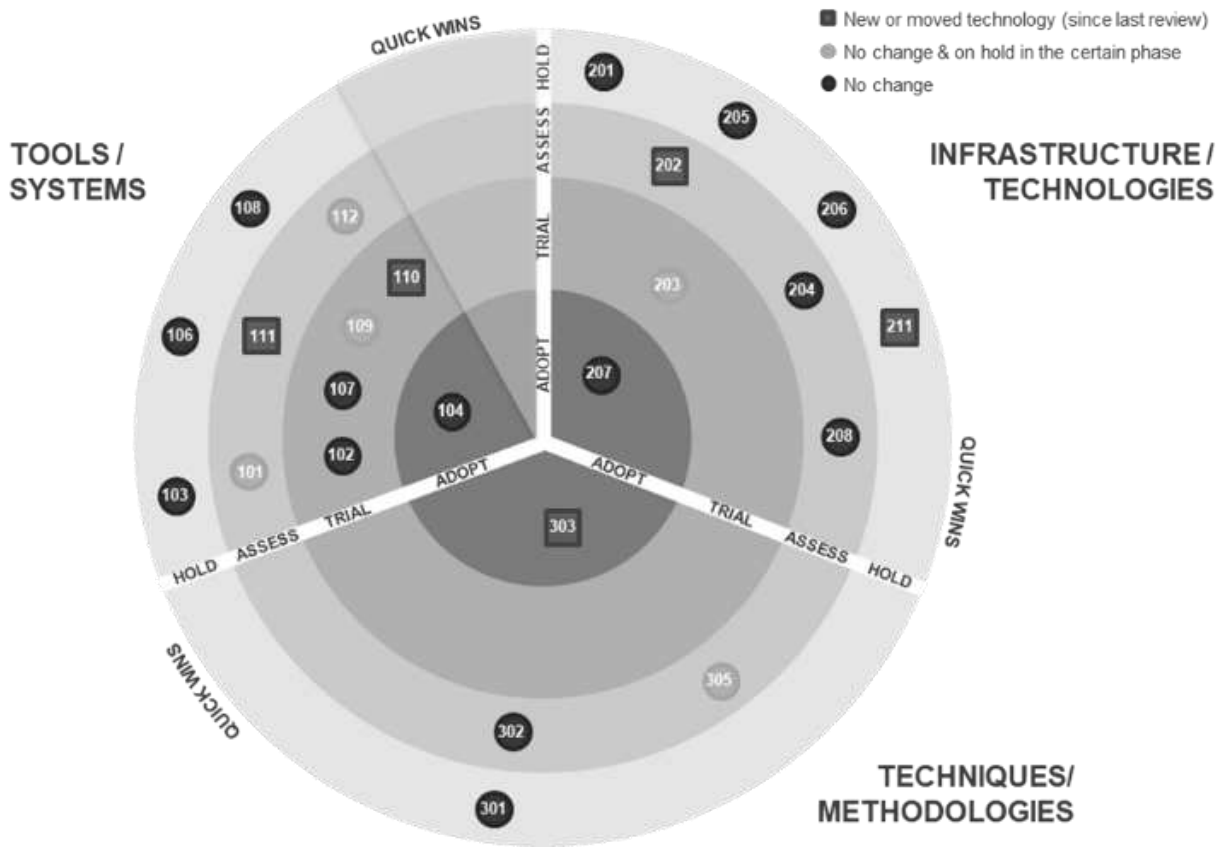

Figure 29: Technology radar. Source: Own illustration

Digitalization assessment is fueled by the various inputs described before, and categorizes the submissions according to three dimensions:

- **Complexity** considers any criteria that could affect the implementation. Expected project duration, number of involved parties/departments, probability of success to name some.

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- **Value** focuses on three areas, i.e. importance, functionality, and relevance. Relevance values the appropriateness of the submission to current challenges and targets within the organization. Functionality assesses a possible comparison of different options, e.g. tools on the market within one assessment. Importance rates a state of significance within firm's improvement and development status.
- **Return on Digitalization (ROD)** reflects the financial view on a submission. For calculation, the return on any investment, a revenue that originates in the installed improvement and the expenses that are necessary for implementation must be documented. On this basis the potential profit is calculated and can be expressed in years by comparing it to the current costs. The ROD value is then categorized from 0…high profitable (ROD < 0.5 years) to 5 financially not feasible (ROD > 7 years).

For visualization purposes, the three dimensions are represented in a digitalization cube as shown in Figure 30. Together with any other submission the valuable projects based on the indicators described can be visually identified by the indicated smaller cube area.

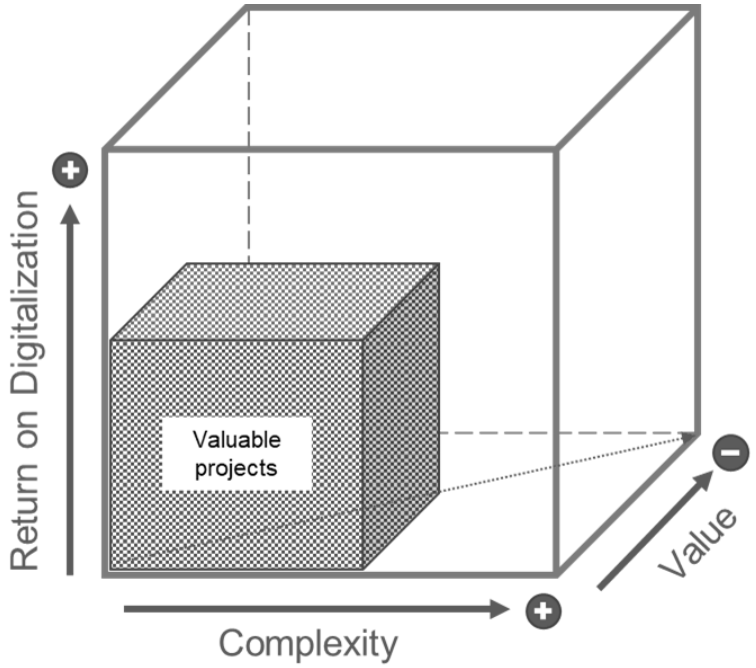

Figure 30: Digitalization cube. Source: Own illustration

Finally, all the three dimensions are weighted and calculated to achieve an allover digitalization index of the submission that is then pitched in the systems committee. There, the decision is made on further processing or backlogging the item, based on the amount of current work in progress.

3.3.4.2 Task Management - Principles of Flow

As described in the theoretical part of this thesis, lean principles in IT operations are the basis for a constant output of results. This chapter focuses on these principles and describes the

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introduction of task management in the Digitalization and IT department on the principles of flow. In the best-case, task managements are linked to worklogs which increases past documentation and future prediction analysis.

A first step in the principle of flow is making work visible. Therefore, all tasks that are done by team members in the department are visualized on electronic cards in a Kanban board where the progress of work is mirrored by the flow of the card from the left to the right, based on a different status. For transparency reasons the Kanban board should include all tasks the department is working on. However, this needs the functionality of quick and easy filtering on e.g. my own tasks, the tasks of a group or showing different types of tasks. In the current phase, we do not focus on DevOps which means that the tasks in the progress area are not separated any further.

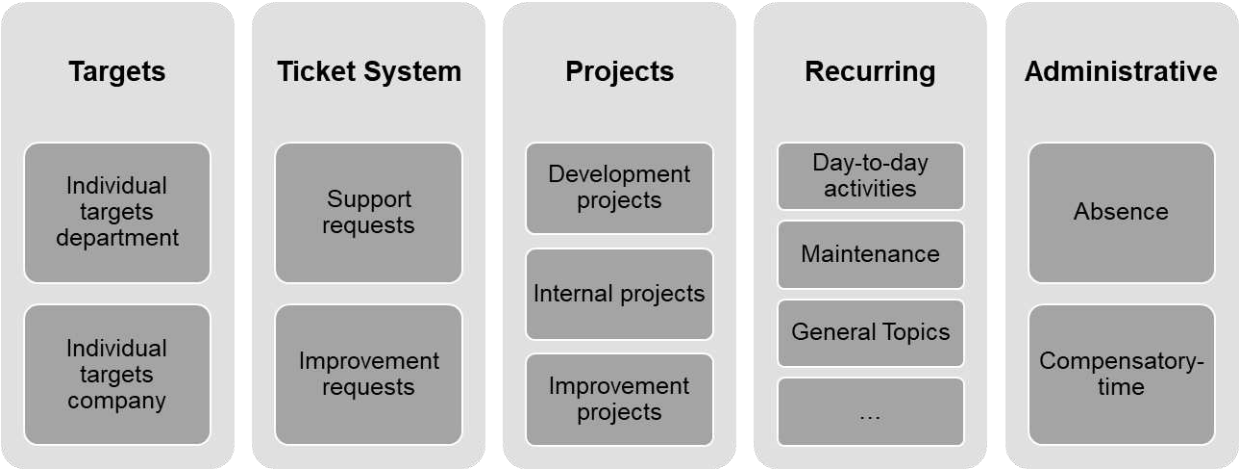

Figure 31: Types of task in a task management. Source: Own illustration

A possible task categorization is shown in Figure 31. It is important to define in detail what the specific categories mean and what should be part of them as the organization of tasks is given mainly to the team members themselves. A basis therefor is the mutual understanding throughout the team why it makes sense to categorize tasks like this. The benefits are:

- Reporting provides efforts and allows re-engineering the organizational design based on the demand
- The more mature the department's purpose is fulfilled the lower should be the effort on support tickets and the more time is available for strategic work in targets or improvement projects
- Purpose can be steered by team members themselves in terms of taking on work from the backlog in case priorities of the organization change.

As each of the categories above requires different workflows during its journey from creation to finish, depending e.g. on customer interaction, the Kanban board shall be able to amalgamate various statuses to some specific ones as shown in Figure 32.

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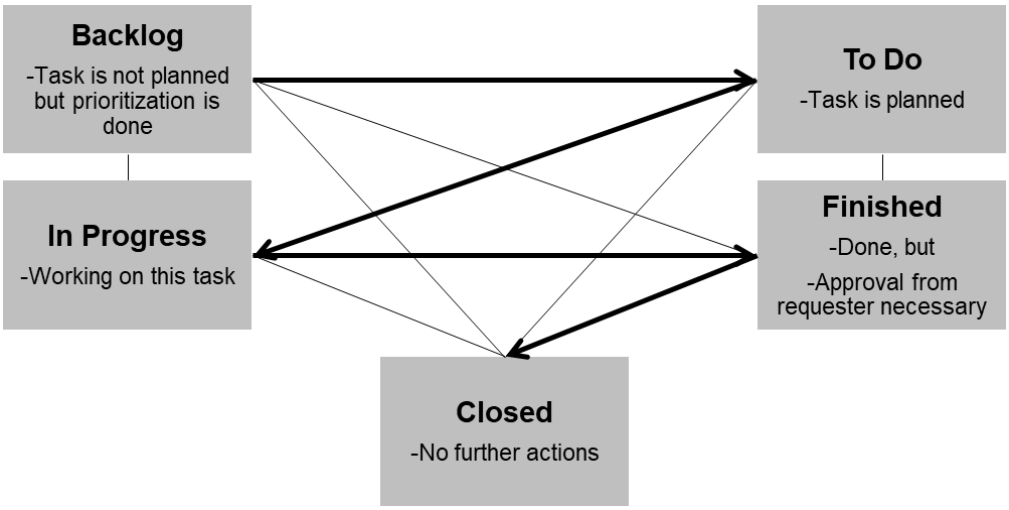

Figure 32:Statuses of work in task management. Source: Own illustration

In phase 1 focus shall be put on five status properties without restrictions in moving between them. This means every status shall be accessible from any current one. Nevertheless, there is an ideal path of execution illustrated by bigger arrows in the figure.

3.3.4.3 Adapt Cloud Usage by Cloud Adoption Frameworks

14% of SMEs in Austria in the industrial area say that cloud services are strongly relevant to them with high single digit growth every year and on-premise data storage is on the decrease in a high single digit from 2018 to 2019 (WKO 2019, 63). The trend to outsource specific services and tools into clouds is unstoppable as described also in chapter 2.1.

Companies starting in 2019 to transform their IT are often slow followers and have not yet gained knowledge on this topic. Therefore, the structure must make sure that cloud adoption could be handled within the team. The new team must build up knowledge as fast as possible and IT leaders must promote the topic with studies, research, and best practice examples. For example, today's arguments are (Christiansen 2016)

- Providing faster, more reliable, and less expensive services
- Scaling IT processes up and down as needed
- Reducing installation of commercial off-the-shelf software which follows no mandatory, disruptive, costly, and complex updates anymore
- Increasing reliability and security compared to on-premise installations for specific sets of data and self-developed applications
- Increasing time spent for business purposes to consult in using the power of new technologies instead of maintaining local hardware with updates, etc.
- Reducing IT overhead costs by 30-40%

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Vendors that offer public or private cloud services, e.g. Amazon, Microsoft, Google to name the most famous ones, promote a cloud adoption framework to ensure strategic, planned, and organized start into cloud use. In detail, a separation between a general cloud adoption or adoption of cloud-based productivity tools is necessary. Productivity tools affect a whole organization compared to a limited group of resources to drive cloud adoption for outsourcing workload. Nevertheless, both of them mean changes in behavior for employees, and change can be hard in this respect.

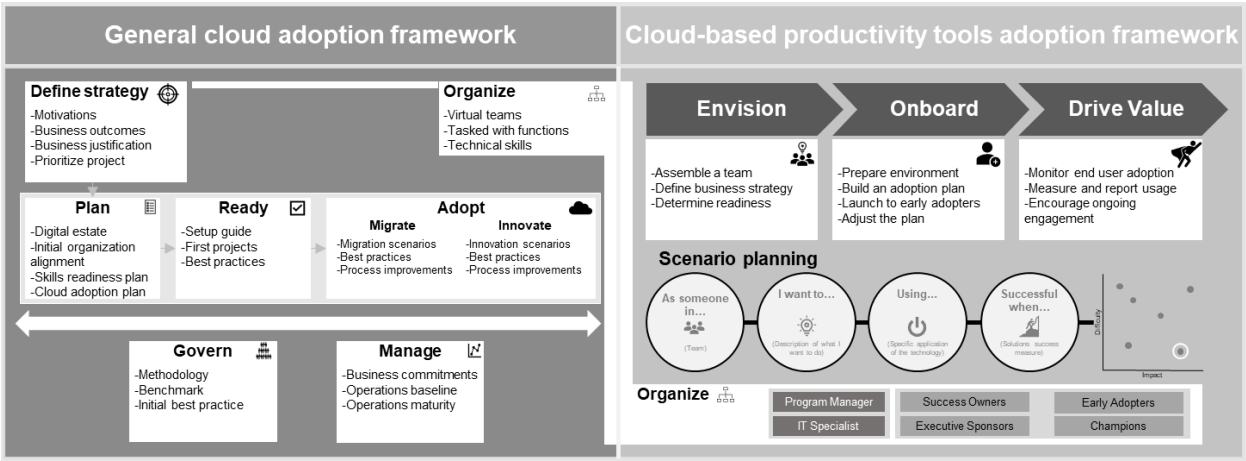

Figure 33: Cloud adoption frameworks. Adapted from (Blanchard 2020, O.V. 2019)

First, a general cloud adoption framework (CAF) shall follow a process as shown in the left part of Figure 33. The following main items must be considered in setting up a CAF in an organization: (Blanchard 2020)

- **Organize:** It is essential to have a well-organized cloud adoption organizational structure. Depending on the maturity of the team, various types of team compositions can be chosen. A common solution for a start is to establish a virtual team that is tasked with required functions and runs adoption in an experimentation focused environment. As time evolves, more tasks and functions are added to target finally a cloud-first operating model.
- **Define Strategy:** A cloud strategy is the basis to leverage its possibilities. The documentation of motivations, financial KPIs and first adoption projects (e.g. productivity tools) provide all stakeholders with the facts on the way.
- **Plan:** The planning phase transforms the cloud strategy into an executable plan. Estates are analyzed, organization stakeholders are involved, the team knowledge increase path is documented and summarized in the cloud adoption plan.
- **Ready:** The technical readiness of the environment is considered in this phase as it provides the “landing zone” for first workloads.

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- **Adopt:** Migration of workloads that may make sense to be moved are assessed. The iterative process is based on best practice. In addition, innovation on running solutions opens the boundaries for new business value creation with existing services.
- **Govern:** As cloud services change traditional approaches on handling, e.g. data centers or workloads, policies existing for on-premise must be added with policies for the cloud.
- **Manage:** Ongoing operations are essential for added value within running cloud services. Strategy is considering the mid-term adoption. However, in managing the current operation commitments on workloads, for example, are necessary. The operational management must establish a value driven and cost-optimized service.

Second, a framework for cloud-based productivity tools adoption puts attention on efficiency increase for the users. As illustrated on the right part of Figure 33, adoption shall cover three steps which are described below:

- **Envision:** In this first stage it is important to onboard the correct resources and roles into the adoption process. The success here is linked to the IT relevant resources, an overall program manager and an IT specialist. Both of them must raise awareness on the topic and need to ensure the readiness of the infrastructure which is linked to the general CAF described above. Equally important are executive sponsors that promote the adoption in the executive levels, success owners who are able to translate business needs into the capabilities of the tools, early adopters for launching the toolsets and understanding the needs of less experienced team members, and champions that act as trainers to adopt their teams to a new way of work. In this stage also scenarios on improvements shall be worked out to leverage the possibilities of the toolset.
- **Onboard:** The second stage shall provide a test run before scaling a toolset to the whole business. With the help of previously defined resources, the adoption plan shall be evaluated, the environment be prepared, and finally early adopters are given the toolsets. With their first feedback, adoption shall be adjusted before a company-wide launch.
- **Drive value:** Usage and satisfaction are essential for any adoption process. Therefore, measures and reports must be used and interpreted. This allows focused ongoing engagement activities within the workforce to foster a permanent drive for excellence by building new scenarios and increasing efficiency throughout the firm.

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3.3.4.4 Digitalization Project

A project dealing with the implementation or ongoing development of a tool shall be well structured and documented at any step in the process. The three main parts are software selection, software implementation and continuous improvement as provided in the figure below.

Between software selection and software implementation the decision from the systems committee based on the assessment logic described in chapter 3.3.4.1 is located.

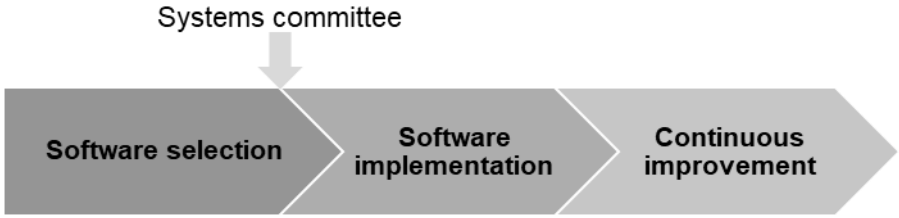

Figure 34: Digitalization project process. Based on data from (Groß/Pfennig 2019)

Figure 35 provides a detailed overview of each of the above-mentioned process stages. First, in the software selection phase it is essential to analyze processes and document requirements as basis for a supplier pre-selection. This is followed by checking the suppliers service in detail and final negotiations and contracting.

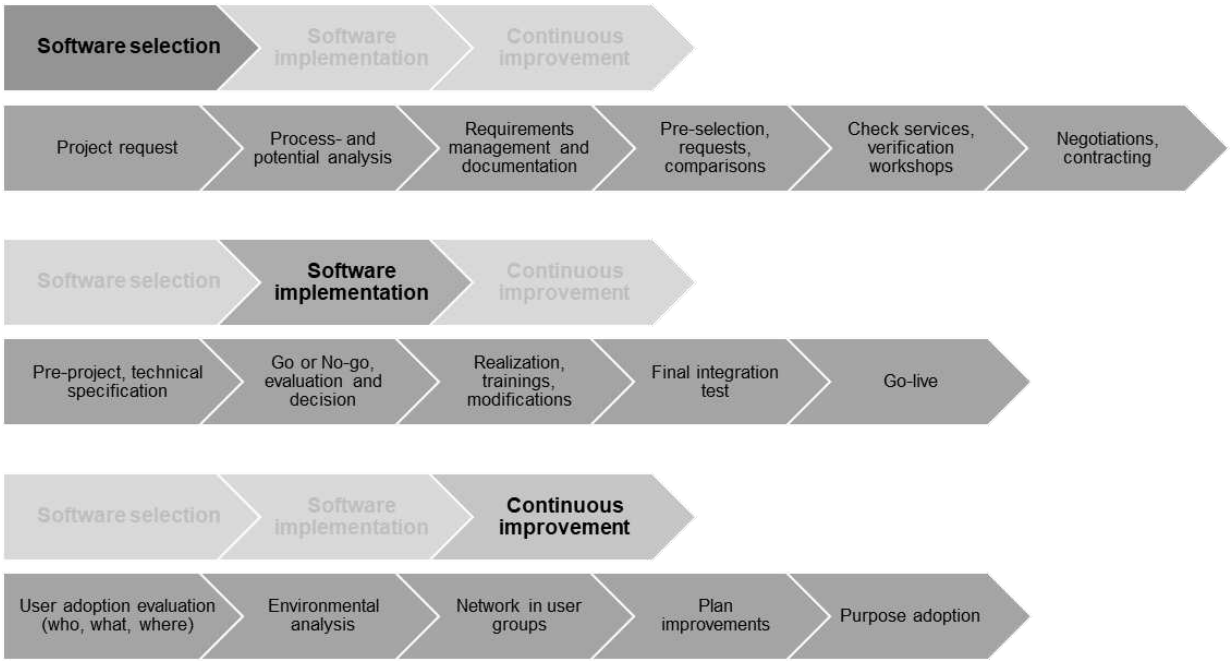

Figure 35: Digitalization project process details. Based on data from (Groß/Pfennig 2019)

Second, the implementation takes over the requirements from the selection and puts it into detailed technical specifications aligned with the contract partners. At this stage, an exit point is defined in case of disagreement or changing environmental conditions. In case of a “go” the project is realized with focus on time, cost, scope and quality, key users are identified and trained,

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and user adoption starts. The final integration test is the last check of all realized modules and is followed by the “go-live”.

Third, as it should be part in any IT department, continuous improvement and evaluation of system landscape is done. This is supported by user data with respect to the software adoption, followed by environmental analysis and knowledge-exchange in user groups. With this knowledge and internal improvement requests the landscape is in continuous change to get the most value out of it.

Organization

Based on skillset and motivation of employees, each team member in the department shall be allowed to lead a digitalization project. Additionally, each member is also joining project teams in their assigned roles and specialization. For example, in a digitalization project where a BA member is defined as project leader, IT I&S has a role to be fulfilled as far as security or infrastructure is concerned in any project phase. Same situation occurs for BPM members for support on process design and alignment in the software selection phase.

(Aldrian 2020) points out the use of a standard project process model in a bigger organization, that should be unique all over the organization in all matters handled in projects. This ensures standard reporting and task organization and a multi-project environment. Projects must be given their own structure in this respect.

3.3.4.5 Product and Service Development Project

In the current stage of maturity, consulting resources are not yet skilled enough to be part in product and service development projects. For this reason, necessary knowledge is brought into those projects by external consultants, if needed.

A first step is to exchange with product management as well as research and development departments on technologies that could result in a possible business value in future, so that skills could be built up internally continuously. At this point the technology radar and trend workshops within innovation- or product management should be used as a basis.

3.3.5 Resources

The necessary capabilities and mindsets of employees in departments that are shifting to digital in a first phase as mentioned in the chapters before, are described in this chapter. Although this thesis is not putting focus on change and culture, those areas are to be discussed in this chapter to draw a picture of the ideal match between structure, process, strategy, and mindset of people. (Kreutzer 2017, 91) mentions in this respect the mindset of „*the quest for continuous innovation*” in the relationship of digital performance.

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First, resources affected by the transformation must be involved in the whole process of reorganization to encourage transparency and trust. This starts on the one hand with first introductions of the concepts and explaining the “Why?”. In collaboration, affected employees and management develop the role descriptions, and interfaces in the identified organizational context must be identified and aligned.

Second, employees must be coached in the dualism of operational and strategic work as this will be the basis for continuous improvement and first steps to phase 2, the two-speed IT (Kreutzer 2017, 95). Therefore, team members need to be involved in strategic planning which, again, fosters transparency. Only with an understanding and willingness of extending the scope of work from operational to strategic tasks employees are getting the chance of their potential development.

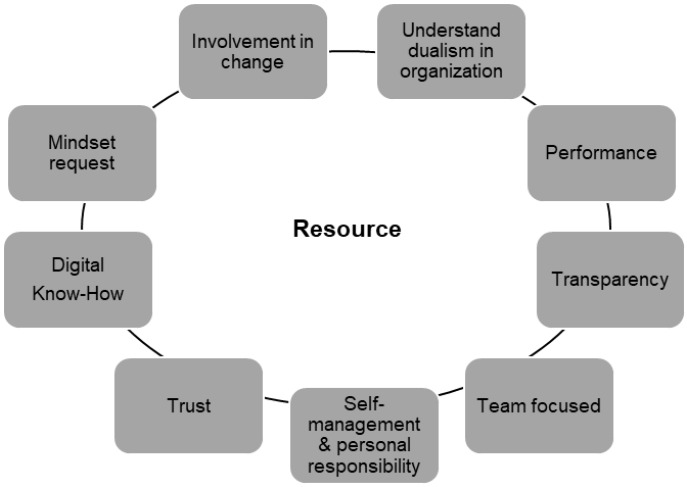

Figure 36: Resources in the transformation. Source: Own illustration

Third, a culture of failing as part of learning is essential to become a digital leader based on permanent innovation. Failing becomes part of the daily routines and is leveraged to the learning curve of the whole team with the help of transparency and documentation. This needs trust, and performance orientation (Kreutzer 2017, 97). To achieve that, leadership must change its performance evaluation and reaction on failures.

Fourth, technical capabilities must exist or need to be trained to a certain extent. Consultants need broad knowledge whereas developers need specific knowledge. Allover a mindset of careers, not roles, must be fostered to keep in-house developers for the long term. The more narrow a role is described, the more limited are employees in their strive for broader understanding (Vinter et al. 2020).

Fifth, resources grow in their area of work by servant leadership that encourages self-managed employees with the intention to take over responsibility by themselves. It is no longer given to rely on a leader that represents my failure or success against others. Correspondingly, the team focuses on its whole performance more than on individual success stories.

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3.3.6 Organization's Readiness for Further Transformation

There are no quantitative measures that provide a decision base for an overnight shift from phase 1 to phase 2. In other words, willingness of decision makers in the current phase is the promotor of a shift in the way people interact. With minor steps such as change in how decisions are made, empowerment of trust and allowance of failure, the start of a movement is possible.

Nevertheless, there are qualitative signs that could allow an evaluation of readiness. Among that, as mentioned by (Laloux 2014) there will be no black and white in this respect. Figure 37 provides from the authors point of view the most important qualitative aspects for a comprehensive move to phase 2.

Fear is the biggest inhibitor of unique outcomes and limits people in using their talent in a professional environment. Therefore, trust dominates and is shown by reduced number of rules and policies. A sign of maturity is that no new rules are worked out in case a negative issue occurred. The power of the team's internal sense of purpose can defend, and people learn by coaching, so that "bad" issues do not happen again.

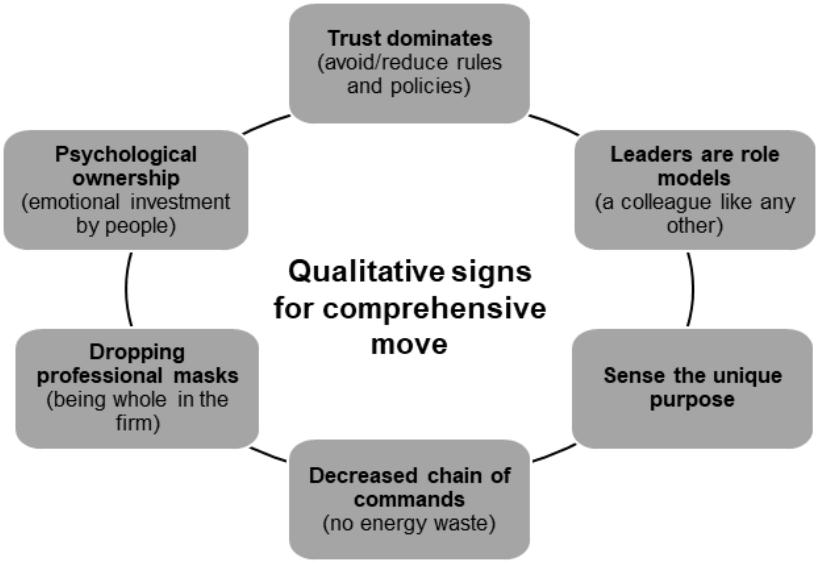

Figure 37: Examples of qualitative readiness measures. Based on data from (Laloux 2014)

Leaders shall act as role models in any case, nonetheless in this respect they must act with much more focus on the principles of self-management. Any little fall back to predict and control behavior would harm the ongoing transformation. To emphasize that it is important that the team members remind each other instantly in case someone drifts back. In short, leaders must be ready to leave it to the team's experience and learn to get ready for further transformation.

At the same time chain of commands which are usually long in hierarchic structures must be reduced to a minimum. This means that it will not make sense to switch to a structureless organization without allowing team members to decide themselves in their assigned roles on the tasks to be done.

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Persons who can drop their professional mask they were trained to wear until the start of transformation allow other team members to know how a meaningful and purpose-based relationship can occur. In case, people can say, "*here I can fully be myself*" and do no longer speak of being a victim or savior of an issue or someone else, there is a chance to move on.

Teams monitor their own performance and do not need someone who looks over their shoulders and monitors their work. This needs full transparency for everyone, not only for the leaders as it is in traditional structures. In the words of (Laloux 2014), this is enforcing a psychological ownership from people opposite the firm. (Schweighofer 2020) emphasizes the continuous learning journey that not only employees need to go through as *"also we as managers must learn to act in such ways, which is also not that easy."*

When the department can act more and more like a living organism, people get to sense the unique purpose the whole team can have for its outside environment. This is not just the firm's boundary, it includes the macro and micro environment that was prepared in chapters 3.1.1 and 3.1.2.

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3.4 Phase 2: Bimodal, Less-structured IT

Phase two in transformation has two interconnected focus areas. First, the move from hierarchical to a network structure IT by encouraging self-management, wholeness, and purpose. Second, the team's understanding of acting in two speeds on the one hand to ensure core application availability and, on the other hand, to enable quick and clean solutions for business needs.

As this thesis puts focus on phase 1 and its evaluation, in this chapter many aspects are described in short with no further detailed discussion. From the author's perspective the mentioned topics are essential, based on literature and evaluation of phase 1, but need for implementation more precise explanation.

3.4.1 Management

The more mature people get in their understanding of a purpose driven structure, the less managerial activities are needed to be performed by a single person, presented normally on higher levels in a hierarchical approach. In the concept, hierarchic structures spring up fluently and change organically driven by the purpose of the team. This does not mean that all people are equal in their responsibilities, as there will always be somebody who has more contributions to make on the basis of their expertise, interest or willingness to step in (Laloux 2014, 68).

Significant is the change in middle management roles like seniors and team leaders. It is important to understand for all team members that there is no managerial ladder to climb. People that have expertise, strong interpersonal skills, and willingness are transformed from bosses to coaches. Moreover, coaches have no responsibilities compared to bosses, as responsibility always lies with the team and the representor for the outside environment.

Figure 38: Managerial change of thinking. Source: (Juncu 2015)

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The needed representor for the outside can somehow be seen as the department leader in the previous phase. (Laloux 2014, 135) argues that in such environments more management and leadership happen than in less mature organizations since the tasks, e.g. setting direction, objectives, planning, directing, evaluating, are spread widely and not narrowed to a single role.

The move from phase one to phase two is not happening overnight. It needs willingness of the previous phase managerial positions to work on the concepts that allow less structures. Also, the mindset will change slowly by letting groups emerge and disappear and to allow people to make decisions, which normally someone else has made for them.

3.4.2 Structure

The proposal for a phase two organizational structure is provided in Figure 39. This represents parallel operating teams named “operational units” (OU) where people are linked by their specific current purpose. Between those teams, illustrated as dark grey circle, a web of individual and on purpose contracting is symbolized by the lines connecting each of them together.

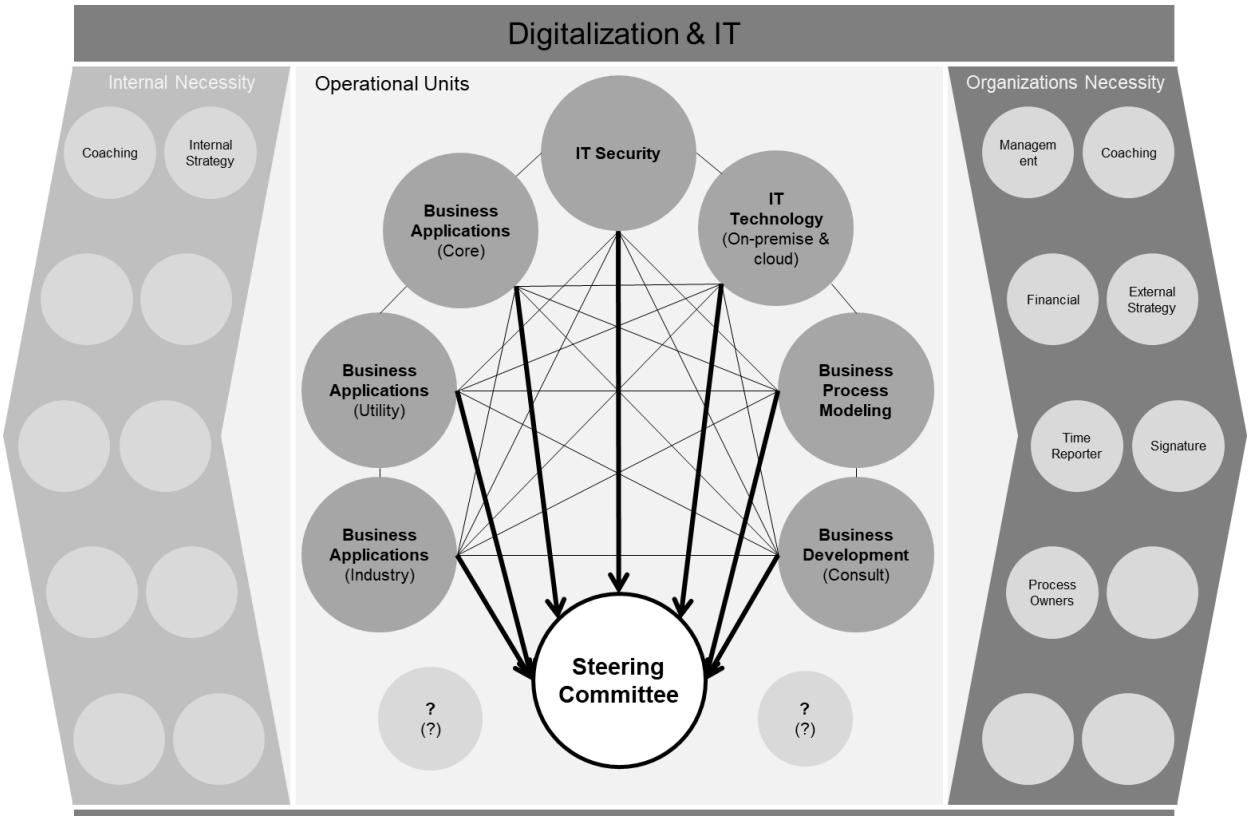

Figure 39: Digitalization & IT phase 2 organizational structure. Source: Own illustration

It is important to understand that this picture shows a snapshot on how the structure could be explained to someone at a specific point in time. As structure follows purpose, permanent changes occur in this living organism. Therefore, it could start with reduced amount of OUs which is then extended to put more occurring activities into the OUs hands.

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3.4.2.1 Internal-, Macro- and Micro-Environments

Both arrow shaped silhouettes on the left and right side represent either roles and activities necessary from a company's perspective (Organizations Necessity) or from the department's perspective. Both are influenced by micro- and macro environment. Accordingly, outside needs are not mirrored to inside needs as self-managed teams. In this case, OUs handle managerial topics on their own without losing energy in a chain of commands.

Internal necessity

In the figure, two circles are shown that are described below. We should not fail to mention that leadership is no role that is taken over internally, as due to self-management a group is motivating themselves to achieve a common purpose.

- **Coaching:** Every member has talents, skillsets that should be leveraged within the team. They must be made transparent and used by the members among each other. Mainly, this improves skills, knowledge, and interpersonal contact.
- **Internal strategy:** A company's macro environment and also team internal movements lead to the necessity of an internal strategy. The intention is to put focus areas on the table that the whole team is aiming to achieve in alignment. This could be the adoption of a specific new technology e.g. remote IT service management.

Organizations necessity

The figure provides a mass of activities and roles that are needed because of an organization's hierarchical structure. Two of them shall be mentioned here:

- **Management:** One person of the team must be chosen to represent the group's interest inside the company's management team and who is the link in the chain of commands made on behalf of the management. As the company is following a prediction and control mechanism and, therefore, it is non-transparent to lower levels, the chosen person must be "elected" for a longer period as the management team will not allow a permanent change of this person.
- **Signature:** As there are legal obligations in the empowerment to sign contracts with external and internal parties, the group must fulfill them with the right setting of "elected" people. The mature the team gets in this respect the less authorities will be assigned to one person, the reason being that team members themselves take over responsibility for the task they are carrying out and for the signatures they make, with nobody else to do this for them.

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3.4.2.2 Operational Units and Steering Committee

Each of the current represented OUs in Figure 39 is following a specific purpose which is instantly defined for the beginning but could also change over time. Even the number of OUs is not fixed as anytime there could a new need arise to form one, due to a new purpose.

Internal OUs shall not have more than 10 people at a time to ensure an efficient way of collaboration. In case of scaling up, i.e. additional people, the size of the OUs can be enlarged. It is important that they can align, operate, and make decisions. If there is a feeling that there are too many people, then organically new OUs with either the same or a different purpose emerge. In each OU different tasks need to be done, which mirrors in some respect the roles from phase one.

As most of the OUs shown are in some way and purpose also considered in phase 1, at this stage only one additional OU, **business development**, shall be described. In the thesis it was often mentioned that IT departments are not only needed for process, tools and infrastructure which was issuing phase 1 mainly. The upcoming macro-environmental reasons like (technology, platforms, etc.) need expertise when it comes to new technologies like cloud services, IOT, remote working, remote service to name some. As shown by a survey from (WKO 2019, 13) digitalization will much more affect the market than internal strategies in future, the role of IT-skilled people will get more important within product- and service development initiatives. Especially in this role, people with experience in new technologies are needed to support product management, and also research and development with state-of-the-art technology possibilities.

In the foreground of the OUs a circle named **steering committee** is located centrally in the lower area of the figure where all OUs are linked to. This represents the structural elements that were described in phase 1 as systems committee or jour fixe. As there are decision-making processes necessary where each of the OUs must be given a voice, the steering committee is the place to happen. Each of the OUs is sending one representative to it who has skillset and expertise to embody the OUs voice within the others. Over time and with higher mature stages of self-management less topics will need the committees for decision-making, as they will be made between the OUs itself.

3.4.3 Processes and Tools

To avoid repeating the application of tools and processes described already in chapter 3.3.4, the focus is put here on self-management principles, DevOps adoption and two speed-IT. Self-management sets people in a situation to take decisions, to take on responsibility and to respond to change anytime. DevOps shall be adopted in task management for a better overview of the status of work. Bi-modal IT must be achieved by the people's mindset in the ability to prioritize needs.

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3.4.3.1 Self-management Processes

Figure 40: Self-management (processes). Based on data from (Laloux 2014, 209)

Workable solutions, fast iterations: Roles in less structured organizations emerge in dependence of the need. As an example, let us say that the organization's environment requests the idea for a tele-conference system. The logical next step is to discuss the idea with security and infrastructure and most likely someone will step forward and take on the role to organize and implement the system. Naturally, we would try to predict and control what we do and look for the perfect solution. But here the disadvantage of prediction and control is that "*predictions lose all relevance in a complex environment"* (Laloux 2014, 210). Therefore, the process is to waste no time on predicting and finding the best solution. Instead, the team shoots "*not for the best possible decision, but for a workable solution, that can be implemented quickly"* (Laloux 2014, 211). With that it is possible to revise and improve at any time. It is important to understand the term "workable", which means "*a solution that nobody believes in will make things worse"* (Laloux 2014, 211).

No top-down targets: The complex environment, as mentioned before, is influencing long-term, top-down targets by an unforeseeable future. Further targets are not suiting to inner motivation and limit our capacity for finding new possibilities. Therefore, in the self-managed structure people give themselves target when they choose to do that. The important thing is that the team understands its purpose and that those self-set targets are aligned within the team. With all this in mind, the team must accept the top-down targets from the organization's environment, but it will tackle those targets as a group. The team discusses the task given, aligns which OUs must take part to achieve it and specific people will take over. The team must find a solution to either fulfill the target or request an alignment with the management in case the target is in teams' point of view not for purpose. (Laloux 2014, 212)

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Simplified budgets: Same as before, there is a budget frame established as IT acts for the biggest number of tasks as support activity. Within the team it is mandatory that the current monetary situation is made transparent. Anyone shall at any time see what bills the department must pay. The whole spending's can be challenged within the steering committee at any time. There, opinions, and suggestions are offered to the spending role. (Laloux 2014, 213)

3.4.3.2 DevOps - Next Step in the Principle of Flow

Established IT departments act mainly on brownfield services in case tools are already in use. Brownfield DevOps projects "*are existing products or services that are already serving customers"* (Kim et al. 2016, 55) in its current operation for a longer period of time.

In phase 1 we installed a first step in the principle of flow, making work visible, within the task management. Now to make a next step two further principles shall be considered as shown in bold letters in Figure 41.

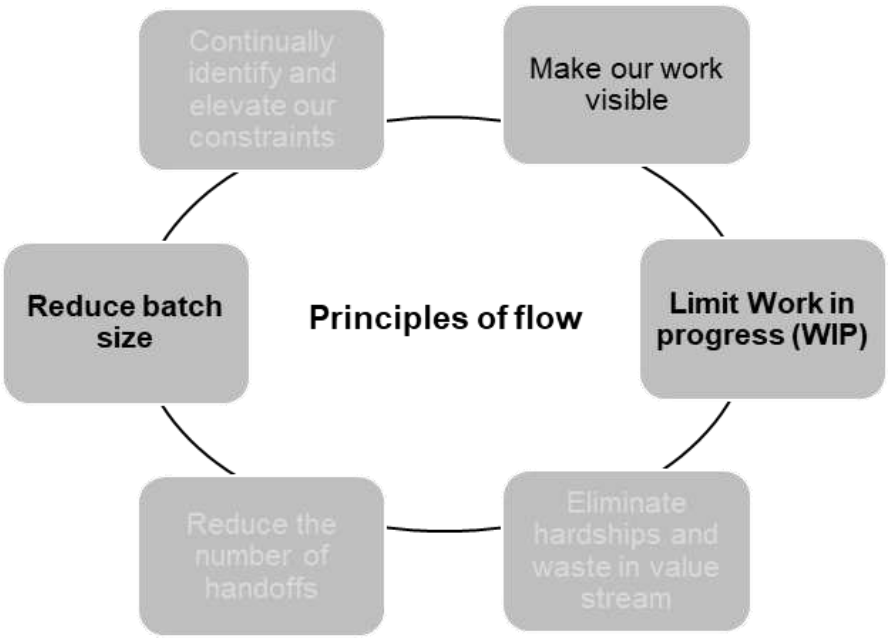

Figure 41: DevOps - Phase 2 steps in principle of flow. Source: (Kim et al. 2016, 15)

Limit WIP: "*Stop starting. Start finishing"* (Kim et al. 2016, 18) is the guideline. This means that the number of tasks for every team member in the KANBAN board in the status "in progress" is limited. No matter what type of task it is, the maximum number is not allowed to be exceeded. With this practice the people waiting for new work in the team could find out where there is an issue in any previous resource and assist or improve there. The number of tasks can be defined individually and is adjusted anytime there is a need for it. The important thing is that the process time and further lead time is reduced, and unplanned work is not interrupting the working people. Furthermore, we see that with work items we do not know how much time they will take; this allows limiting the simultaneous tasks work is done for.

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Reduce batch size: To support WIP batch size reduction supports agility in the flow of work. The smaller the tasks, the faster the team can deploy changes on customers. This makes the customer believe that he is supported and heard, and IT is providing continuous results. In smaller steps, e.g. 1 week, the impact of failures compared to a huge development effort of 3 months is perceived much smaller by the customers. Also testing should then be done in similar batch sizes, which means that testing does not wait for the full release. They test already smaller deployments every week.

3.4.3.3 Bimodal Principles

To start with bimodal principles the stock of current processes, software and hardware must be taken. If there are any processes identified which could be made digital by leveraging technologies easy these are first candidates to move to an interactive, agile handling (Adanza 2016).

From the organization's perspective people shall find out over time if they can do work in an environment of speed and agility or if they are more motivated to act in a setting of efficiency and stability. Coaches with skills in the speed environment doing work successfully shall help unexperienced persons making a continuous shift to the speed environment (Adanza 2016). This setup allows the department to provide quick solutions on the one hand and, on the other hand, to handle traditional tasks at the same time. It is not an "either-or" in this phase of evolution within an IT department, it is an "and" to provide customers with the requested solutions for efficient work.

It is important not to forget that also in a speed environment, efficiency and stability play a role. However, the focus is to deliver fast and change in short cycles afterwards if stability is not provided to the full extent for the start.

3.4.4 Resources

> "People know that information will not be used against them. No one needs to be protected by the facts, good or bad" *(Laloux 2014, 124).*

To emphasize this, it will be hard for both, management, and employees, to act and react in the daily work with full transparency and no blame. When failures happen, the team learns from them and improves.

There will be people that do not want to follow a way of self-management and do not want to take over responsibility for what they do. These team members will not have a place in an organic organization. Nevertheless, anybody must be given a chance to learn and if the team itself decides that due to performance evaluations resources do not fit anymore, any dismissal is a collective decision.

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Figure 42: Skills and attributes in a steering committee. Source: Own illustration

Based on the previous discussion, not every team member will be skilled, experienced, or willing to take part in the steering committee. The OUs decide who shall take part, nevertheless Figure 42 provides in the author's view the most important skills and attributes this person shall have.

3.5 Phase 3: Strategic Self-organized Staff Units

The last phase is adopting further organizational designs from the previous stages. As described by (Urbach/Ahlemann 2019), various aspects will shape the information technology approach where some are presented in Figure 43. Phase 3 prolongs the technological developments in product and service developments and puts IT in a strategic coordination role in close collaboration or even as part of the different business units.

Figure 43: Phase 3 overview. Based on data from (Urbach/Ahlemann 2019, 106)

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As skilled and experienced employee's IT personnel is working as a consultant to all internal and external stakeholders. In this respect it is assumed that hardware is shifting from on-premise to IaaS concepts and, therefore, capital expenditure (CAPEX) is moved to operational expenditure (OPEX) costs, too. In fact, this means that IT resources are working like self-employed within the organizational boundaries with a central coordination. A central coordination is needed to strive for an executive role, the reason being that in hierarchical structures only the ability of aligning digitalization initiatives can get the right status and can be leveraged for new value creation.

For such business development initiatives an innovation-driven culture is necessary to allow people the spinning of new models and possibilities in how to achieve improvements, support new digital business models and leverage new technology embraced by digital transformation.

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4 Evaluation

This chapter documents specific scenarios and indicators to evaluate the practical readiness of the developed organizational design in the previous chapter.

On the one hand, the evaluation focuses on quantitative criteria identified and, on the other hand, qualitative criteria analyzed during an implementation of phase 1 in the case study of LOGICDATA. They are based on real events that happened and are either compared with a status quo or document results achieved. Further experts are interviewed to evaluate the organizational match of the structure. All of them are based on real events that happened. The case study materials have been made available to the author, allowing an assessment of the readiness of the designed model.

The chosen criteria are shown in Figure 44. They will be discussed in the following chapters where first, a description, second, their relevance to the case of LOGICDATA is provided, and third, the positive or negative effects with actions to take are provided to the reader.

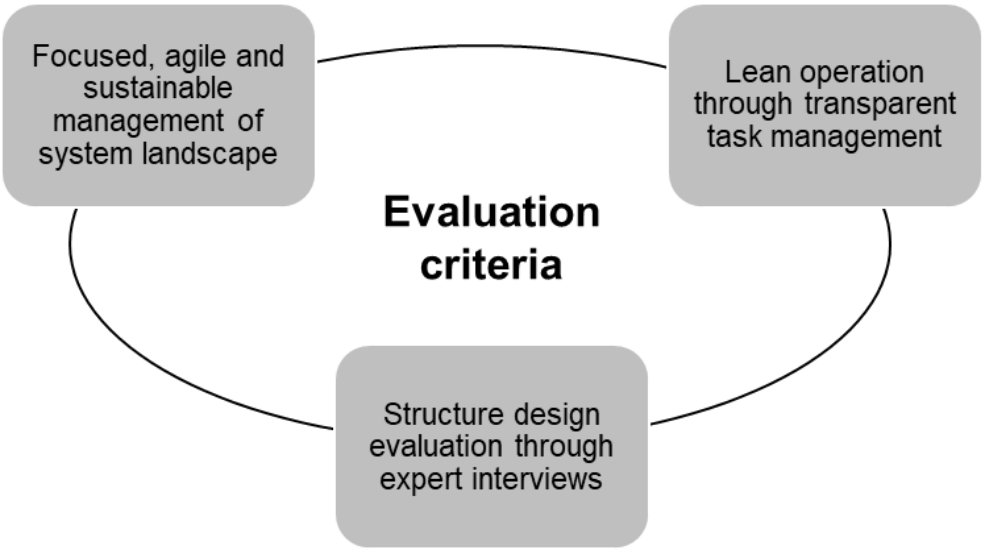

Figure 44: Evaluation scenarios and indicators. Source: Own illustration

4.1 Criteria 1: Focused, Agile, and Sustainable Management of System Landscape

Over the years, the system landscape of LOGICDATA grew to an inhomogeneous, disproportionate, and unmanageable environment. New tools were introduced by focused teams' responsibilities without a general assessment of the organization's needs and structures.

The goal is to significantly reduce the volatility in the number of systems by clear structure and processes. This means the total number of tools shall not change in the evaluated period. New requests from the organization shall be handled through the digitalization roadmap process. A systems committee shall be set up and an advice process shall be used in decision-making

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there. A survey within the case of LOGICDATA shall additionally provide qualitative assessment of the implemented practices.

4.1.1 Criteria Relevance

In growing organizations new employees are hired permanently and organizational restructurings happen. Any available system must be able to scale easy and fast with unchanged service efforts. Support efforts are not allowed to rise in the same proportion as new people are onboarded. Employees allover the company, shall excel in their area of expertise, without a permanent need on finding new tools to work efficiently.

The more employees can focus on their role purpose, the lower will be time lost on inefficient tool handling and support activities for tool administration. This time can be used then for improvements and further satisfaction increase of users.

4.1.2 Impacts on the Organization (Department and Company)

Tools introduced with a strong team, or department related focus, are not linked to any company-wide governance as far as security or reliability are concerned. Therefore, three major impacts are identified:

- IT department is made responsible for not working operations due to changes in security or reliability issues. For example, a change of firewall properties can be mentioned that influences all tools using web servers. As IT is not aware of the systems used, minor changes affect downtimes throughout the company and, therefore, huge support activities and “fire extinguishing” by IT personnel.
- The issuer and administration of the tool is suffering on increasing service and maintenance efforts. For example, the tool is used by more than one department, so the support must be extended to several departments. This reduces user experience as administration is mainly working on supporting instead of improving the system.
- Costs and efforts are non-transparent throughout the company which prevents decisions to be made on facts.

Structure: The implementation or improvements are coordinated by the starting department. In the traditional function structure, tasks were assigned to various teams without temporary project installments. Huge efforts are necessary to align the distributed responsibilities, and due to constant changes, the efficiency in providing the necessary information to the correct resources is reduced. Agile approaches have been prevented by the existing team structures and missing flexibility in task and competence allocation.

Process: LOGICDATA uses no process for implementing or outsourcing tools from the system landscape. Each of the distributed teams decide themselves and uses waterfall planning

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methods for implementations and improvements. For new technologies and permanently varying requirements these methods do not fit anymore. Planning provides in many cases an illusion, as many adjustments happen during implementation and improvements. Approvals and decisions were made on the basis of non-transparent figures as far as the organizational context is concerned. Coupled with inability to achieve purpose, it leads to dissatisfied employees and management. In the same way costs are allocated to the department's cost centers only, missing holistic data for the organization's effort as a decision base.

4.1.3 Phase 1 Approach

Structure: The systems committee as organizational element combines stakeholders and expertise throughout the information technology area in a non-hierarchical structure. Systems committee is designed as a fast and agile unit that is adapted to the challenge that needs to be solved. This leads to less information loss concerning the specific topic.

Incoming requests are transparent and communicated throughout the committee members. Within the group there are no further interfaces, so tasks and progress are transparent to the group at any time.

On new tools implementation, a focus is set on fast iterations and workable solutions, so that the rigid behavior from the past is replaced by quick feedback and fast provisions of solutions.

Decisions are grounded on facts due to the assessment logic and legitimate objections by the group. Decisions are newly evaluated instantly if requirements or environment changes.

Employees and also midlevel and upper management are advised to submit improvements or requests via the project submission to the digitalization roadmap. This supports the focused digitalization investments based on calculated total assessment ratings.

Process: Long term goals are not yet in the focus as there are too many facts unknown. Therefore, agile methods and short-term achievements are prioritized. This leads to next step planning instead of insecure long-term outlooks.

The more flexible work is done, and the smaller tasks are made, the less time is lost because of changing requirements. Strategic planning is put to the upper management, whereas the system landscape is an organic organism under permanent change.

People take on new submissions by themselves, assist the requester with their expertise and pitch the idea together with the requester to the systems committee.

Resources: Application consultants are put into the decisions group, which is critical due to less experience. Trust and advices from affected parties and experts (internal or external) equip them with the knowledge to find the right way in decision-making.

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Documentation: In the 6 months evaluation phase, 8 digitalization assessments have been made on the basis of incoming submissions. The digitalization assessments took on average about 5 days with 10 hours on average. In this period two tools have been decided to be implemented. Both are providing short-term cost savings as well as improvements to data governance within the company. Furthermore, also two have been deactivated and phased out.

The system landscape increase was greatly reduced as the rise in number of tools in this period was 0% compared to a year over year increase of 51% in the previous year over year.

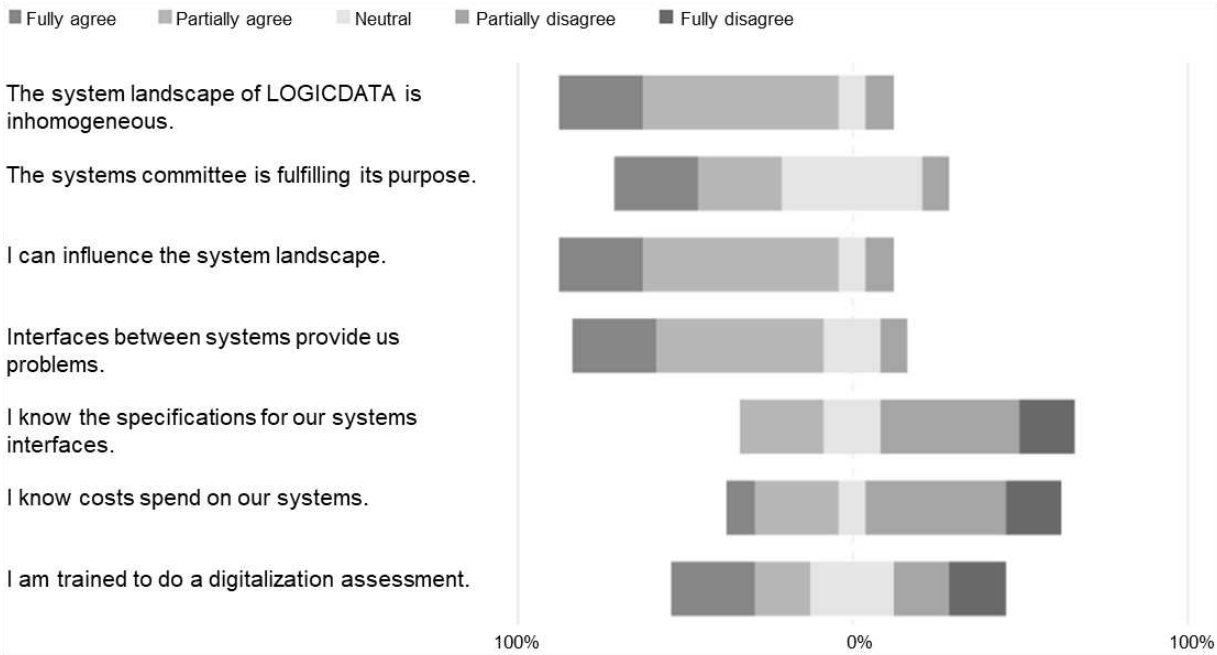

Figure 45: Systems landscape survey LOGICDATA. Source (Kügerl 2020)

(Kügerl 2020) provides the results within a survey in the case of LOGICDATA presented in Figure 45. The survey questions are listed in Appendix 4 of this thesis. Only 50% of participants see systems committee fulfilling its purpose for now and over 80% define the system landscape still as inhomogeneous. All recipients see their ability in influencing the landscape positively whereas systems interfaces and costs are weak spots. Here, more than 50% prolong a missing interface specification and a lack in cost transparency.

4.1.4 Conclusion

The advantages of the digitalization roadmap as a visualization of initiatives are transparent information sharing and the systematic shaping of the systems landscape within LOGICDATA. In 2019, compared to 2018, the amount of new hiring was reduced, and the number of employees stayed the same compared to the two previous years when approximately 40 new employees have been onboarded every year. The point that the author wants to make here is that this for sure had an impact on the number of new tools introduced, too.

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Decision-making based on self-management is somehow possible due to equal rights within the committee, nevertheless there is potential to focus more on the advice process prior to systems committee meetings via the collaboration platform.

There is still huge potential to reduce costs and still provide the same or higher user experience. To emphasize that the digital workplace initiative including classification of standard software packages for employees could be mentioned. It is necessary to provide for a specific use, e.g. task management at least two to three specific tools that are administrated by the BA unit. User can decide what to choose for their individual purpose only. For common purpose like projects one specific tool must be used by all employees.

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4.2 Criteria 2: Lean Operation through Transparent Task Management and Improved Core System Handling

Making the work visible, is the first and most important aspect in the principle of flow in DevOps and lean operation. For that reason, a task management has been introduced in the department. First, the transparency of all work shall be improved, second the user adoption and coaching must be ensured, third the ongoing relation of improvement to support is documented and fourth reporting measures are introduced.

4.2.1 Criteria Relevance

In 2.2.4.2 the author provided the first metaphor “make work visible” for the concept of flow in lean operations within IT departments. Therefore, the introduction of a task management is a relevant criteria. The increased transparency and the overview on any task within the whole department allows prioritization, public to anyone in the whole organization. With visible work, further pain points in the process can be identified and improved.

4.2.2 Impacts on the Organization (Department and Company)

Requests from employees to IT related disciplines are not handled in a central place. Therefore, three major impacts are identified:

- The various teams that include IT functions and also the total organization have no overview and indicators on the general workload of IT as a support function.
- It is not possible to prioritize the various types of tasks within the organization, especially when different IT functions (e.g. hardware, security, process) are needed to finish it.
- Missing prioritization is overwhelming staff. The relation between support and improvement is not fulfilling purpose of continuous improvements.
- A lack of history and transparency on finished tasks does not allow improving the support function in total.

Structure: The various teams having IT functions installed their own task management in the past. This means each team leader focused on performing well in his responsibility area. The necessary alignment between the functions often led to various tasks for the end user and non-transparent communication throughout the company.

Process & Tools: LOGICDATA uses no common process for task management. Support tasks did follow various workflows, specifically defined to fulfill the departments needs in the specific team. Furthermore, various systems are used that do not enable documented communication with the requesters or easy assignee changes. The user experience is not given

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in this respect and process KPIs are not comparable within the IT functions. This allows no decision and prioritization grounded on facts.

4.2.3 Phase 1 Approach

Structure: The implementation was guided by business process modeling and the core team including representors of each operational unit (IT I&S, BA). The structure modeled in the organizational design in phase 1 was considered in the design. In detail, each of the operational units gets their own KANBAN board with customizable filters. Nevertheless, there is still a total overview with one KANBAN board showing the whole department's backlog and workload. This provides the manager with a good overview and allows to step in, if prioritization needs to be adjusted.

As software tool, JIRA Service Desk was chosen. The key reasons were increased user experience due to a customer portal for creating requests; interfaces with existing products from the same supplier that were already used within the company; the possibilities of modifying it to specific needs of the operational units; and the transparency in communication on task processing.

Process: For all operational units and task categories, a common process was introduced as shown in Figure 46. The process target is to ensure transparent progress of steps a request is going through.

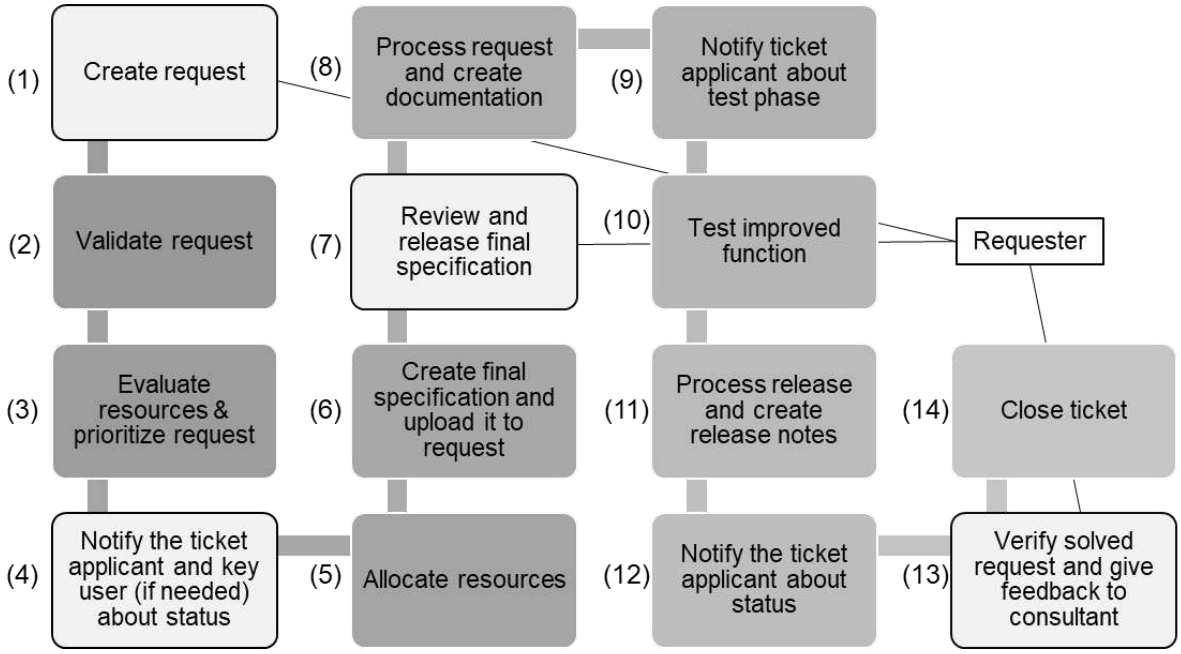

Figure 46: Request process LOGICDATA. Source: Own illustration

To point out the interactivity with the requester that is ensured throughout the process by the software tool used, process steps (4), (7) and (13) are anchoring the release and the verification of the implemented request by the requester. Beyond that, the steps (2) and (3) guarantee the

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validation of the request content and a prioritization by the application consultants. To agree on the scope in step (6), a specification is created. Implementation and testing are done in (8), (9) and (10). In phase 1, focus is put on preparing an environment of quick releases whereas in phase 2 quick and continuous releases are installed. Final documentation (11), notification (12) and verification (13) are done before the request is closed.

Resources: The key resources in this process are the application consultant, the requester, and the developer. Application consultants ensure the flow of work and are aware of the ongoing activities; requesters are the interface and issuer of the task; and developers are implementing the specified solution in constant exchange with the consultant.

Documentation: The concept of the KANBAN board implemented is shown in Figure 47. The following aspects have been considered:

- Defining main card content to quickly see the main properties of the card **(1)**
- Defining quick filters for various boards, e.g. show my tasks only, shot incident tickets only, etc. **(2)**
- Installing various boards for different views, e.g. board for IT I&S only **(3)**
- Showing the main status at once **(4)**
- Including several employees in one board **(5)**
- Combining all types of tasks in a central place and make every work visible in form of a card

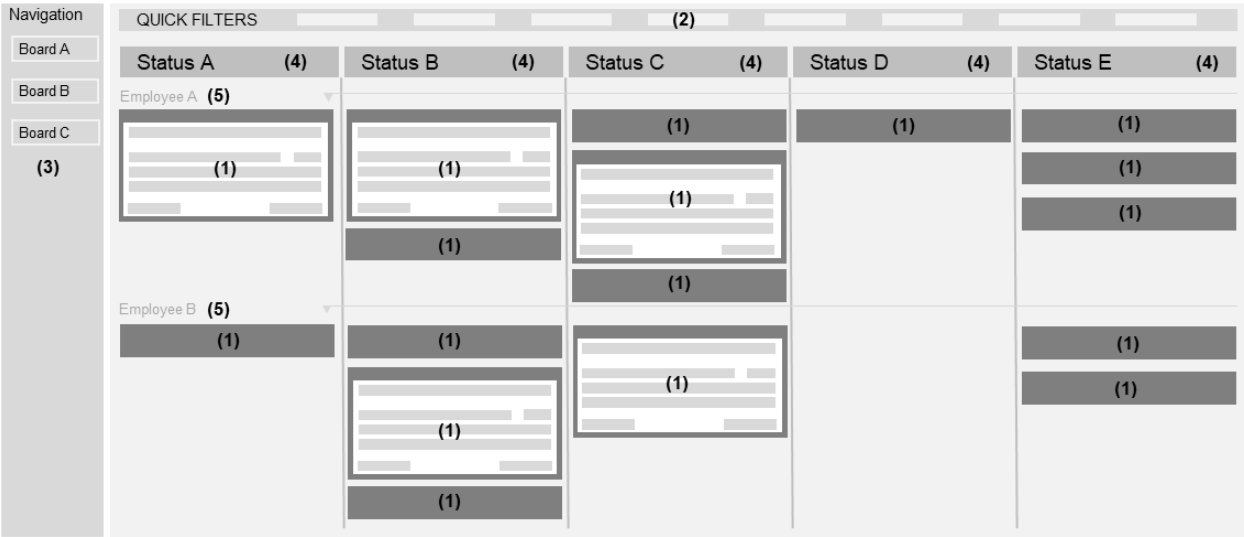

Figure 47: KANBAN board concept for task management. Source: Own illustration

Figure 48 provides survey results based on (Kügerl 2020) that present a positive trend in adoption of the task management in case of LOGICDATA. Positive is the understanding of purpose, task categories and work in progress where two third of participants fully agree. Furthermore, positive is also the increased transparency as over 50% use the possibility of seeing

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whole department's tasks. The potential is identified in the tools possibilities as only 35% have at this point adjusted their views to their personal needs.

Figure 48: Task management survey LOGICDATA. Source: (Kügerl 2020)

The relationship between support and improvement work indicates the ability of the organization to develop the tools further. Figure 49 is illustrating for the BA ERP group the decrease of support activity efforts on the one hand and, on the other hand, the increase in improvement activity efforts.

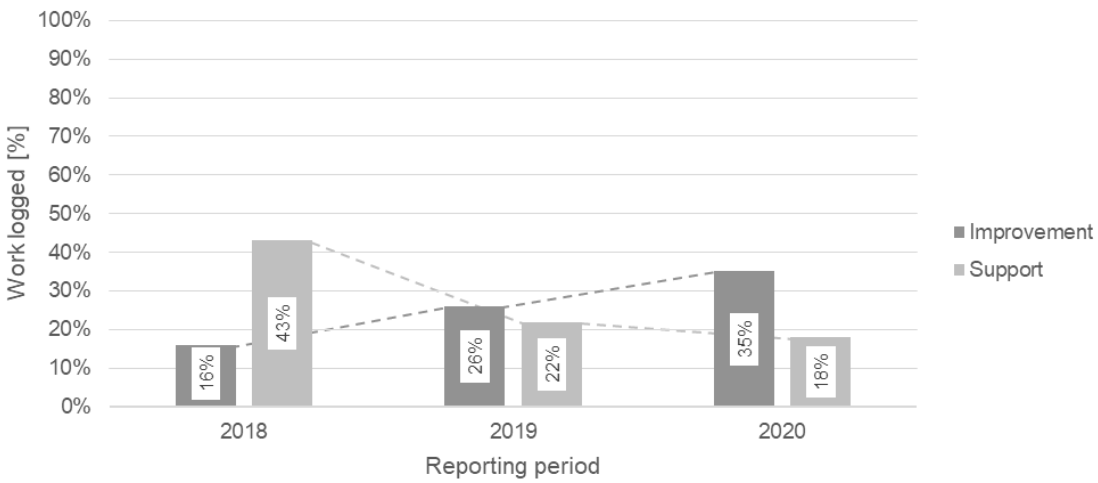

Figure 49: Ratio of workload for support and improvements over time for ERP activities. Source: Own illustration

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4.2.4 Conclusion

The first step of continuous flow to make work visible is done. However, reporting and KPIs need to be introduced now for controlling the flow and allow setting corrective actions based on facts. Table 5 provides simple KPIs that should be used in a task management that may include IT service management indicators within an IT department (Abel 2020).

Type	Incident Management	Improvement Management	Task Management
Implementation	• Number of incidents per category in absolute figures • Average rate of open incidents in % • Number of major incidents in absolute figures	• Number of improvement initiatives in absolute figures • Rate of open improvement initiatives in % • Number of improvement initiatives per issuing business unit	• Amount of time spent per category (general, improvement, support, target, project, maintenance) in hours • Amount of tasks per category in absolute figures
Effectivity	• Rate of incidents solved in time in % • Number of recurring incidents (incident happens again despite having been solved) • Average incident solving time in hours • Average response time (message to first reaction) in hours • Customer satisfaction	• Average improvement solving time in days • Rate of improvements solved, running and rejected in % • Customer satisfaction	• Amount of tasks in progress per employee in absolute figures • Rate of tasks in progress per employee in % • Amount of tasks in backlog per operational unit • Ratio of unresolved tasks in % (excluding task category general)

Table 5: KPIs in task management. Based on data from (Abel 2020)

The issue of transparency called for several coaching's within the department's organization, to understand the importance on why to present employees' tasks in this transparent and documented way. Rumors that managers spy out what everyone is doing came up. It is important to point out that task management is transparent for all employees, also for the tasks of the managers, to provide the sense of equality.

There are improvements that may be considered in the future:

- Changes, e.g. updates on operating systems or project specific work, must be made visible easily. This could be achieved by further categorization of tasks. For example, a task for an employee working in a project that needs a change in a system may have also the category project, system update, etc.
- Awareness on employees must be increased when it comes to documentation and accuracy on their tasks. Laziness in task maintenance makes it harder for previous or following work centers to plan their work. Here, additional coaching is necessary.
- DevOps process models are not yet implemented. This must be introduced in a further step by creating additional card types that follow a different workflow and allow a differentiation between development and operations work centers.

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4.3 Criteria 3: Structure Design Evaluation through Expert Interviews

4.3.1 Criteria Relevance

IT managers from either developing and producing or consulting firms have been interviewed about two areas. On the one hand, they were asked to provide insights in processes and organization principles and, on the hand, to evaluate and discuss the organizational structure from phase 1 and phase 3 provided in chapter 3.3 and 3.4. The results provide feedback from operating environments to be considered in this thesis and any further work. Those operating environments are described in the following chapter.

4.3.2 Summary

All interviewees provide a clear yes when being asked if IT departments drive digitalization in their or their consulted organization. Nonetheless, development-oriented companies state clearly that they drive internal digitalization now, not yet digitalization in higher levels as shown in Figure 6. That does not mean that the companies do not take activities in this direction but IT as department is, if considered, merely acting as service provider within other organizational entities. Consultancy representors state clear that they consult internal digitalization only.

Environment

Interviewees are either managers in IT departments or board members in IT consultancy. IT departments with 15-60 employees are within their area of responsibility. IT managers represent SMEs and international corporations whereas IT consultancy board members embody local consultancy for SMEs to international corporations in size.

Structure

What interviewees have in common, is the opinion that process design is a necessary skillset in driving internal digitalization. In specific (Aldrian 2020) points out

> *"we have a huge challenge in the understanding of business processes versus information processes as business process modeling is not equipped with skills to translate business processes in information processes that consider interfaces, systems, data, etc."*

In a functional structured organization, the three main areas in phase 1 model are generally supported by the interviewees. (Aldrian 2020) states clearly that it is necessary to combine business and IT layers:

> *"that includes business process design, information process design, infrastructure architecture … Exactly these topics need to be built up in one place. Everything else is historic."*

(Hatahet 2020) argues in this respect for the bridging of traditional IT and business units by using consultancy components in the forms of Chief Digitalization Officers (CDOs) or digitalization

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departments, which are able to consider "*what do they overall need, how do they work now and start then a tool evaluation.*" Furthermore, he strongly pushes for unlinking digitalization from IT service provision:

> *"this role [digital transformation manager] must be extracted from this structure [phase 1] and a … department needs to be made that combines targets of IT, business units and organizational targets. That [department] defines a new future and then tells IT what services are needed to achieve the transformation."*

Despite support, there are various concerns with it as, for example, (Schweighofer 2020) points out:

> *"The challenge I see here…is that information is flowing to slow. There is often too much of a silo-thinking…. everyone acts in his area of responsibility and is setting its borders. This creates thinking areas which worked quite well in the past when things happened with much less speed."*

(Hatahet 2020) states clearly the outdated approach this model follows and gives value only to a phase 2 that includes more internal stakeholders as digital transformation is affecting the organization on a whole:

> *"The first figure [phase 1] shows to me an old model that follows a hierarchical structure. … That would be a transformation process. To organize the non-organized [IT] into the first figure, but the big picture would be the second one. … I miss here-what I see in the second figure [phase 2]-the other parts acting in organization and needed for transformation."*

Despite phase 2, structure is intended to be a further development of phase 1 interviewees showed interest in combining both structures. Either by a co-existence depending on the purpose or to allow the need for speed in the bimodal perspective. (Aldrian 2020) argues that due to a well-organized project process in his environment:

> *We can say that the project organization is mirrored in phase 2 and the structural in phase1. … We use the functional structure to run the classical IT. If I do not have any improvement projects, no strategic tasks-means a progressive standstill, then I only need IT to keep alive. Therefore phase 2 is from my perspective not the right fit.*

Also (Kleindienst 2020) makes the point that a phase 2 structure could foster a less thinking in specific areas and responsibilities, which may help to envision a big picture and allow more flexibility in resource shifting. In his answer, when a team could be ready to adopt, he argues:

> *"I think that for a complete phase 2 there could be a transformation phase… For example, to dissolve structural hierarchy, but the nomination of circle representors is done from a central point. … could be a starting point for transformation until the team is ready to do I themselves.*

Resources

A sensitive topic identified is the readiness to transform into the different phases, especially phase 2. The common statements supported the need for a well prepared and accompanied change process for both employees and managers. (Schweighofer 2020) mentioned his experience with self-management steps with

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> *"it was clear in the past that there is always a manager who is responsible and if I don't know something, I ask him…. … we recognize this is an extreme balancing act between, you have said that I can do that, and hot to get things done. Here also management must learn to act in such ways, which is also not that easy."*

(Kleindienst 2020), (Hatahet 2020) and (Aldrian 2020) point out that specific groups of people need a different leading style. For example, "*leading of consultants is a different one as of IT I&S*" and "*I think there are resources that have no will to see a bigger purpose*" or "*what if a previous leader is then not anymore in the position of leading?"* All statements somehow admit that a change from a known way of managing resources up to a, for most of us, fuzzy way requires a huge portion of courage to change.

A statement from (Schweighofer 2020) that should be mentioned at this point is, *"What comes into play is that personal strengths of people can be leveraged more compared to traditional models."*

This supports (Laloux 2014) when he is describing in his research that in less structured and controlled organizations, people are given the possibility to run their individual talents instead of being described with an underlying worldview of laziness and dishonesty.

(Hatahet 2020) points out that a new way of thinking is necessary to achieve digital transformation. Resources not willing to adopt must be made clear that "*with willingness to adopt and life-long-learning there is no fear to lose a job due to digitalization."* Elderly are kept supporting in business,

> *"but in parallel we create a new area. … an own department with 1-2 people … to introduce cloud, collaboration and new thinking's…they create an environment besides the existing… Interestingly with help of a translator of technology to management…two young employees start transforming the company on a whole."*

Also on the ability of resources to act in a self-managed way (Hatahet 2020) argues

> *"two types of people…first that can work creative and free…those who have learned that. They act in a defined framework. Second, … employees completely unable to act independently…this is the mass … the mass is not capable of organizing itself…they did not learn that. Because they are not able to the firm must have a process to make them creative or relieve any restriction in this concern."*

4.3.3 Conclusion

To sum up the core messages that can be derived from the interviews made, are as follows:

- Digitalization is in its development stage within IT departments common in giving value to the organization by internal use of new technologies. The use of new technologies to foster customer experience and create new business models is either not yet lived or not part of IT yet.

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- Business process modeling is well to be considered but the picture is complete only with the integrated skills of linking it to information processes that are needed to translate the needs of business into the world of systems, interfaces, and data.
- A co-existence of both phase 1 and phase 2 supports the need for bimodality within IT to an extend that is worth evaluating.
- Specific roles in phase 1 structures could be used to design the path for the whole IT organization to start transforming into a phase 2 like organizational design by defining processes on how work is done.
- Managers are leading by example and are drivers, therefore they must want to transform.
- Various characters of employees must be known to the managers and team members to allow a homogeneous interaction and react to personal weaknesses and strength.
- Personal talent is not exhausted by locking employees in specific roles only. Allowing to expand the work areas is providing much more possibilities to identify undiscovered strengths.
- New thinking is essential that business units and organizations can transform to digital. Only with the capabilities' and readiness to understand internal digitalization it makes sense to start it.

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5 Discussion and Conclusion

This chapter offers a summary of the work done throughout the chapters of this thesis. Moreover, conclusions out of the evaluation are reviewed, documented and finally an outlook including possible next steps and suggestions to the case is given.

5.1 Summary

The thesis is preparing traditional IT departments with a possible, suitable organizational design to follow the potentials digitalization could leverage in a company's operation. Structures, processes, and tools are described to transform traditional IT departments into competitive, integrated and purpose-driven business departments.

The digital (r)evolution challenges existing organizational designs in all industries. An ongoing, growing-in-speed-rise of new technologies drive digitalization on the one hand and provide challenges on the other hand. Digital transformation is more than reducing paper in organizations, it is an all-encompassing change in all areas where information technology is used. It reaches from simple digitization to new business models to generate new revenues by leveraging the risen technological possibilities. Chapter 2 is offering a general discussion on digitalization. In particular, drivers and effects, its use and also benefits and risks are documented on the basis of literature analysis. These topics are delivering the necessary understanding with regard to changes an organization is opposed to and has to react to stay competitive in the current complex environment. The last chapter on digital transformation 2.1.5 elaborates the coexistence and influences between digitalization and organizations. As a second area to be discussed, organizational solutions in chapter 2.2 provide basic concepts of traditional and modern approaches always putting focus on the influence of digitalization. The final chapter within the second part of this thesis (2.2.4) documents trends in IT organizations that showed up over the last decade and that will have a major influence on the following organizational design.

In chapter 3, a first analysis of the organizational environment in general and specific to the case of LOGICDATA is documented. As a further step, the IT department's current organizational context (3.1.2) is described which is further explained in chapter 3.1.3, where the need for transformation is outlined. As the whole transformation process is linked to a huge organizational and cultural change, the developed model is split up in three phases. Chapter 3.2 shows an overview of the phases that are documented in the next chapters. The focus is put on phase 1, described in 3.3 providing the structure, management, processes, tools and resources that should help organizations to structure their IT department in a competitive way. The ability to adjust, scale and modify are considered and in conclusion, chapter 3.3.6 documents the criteria of readiness for an ongoing transformation.

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Compared to phase 1, phase 2 (3.4) puts focus on agile principles by further implementation of development and operations, and self-management principles combined with a draft of an hierarchy-less organizational structure. Phase 3 (3.5) presents an outlook as last part of the organizational model definition.

Because of the variety of processes and tools, chapter 4 documents two criteria classified as relevant for a working model in the case of LOGICDATA. These include homogenous system landscape and lean operation through transparent task management. As a third criteria in 4.3 a qualitative evaluation of the tools and processes provided in phase 1 and a discussion about the developed structures is documented by interviews with experts in the field of IT organization and a survey among the affected employees of LOGICDATA.

The outcomes documented in chapter 4 are summarized in chapter 5.2, where specifics of the two previously developed and discussed models are shown. It shall highlight advantages of the implementation of the models on the one hand and show also disadvantages and preconditions for successful transformation on the other hand. A final outlook in chapter 5.3. supports next steps in transformation and asks open questions for further research on general or specific topics.

5.2 Conclusion

For internal digitalization efforts in SMEs, phase 1 provides a first step to start integrating process modeling (business and information) in the area that supports business operations with new technologies, “Digitalization and IT”.

Integrating digitalization in customer experience and new business models in existing organizations is challenging. Managers struggle with setting up an environment in the firm that fits to leverage new technologies inherent in digitalization. As phase 2 includes business development within “Digitalization and IT”, a strategic force to push firms in this direction is implemented.

Managers in phase 1 must envision the big picture to steer the operational units in the same direction. As long as operational units are not supporting each other, improvements and adoptions will not be valued by the units as a team’s success.

Resistance in the change process to achieve phase 1 where, on the one hand, roles are rearranged in the organizational context and, on the other hand the physical location in the company is changed, must be addressed and coached carefully by managers.

Stable and reliable versus quick and agile: both are movements that must be considered in IT departments nowadays. Traditional structures may not support the second, which supports a co-existence of both phase 1 and phase 2 structure.

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Changing a structure is not bringing any transformation to live. In transformation processes, change and a supporting culture must be considered.

Providing employees with the feeling that in phase 2 they are empowered within their professional environment and that they are able to provide value to the firm with the task they are fulfilling, is essential for self-management success. I want to point out, that there are employees who will not be following this path. Either agreements are made to onboard and integrate them or dismissals will occur.

Modern organizational solutions fit more the requirements of the uncertain requirement companies are dealing with nowadays. Nevertheless, I am aware that the changes proposed in phase two in the organizational structure will be essential for the affected departments and roles. Such fundamental changes may fail either due to the management's inability to execute and lead, or due to lacking acceptance of employees.

Also, in less structured organizations there is a hierarchy and resources need to be coached to accept and regulated things on their own. The phrase "let the manager decide" that we have learned some time ago must always be questioned.

I want to close this chapter with the words of (Hatahet 2020) in his final statement about the start of digital transformation within a company:

"If you don't do it, your superior will do it"

5.3 Outlook

Ongoing radical changes in their environment will leave back organizations that are not ready and able to adopt. Setting up an organizational design that is reactive to changes must be the preliminary goal of managers today.

To extend the underlying work following topics should be addressed:

- Defining and setting up an organizational design where co-existence of phase 1 and phase 2 are achieved
- Working out a supportive culture and change processes for transforming traditional IT departments to modern business driven and digitalization driver entities within organizations
- Defining a common internal project process that allows improvements with digitalization background to be integrated in any other development project within the firm

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Appendix 1: Role Description Examples

Application Consultant

Description	Actively shaping our system landscape and optimizing processes.
Requirements	• Completed higher education with focus on IT, software, telematics, business informatics, etc. • Professional experience with application support or consulting • Strong understanding of business processes • Technical know-how in object-oriented programming (.Net / C#) and databases (SQL) is an advantage • Communicative personality • High customer orientation • Proactive approach • Passion for continuously improving the status quo • Independent and structured working style • Analytical thinking • Good project management skills • Independent working style
Tasks for role	• Evaluate, design, and specify solutions for developing our systems further • Handover of specifications to developers • Optimization of our business processes together with functional teams • Initiate and coordinate improvements from big picture perspective • Evaluate new systems and challenge exiting ones • Test new applications, create training documents and train users • Interface between key users and developers as well as external development partners • Administration and support
Targets for role	• According to the defined targets • Continuously improve LD's system landscape • Automate business processes and increase efficiency

Application Developer

Description	Develop our systems further
Requirements	• Completed higher education with focus on IT, software, telematics, etc. • Very good technical know-how in object-oriented programming (.Net / C#) • Knowledge of databases (SQL) • Independent and structured working style • High degree of quality awareness • Solution oriented thinking • Willingness to learn • High reliability
Tasks for role	• Design and develop solutions for our systems • Ensure high quality of solutions • Technical documentation • Maintenance • Technical support • Administration, set-up and configuration
Targets for role	• According to the defined targets • Ensure smoothly running systems within the LD group • Continuously improve LD's systems
Competences/Authorities	• Member of the system committee

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Digital Transformation Manager

Description	Actively shaping innovative digitization projects, which help to revolutionize business processes, optimize interfaces, and achieve a seamless integration of the value chain
Requirements	• Technical and/or business university degree (e.g. IT, Industrial Management, Production Management, Supply Chain Management) • Experience with the implementation of digitization projects and change management • Several years of professional experience with ERP-Systems and related software systems • High personal interest for the latest technological trends and digitalization • Understanding of business processes • Communicative personality • Entrepreneurial thinking • Proactive approach • Passion for continuously improving the status quo • High customer orientation • Good organizational and project management skills • Independent working style and hands-on mentality
Tasks for role	• Initiate further development of our system landscape • Coordinate digitalization projects • Identify, evaluate, and prioritize digitization activities • Screen and share best practices proactively from both inside and outside the company • Maintaining the digitization roadmap and advising management • Change agent for digitization within the organization
Targets for role	• According to the defined targets • Taking the role of an “out of the box thinker” • Drive digitalization initiatives which increase our efficiency and help us to become a digital champion
Competences/Authorities	• Member of the system committee

IT Security Expert

Description	Ensure a secure IT environment with a very high degree of functionality for users
Requirements	• Technical education (HTL, FH, TU) with focus on IT-Security • Several years of experience in IT security • Specific knowledge in common operating systems, databases, cloud solutions and applications servers • Advanced experience with security devices like network devices, IPS, Firewalls, monitoring and filtering systems • High knowledge about cybercrime industry and their working scheme / attack vectors • High security and quality awareness • Entrepreneurial thinking • Independent working style • Proactive attitude • Solution oriented thinking • Willingness to learn
Tasks for role	• Create business-oriented concepts for secure IT solutions • Find ways to implement new systems and technologies in a secure way • Ensure secure and efficient environment from IT perspective • Work with external consultants/companies to improve IT Security and prevent cybercrime attacks • Coach and consult the other teams in IT security topics • Security Vulnerability Management: Assess security level, identify weak points and derive measures • Maintenance of mobile devices • Be consultant in DSGVO topics
Competences/Authorities	• Access to server rooms • Create and disable accounts • Access to Active Directory

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Senior Platforms

Description	Actively shaping and ensuring smooth operation of the system landscape within the company
Education	• Academic degree in Industrial Engineering, Industrial Management, or IT related studies
Vocational experiences	• Professional experience with application support or consulting
Specialized knowledge	• Technical know-how in object-oriented programming (.Net / C#) and databases (SQL) is an advantage • Strong understanding of business process
Personal characteristics	• Leadership personality • Entrepreneurial thinking • Good communication skills • High customer orientation • Proactive approach • Passion for continuously improving the status quo • Independent and structured working style • Analytical thinking • Good project management skills
Tasks for role	• Evaluate, design, and specify solutions for developing our systems further • Handover of specifications to developers • Optimization of our business processes together with functional teams • Initiate and coordinate improvements from big picture perspective • Evaluate new systems and challenge exiting ones • Test new applications, create training documents and train users • Interface between key users, developers as well as external development partners • Administration and support • Resource planning, nomination of project team members • Effort & time estimations for his area of responsibility • Ensure that processes are met • Create conditions for a good teamwork and cooperation with other teams • Foster business driven thinking and customer orientation (internal & external) • Prepare relevant information to support management decisions
Targets for role	• According to the defined targets • Continuously improve LD's system landscape • Ensure smoothly running Interfaces between systems • Ensure a trouble-free operation of our system landscape in the LD group (maintenance, support, etc.) • Automate business processes and increase efficiency
Competences/Authorities	• Vacation planning • First level performance reviews (appraisal interviews) • Member of the system committee

IT Administrator

Description	Ensure a smoothly working IT infrastructure for users
Requirements	• Technical education, HTL or similar with matriculation • Experience in IT advantageous • Basic understanding of IT security and business applications • High customer orientation • High quality and security awareness • Independent working style • Willingness to learn • Results oriented
Tasks for role	• Installation of user software • Purchasing of hardware and software • First contact for support • Maintenance of user accounts • Work with 2nd level support to solve issues
Competences/Authorities	• Access to server rooms • Create and disable user accounts

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Team Lead Infrastructure & Security

Description	Management and continuous development of the team
Requirements	• Academic degree in IT related studies with focus on security • Several years of experience in IT • Experience in personnel and project management • Detailed knowledge in security engineering • Leadership personality • Entrepreneurial thinking • High quality and security awareness • Good communication skills • Ability to motivate people • Distinct sense of responsibility
Tasks for role	• Lead the team IT Infrastructure & Security • Continuously question the current IT environment and use new technologies to increase effectiveness and efficiency • Create conditions, which empower the team to reach the targets and continuously develop further • Promote and develop every team member • Create conditions for good teamwork and cooperation with other teams • Foster business driven thinking and customer orientation (internal & external) • Prepare relevant information to support management decisions • Resource management within the team • Budget responsibility
Targets for role	• According to the defined targets • Taking the role of an “out of the box thinker” • Drive digitalization initiatives which increase our efficiency and help us to become a digital champion
Competences/Authorities	• Access to server rooms • Create and disable accounts • Access to Active Directory • Cost center responsibility • Personal responsibility • Member of the system committee

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Appendix 2: Fact Sheet from Technology Radar

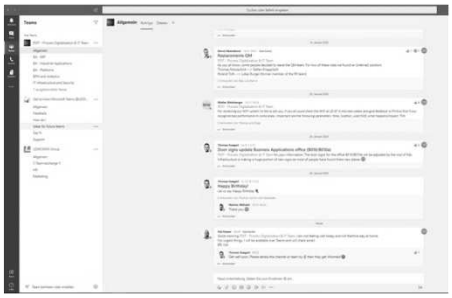
110 – COLLABORATION HUB

Area: Tools/Systems

Radar: Trial **Contact:** THKU

Description

Collaboration hubs are tools and services, which enable a central team communication in one place. The main purpose of such systems is to increase the efficiency in the communication and collaboration of interdisciplinary, global teams. One of this tools is Slack, which provides functions that all your team communication is instantly searchable and available wherever you go. Furthermore all your messages and files from other platforms like Dropbox or Google Docs can be integrated, so that one central information and communication hub exists. That improves the communication, provides faster support and keeps user up to date.



Maturity level of the technology

Collaboration tools are on the market since several years now offered by various companies with different scope of services. Therefore the maturity level of this technology can be seen as high. Furthermore some well-known companies use Microsoft Teams or slack, what indicates the value of these applications.

Microsoft Teams chanty Mattermost slack flock Stride

110 – COLLABORATION HUB

Area: Tools/Systems

Radar: Trial **Contact:** THKU

Use Cases for LOGICDATA

- Internal & external communication
  - Chats
  - Telephone & video conferencing
- Data sharing
- Systematic data archiving

Risk / Challenges / Barriers

- Finding the right balance between IT security and the usage of cloud based services
- Configuration – danger of data leaking if workspaces are not configured correctly

Benefits

- Improved communication between individuals, teams & projects
- Easier sharing of documents
- Higher availability & accessibility (mobile apps)
- Higher transparency in communication channels
- Easier management of polls (ask questions ...)
- Integration of other tools for higher efficiency
- Adaptable solutions for different teams

Status

The free version of Slack was tried out within the previous PE Test team within FY18/19. Furthermore, Skype4Business for supporting issues at LD-HR was tested by the Software development team. Based on the evaluation of the Microsoft Teams solution, a trial, that is still ongoing, was started by PDIT within Q4/2019.

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Appendix 3: Interview Questions

1. Align on type of anonymity of the interviewee and organization!

General questions to the **organization/organizations you consult**:

1. Do your IT department/IT departments you consult drive digitalization in the/their organization?
2. Are you using cloud services in your organization (cloud only, hybrid, on-premise only)? *Why/Why not?*

3. Compared to the company/companies consulted size, what percentage of people is working in the IT department on average?

   How much of them do have a hierarchical role, this means they must forward information in the chain of commands.

For each of the following **practices and processes**: In what ways does your (IT) organization/(IT) organizations you consult approach them and what makes them unique in your/their field?

1. System landscape (own organization/consulted organizations)

   For example: Who monitors the system landscape? Which KPIs do you use for it? How do you add/remove systems? Who decides on that?

2. Digitalization roadmaps (own organization/consulted organizations)

   For example: Do you have one? How do you assess a digitalization initiative? How do you prioritize initiatives?

3. Task Management (own organization/consulted organizations)

   For example: Do you have one? Which KPIs do you use? Do you track efforts on each element?

4. Self-managed/empowered employees (own organization/consulted organizations)

   For example: Are your employees making decisions on their own – are they empowered? If yes, to what extend (monetary, responsibility)? Do you insist on a chain of commands? Why? Do you foster transparency within your IT organization (budget, tasks, …)? Do you foster a failure culture as part of employees learning curve?

5. Two-speed / Bi-modal organization (own organization/consulted organizations)

   -Stability, Reliability and Security (Systems of record) - "slow" environment

   -Speed, Agility, on-demand adjustments (Systems of engagement) - "speed" environment

   For example: How would you define your IT organization (slow, speed, both)? How do you enable your organization to consider both? In case of just one area is considered, do you try to act in the opposite area? If yes, how?

6. Functions within the IT department/area (own organization/consulted organizations)

   For example: Is business process modeling and analytics part of your IT organization? Why/Why not? If yes, is it dedicated to persons, or is the knowledge spread distributed in the team?

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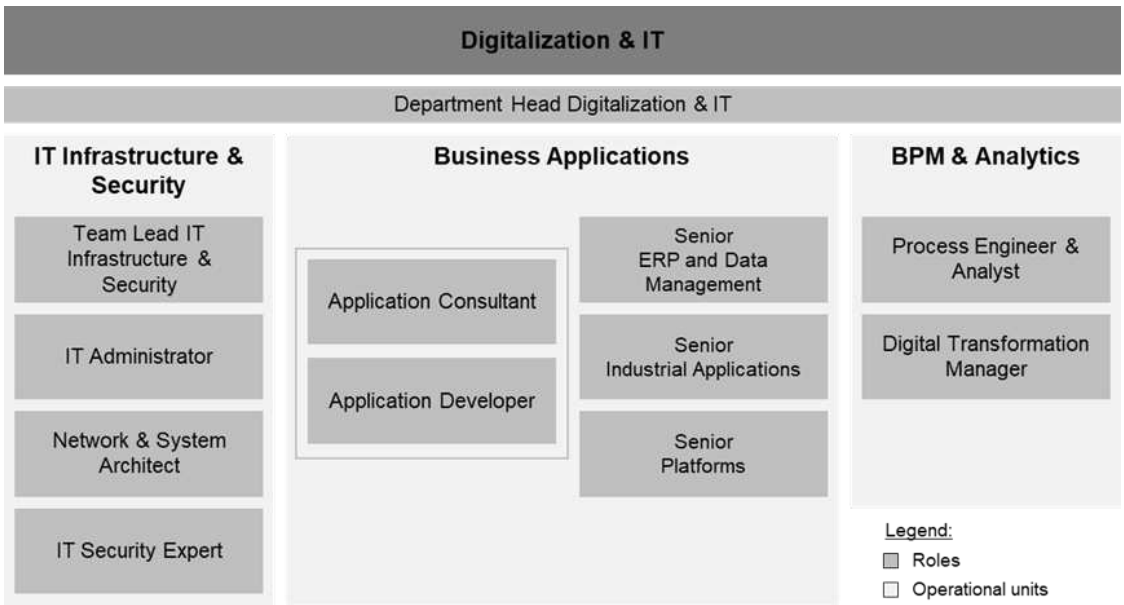
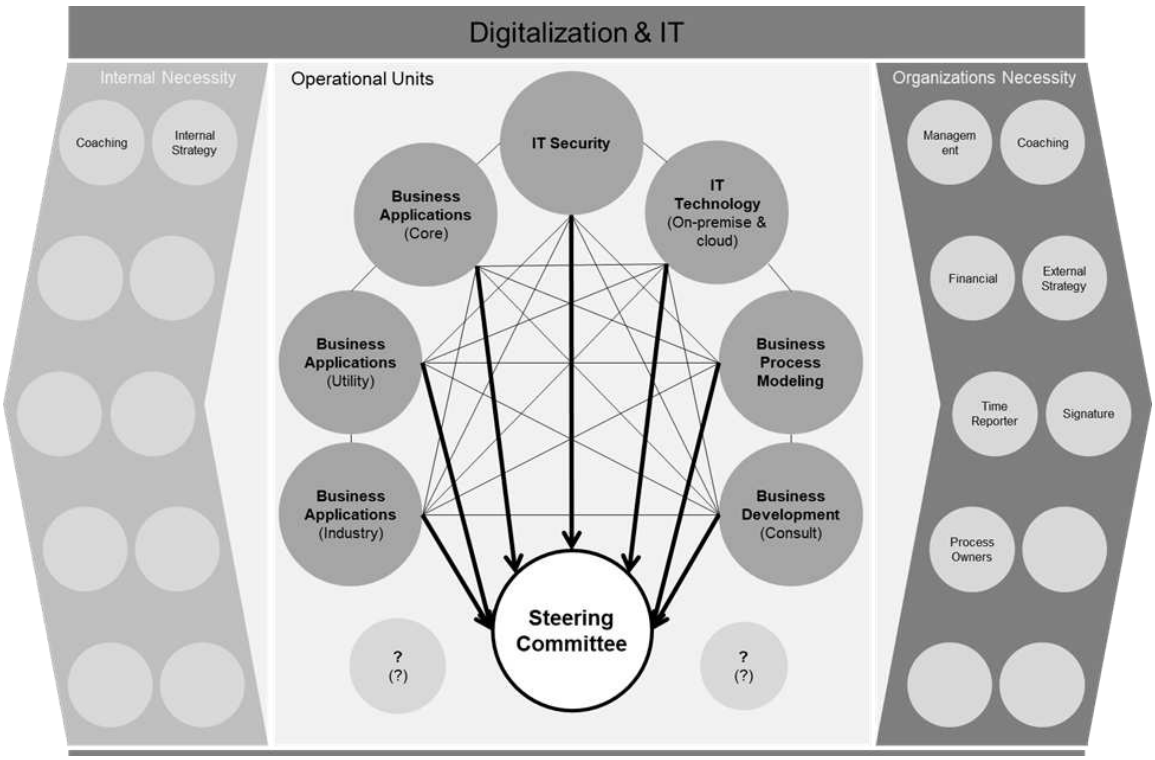
First question for **your/consulted organizations**. Following questions for each of the presented **organizational structures**:

1. In what way is your IT organization structured/are IT organizations structured you work with?

   For example: Functional/Divisional/Matrix/…? Hierarchical? Are IT employees' part of business units? Are IT employees taking part in product/service development projects? Do IT employees take over several roles (e.g. consultant, developer, process designer, Infrastructure administrator, project leader…)?

As part of the thesis a transformation from a traditional to a digitalization ready/modern styled IT organization is discussed in phases. The two following pictures show the organizational structure of phase 1 and phase 2.





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2. In what ways do you sense IT organizations would benefit from a structure like that?
   For example: What do you receive well that an IT organization would adopt?

3. In what ways do you sense IT organizations would have problems do adopt structures like that?
   For example: Where do you see issues that an IT organization would adopt?

4. When would you define a team as ready to adopt a structure/parts of the structure like that?
   For example: What skills, mindsets, knowledge would be needed? Would most employees understand the purpose? Would the organization's management be open to it?

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Appendix 4: Survey Questions

Task Management at LOGICDATA

1. I used the advantage of seeing tasks of my team members in the last 2 months.
2. I use the task management to organize my work.
3. I know what "Work in progress (WIP)" means and how it influences the team's performance.
4. I like to see all my tasks (tickets, targets, recurring tasks, etc.) in one KANBAN board.
5. I created my own quick filters to customize the KANBAN board to my personal needs.
6. I understand the purpose of our task management.
7. The difference between targets, projects and tasks is clear to me.
8. The task management is well prepared, but...

System landscape at LOGICDATA

1. The system landscape of LOGICDATA is inhomogeneous.
2. The systems committee is fulfilling its purpose.
3. I can influence the system landscape.
4. Interfaces between systems provide us problems.
5. I know the specifications for our systems interfaces.
6. I know costs spend on our systems.
7. I am trained to do a digitalization assessment.
8. The systems committee is working well, but…

General questions (Knowledge, Agility, Organization)

1. I increased my knowledge on our system landscape in the last 6 months due to transformation.
2. I increased my knowledge on our processes in the last 6 months due to transformation.
3. I can consider company processes in my consultant work.
4. I increased my specialized skills in the last 6 months (Coding, Process Design, etc.)
5. I can decide on topics with advice of affected people and expertise, without considering my direct superior.
6. I like to decide more often on topics with advice of affected people and expertise, without considering my direct superior.
7. My mistakes help me and my team to improve.
8. I can make mistakes without fear of being punished to a later stage.
9. The current structure is complicated (too many hierarchical layers, too many interfaces, ...)
10. Departments communication is transparent.
11. The departments Jour Fixe is non-transparent.
12. The organization of Processes, Digitalization, IT is fine, but ...

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