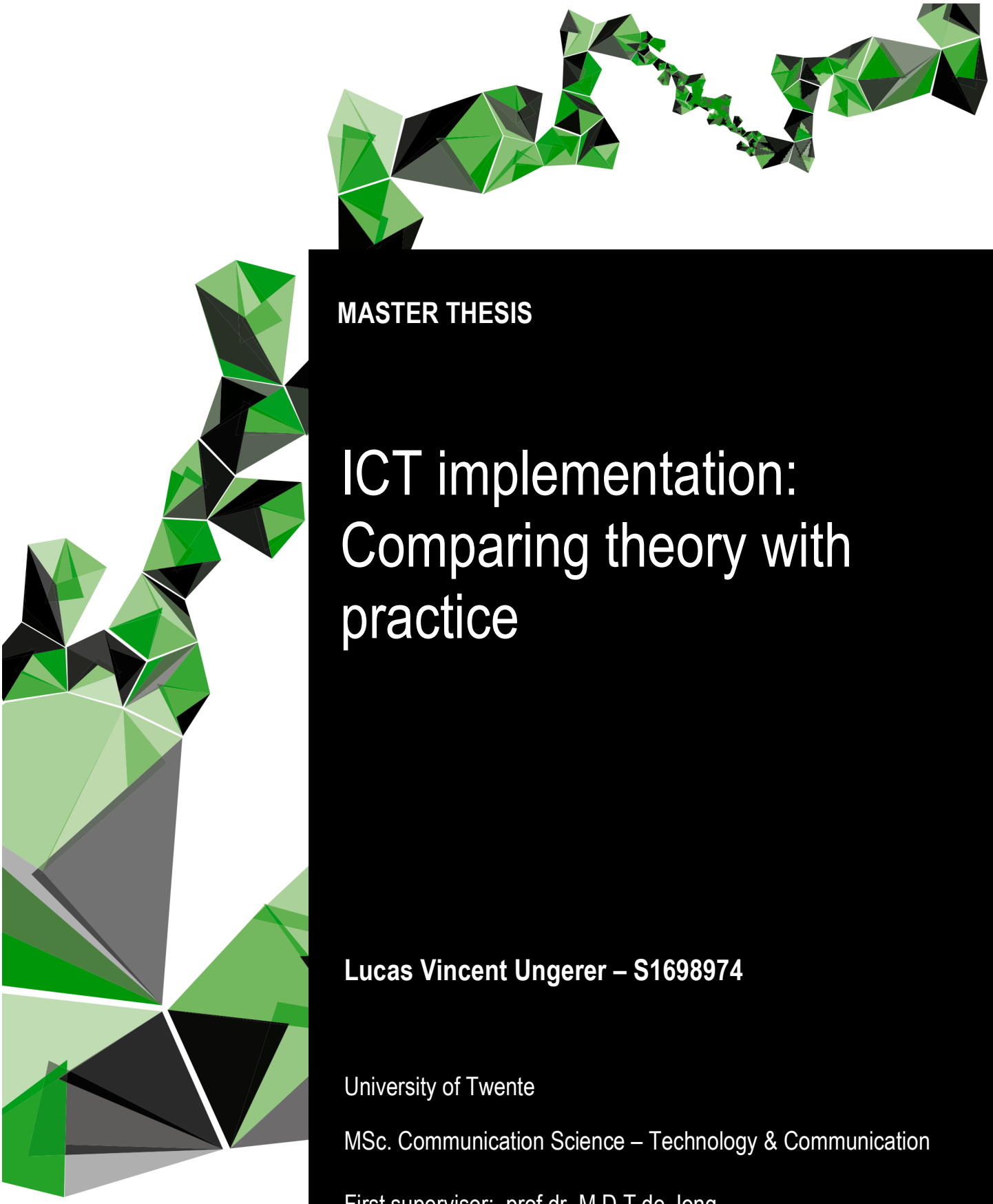

MASTER THESIS

ICT implementation: Comparing theory with practice

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Abstract

Purpose: Information and communication technologies (ICT) implementation has become increasingly important for organisations. However, numerous examples exist of ICT implementation failures by unforeseen struggles and factors. Hence, there is need to investigate and construct a clear ICT implementation model that shows the stages an ICT implementation goes through, including factors that could potentially cause success and failure, both from theory and practice.

Method: 25 interviews with practitioners were conducted in order to get an overview of the practice. The interviews were focussed on getting to know factors that influence the success or failure of ICT implementation processes. To realise this, the critical incident technique was used throughout the interviews.

Results: The literature review showed a specific focus on factors that had to do with management and leadership for both the success and fail factors, while the data from the participants varied. The participants indicated that factors regarding knowledge were very important for the success of an ICT implementation. On the other hand, the results from the participants indicated that failure was mostly caused by factors regarding the employees and management themselves.

Conclusion: The factors are gathered in a self constructed ICT implementation process model consisting of five stages, namely: recognition, preparation, pre-implementation, implementation and sustainment. Furthermore, every stage is supplemented by several success and fail factors of importance, both gathered from literature and practice. The model provides practical implications by providing factors that influence ICT implementation performance in each stage of the process.

Content

1. Introduction

Approximately 300 years ago during the 18th century the introduction of the steam engine caused a big transition of the textile industry and led to the establishment of industrial cities. This period was later referred to as the First Industrial Revolution (Xu, David & Kim, 2016). Around 150 years later, the second industrial revolution started, which was featured by hard-working employees, the introduction of mass production and the introduction of the internal combustion engine (Niiler, 2019). The third industrial revolution, which started in the early 1960s, was featured by a shift from analogue electronic technologies to digital electronics (Vale, 2016). Currently, we are in the fourth industrial revolution named industry 4.0. Industry 4.0 is ICT based, which is featured by automation and digitalization (Lukac, 2015). This influences all industries, because new technologies, such as IT, Internet of things and cloud computing contribute to the value creation of firms.

The importance of industry 4.0 in firms has increased during recent years "While in 2015, only half the manufacturing executives interviewed cited digitalization and automation of business processes as a top IT priority, in 2016 more than 90% are investing in these areas (CGI, 2017, p. 6)". ICT are part of this fourth industrial revolution and are transforming firms significantly. Rouse (2019) states that there is no single, universal definition for ICT. In general, the term is interpreted as meaning all devices, networking components, applications and systems that together make sure that individuals and organisations can communicate in the digital world. "ICT has transformed the ways things are made by integrating contemporary technologies with new or optimized processes and methods of doing things (WFEO, 2019)".

Chege, Wang & Suntu (2019) found that ICT innovations influence firm performance positively. According to this research, firms should develop innovative strategies to enhance firm performance. This shows the importance of developing strategies in order to successfully implement ICT measures within firms. According to Roztocki & Weistroffer (2011) the existing business environment influences the successful implementation, adoption and use of information technology. They state several features of business environments, such as law and regulations and infrastructure, which can influence effective information technology implementation. Moreover, multiple components of ICT capabilities of firms aid can positively influence small firm's competitive advantage (Parida, Oghazi & Cedergren, 2016). Together, literature shows that ICT can be beneficial for firms, which raises the need to investigate these contributions in detail. Research into these areas will provide manufacturing firms with strong handles to make ICT implementation successful and limit the risk of ICT implementation failures.

However, digitalising and automatizing firms by implementing ICT projects does not speak for itself and often happens to be more difficult than expected, because of different kinds of unforeseen struggles that may occur during the process. Numerous examples of firms who failed to implement ICT can be found on the Internet, often with catastrophic consequences in the end. One of the most extreme examples of ICT implementation failures was a healthcare service company FoxMeyer in the 1990s that planned an investment for a new enterprise resource planning system. The project resulted in a total disaster and costs went far over 100 million dollars leading to the

bankruptcy of the company (Hamrouni, 2020). Up till now, many other examples with severe and less severe consequences can still be found in the news media. This shows that ICT implementation is risky and should be well managed.

Hence, the research question in this research that will be answered is:

- What success/fail factors can be found in theory and in practice, and what are the comparisons/differences between success/fail factors in theory and practice for ICT implementations?

The answer to this research question will add to the available knowledge and literature regarding factors influencing ICT implementations . Next to this, the outcome has practical relevance by pointing out information that organisation can benefit from. Organisation can look into the success and fail factors and adjust ICT implementation processes accordingly.

The paper will proceed as follows: a literature review is conducted into different areas of ICT implementation. This includes the theory of sociomateriality, theoretical models related to ICT implementations, ICT implementation process models and theories regarding success and fail factors of ICT implementations. Moreover, 25 interviews are conducted focussed on finding success and fail factors in practice as well. This results into a comparison in between theory and practice, followed up by the creation of my own ICT implementation model, which includes all success and fail factors mentioned.

2. Theoretical framework

The theoretical framework consists of an overview of the most important implementation models, theories and factors in the field of ICT implementation. First, the relevant connection in between work and technology in general is described by using the theory of sociomateriality. Then, four frameworks that provide relevant components, constructs and factors necessary for the actual implementation processes are discussed. Next to this, five relevant ICT implementation process models will be described. These five process implementation models are process oriented and provide clear phases and steps for successful implementation of ICT technologies. Lastly, empirical research is looked into in order to find success and fail factors regarding ICT implementations.

2.1 Sociomateriality

In order to analyse an ICT implementation model it is crucial to understand the connection in between technology, work and the organization. The term sociomateriality is a combination of both the words "social" and "material". Fenwick (2014) argues that "material" indicates all things in our lives, both technological and natural or organic and inorganic. The "social" indicates cultural discourse, fears and desires and symbols and meanings. Moreover, the social in sociomaterial includes the communication between humans and non-humans, in which for example technology can be distinguished amongst the latter of the two (Moura & Bispo, 2019). Orlikowski (2007) indicates that social and material have to be seen as two parts of reality that are fused together. That is why they indicate that "there is no social that is not also material, and no material that is not also social (Orlikowski, 2007)".

Sociomateriality sees both technology and social practice connected to each other (Bavdaz, 2017). The workplace is an important situation in which both social and technology come together. Sociomateriality offers a fairly new way of studying the implementation of technology in the workplace, which is needed to measure the consequences of ICT implementations. The theory makes it possible for researchers to allow studying both the material and the social at the same time (Parmiggiani & Mikalsen, 2013). The material in the workplace is increasingly becoming digital and the increase of the term technology has contributed to the increasing use of sociomaterial ways of measuring the consequences of ICT implementations (Bavdaz, 2017).

The concept of sociomateriality has been around in different variants for a very long time. In 1979, sociomatter is explained as the involvement of "human beings and things in a useful context". Even earlier, in the 1950s theorists already argued that technological change consisted of both the material and the social. According to Parmiggiani & Mikalsen (2013) the popularity of sociomateriality has increased by arguing the separation between technology, work and the organization at once. Sociomateriality can be seen as the "analytic break" that has the potential to escape the opposite opinions that exist between the technical and the social.

According to Johri (2011) sociomateriality is a key theoretical concept that can be used to further advance the research, design and the use of learning technologies in practice and the workplace. Johri (2011) quotes a vivid example of Orlikowski & Scott (2008, p455) about the essence of sociomateriality. It is asked to imagine a battlefield of soldiers that are all lined up. It is stated that there are no soldiers that are not wearing their uniforms and arms, because they shape each other. There are no soldiers that don't wear their essential materials. They simply do not exist. They are immaterial without their essential materials. Just like the soldiers and their materials and arms, it is hard to imagine learning without materials. Materials such as books, whitepapers and blackboard, but also more recent materials, such as technologies shape the way people learn. Johri (2011) argues "within the context of learning technology, socio-materiality can play a critical role by helping us overcome an inherent dualism in the learning technologies literate between the social implications of technology use and the material aspects of technology design; this dualism either privileges the social of the technical while failing to provide proper attention to the socio-material assemblage". The same accounts for sociomateriality in the context of organisations. It is hard to imagine organisations' "material" being non-technological. ICT has found its way into organisations. It shows the relevance for investigating factors influencing ICT implementation in organisations.

Parmiggiani & Mikalsen (2013) conducted a systematic mapping study of several emerging concepts and definitions in the literature surrounding sociomateriality. They investigated how sociomateriality has been used in empirical studies. According to them, the debate differentiated between defining sociomateriality as "just a fancy term to define technology" to others using it to define the theory of human-technology relationships. Their research aims to contribute to a wider understanding of sociomateriality. Their systematic mapping consisted of an extensive literature review consisting of over 900 results, which were narrowed down by using filters. Their analysis led to finding three facets that characterize empirical sociomaterial research. These facets are substantiated and should be used as an addition to current sociomateriality discourse in order for the field to gain a wider understanding of the topic. The systematic map consisted of three facets that investigated the "what", "how" and the "where/when" of sociomateriality.

Fenwich et al (2011) state that four theories can be considered as a sociomaterial theory. According to them, these theories all have the assumption to understand the world from a sociomaterial perspective. These theories "seek to track how knowledge, knower, and known emerge jointly as/in activity". The theories that are discussed are: actor-network theory, complexity theory, cultural-historical activity theory and spatial theory. Fenwick et al (2011) describe these theories in their paper. In short, the actor network theory is also called the "sociology of translation". The theory aims to analyse how "the micro-interactions within networks of heterogeneous actors constitute social standards (Fenwick et al, 2011)". Next to this, the complexity theory states that people and context represent a system in an inseparable way. Next to this, the culture-historical activity theory states that material artefacts mediate in between culturally situates activities systems. Lastly, the spatial theory is about space and sees "the concept of space as a static environment and as a backdrop for the actions of actors (Fenwick et al, 2011)".

All in al, the sociomateriality theory shows that it is important to not only look at ICT implementation itself. It is rather important to look at the contributions for both the social and material. Both the social and the material aspect should be taken into account in the whole implementation process, from start to finish. A new ERP system can be successfully implemented, however, if the people can't use the system, it will still not contribute to any significant changes. It will probably only partly solve or contribute to the sought for contribution of the implementation. However, if the social is taken into account next to the material, in other words, a sociomaterial approach is taken, the implementation is more likely to fulfil the planned contribution. In other words, an ICT implementation is more likely to be successful when both facets are taken into account. The theory is important to consider throughout the implementation process and the construction of the implementation model that is proposed in this paper.

2.2 Theoretical perspectives on implementation

In the previous section, the essential combination of work and technology was discussed. In order to follow up on this, this section describes four relevant theoretical perspectives. All four provide key components, factors and elements for successfully implementing innovations, such as technology in the work place. They address relevant aspects that are critical for the success throughout the whole ICT implementation process.

2.2.1 Knowledge-to-action framework

The knowledge-to-action framework consists of two interrelated components: the knowledge creation funnel and the action cycle (Crockett, 2017). Both components consist of multiple underlying phases, which are all interrelated and dynamic, which means that they can influence each other (Field et al, 2014). The knowledge-to-action framework, proposed by Graham (2006) was constructed in order to counter an increasing difficulty of putting knowledge into action. It does so by providing key elements that are essential within this process. The framework can be used to put knowledge or ideas regarding ICT implementation processes or into actual actions. The knowledge funnel refutes the synthesis and production of knowledge. The knowledge moves through the tunnel. In here it is refined to be more useful for end users (Crockett, 2017). This funnel consists of three phases: knowledge inquiry, knowledge synthesis and the creation of knowledge tools and products. The knowledge inquiry phase consists of first generation knowledge, which is still out of scale and should still be narrowed down. Knowledge inquiry implies to most of the knowledge and studies. The knowledge is vague and should not be presented and translated yet. The second phase is called knowledge synthesis and it consists of incorporating results and narrowing it down to make it more practical. The practicality of the knowledge is essential when considering an implementation's perspective and potential. The third phase is called knowledge tools and products, which is knowledge that is narrowed down and can be considered as the most specific and refined of them all.

These types of knowledge contribute to the first step of the action cycle: identifying the problem (Crockett, 2017). "The action cycle outlines a process, representing the activities needed for knowledge to be applied in practice; knowledge is adapted to the

local context, and barriers and facilitators to its use are explicitly assessed (Field et al, 2014, p. 2)". The phases mentioned in the action cycle are not chronologically and can be carried out simultaneously and be influenced by the phases of the knowledge funnel (Crocket, 2017). The applicability of ICT implementation can be argued as follows. The knowledge that was gathered on ICT implementations and the ideas that followed from this can be put into practice by going through the phases of the action cycle. These phases are" identifying a problem, adapt knowledge to local context, assess barriers and facilitators, select tailor and implement interventions, monitor the knowledge, evaluate the outcomes and the knowledge should be sustained.

All in all, The knowledge-to-action framework, proposed by Graham (2006) was constructed in order to counter an increasing difficulty of putting knowledge into action. The knowledge-to-action framework consists of two interrelated components: the knowledge creation funnel and the action cycle. The knowledge creation funnel consists of three phases: knowledge inquiry, knowledge synthesis and the creation of knowledge tools and products. On the other hand, the action cycle consists of multiple phases, which are: identify the problem, adapt knowledge to local context, assess barriers to knowledge use, select, tailor, implement interventions, monitor knowledge use, evaluate outcomes and sustain knowledge use (Field et al, 2014).

2.2.2 Normalisation process theory

The normalisation process theory (NPT) proposes four components, namely "coherence (or sense-making), cognitive participation (or engagement), collective action (work done to enable the intervention to happen) and reflexive monitoring (formal and informal appraisal of the benefits and costs of intervention)(Murray et al, 2010, p. 2)". The normalisation process theory (NPT) addresses factors of importance for the implementation of interventions into routine work. The theory offers a framework that indicates the potential of certain implementations.

Coherence describes if the intervention makes sense, is easy to describe, its purpose and if it is clearly distinct from other interventions. Cognitive participation describes the possible engagement of the target groups and if the target group will understand the point if the intervention. Thirdly, collective action is about the effects of the intervention on the user groups. The impacts the intervention has on the resources, power, division of labour and the resources needed to counter this. Lastly, reflexive monitoring takes place after the intervention has been implemented. It is about how users perceive the intervention and the advantages and further effects of the intervention.

Some innovations can be very realistic and seem to be prosperous, however, its successfulness depends on its effectiveness in the real world. Trials are essentials in order to come closest to the implementations effectiveness in the real world. The Normalisation process theory proposes a framework, which guides researchers by stating important elements that are relevant for success (Murray et al, 2010).

All in all, the normalisation process theory (NPT) addresses factors of importance for the implementation of interventions into routine work. The NPT consists of four components: coherence, cognitive participation, collective action and reflexive monitoring.

2.2.3 Organizational model of innovation implementation

The organizational model of innovation implementation (Teal et al., 2012), states that the effective and consistent use of innovations depends on the organization's readiness for change, the level of management support and resources available, the implementation policies and practices, the climate for implementation and if users of the innovation find the innovations fulfilling in regards to their values. In the following, these constructs are briefly discussed.

Firstly, organizational readiness for change (ORC) refers the collective mind set of the organizational members, regarding confidence and commitment towards the innovation. Secondly, management support is critical throughout the innovation implementation. The management is in charge and controls resources and organization priorities. Thirdly, resources that contribute to the implementation should be available. Moreover, implementation policies and practices (IPP) are stated in the organizational model of innovation. It includes strategies, structures, plans and practices that organizations should promote in order to successfully promote innovations. An increasing amount of IPP's used by an organization to support innovations will lead to better innovation implementation. The fifth construct is called the implementation climate and entails the perception of organizational members of the innovation use in regards to its expectations, support and rewards. Lastly, the innovation-values fit refers to how organizational members perceive the fulfilment of their values while using the innovations. Organizational members should believe that the organizational innovations keeps the internal value intact and keeps them in mind while implementing.

All in all, the organizational model of innovation implementation includes several constructs that influence implementation effectiveness. These are: organization's readiness for change, the level of management support, the resources available, the implementation policies and practices, the implementation climate and the innovation-value fit (Teal et al, 2012).

2.2.4 Implementation drivers

There are three categories of implementation drivers, namely competency drivers, organization drivers and leadership drivers (Fixsen et al, 2016). This theory can be used to distinguish the presence of implementation drivers within the manufacturing firms in order to successfully implement ICT and make use of the benefits that ICT offers. In the following, these three are briefly explained.

Firstly competency drivers are instruments to develop the ability of individuals in order to implement an innovation as intended to. One can think of a selection of the right people, training and coaching these people, so the understanding is maximized and these individuals are component enough to be beneficial (Fixsen et al, 2016). Secondly organization drivers are "mechanisms to create and sustain hospitable organizational and system environments for effective services" (Fixsen et al, 2016, p. 2). This driver consists of system interventions, facilitative administration and decision support data systems. Lastly, leadership drivers are very important in influencing the success of an implementation. Before an innovation is successfully implemented, one

has to look into the leadership strategy that possibly contributes the most to the innovation. Within this driver, two types of leadership style are distinguished: technical and adaptive (Fixsen et al, 2016).

All in all, the implementation drivers point out the three drivers that influence successful ICT implementation. There are three implementation drivers proposed: competency drivers, organization drivers and leadership drivers.

2.3 Implementation process models

This section focuses on implementation process models. While the previous section focuses on theoretical perspectives on ICT implementation in general, this section will focus on specific process models that indicate specific stages that an ICT implementation will go through. Many organizations see smart industry and ICT solutions as a challenge instead of an opportunity (Anderl, Picard & Wang, 2016)**.** The most fundamental problem within these organizations is to effectively manage implementations. These organisations don't know where and how to start the implementation process. Implementation models can contribute and can be the key to a successful implementation process (Niazi, Wilson & Zowghi, 2003). According to Peukert et al (2020), implementation models organize certain elements and methods of managing a project into phases and processes. Implementation process models are known to provide one with clear handles by structuring as-if situations into concrete and defined targeted states. Moreover, handles for multiple structured and defined steps that provide a logical sequence. Implementation process models also provide tools for all steps that can be used to realize and fulfil them (Peukert et al, 2020). According to Niazi, Wilson & Zowghi (2003) that talk about software process improvements, studies have shown that managers want guidance on how to implement implementation activities instead of hearing what activities to implement.

2.3.1 Software process improvement model

The first model is developed in the paper of Niazi, Wilson and Zowghi (2003). This paper introduces the software process improvement model. The model consists of six phases that together provide practitioners with advice in order to successfully implement software process improvement programmes. These phases are: awareness, learning, pilot implementation, SPI implementation action plan, SPI implementation across the organization and maintenance. In the following, these phases will be briefly discussed.

Awareness is the first phase of the SPI implementation model. It was stated by practitioners that it is essential to organize multiple sessions in order to create awareness by providing sufficient knowledge to all involved staff members. By creating awareness, potential barriers like staff resistance can be avoided (Niazi, Wilson & Zowghi, 2003). The next phase is called learning and consists of the provision of knowledge. Practitioners should have the right knowledge of the critical technologies that are needed in order to improve software processes. Training sessions can be planned to achieve this. Pilot implementation is the next phase mentioned. It is recommended that practitioners implement the SPI programs on a small scale within a

certain department of group of staff members. The findings of a pilot can be used to improve long term. In the fourth phase, SPI implementation action plan, an action plan is created. The action plan should consist of activities, schedules, allocated resources, responsibilities, budget and milestones. The implementation across the organization is the fifth phase. Based on the results and the improvements of the pilot implementation together with a clear action plan, the implementation can be implemented throughout the organisation. Within this phase, senior management commitment together with support and confidence of the staff members are very important. Lastly, the sixth phase is called maintenance in which the SPI implementation is continuously improved and monitored. Practitioners proposed to keep initiating training session in order to keep the knowledge of staff members up-to-date.

All in all, Niazi, Wilson & Zowghi (2003) proposed the SPI implementation model, which provides practitioners with advice in order to successfully implement software process improvement programmes. These consist of six phases: awareness, learning, pilot implementation, SPI implementation action plan, SPI implementation across the organization and maintenance.

2.3.2 Implementation stages

Next, the implementation stages by fixsen et al (2013) are discussed. The implementation stages can be helpful in analysing and comparing the actual implementation processes of the manufacturing firms. These implementation stages are the following: "exploration, installation, initial implementation and full implementation (Fixsen et al, 2013). All four stages are discussed in the following. The first stage is called exploration, which consists of analysing the status quo of existing approaches and looking into the strengths, weaknesses and gaps of these approaches. The outcome of this stage should define and create a critical and detailed starting point for innovation. This can be achieved by creating a common understanding and acceptance of the innovation in mind. The next stage is called the installation stage, in which the resources and activities that are needed to fully engage in new ways of work are acquired and developed. An important activity in this stage is the selection of capable personnel, both internally and externally. Thirdly, the initial implementation stage starts when the first practitioners are attempting to use the innovation that is being implemented. Just like the pilot implementation phase of Niazi, Wilson & Zowghi (2003), this stage is about getting familiar with the innovation and acquiring the new skills in order to use the innovation. Lastly, in the full implementation stage the innovation will be fully implemented. The innovations will be seen as a standard way of working. Organisation should keep providing users with training session in order to make sure that their knowledge won't fade away. The innovation is monitored and improved during this stage.

All in all, the implementation stages can be helpful in analysing and comparing the actual implementation processes of the manufacturing firms. The implementation stages proposed by Fixsen et al (2013) are: exploration stage, installation stage, initial implementation stage and full implementation stage.

2.3.3 Basic steps for initiating digital transformation

In the paper of Bechtold et al (2014) a six step-journey towards industry 4.0 and smart solutions is proposed based on their practical experience. The six steps are about conducting a digital maturity assessment, identifying the opportunities and threats in the industry 4.0 environment, defining the industry 4.0 vision and agenda, prioritizing the transformation domains, deriving the roadmap towards industry 4.0 and implementing and sustaining the change. In the following, the steps are briefly explained. Firstly, the company should conduct a digital maturity assessment in order to find out about strengths and weaknesses and getting to know the status quo of current industry 4.0 and ICT measures within the company. Next, the opportunities and threats in the industry 4.0 environments should be identified. These will contribute to finding the true essential and most relevant value drivers for the company. Thirdly, the digital vision and strategy should be defined. Based on the previous steps, the company has to define a clear vision for the digital future. It is important to define clear short and long-term objectives. The vision should be shared and agreed upon by all executives in order to successfully start implementing. Moreover, the transformation domains need to be prioritized. Some domains will be easier to transform than other domains. The digital journey and its domains should be put into a prioritization matrix in order to identify the easier quick wins, and the longer lasting wins. Next to this, the roadmap towards industry 4.0 should be derived. The roadmap can contribute to making the digital journey tangible. The roadmap should contain an overview of the different phases and the timing of the digital journey. Lastly, The change should be implemented and more importantly sustained, which is in line with the philosophy of the previous models of Niazi, Wilson & Zowghi (2003) and Fixsen et al (2013).

All in all, Bechtold et al (2014) propose a six-step journey towards a digital transformation. The steps mentioned are: conduct a digital maturity assessment, identify the opportunities and threats in your industry 4.0 environment, define your industry 4.0 vision and strategy, prioritize the transformation domains, derive the roadmap towards industry 4.0 and implement and sustain the change.

2.3.4 Guideline for developing industry 4.0 business models

Anderl, Picard & Wang (2016) proposed a guideline that consists of chronological phases, which are: the preparation phase, the analysis phase, the creativity phase, the evaluation phase and the implementation phase. They developed a guideline for introducing industry 4.0 to small and medium sized businesses. They noticed that numerous companies are not seeing the true contributions that industry 4.0 and ICT solutions have to offer. Moreover, companies that try to implement ICT solutions are getting stuck and are not completing the implementation process. The guideline consists of five phases that are guiding companies into a successful implementation.
The first phase named the preparation phase in which all relevant individuals should form a solid knowledge base regarding ICT solutions, which is similar to the awareness phase of Niazi, Wilson & Zowghi (2003) and the exploration phase of Fixsen et al (2013). The second phase is called the analysis phase and focuses on identifying the starting position in terms of industry 4.0 and ICT solutions. This phase consists of an internal competence analysis and an external competence analysis regarding ICT. The third

phase is called the creativity phase in which a workshop is organized where participants creativity is tested and elaborated. The creativity phase consists of two parts. The first part consists of individuals generating ideas and solutions for boosting performance regarding smart solutions. Afterwards, these individuals split up in different groups in order to elaborate upon these ideas and further refining and developing them. The fourth phase is called the evaluation phase and targets the presentation of the outcomes of the creativity phase The fifth phase is called the implementation phase. During the implementation phase, the ideas generated during the creativity phase and elaborated during the evaluation phase are further specified and transferred to projects.

All in all, Anderl, Picard & Wang have proposed a guideline for industry 4.0 and ICT solutions implementation. They developed a guideline for introducing industry 4.0 to small and medium sized businesses. The guideline consists of five phases: preparation, analysis, creativity, evaluation and implementation.

2.3.5 Implementation process model

Peukert et al (2020) proposed a five-step process model for successful implementation and demonstration of industry 4.0 showcases. Their holistic approach focuses on the identification of possible hick ups that hold back performance and successful implementation. The implementation process model by Peukert et al (2020) comprises of five different phases, which, chronologically are, initialization, analysis, conceptualization, realization and demonstration.. All five of these steps are briefly explained in the following.

It starts with the initialization phase, which deals with the problem definition and project planning. In this phase all executives and management personnel should be included from all relevant departments. All departments should present their thoughts and should be represented into the constructed problem definition. The next phase named the analysis phase exposes the status quo and reveals potential improvements. The status quo has to be investigated distinctly to make sure that potential strengths and weaknesses are exposed and an initial solution approach can be developed. The conceptualization phase looks into the problem and focuses on coming up with a smart solution for targeting the problem. The realization phase focuses on implementing the smart solution that was proposed in the earlier stage. The phase consists of four steps, “requirements catalogue”, “market overview”, “pre-selection” and “final provider selection”. Ones agreed with one of the providers and implementing the industry 4.0 measures, the realization phase is considered as completed. Lastly, the demonstration phase looks into the transformation of the solution into a showcase that could serve as an inspiration for others in the smart transformation.

All in all, Peukert et al (2020) have constructed a holistic implementation process model for successful implementation and demonstration of industry 4.0. The implementation model consists of five different phases, which, in a chronological manner present how an implementation process can be conducted.

2.4 Comparing the theoretical perspectives and process models

In order to summarize and compare the previously discussed models, a theoretical framework is constructed in figure 1. To construct this theoretical framework I came up with five distinct stages: recognition, preparation, pre-implementation, implementation and sustainment. These stages were constructed based on the knowledge gathered from the process models. All of these process models consist of different stages as well. These stages were also refuted. This way I could find similarities in between the stages from the different process models. In order to make comparisons and construct a clear overview I gathered all stages and distributed them amongst my own stages. This section provides a brief description of all stages. This is followed up by figure 1, which gathers all theoretical and process models from the previous sections.

The first stage is called recognition, which is characterized by being the starting stage of an ICT implementation. The main objectives during this stage it to create awareness and analysing the current status of ICT implementation. Training session can contribute to gaining sufficient knowledge amongst employees. In order to look into the current status of ICT implementation, a maturity assessment can be conducted, resulting in the exposure of strengths and weaknesses, which could result into a problem definition.

The second stage is called preparation and is about creating an action plan of the ICT implementation. It is about setting up a digital vision and an agenda of steps. The action plan should consist of activities, schedules, allocated resources, responsibilities, budget and milestones. In this stage one has to look into the results of the analysis and the maturity assessments from the previous stage. Moreover, it is essential that the resources and activities needed are looked at and a solution of the problem is introduced. This could for example be achieved by providing a workshop in which domains are prioritized and where the analysis and the problem definition are followed up.

The third stage is called pre-implementation and is about getting to know the solution of the problem. The ideas that were gathered from possible workshops or brainstorm session are made tangible by providing a roadmap related to the actual implementation that is being implemented. Handles are provided in order to make the digital journey definite. The ideas are being put into practice and the first steps of the definite ICT implementation are taken. The first practitioners will be using the ICT implementation in the form of pilot. The practitioners will provide feedback and the experiences of these initial practitioners will be used to increase the usability of the ICT implementation.

The fourth stage is called implementation and is about implementing the actual ICT implementation and providing a solution for the problem that was defined in the earlier stages. Based on the feedback and experiences from the pilot implementation, the implementation is improved. During this stage, the ICT implementation is going to be seen as a standard way of working. Guidance is critical during this stage; the practitioners should be guided throughout their adoption of the technology. Moreover, management commitment, support and confidence of practitioners are essential during this stage.

The fifth and last stage is called sustainment and is about sustaining the change and making sure that the ICT implementation is continuously improved and monitored. One of the hardest parts of the digital transformation is actually sustaining the change, there is a lot involved in order to make this a success. It is about to keep initiating training session in order to keep the knowledge of staff members up-to-date.

Lastly, the framework consists of overlapping elements, factors and components. These are the constructs of the theoretical implementation perspectives in section 2.2 and are important throughout all the stages in the ICT implementation model. They are summarized in the overlapping block in the framework in figure 1.

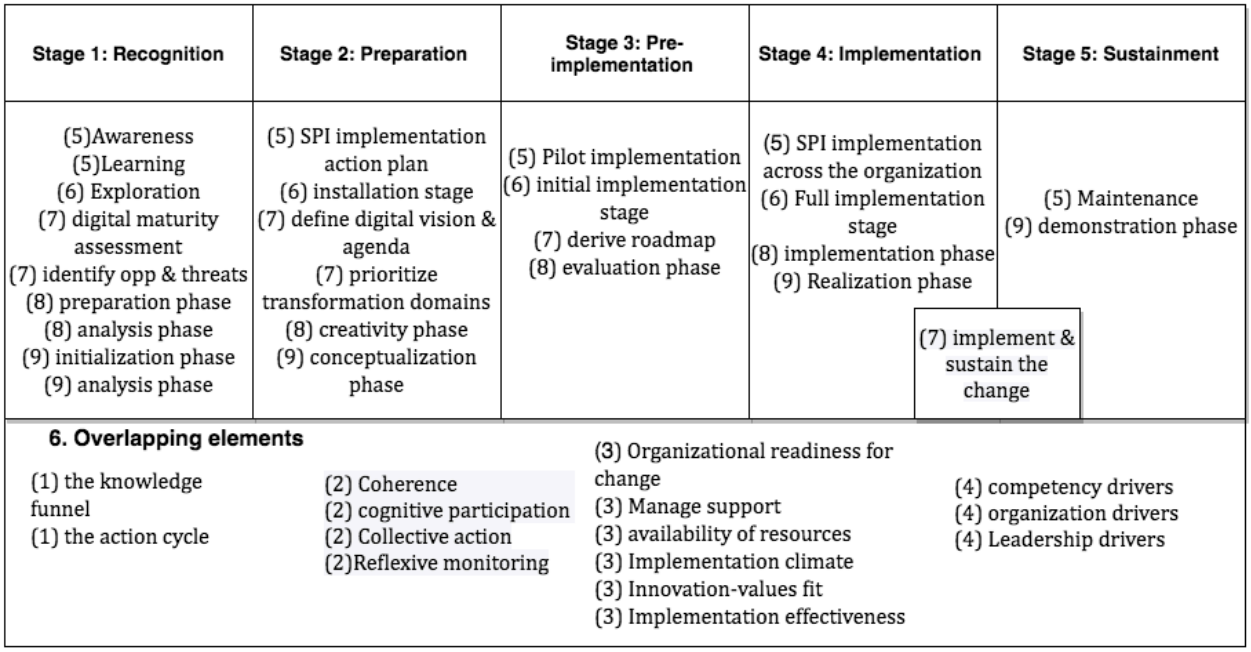

Figure 1. Theoretical framework on comparing the theoretical models

*Note: (1): the knowledge-to-action framework, (2): The normalisation process theory, (3): Organizational model of innovation implementation, (4): Implementation drivers, (5): SPI implementation model, (6): Implementation stages, (7): Basic steps for initiating digital transformation, (8): Guideline for developing industry 4.0 business models, (9): The implementation process model

2.5 Empirical research into success and fail factors for ICT implementation

Previously, all the phases from the literature showed the importance of having a step-by-step approach while implementing ICT solutions. Next to this, several theoretical perspectives were described that could contribute to ICT implementation. However, it is key to also focus on empirical studies and point out specific factors that influence the success of an ICT implementation. This section summarizes success and fail factors proposed by nine different papers within the field of ICT implementation. All these papers were selected, because they did an empirical study on success and fail factors of ICT implementation. First, the papers are introduced, and then the dimensions that were created in this research are refuted, the distribution are shortly explained and most importantly, both the success factors and fail factors are provided in two overviews.

In order to construct a model for the implementation of ICT technologies, success and fail factors will be analysed. In the following, the success and fail factors gathered from the literature review are analysed and described. Next to this, the factors are distributed among five different dimensions to provide a clear overview. These dimensions were constructed by myself and are described in the following. All in all, a total of 50 success factors and 52 fail factors were identified, which are shown in table 2 and table 4. A summary of these factors is given in appendix 8 and 9. The most striking factors are discussed in the following part starting with the success factors and then continuing to the fail factors.

Table 1 shows the nine references and the number of success and fail factors the reference contained. One can see that reference one provided 8 success factors and 14 fail factors to the results of the literature review.

Table 1. References used for finding success/fail factors and frequency of mentions

Reference:	Success factors	Fail factors
1. Arendt, T. (2008)	8	14
2. Chow, T., & Cao, D. (2008).	18	13
3. Dhir, S., Kumar, D., & Singh, V. B. (2019).	8	11
4. Ebad, S. A. (2018).	-	18
5. Mehdian, R., & Hasdemzadeh, G. (2014).	-	21
6. Milis, K., & Mercken, R. (2002).	8	-
7. Niazi, M. (2015).	32	-
8. Niazi, M., Zowghi, D., & Wilson, D. (2003).	17	11
9. Wielicki, T., & Arendt, L. (2010).	-	8

2.5.1 The dimensions and distributions

In total the literature review provided 50 success factors and 52 fail factors. In order to distribute and make a clear overview five different dimensions were created. The dimensions were constructed based on the subjects of the different factors, so the factors can be distributed in a clear manner. The dimensions that were created are the managerial dimension, the process & communication dimension, the technical dimension, the knowledge dimension and the people dimension. Next to this, four different distributions were created. The success factors in literature are shown in distribution 1, the fail factors in literature are shown in distribution 2, the success factors in practice are shown in distribution 3 and the fail factors in practice are shown in distribution 4. In the following the dimensions will be explained.

The first dimension that is discussed is the managerial dimension. The success and fail factors that are distributed under this dimension have got everything to do with leadership and management. It is about the management itself, but also about the factors that need managing. For example, management support is one of the factors within this dimension, but it is also about facilitating the implementation process, creating a clear project plan and making sure that there are no unexpected high expenses. Moreover, it is about the management of expectations, the time estimations and the construction of teams and necessities.

The second dimension is called the process & communication dimension. It is about the processes and communication during the implementation process. It consists of more indirect factors that are influencing implementation processes, such as the size of an organization and the organizational politics. It includes internal process & communication factors, such as organizational culture and resistance to change, but also external factors, such as the insufficiency of suppliers. It is about culture, motivation, flexibility, communication, efficiency and many more of these factors that influence the implementation from a process & communication perspective.

The third dimension is called the technical dimension and is about the information and communication technologies, such as software and systems. It is about all factors that positively or negatively influence the technology itself. Examples are, a bad or good functioning system, loss of data and intermediate monitoring. On the other hand it is also about managing the requirements of the technologies needed and making a good selection or justification based on this.

The fourth dimension is called the knowledge dimension and has everything to do with the knowledge of individuals within the organisation. It can be about the presence of knowledge itself, but also about learning individuals the needed knowledge, by for example training, manuals and guidance. It is about keeping individuals up-to-date, but also about the knowledge gap in between developers and users. Moreover, the experience and competences of individuals is part of this dimension.

Lastly, the fifth dimension is called the people dimensions and is all about factors that have to do with the individuals themselves. It is about the involvement of employees in the implementation process and making their influence and ideas count. It is about looking into and focussing on usability of the implementations. It is about the user and

their needs and the factors surrounding these users, such as their mind set and their support towards the whole implementation. Teamwork is also part of this dimensions and managing the relationships in between individuals in these teams.

2.5.2 Success factors in literature

Throughout this literature review 50 success factors were selected. Table 2 contains all 50 success factors that were gathered. As one can see in table 1 not all references contained success factors, six out of nine references did contain them. The objective of this section is to identify and present the success factors from the conducted literature review. Exposing these factors could contribute to constructing the ICT implementation model.

Success factors or critical success factors "are the areas of your business or project that are vital to its success. Identifying and communicating success factors within your organization helps to ensure that your business or projects is focused on its aims and objectives (The Mind tools content team, 2019)". It is important to identify these success factors throughout the literature in order to get an overview of what factors are considered to bolster a successive implementation of ICT. According to Niazi (2015), who focuses on software process improvements and implementations, states that in order to successfully implement any kind of software initiative, the awareness on factors that could influence success should increase. These factors can influence projects in a positive manner and should be explicitly outlined before the actual implementation starts (Niazi, 2015). The knowledge surrounding these success factors could contribute to improved effectiveness in finding the solution for a problem and effectively implementing this solution. Finding the appropriate ICT solution for a problem is essential for successfully diseasing the problem. Milis & Mercken (2002) compare it to the pharmaceutical world in which the combination of a good diagnosis and prescribing the right drug could cure a patient. However, a combination of a wrong diagnosis and drug could be fatal.

The success factor that was mentioned most was "senior management commitment/support". This factor was mentioned 5 times, meaning that 5/6 or 83% of the papers mentioned this factor. According to these references it is essential that the management is committed and supports to implementation project. Chow & Cao (2008) tested successfulness of agile software developments and researched the existence of a strong management commitment and concluded that it is a critical success factor, which positively contributes to successful agile software development projects.

Moreover, encouraging communication, cooperative culture and training and mentoring were each mentioned in four references out of the six (67%). Communication throughout the implementation process is key to success according to these references. Good and encouraging communication is vital for the acceptance of anything that is new (Milis & Mercken, 2002). Moreover, a cooperative culture happens to influence implementation processes positively as well. When the culture within the business is very traditional it could negatively influence the success of new implementations. According to Milis & Mercken (2002) it is harder to make cultural changes than technical changes, because a culture influences every facet of the organisation, which includes, for example, management styles, attitudes and adaptability to change. That is why; a

cooperative organizational culture that empowers innovations and changes instead of a hierarchical traditional organizational culture is key to successfully implement (Chow & Cao, 2008). Lastly, training and mentoring was also mentioned four times during in this literature review. Arendt (2008) argues that most of the time businesses don't have people with the right and sufficient ICT knowledge. "Therefore, there is even a greater need for owner-managers to invest in the training of each employee to help them to gain the basic skills that might facilitate an easier implementation of e-Business solutions suited to each company (Arendt, 2008)".

Next to this, five success factors were mentioned three times throughout the references. These are, "proper project resources", "reviews/testing", "experienced staff", "regular meetings" and "teamwork". Moreover, the other 41 success factors were mentioned ones or twice throughout the references.

One can see that the managerial dimension has the most mentions. The managerial dimension indicates factors that are related to managing an implementation process and about leadership. It is about a clear project plan and clear and relevant implementation goals, but on the other hand, it is also about management commitment and support. The factors represented under the managerial dimensions were mentioned 28 times in the literature review. It indicates and outlines the importance of the dimensions as stated in literature. It suggests potential for success within this dimension.

Table 2. Distribution 1 "success factors in literature"

Success factors in Literature	Frequency	Success factors in Literature	Frequency
1. Managerial	**28**	3.3 ICT requirements management	1
1.1 Senior management commitment/support	5	3.4 project requirement management	1
1.2 Creating process action teams/change agents and opinion leaders	2	3.5 Monitoring	1
1.3 Clear and relevant implementation goals	2	**4. Knowledge**	**22**
1.4 Process ownership	2	4.1 Training and mentoring	4
1.5 Managing the implementation project	2	4.2 Experienced staff	3
1.6 Internal leadership	2	4.3 Providing enhanced understanding	2
1.7 Clear project definition	1	4.4 Regular meetings	3
1.8 Clear project plan	2	4.5 Understanding process and issues	1
1.9 Clear project team	2	4.6 Awareness for ICT implementation	1
1.10 Proper project resources	3	4.7 Analysis	1
1.11 Change management	1	4.8 External implementation agents	1
1.12 Defined implementation methodology	1	4.9 Team member with competence	1
1.13 Continuous process improvement	1	4.10 Knowledge of management	1
1.14 Facilitation	1	4.11 Post budget evaluation	1
1.15 Implementation management	1	4.12 post risk analysis	1
2. Process & Communication	**18**	4.13 Skilled personnel	1
2.1 Staff involvement	2	4.14 Knowledge among personnel	1
2.2 Encouraging communication	4	**5. People**	**14**
2.3 Reward schemes	2	5.1 Staff time and resources	2
2.4 Clear standards and procedures	2	5.2 Tailoring improvement initiatives	2
2.5 Cooperative culture	4	5.3 Implementation people well respected	2
2.6 Motivation	2	5.4 Managing relationships	2
2.7 Visible success	1	5.5 Teamwork	3
2.8 High staff moral	1	5.6 Usability	1
3. Technical	**8**	5.7 User involvement	1
3.1 Reviews/testing	3	5.8 User influence	1
3.2 Good selection and justification (system)	2		

2.5.3 Fail factors in literature

Throughout this literature review 52 fail factors were identified. Table 3 contains all 52 fail factors that were gathered. As one can see in table 1 not all references contained fail factors, seven from the nine references did contain them. The objective of this section is to identify and present the fail factors from the conducted literature review. Exposing these factors could contribute to constructing a successful ICT implementation model.

Fail factors or barriers are the opposite of success factors. As previously mentioned "success factors are the areas of your business or project that are vital to its success. Identifying and communicating success factors within your organization helps to ensure that your business or projects is focused on its aims and objectives (The Mind tools content team, 2019)". On the other hand, fail factors or barriers are factors that contribute to the failure of an implementation and that should be overcome (Wielicki & Arendt, 2010). Barriers and fail factors can discourage businesses to adapt and implement ICT solutions. Arendt (2008) claims that barriers and fail factors of ICT implementation makes it more likely for business to stay on the wrong side of the digital divide. In his paper, it is stated that the digital divide contains businesses that are connected and businesses that are not connected. The wrong side entails all businesses that are not connected. Moreover, fail factors and barriers disable businesses to get on the right side of the digital divide by successfully implement ICT implementations.

The fail factor that was mentioned the most was the lack of (management) support. This fail factor was mentioned in five of the seven references. Meaning that 71% of the references mentioned this. Most of the times the lacking support was focussed on the lack of management support, however, multiple different supports were mentioned, such as lacking vendor support or user support (Ebad, 2018). According to his research, lacking support from all areas can increase the probability of failures within the ICT implementation process. One of the examples that were mentioned was during one of his interviews. One of the interviewees said the implemented system was down and the internal knowledge amongst employees was lacking and the vendor support was minimal, because of the geographical distances in between them.

That brings us to the fail factors that were mentioned four times. These were a lack of planning, inexperienced (IT) staff members and lacking knowledge. Lack of planning is a very important factor for failure. Without appropriate planning it is hard to make good estimates of resources, costs, and schedules (Ebad, 2018). According to Niazi, Wilson & Zowghi (2003), software process improvement implementations without clear planning will lead to chaotic situations, which leads to uncertainty. Inexperience (IT) staff members are also one of the fail factors that were mentioned four times. Having inexperienced staff members can undermine the success of implementations. Without the knowledge of change and implementation already rooted within the staff, resistance is more likely to happen (Niazi, Wilson & Zowghi, 2003). Lastly, lacking knowledge is one of the key factors for failure of ICT implementations. Without the right information and knowledge it becomes harder to find the right ICT solutions. Especially in SME's a lack of human capital resulting from lack of knowledge and skills results into an increasing chance of failure (Arendt, 2008).

Next to this, six fail factors were mentioned three times throughout the references. These were: “unclear (cost) estimates in initial stage”, “financial limitations/lacking funds”, “traditional organizational culture”, “lack of (human) resources”, “changing the mind-set of management and technical staff” and “lack of user participation”. The other 42 fail factors were mentioned ones or twice.

One can see that just like the success factors part, the managerial dimension has the most mentions. The managerial dimension indicates factors that are related to managing an implementation process and about leadership. It is about the size of the project, high expenses and lack of consensus among managers. On the other hand, it is about instability in the management team and a lack of a clear goals and project management. The factors represented under the managerial dimensions were mentioned 42 times in the literature review. This is more than two times the amount that was mentioned in the second most mentioned dimension. It outlines the possibility for failure and the potential for bypassing these fail factors by looking into them and recognizing them.

Table 3. Distribution 2 "fail factors in literature"

Fail factors in Literature	Frequency	Fail factors in Literature	Frequency
1. Managerial	**42**	2.7 Insufficient suppliers	1
1.1 Implementation gets in the way of real work / ignoring organizational objectives	2	2. 8 Endangering job security	1
1.2 Lack of support (from management)	5	2.9 Lack of intention to change	2
1.3 Failure to identify all stakeholders	1	2.10 Organizational culture (traditional)	3
1.4 Misunderstanding requirements	2	2.11 Organisation size	1
1.5 Lack of planning	4	2.12 Lack of flexibility	2
1.6 Unclear (cost) estimates in initial stage	3	**3. Technical**	**9**
1.7 Unclear objectives	1	3.1 Too much paperwork required	1
1.8 Size of project	1	3.2 Using inappropriate testing tools	1
1.9 Lack of consensus among managers	1	3.3 Using new technology	1
1.10 Lack of attention to organizational behaviour	1	3.4 Poor quality code	1
1.11 Lack of awareness in management team	2	3.5 Inappropriate implementation	2
1.12 High expenses	2	3.6 Complexity of the system	1
1.13 Instability in executive team	2	3.7 Lack of suitable software	2
1.14 Financial limitations/lack of funds	3	**4. Knowledge**	**15**
1.15 Conflict in executive team	2	4.1 Lack of (human) resources	3
1.16 Lack of agreement with organizational needs	2	4.2 Inexperienced (IT) staff	4
1.17 Difficulty in justifying expenses	1	4.3 Lack of knowledge	4
1.18 Lack of long-term vision/strategy	2	4.4 Lack of understanding of business processes	1
2.1.19 Lack of an information system plan	2	4.5 Lack of skilled employees	2
1.20 Lack of clear project scope	2	4.6 Lack of standard operating procedures	1
1.21 Lack of project management competence	1	**5. People**	**11**
2. Process & Communication	**20**	5.1 (IT) staff turnover	2
2.1 Time pressure/unrealistic time schedules	2	5.2 Changing the mind-set of management and technical staff	3
2.2 Organizational politics	2	5.3 Lack of user participation	3
2.3 Negative/bad experience	2	5.4 Conflict between users	1
2.4 Poor communication	2	5.5 Lack of teamwork	1
2.5 Weak rules and regulations	1	5.6 Lack of interest in changing	1
2.6 Lack of good infrastructure	1		

3. Methodology

This section will explain the methods used in this research in order to answer the research question. The goal of this research is to find existing ICT implementation models and success and fail factors of ICT implementation in theory and in practice. The methods used in order to select the data in practice are provided in this section.

The research design is described in the first section. After the research design an interview guide is provided, followed up by all relevant information about the participants of the conducted interviews. Lastly, the relevant information in regards to the analysis is provided.

3.1 Research design

The research consists of open-ended interviews with 25 participants. In order to make sure that the answers were usable the critical incident technique (CIT) proposed by Flanagan (1954) was used. "The critical incident technique is a well proven qualitative research approach that offers a practical step-by-step approach to collecting and analysing information about human activities and their significance to the people involved" (Lipu, Williamson & Lloyd, 2007, p. 53). The critical incident technique is about critical incidents observed by the participant. In the case of this research, the critical incidents are the ICT implementations. The participants were specifically asked about success and fail factors in ICT implementations that they had experienced and the argumentation on the thing that failed or succeeded. These incidents were asked in open-ended questions. The main benefit of open-ended questions is to encourage deeper learning (Bais, Hussain & Samad, 2012). The participants are not already steered into a direction by the possible answer options (Züll, 2016).

The combination of both open-ended questions and asking about critical incidents steers the participants' reaction into the right direction while maintaining a wide range of possible answer options, because of the open-ended questions. It enabled me to receive the answer that I was looking for with the extended answer options of the open-ended questions.

3.2 Interview guide

The interview guide is about the purpose of the interview and discusses all the details of the interview including preparations and setting. The interview conducted in this research consists of multiple parts. The steps of Bolderston (2012) were used as preparation for the interview process. The whole interview can be found in appendix 1.

First the participants were introduced to the essence of the research, the importance of the interview and about the questions that were asked. After this, the interview started. Firstly, the participants were asked about general information regarding education, age and job title. Next, the interview focussed on the introduction of ICT by using general questions related to ICT implementations. The interview proceeded by asking about a failed and succeeded ICT implementation and its argumentation. Follow up questions

were used in this part to get all the relevant information from the participants. Lastly, the participants were asked about their general thoughts on success and fail factors for ICT implementations. This part consisted of an open discussion in which thoughts were shared about the relevance of some factors during ICT implementations.
In general the interviews took roughly 30 minutes per participant and were preferably conducted by face-to-face meetings. However, a lot of the interviews were done via video meetings, because of the COVID-19 measures.

All in all, the interview is constructed with care to make sure that the participants felt comfortable and achieve the best possible understanding of the topic to promote validity and reliability of their answers. The whole interview script can be seen in appendix 1.

3.3 Participants

The first selection criterion for the participants was knowledge based. The participant should exhibit some basic knowledge of ICT implementation. Next, they should have had experienced at least one full ICT implementation process during their working career. Moreover, I aimed to interview participants from different areas, so from different departments, companies and if possible, regions in the Netherlands. In order to receive a rich set of data, the aim of the research was to interview at least 20 participants.

A total of 25 participants were interviewed of which four were female and the rest were male. It means that 84% of the participants were male and 16% was female. Moreover, participants from different ages were interviewed the average age of all participants was 31.1 years old, with the youngest being 21 and the oldest 64. All participants are shortly described in appendix 2 and 3 in which their characteristics are described.

To make sure that a wide variety of different participants were interviewed it was key to make sure that multiple participants from different disciplines and companies were interviewed. In total, three HR advisors were interviewed, which were all from different companies. Moreover, two sales employees, an outbound customer advisor, a back office employee, a recruiter, an administrative assistant, a customer service employee, a supply chain planner and an EPA advisor were interviewed. Furthermore, interviews were also conducted with participants who are active in managerial functions, such as two project managers both working for different organisations, a business manager, a management trainee, a client manager and a head of production. Lastly, there was also a discipline of work originated by ICT implementation with function such as; two online marketers working in different organisations, two online technical advisors, an online editor, an online product content specialist and an information security consultant.

All participants were asked about the amount of ICT implementation that they have experienced. The answers ranged from 1 to 35 experienced ICT implementation with an average of 8.1 per participant. Next to this, the participants were asked to state the percentage of ICT implementations that were a success. The answers ranged from 20% to 100% success rate, with an average of 71%. The full characteristics can be found in appendix 4.

The first contacts with the participants were made via LinkedIn or WhatsApp. These mediums were used to send a message in which the research was shortly explained and the expectations of the participants were shortly discussed. Before sending this message, I looked into their LinkedIn to find out the likelihood of the knowledge of ICT implementations. Most of the participants are from my own network, so I already knew whom I was talking to and what background they had.

3.4 Analysis

Mortensen (2020) provides a step-by-step approach on the analysis of interview results. These steps were used to analyse the results from the interviews. Firstly, the audio recordings had to be transcribed in order to work with the data later on. The audio was recorded and transcribed into word documents immediately afterwards. The preliminary ideas for coding were thought about by going through the interview results and making notes of the answers. Initial codes were generated, which are short descriptions of the topic that were talked about in the interview. A start was made in organizing the results. It is key to put the codes into themes. Otherwise it will just be a very comprehensive list of factors. Multiple factors were combined and distributed in a clear manner. Afterwards, these themes were reviewed and refined. The codes were punctually looked at and fitted to the proposed themes. Next, the themes were made concrete and official. All the themes were analysed and the most fitting themes were selected and the codes are distributed amongst them. In this research, the themes are named dimensions and the codes are the success factors and fail factors. The full explanations of the dimensions can be found in sections 2.4. After the transcription of the results, the conclusions could be drawn and the comparisons with the data from literature were drawn.

4. Results

This section will explain the results of the interviews. First, the success factors that were mentioned in the interviews are provided. Next, the fail factors mentioned in the interviews are given. One can find all the relevant information of the participants in appendix 3, 4 and 5.

4.1 Success factors in practice

After conducting the interviews a total of 214 success factors were mentioned, but due to overlap, 46 unique success factors were mentioned. Table 4 shows all 46 success factors that were gathered. Next to this, appendix 5 shows the number of success factors, fail factors and total factors that each participant provided. The objective of this section is to identify and present the success factors that were gathered from the interview sessions. Exposing these factors could contribute to constructing the ICT implementation model.

The success factor that was mentioned the most was “good communication”. It was mentioned 21 times, meaning that 84% of the participants mentioned this factor. Communication was used as an umbrella term for multiple facets of. Employees should know what they are up to at the start of an ICT implementation and shouldn’t be lacking behind. On the other hand, some participants mentioned internal communication as important while others explicitly had experiences with external communication, in between an external consultant and the employees. Moreover, some participants mentioned communication after the ICT implementation was introduced, so related to sustainment of the ICT implementation. Next to this, some participants thought communication was needed in order to be transparent. Participant 4 mentioned: “the open communication and transparency of the ones in charge made sure that all the changes were clear”. All in all, the success factors “good communication” was about different forms of communication and was used as an umbrella term to collect the data under one factor. At the end, it all came down to having efficient and good communication.

Moreover, both “(online) training” and support base were the second most mentioned success factors in the interviews. Both were mentioned 14 times, indicating that 56% of the participants mentioned these factors. Trainings were considered to be essential by some participants. Participant 7 spoke from his own experience when he said, “it was very good that we got training sessions in order test out the new software system”. Some mentioned that trainings should be considered at the start of the process in order to gain theoretical and practical knowledge about the ICT implementation. Moreover, some mentioned that trainings were needed throughout the whole process in order to sustain theoretical and practical knowledge and to keep using the ICT implementation in a successful manner. Next to this, it was also mentioned that trainings should be considered after small or large changes and updates to the implementation. Next to this, the support base was considered to be very important in the interviews. Participant 12 even named it “the biggest problem to control, especially in a big organisation”. He added to this by stating that without a support base, employees are not going to use the software. Most of the participants had experiences with the support base in a beneficial

or unfavourable manner. It was told that the individuals that have to use the ICT implementation should consider the implementation as added value. When individuals can see the benefits of an ICT implementation they are more likely to embrace the implementation rather than to neglect it. It was mentioned that knowledge and transparency amongst individuals is key to create this support base.

Table 4. Distribution 3 "success factors in practice"

Success factors in Practice	Frequency	Success factors in Practice	Frequency
1. Managerial	**45**	3.3 Testing	3
1.1 Good estimation of time	7	3.4 Alignment between departments	2
1.2 Good estimation of (user) needs	9	3.5 Intermediate monitoring	3
1.3 Pronounce expectations clearly	5	3.6 Document the changes	1
1.4 Good estimation of budget	5	3.7 Well functioning system	4
1.5 Presence of change board	1	**4. Knowledge**	**72**
1.6 Responsibility of essential persons	2	4.1 Good education	12
1.7 Expectation management	5	4.2 (Online) training	14
1.8 Clear division of roles	3	4.3 Training for new updates/aftercare	8
1.9 Clear planning	5	4.4 Guidance	5
1.10 Good estimation of activities	3	4.5 Presence of knowledge (essential persons)	8
2. Process & Communication	**39**	4.6 Involvements experts	2
2.1 Good communication	21	4.7 Personal assistance employees	3
2.2 Adaptive/innovative culture	4	4.8 Conducting pre-research	3
2.3 Clarity	2	4.9 Having a good manual	8
2.4 Substantiated timing	2	4.10 Information provision (oral)	1
2.5 Smooth process	1	4.11 Involving people with experience	3
2.6 Manage external factors	1	4.12 Employees are up-to-date	2
2.7 Transparency	1	4.13 Good introduction towards employees	2
2.8 Stability	2	4.14 Information easily accessible	1
2.9 Healthy pressure	2	**5. People**	**40**
2.10 Efficiency	2	5.1 Involve the right persons (users, employees)	13
2.11 Affinity with the implementation	1	5.2 Support base users/employees	14
3. Technical	**18**	5.3 Focus on users/usability	10
3.1 Small changes per time	2	5.4 Point of contact	3
3.2 Integrating systems	3		

Thirdly, “involve the right individuals” was mentioned 13 times. Indicating that 52% of the participants mentioned this. Just like more factors it is an umbrella term, because it indicates a wide range of individuals. However, it was restricted to the internal individuals such as employees and management. It is important that management is involved. On the other side, it is essential that users and employees are involved in the whole process in order to increase efficiency. Pilots could be used, in which users share share their experiences, which could contribute to increase the usability of the implementation.

One can see that the knowledge dimensions stands out with 72 mentions in table 4. The knowledge dimension indicates everything related to the knowledge of individuals within the organisation. It is about knowledge of personnel in general and about learning and training possibilities in order to gain the relevant knowledge.

4.2 Fail factors in practice

After conducting the interviews a total of 159 fail factors were mentioned, but due to overlap, 38 unique fail factors were mentioned. Table 5 shows all 38 fail factors that were gathered. The objective of this section is to identify and present the fail factors that were gathered from the interview sessions. Exposing these factors could contribute to constructing the ICT implementation model.

The fail factor that was mentioned the most was "incomplete communication". This factor was mentioned 18 times, meaning that 72% of the participants mentioned this as a fail factor. As previously mentioned in the section of the success factors, communication is an umbrella term for multiple facets of communication. Communication is related to internal communication, external communication, transparency and sustainment. To provide one example, participant 15 pointed out the importance of external communication as he mentioned that incomplete communication with the customers is one of the fail factors.

Secondly, resistance and a lacking support base were the second most mentioned fail factor during the interviews. Twelve participants mentioned the fail factor of a lacking support base and resistance. This indicates that 48% of the participants mentioned this fail factor during the interviews. A lacking support base and resistance can break an ICT implementation, if individuals don't see the potential of an implementation and are resistant for implementation, it could hold back the efficiency of the implementation.

Thirdly, there were four fail factors that were mentioned eight times during the interviews. These are: wrong estimation of budget, lacking knowledge of essential persons, lack of usability and wrong estimation of user needs. All of these factors were mentioned eight times, meaning that 32% of the participants mentioned one of these factors. Firstly, the wrong estimation of budget could lead to pitfalls in a later stage. On the one hand, an ICT implementation can be more expensive than expected. Participant 2 pointed out the estimation of the budget is one of the things that are going wrong regularly. If you cannot afford these expenses, because it was simply not taken into account when drawing up the budget, it could lead to not completing the whole ICT implementation process. On the other hand, a wrong budget could lead to spending more money than expected, which could result in cutting costs on another level. Secondly, the lacking knowledge of individuals could result in individuals that are not using the ICT implementation in the right way. The technology could be successfully implemented, however, if individuals don't use it in the right way, it could still result in failure. Moreover, a lack of usability could result in resistance amongst employees. On the other hand, it could decrease efficiency, because the ICT implementation is lacking usability. Lastly, a wrong estimation of user needs is also an important factor. It could lead to an ICT implementation that is not needed, or doesn't tackle the initial problem. Participant 19 was one of the persons that emphasised this strongly by stating that it is essential to involve users in the implementation process from start to finish, this is the key to tackle this problem.

Table 5. Distribution 4 "fail factors in practice"

Fail factors in Practice	Frequency	Fail factors in Practice	Frequency
1. Managerial	**35**	3.4 (dis) integrating systems	4
1.1 Wrong estimation of budget	8	3.5 Bad performance of idea	3
1.2 Incomplete planning	6	3.6 Delays	4
1.3 Wrong estimation of time/time pressure	6	3.7 Loss of data	1
1.4 Lack of (inclusive) pre research	2	3.8 Bad functioning system	2
1.5 Wrong estimation of necessities	3	**4. Knowledge**	**32**
1.6 Lacking overview implementation	2	4.1 Lacking knowledge essential persons	8
1.7 Wrong team formation	2	4.2 Knowledge gap between developer and user	4
1.8 Lack of expectation management	3	4.3 Employees are not up to date	3
1.9 Wrong estimation of activities	2	4.4 Lacking experience	3
1.10 Wrong estimation of scope of project	1	4.5 No manuals/bad manuals	6
2. Process & Communication	**27**	4.6 Lack of training	6
2.1 Incomplete communication	18	4.7 Detect issues not in time	2
2.2 Conservative culture	4	**5. People**	**39**
2.3 Miscommunication inter & extern	1	5.1 Lacking input of (key) users	7
2.4 Lack of support	2	5.2 To many external persons involved	2
2.5 Manage external factors wrongly	1	5.3 Lack of usability	8
2.6 Lack of continuity	1	5.4 Wrong estimation user needs	8
3. Technical	**26**	5.5 Divergent interest of departments/employees	1
3.1 Manual actions	4	5.6 Lacking support base/resistance	12
3.2 Align different departments	4	5.7 Human mistakes	1
3.3 Complexity	4		

One can see in table 5 that the all dimensions are mentioned in between 26 and 39 times, meaning that they mentions are very equally distributed. However, the people dimension appears to be the highest with 39 mentions. This dimension is all about factors that have to do with the individuals themselves. It is related to usability, the involvement of employees in the process and the support of individuals towards the implementation

5. Discussion

In this section both the factors gathered from literature and from the interviews are compared. The most noticeable differences and comparisons will be exposed, resulting into an ICT implementation process model summarizing all factors and distributing them among stages in an ICT implementation model. Next to this, the limitations and suggestions for future research are given, followed up by a conclusion.

5.1 Comparing theory with practice

First, the success factors in both the literature and the interviews are compared. Afterwards, the same is done for the fail factors. Afterwards, an overview is provided of both success and fail factors in theory and in practice.

5.1.1 Success factors

Firstly, a small summarization of the success factors in literature is provided in the following. During the literature review a total of 50 distinctive success factors were found. A total of six different researches mentioned them. In section 2.5.2, one can see all success factors in a distribution. In accordance to the information stated and distributed in table 2, the dimensions that was mentioned the most was the managerial dimensions. This showed that factors dealing with management and leadership are represented the most in theory. It is about management decisions, support and perseverance. At the end of the day, the factors of the managerial dimension were mentioned a total of 28 times during the literature review. The knowledge dimension was mentioned 22 times, followed by the process & communication dimension (18 times). Lastly, the people dimension was fourth with 14 mentions and the technical dimensions was mentioned the least (8 times). The most mentioned individual factor was “senior management commitment/support” with 5 mentions, meaning that 83% of the papers stated this factor. It was argued that the support of the management in the whole ICT implementation process is important.

Secondly, the success factors mentioned during the interviews are summarized in the following. A total of 25 participants were interviewed during the interview sessions. A wide range of ages, job titles and experiences were interviewed to collect a variety of data. One can see all success factors that were mentioned during the interview session in table 4, and the explanation in section 4.1. During these 25 interviews, 214 success factors were mentioned, but due to overlap, it came down to 46 distinctive success factors. One can see that the knowledge dimension was mentioned the most during the interview session. This indicates that the participants mentioned factors regarding knowledge of individuals within the organisation the most. The factors among this dimension are about knowledge of personnel in general and about learning and training possibilities in order to gain this relevant knowledge. The success factors of the knowledge dimension were mentioned a total of 72 times. Moreover, the factors within the managerial dimension were mentioned 45 times, followed by the people dimensions (40 times). Lastly, the process & communication dimension followed closely with 39 mentions and the technical dimensions was mentioned the least (18 times). The success

factor that was mentioned the most was “good communication”, which was mentioned by 84% of the participants.

One can notice that there are several comparisons and differences in between the results from the literature review and the interviews. First of all, the cumulative mentions of the factors were different. As stated before, the cumulative mentions of success factors in practice (SF_P mentions) were 214. On the other hand, the total amount of cumulative mentions in literature (SF_T mentions) was 90. However, because of overlapping factors, it is also interesting to state the amount of unique factors. The literature review on success factors (SF_T factors) had 50 unique success factors while the participants came up with 46 unique success factors (SF_P factors). One can see that the interviews provided more data than the literature review that is why a relative distribution is created in table 6 in order to provide a valid comparison in between both the unique success factors and the cumulative mentions. This distribution provides an overview of the division of success factors amongst the five dimensions.

One can see the relative distribution of cumulative mentions (SF_T mentions) and the factors mentioned per dimensions (SF_T Factors) in the literature review in table 6. In both the managerial dimension is mentioned the most. One can argue that theory’s main focus is on factors that can be put into the managerial dimension. One could argue that things related to management are the most important in the success of an ICT implementation. Possible reasons for this focus on management can be the resistance to change of the management, a traditional focus on old processes, the mind set of the management or a limited supply of resources provided by the management.
On the other hand, the relative distribution of cumulative mentions in the interviews (SF_P mentions) and the amount of factors mentioned per dimensions (SF_P Factors) can be seen in table 6 as well. In both, the participant’s main focus is on factors that have to do with the knowledge dimension. The participants’ main focus was about factors that belong to knowledge. Reasons for this were provided during the interview sessions. It was argued that without knowledge, the employees don’t know the true benefit of the ICT implementation and could be resistant to changing. On the other hand, a lack of knowledge could also lead to wrong use of the implementations. Training sessions, guideline and manuals were stated as possible solutions.

Based on this knowledge, one can state that there is a difference in between theory and practice. Theory focuses mainly on factors that belong to the managerial dimension, although the knowledge dimension is also mentioned a lot. On the other hand practice focuses mainly on factors that belong to the knowledge dimensions.

Table 6. Relative distribution success factors

Dimension	SF_T mentions	SF_P mentions	SF_T Factors	SF_P Factors
Managerial	28 (31%)	45 (21%)	15 (30%)	10 (22%)
Process & communication	18 (20%)	39 (18%)	8 (16%	11 (24%)
Technical	8 (9%)	18 (8%)	5 (10%)	7 (15%)
Knowledge	22 (24%)	72 (34%)	14 (28%)	14 (30%)
People	14 (16%)	40 (19%)	8 (16%)	4 (9%)
Total:	**90**	**214**	**50**	**46**

***SF_T = Success Factors Theory / SF_P = Success Factors practice**

5.1.2 Fail factors

As done for the success factors in the previous section, a summarization of the fail factors in theory is given in this section. During the literature review 52 fail factors were found. In total, seven from the nine papers mentioned a wide range of different fail factors. One can see all fail factors mentioned in table 3. During the literature review, one could see that the factors amongst the managerial factors has the most cumulative mentions, indicating that factors, which are dealing with management and leadership were mentioned the most in theory. As stated before, the factors are about managerial decisions, support and perseverance. The managerial dimension was mentioned 42 times during the literature review. Next to this, the process & communication dimensions (20 times) and the knowledge dimension (15 times) were the second and third most mentioned. Moreover, the people dimension was mentioned 11 times and the technical dimension was only mentioned 9 times. The most mentioned fail factor was the "lack of (management) support: with five times, meaning that 71% of the researches mentioned this factor. Non-Supportive management seemed often to be the cause of ICT implementation failures.

Secondly, the fail factors that were mentioned in the interviews are summarized in this section. A total of 25 participants were interviewed during these interview sessions. As stated before a wide range of characteristics were selected in order to get a variety of data. One can see all the fail factors in practice and its explanations in the previous sections. A total of 159 fail factors were gathered throughout the interviews. However, due to overlap, 38 unique fail factors were found. The cumulative mentions of the dimensions for this distribution were the closest to each other. At the end of the day, the people dimension came out to be the most mentioned fail factor during the interviews with 39 cumulative mentions. It indicates that the participant argued that the individuals in organisation as the most important fail factor. It involves, usability, the involvement of users in the process and support of individuals towards the implementation process. Next to this, the managerial dimension and the knowledge dimension followed closely with 35 mentions and 23 mentions. Lastly, the process & communication dimension was mentioned 27 times and the technical dimensions were mentioned 26 times. The fail factor that was mentioned the most was "incomplete communication", which was mentioned by 72% of the participants. Pointing out the importance of focussing on the right communication.

Again, it is noticeable that there are several comparison and differences in between the results from the literature review and the interviews. First of all, the cumulative mentions of the factors were different. As stated before**,** the total amount of cumulative mentions in literature (FF_T mentions) was 97. On the other hand, the cumulative mentions of the fail factors in the interviews (FF_P mentions) were 159. However, because of overlapping factors, it is also interesting to state the amount of unique factors. The literature review on fail factors (FF_T factors) had 52 unique fail factors while the participants came up with 38 unique fail factors (FF_P factors). One can see that the interviews provided more data than the literature review that is why a relative distribution is created in order to provide a valid comparison in between both the unique fail factors and the cumulative mentions. This distribution provides an overview of division of fail factors amongst the five dimensions.

Table 7 shows the relative distribution of cumulative mentions of fail factors (FF_T mentions) and the distribution of unique factors (FF_T Factors) in the literature review. One can look into this relative distribution for mentions and argue that theory's emphasis is on fail factors that can be put in the managerial dimensions. The managerial dimension had 43% of de total cumulative mentions from the literature review. This observation is strengthened by the amount of unique factors that belong to the managerial dimension (40%). Noticeable is that for both the success and fail factors in literature the managerial dimension is mentioned the most. As mentioned before, it indicates the importance in theory of factors regarding management.

On the other hand, table 7 also shows the relative distribution of cumulative mentions of fail factors (FF_P mentions) and the distribution of unique factors (FF_P factors) in the interviews. One can see that there is a difference in between cumulative mentions and unique factors in the interviews. The people dimension was mentioned the most, but the managerial dimension has the most unique factors. It shows the importance of the factors that belong to the people dimension. Factors like, "lacking support base", "lacking usability" and "lacking input of key users" were mentioned a lot. However, the most unique factors belonged to the managerial dimension, which shows that the widest range of factors were mentioned regarding management.

Table 7. Relative distribution fail factors

Dimension	FF_T mentions	FF_P mentions	FF_T Factors	FF_P Factors
Managerial	42 (43%)	35 (22%)	21 (40%)	10 (26%)
Process & communication	20 (21%)	27 (17%)	12 (23%)	6 (16%)
Technical	9 (9%)	26 (16%)	7 (13%)	8 (21%)
Knowledge	15 (15%)	32 (20%)	6 (12%)	7 (18%)
People	11 (11%)	39 (25%)	6 (12%)	7 (18%)
Total:	**97**	**159**	**52**	**38**

***FF_T = Fail Factors Theory / FF_P = Fail Factors practice**

To conclude one can see that the managerial dimension is mentioned the most in literature. Both the cumulative mentions and the unique factors for the success and fail factors of the managerial dimension are represented the most in literature, indicating that literature focuses mostly on factors regarding management and leadership. On the other hand, the outcomes of the interviews differed. One can see that the knowledge dimension has the most attention when participants were talking about success factors. Both the cumulative mentions and the unique success factors of this dimension were mentioned the most during the interviews. On the other hand, one can see that the most cumulative mentions for fail factors where located in the people dimensions. However, the most unique fail factors where mentioned in the managerial dimensions, indicating a wide range of different factors regarding management and a lot of mentions for factors regarding the people dimension.

5.2 Practical implications

In this section an ICT implementation process model consisting of five stages is proposed. All the success and fail factors that were collected in this research were distributed amongst these stages to provide an overview of the factors for each stage in the ICT implementation process.

The goal of this research is to create something tangible with practical relevance for the readers. In order to do so, the results from the literature review and all the interviews are combined and summarized into an ICT implementation model. The stages that were constructed in section 2.4 are used again. The model in section 2.4 consisted of all the phases and stages of the process and theoretical models, which isn't the case in the ICT implementation process model proposed in this section. The ICT implementation process model consists of all factors that influence ICT implementation, which were gathered throughout this research. It means that all factors are distributed amongst the different stages: recognition, preparation, pre-implementation, implementation and sustainment. It means that over 200 different factors are distributed into the model. I chose to do this by creating four different types of factors for each stage referring to the four distributions provided in this research. Namely: SF_L, which stands for success factors in literature, FF_L, which stands for fail factors in literature, SF_P, which stands for success factors in practice and FF_P, which stands for fail factors in practice. The collected factors are distributed amongst all stages, meaning that every stage consists of success factors and fail factors, both in theory and practice. In addition, some factors where important throughout the whole ICT implementation process. Hence, numbers 1.6/2.6/3.6/4.6 are shown in the overlapping box at the bottom of the framework. The specific factors that belong to each categorisation are provided in appendix 10.

The ICT implementation model is designed to provide a clear and accessible overview of factors that can positively or negatively influence an ICT implementation per stage. It shows the importance of factors from the starting stages until the ending stages. It is recommended for organisations to look into the model and use it as a guideline for their ICT implementation processes. The end goal of the ICT implementation model is to provide a clear model that should positively contribute to organisation's successes in implementing ICT implementation. It should make sure that an increasing amount of ICT implementations are completed successfully.

Stage 1: Recognition	Stage 2: Preparation	Stage 3: Pre-implementation	Stage 4: Implementation	Stage 5: Sustainment
1.1 SF_L for recognition stage	1.2 SF_L for preparation stage	1.3 SF_L for pre-implementation stage	1.4 SF_L for implementation stage	1.5 SF_L for sustainment stage
2.1 FF_L for recognition stage	2.2 FF_L for preparation stage	2.3 FF_L for pre-implementation stage	2.4 FF_L for implementation stage	2.5 FF_L for sustainment stage
3.1 SF_P for recognition stage	3.2 SF_P for preparation stage	3.3 SF_P for pre-implementation stage	3.4 SF_P for implementation stage	3.5 SF_P for sustainment stage
4.1 FF_P for recognition stage	4.2 FF_P for preparation stage	4.3 FF_P for pre-implementation stage	4.4 FF_P for implementation stage	4.5 FF_P for sustainment stage
6. Overlapping elements	1.6 SF_L overlapping elements - 2.6 FF_L overlapping elements 3.6 SF_P overlapping elements - 4.6 FF_P overlapping elements			

Figure 2. ICT implementation model

5.3 Limitations and suggestions for future research

Due to reasons, such as COVID 19, it was hard to find people willing to participate. Next to this, most of the interviews took place online in an online meeting, which is not as direct as a face-to-face interview. Personally, I think the data set would be richer, more valid and reliable, if I could conduct all interviews face-to-face. This observation was confirmed by the interviews that were conducted face-to-face. Participants were able to talk more and felt more comfortable in answering the questions. Another limitation is about the demographic distribution of the participants. All participants were from the Netherlands, and a lot of them from eastern Netherlands. One could state that interviewing international participants could lead to different results. In order to increase reliability and validity, the interview could have been set out internationally.

Future research should look into the characteristics of the participants. A wider range of participants based on type of company, function titles, ages and other characteristics could lead to different results interviewed. Next to this, this research focused on The Netherlands only, future research should be internationally expanded. Furthermore, it would provide great insights if participants were interviewed that were in charge of ICT implementations. One could compare the data from the current participants to the participants that are in charge to implement the ICT solution. Preferably, future research should dive into the different factors that were gathered throughout this research. Especially, the most mentioned factors need substantiation. One could construct a case study at different organisation asking about the different factors. The questions should be related to finding ways in which different success factors can be optimised and fail factors can be limited. One of the most mentioned success factors in this research was “good communication”. The term speaks for itself, but how does one achieve good communication and what is needed to achieve it. Future research should look into these

types of questions and find the right substantiation for these factors. This could increase practical relevance. Lastly, future research should dive into the current proposed ICT implementation model and find a way to display this model into a quick and clear framework. This will definitely bolster practical use. For now, the ICT implementation model needs the explanations provided in appendix 10, which is not ideal.

5.4 Conclusion

At the end of the day, 50 unique success factors and 52 unique fail factors were found in theory. Some unique factors were mentioned more than once, resulting in a total of 90 cumulative mentions for success factors and 97 cumulative mentions for fail factors. In theory, 46 unique success factors and 38 unique fail factors were found. A total of 214 cumulative mentions of success factors and 159 cumulative mentions for fail factors were mentioned. One can see these numbers in table 6 and 7. Table 6 and 7 also show the differences and comparisons between theory and practice. One can see that both the success and fail factors in theory focus on the managerial dimensions, indicating a concentration of factors targeting management and leadership. Both the unique factors and the cumulative mentions have the highest relative value. However, there is a difference of the managerial dimension in between the success and fail factors. For the fail factors, both the cumulative mentions and the unique factors are mentioned the most with almost half of all results. On the other hand, one can see that the relative value of the knowledge dimension of the success factors in theory is also high.

On the other hand, the participant provided results that were more varied. The success factors in practice had a distinct focus on the knowledge dimension, which was the second most mentioned dimension in theory. However, the managerial dimension was the second most mentioned dimension in theory. One could conclude that both in theory and in practice the managerial and the knowledge dimension stick out. For the fail factors in practice, there was also a focus on the managerial dimension for the unique factors mentioned. However, the people dimension got the most cumulative mentions.

One could argue that both the managerial and knowledge dimension are presented the most in this research. They stick out of the rest both in theory and in practice. It indicates a focus on these two in this research and thus the importance of both dimensions for ICT implementations.

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Appendix

Appendix 1: interview

Interview vragen:

Inleiding: in mijn onderzoek wil ik aan de hand van een groot literatuur onderzoek in combinatie met brede inzichten vanuit de praktijk een ICT implementatie model opstellen die gebruikt kan worden voor succesvolle implementatie van ICT in de praktijk. Een deel van dit onderzoek zal dus bestaan uit ervaringen uit de praktijk, die ik hoop doormiddel van dit interview te verzamelen. Ik zal beginnen met wat inleidende vragen die nodig zijn om de participanten van elkaar te onderscheiden en te kenmerken om zodoende verschillende visies te verzamelen van het onderwerp.

- Wat is uw leeftijd?
- Wat is uw geslacht? (niet uitvragen, wel noteren)
- Wat is uw opleiding?
- Kunt u iets over uw werk vertellen? (vrij antwoorden, even goed kijken of de volgende sub-vragen beantwoordt worden)
    - Wat is uw functie?
    - Hoe lang ben je actief in deze functie?
    - Op welke afdeling bent u werkzaam?
    - Wat zijn uw werkzaamheden?
    - Waar houdt uw afdeling zich mee bezig?
    - Wat zijn de kern activiteiten van uw bedrijf?

Inleiding: in het volgende deel zal ik algemene vragen stellen op het gebied van ICT implementatie, de antwoorden geven een globaal inzicht in uw ervaringen op het gebied van ICT implementatie.

- Hoeveel ICT implementatie processen heeft u meegemaakt?
- Hoeveel van deze waren succesvol?
- Wat voor rollen heeft u gespeeld in de implementatie processen?

Inleiding: in het onderzoek gaat het over ICT implementatie processen. Een belangrijk onderdeel van dit onderzoek is het verzamelen van gegevens over specifieke ervaringen met ICT processen in de praktijk. Om die reden zal ik in de volgende onderdelen naar geslaagde en gefaalde ICT implementatie processen gaan vragen. (Meerdere ICT implementatie processen uitvragen mogelijk)

- Kan u een specifiek ICT implementatie proces herinneren waarvan u vindt dat die geslaagd was?
- Kan u dit proces beschrijven?
- Waarom was dit volgens u geslaagd?
- Wat ging goed in dit proces en wat waren de succes factoren volgens u?
- Waren er ook zaken die minder geslaagd waren?
- Wat waren de uitdagingen in dit proces?

- Kan u een specifiek ICT implementatie proces herinneren waarvan u vindt dat die niet succesvol was?
- Kan u dit proces beschrijven?
- Waarom was dit volgens u niet succesvol?
- Wat ging er niet goed in dit proces en wat waren de faal factoren volgens u?
- Wat ging wel goed in dit proces?
- Wat waren de uitdagingen in dit proces?

Inleiding: Tot slot stel ik een aantal algemene vragen m.b.t. ICT implementatie processen. Deze algemene vragen kunnen bijdragen aan de verschillende inzichten m.b.t. ICT implementatie processen.

- Wat is volgens u van belang voor het succesvol implementeren van ICT?
- Wat zijn de grootste uitdagingen in ICT implementatie processen?
- Waarom gaat het vaak mis volgens u?

Appendix 2: Concise overview participants

Several variables are coded within the table. All codes are shortly described in the following. "_Resp" indicates the number of the participants; "M/W" indicates if the participant is a man or a woman; "Function" indicates the function that the participant performs; "ICT_impl" indicates the amount of ICT implementation that the participants has experiences in their working career; "%success" indicates the percentage of experienced ICT implementation that was considered to be a success; "Su_fa_num" indicates the success factor numbers and on the other side "Fa_fa_num" indicates the fail factor numbers.

_Resp	M/F	Function	ICT_impl	%success	Su_fa_num	Fa_fa_num
1	M	HR Advisor	20/30	60%	3.2.1, 3.2.2, 3.4.1, 3.4.2, 3.4.3, 3.5.1	4.3.1, 4.2.1, 4.2.2, 4.4.1, 4.1.1
2	F	HR Advisor	>30	20%	3.2.1, 3.2.2, 3.5.1, 3.1.1	4.2.1, 4.2.2, 4.1.1, 4.1.2, 4.1.3, 4.5.1, 4.5.2, 4.5.3, 4.4.2, 4.5.4, 4.1.4,
3	M	HR Advisor	3/5	60/70%	3.4.3, 3.2.1, 3.5.1, 3.1.1, 3.4.4, 3.4.5, 3.1.2, 3.5.2, 3.1.3, 3.5.3, 3.4.6, 3.1.4	4.4.1, 4.1.1, 4.3.2, 4.1.5, 4.5.5, 4.5.6
4	M	Project manager	3 big ones/multiple small ones	50%	3.4.2, 3.4.3, 3.2.1, 3.5.1, 3.4.5, 3.2.3, 3.3.1, 3.1.5, 3.1.6, 3.1.7, 3.1.8	4.2.1, 4.1.1, 4.1.6, 4.4.3, 4.2.3
5	M	Outbound customer advisor	5	80%	3.4.2, 3.5.3, 3.2.4, 3.4.7	4.2.1, 4.4.1, 4.4.4
6	M	Sales employee	5	80%	3.2.1, 3.1.4, 3.3.2	4.3.1, 4.2.1, 4.3.2, 4.5.7
7	M	Online marketeer	1	100%	3.4.1, 3.4.2, 3.4.3, 3.2.1, 3.5.2, 3.5.3, 3.4.8, 3.4.9,	4.2.1, 4.5.3, 4.5.6,
8	M	Recruiter	10	100%	3.4.2, 3.5.1, 3.1.1, 3.4.4, 3.5.3, 3.2.5, 3.4.10	4.5.1, 4.5.6

9	F	Online marketeer	10	90%	3.2.1, 3.4.5, 3.1.2, 3.4.8, 3.4.11	4.2.1, 4.1.1, 4.1.4, 4.3.4,
10	M	Backoffice employee	5	80%	3.4.1, 3.4.2, 3.4.3, 3.2.1, 3.5.1, 3.4.5, 3.1.2, 3.4.9, 3.3.3	4.2.1, 4.4.1, 4.1.1, 4.4.4, 4.4.5, 4.4.6, 4.2.4
11	M	Business Manager	3	100%	3.2.1, 3.5.1, 3.5.2, 3.5.3, 3.4.9, 3.3.3	4.2.1, 4.5.6
12	M	Supply chain planner	1	100%	3.4.1, 3.4.2, 3.1.2, 3.5.2, 3.4.7, 3.1.9	4.5.6, 4.3.3, 4.4.5, 4.4.6
13	M	Project Manager	35	75%	3.2.1, 3.4.5, 3.5.2, 3.1.3, 3.1.6, 3.1.7, 3.4.11, 3.2.6, 3.2.7	4.2.1, 4.4.1, 4.5.2, 4.5.6, 4.1.8, 4.2.5
14	M	Management trainee	5	80/100%	3.2.1, 3.1.3, 3.1.4, 3.1.7, 3.1.8, 3.1.9, 3.3.4	4.2.1, 4.1.1, 4.1.2, 4.1.3, 4.3.2, 4.1.8, 4.3.5
15	M	Client manager	10	100%	3.2.1, 3.5.1, 3.1.1, 3.1.4, 3.2.3, 3.4.11, 3.1.9, 3.1.10, 3.3.5, 3.2.8	4.2.1, 4.1.1, 4.1.3, 4.1.6, 4.1.7, 4.1.9, 4.4.7, 4.1.10
16	M	Online technical advisor	1	100%	3.4.2, 3.2.1, 3.2.2, 3.5.1, 3.1.1, 3.1.2, 3.5.2, 3.5.3, 3.4.8, 3.2.5	4.2.2, 4.1.2, 4.1.3, 4.5.1, 4.5.3, 4.5.4, 4.5.6,
17	F	Online editor	2	75%	3.4.1, 3.4.2, 3.2.1, 3.2.2, 3.4.5, 3.5.2, 3.4.9, 3.2.9	4.2.1, 4.2.2, 4.4.1, 4.5.6, 4.4.4, 4.4.5, 4.4.6
18	F	Administrative Assistant	5	100%	3.4.1, 3.4.2, 3.2.1, 3.4.4, 3.5.2, 3.4.9, 3.3.6, 3.5.4, 3.4.12	4.2.1, 4.4.3, 4.3.4, 4.2.6, 4.3.6, 4.3.7
19	M	Customer service employee	5	60%	3.2.1, 3.5.1, 3.1.1, 3.1.2, 3.5.2, 3.5.3, 3.1.9, 3.2.8, 3.4.12	4.2.1, 4.1.2, 4.1.3, 4.5.1, 4.5.3, 4.4.2, 4.5.4, 4.5.6, 4.3.5, 4.3.6

20	M	Online Product Content Specialist	5	100%	3.4.1, 3.4.3, 3.1.2, 3.5.2, 3.2.4, 3.4.9, 3.1.10, 3.3.5, 3.3.7	4.5.4, 4.1.5, 4.5.6, 4.4.5, 4.4.6, 4.1.9, 4.4.7
21	M	Online technical advisor	7	80%	3.4.1, 3.4.2, 3.2.1, 3.5.1, 3.1.1, 3.4.4, 3.1.2, 3.5.3, 3.1.4, 3.3.2, 3.1.9, 3.3.7, 3.2.10, 3.4.13	4.3.1, 4.2.1, 4.1.1, 4.1.2, 4.1.3, 4.5.1, 4.5.3, 4.5.4, 4.3.2, 4.3.3, 4.3.4, 4.3.6
22	M	Head of production	4	50%	3.4.1, 3.4.2, 3.4.3, 3.2.1, 3.5.1, 3.4.4, 3.1.2, 3.5.2, 3.1.3, 3.5.3, 3.4.6, 3.3.1, 3.1.7, 3.4.7, 3.4.9, 3.3.3, 3.1.10, 3.3.5, 3.4.13	4.5.1, 4.5.3, 4.5.4, 4.1.5, 4.5.6, 4.3.3, 4.4.5, 4.4.6, 4.2.4, 4.1.8, 4.3.6
23	M	Sales employee	8	87,5%	3.4.1, 3.4.2, 3.2.1, 3.5.1, 3.4.4, 3.5.2, 3.5.3, 3.3.2, 3.5.4,	4.2.1, 4.5.1, 4.5.3, 4.4.2, 4.5.4, 4.5.6, 4.3.4, 4.5.3
24	M	EPA Advisor	10	80%	3.4.1, 3.4.2, 3.5.1, 3.4.5, 3.1.2, 3.5.2, 3.4.9, 3.2.9, 3.3.7, 3.2.10	4.3.1, 4.2.1, 4.1.2, 4.5.2, 4.5.3, 4.4.2, 4.4.5, 4.3.8,
25	M	Information security consultant	4	100%	3.4.1, 3.4.2, 3.4.3, 3.2.1, 3.4.5, 3.5.2, 3.1.3, 3.1.7, 3.1.8, 3.5.4, 3.3.7, 3.4.14, 3.2.11	4.2.1, 4.4.1, 4.1.2, 4.5.6, 4.4.3, 4.1.7, 4.3.8

Appendix 3: Extended Overview participants

As one can see in table 7, 25 participants were interviewed during the research. Together, they gave a very wide range of answers. As one can see a lot of participants had different functions to make sure that the answers were from multiple disciplines. In

this part, all participants are shortly described. Their function is given and some general characteristics of the participants are provided. Moreover, the characteristics of the success and fail factors mentioned are shortly discussed.

Participant 1 is a HR advisor with a lot of experience in the human resource field. His background has always been in the human resources and his highest level of education is a HBO degree in employee and work. The participant indicates to have witnessed around 25 ICT implementations with a success rate of approximately 60%. This participant came up with six success factors and five fail factors.

Participant 2 is also a HR advisor with lots of experience if the human resources field. Her background is in multiple disciplines including mediation and human resources. Her highest level of education is a HBO degree towards the administrative side of things. The participant indicates to have experience over 30 ICT implementations ranging from small adaptions to big systems. The success rate is considered to be around 20%, because most ICT implementation did not reach their potential. The participant came up with four success factors and eleven fail factors making a big contribution to the mentioned fail factors.

Participant 3 is again a HR advisor working, who has recently graduates with a HBO degree in Human resources. He is currently working in the human resources field for around three years. In this time the participant has experienced around three to five full ICT implementation processes and states that around 70% of these were successful. With 12 success factors, this participant contributed to a great extent to the success factors. On the other side, he stated six fail factors.

Participant 4 is a project manager, who has graduated with a HBO degree in economics. He is currently working in the telecom sector for 3 months. Before, he was a project manager in the optical fibre sector for over twelve years. The participant made a very clear distinction in between small and big ICT implementation processes and stated that he has experiences around five big ICT implementations and numerous of small ones. Around 50% of all of these ICT implementations were successful. At the end of the interview, the participant had mentioned eleven success factors and five fail factors.

Participant 5 is an outbound customer advisor at a local insurance company. He has been working at this company for over 2 years. Currently he is finishing his HBO degree in small business and retail management. The participant has witnessed around five ICT implementations during this time, ranging from small implementation, such as Microsoft Teams to bigger implementations. Four of the five (80%) ICT implementations were considered to be successful. He proposed four key success factors and three key fail factors during the interview.

Participant 6 is a sales employee at a local installation company. The company sells boilers and solar panels and he contribute to the sale process. He is actively working here for 2.5 years and is also in his third year of economics on HBO level. During the 2.5 years that he is working for the company he has witnessed approximately five ICT implementation processes of which 80% was successful. The participant proposed three success factors and four fail factors during the interview.

Participant 7 is an online marketer at a local start up. He is currently working here for one year. The company that he is working for is actively engaging in making organisation more visible through online marketing. He is one of the online marketers who need to realize this for their customers. He is not working here for too long, but did witness one ICT implementation throughout this time. This implementation was successful, which indicates that 100% of the witnessed ICT implementation was successful. He did mention eight success factors and on the other hand he stated three fail factors during the interview.

Participant 8 is currently working as a recruiter for a recruiting company. Previously, he has worked as an advisor and as an account manager for several companies. He has a degree in economics on a HBO level. The current company that he is working for focussed on connecting companies to technical employees and engineers. He has experiences approximately 10 ICT implementation processes and stated that all of these were successful. Next to this, he stated seven success factors, but also two fail factors.

Participant 9 is currently working for a local installation company. The participant is working there as an online marketer focussing on gathering leads related to the products that the company offers. She has a background in International Business and languages and graduated from this study three years ago. She stated that she has witnessed roughly 10 ICT implementation processes, from which nine were successful. The participant stated five different success factors and on the other hand also four different fail factors.

Participant 10 is working as a back office employee in a local installation company. He is responsible for the after sales department with tasks ranging from billing to treating complains about the installations of the products. He is currently working in this function for 3.5 years. He has a background as an administrative employee in several companies. He graduated from his studies ten years ago as an administrative employee on MBO level. During his working career he experienced around five full ICT implementation processes of which four were successful. The participant mentioned nine different success factors and seven fail factors during the interview.

Participant 11 is currently working as a business manager in a recruitment company that focuses on connecting technical experts to the right companies. He focuses on expanding the customer portfolio, looking into the market dynamics and directing consultants. He is currently working in this function for three months, before he worked for several years as a recruiter in the same company. His background is into commercial economics on a HBO level. During his working career he has experienced around three full ICT implementation processes. All of these were successful according to the participant. He proposed six success factors and two fail factors in the interview.

Participant 12 is a supply chain planner at a sales company. The participant is planning the production and improvements from the process of planning and production. He is currently working at the company for almost 2 years. Before he has graduated as an MSc Business Administration and he has a degree in HBO commercial economics. During these 1.5 years the participant has experienced one ICT implementation that was also successful. He proposed six different success factors and also four different fail factors.

Participant 13 is a project manager for a software company. The company focuses on implementing and also controlling ICT solutions in primary company processes. The participant is in charge of these processes and has to make sure that the implementations are a success. In regards to this research, his information is extremely valuable, because of the practical knowledge in regards to the topic that the participant has. The participant has a background in communication science and graduated with an MSc in communication science. He is currently working at this company for two years. He has approximately experiences around 35 ICT implementation processes of which 75% was considered to be successful. He mentioned nine success factors and six fail factors in the interview.

Participant 14 is a management trainee at a large automobile producer. His background is in commercial economics on HBO level and an MSc in business administration. He is currently working at this employer for six months and has worked as a financial controller before for two years. He is active on the after sales department and looks at the efficiency of marketing campaigns and business development. He has experienced around five ICT implementation processes of which he considers that four were completely successful. The participant proposed seven success factors and eight fail factors in the interview.

Participant 15 is a client manager at a very large IT consultancy company. The company itself delivers custom IT consultancy to their customers. The participant is responsible for good customer relationships and is in charge of some accounts. He has to make sure that everything that was promised is also fulfilled and is in direct contact with the clients. He has a commercial background as a graduated commercial economic on HBO and a graduated MSc in business administration. During his working career he has experience ten ICT implementation processes of which three big ones. The participant stated that all ten were considered to be successful. During the interview, he came up with ten success factors and eight fail factors contributing significantly to the distribution of both factors.

Participant 16 is an online technical advisor for a local installation company. The participant is responsible for getting online offers to customers that asked for these. He has been working in this role for two years and before he has worked in the same role for a different organisation. He has studied communication and graduated on a HBO level. He named one ICT implementation process that was also successful. Moreover, ten success factors were and seven fail factors were mentioned during the interview.

Participant 17 is an online editor for a local newspaper. She has to make sure that articles are posted in the right way and the website is up-to-date. Moreover, she has to make sure that small articles are written and posted in the newspaper as well. The participant is still studying and currently doing her pre-master in communication science. During her working career she has witnessed two ICT implementation processes of which one was successful and the other was partly successful. She named eights success factors and seven fail factors during the interview.

Participant 18 is currently working as an administrative assistant in a local installation company. She is in charge of entering contracts into the system and other activities that are related to the contracts of the products. She is working at this company for over 2

years. She is currently studying and doing an Msc in industrial engineering. During her working career she has experienced five ICT implementation and all five were successful. During the interview she named nine success factors and six fail factors.

Participant 19 is working in customer services at a multinational telecom company. He is responsible of inbound calls of customers to help them with their problems. He is currently working here for over 2 years. During this time he has experienced five ICT implementation processes of which three were successful. Next to his work, he is still studying international business and languages on HBO level. He contributed significantly to the success and fail factors by mentioning nine success factors and ten fail factors during the interview.

Participant 20 is currently working as a product content specialist at a very large online department store. He has been working for this company for over 2,5 years. He is responsible for the content on the website, the right content should be put under the right products on the website. Next to his work, he is also currently doing a pre-master in communication science. During these 2,5 years he has experience five different ICT implementation and all five were successful according to him. Moreover, he mentioned nine success factors and seven fail factors during the interview.

Participant 21 is an online technical advisor for a local installation company. The participant is responsible for getting online offers to customers that asked for these. He has been working in this function for over five years and before he worked in different functions for the same organisation. His background is as a legal assistant on MBO level. During his whole career he has witnessed seven different ICT implementations of which approximately 80% was successful. During the interview, the participant mentioned fourteen success factors and twelve fail factors, which contributed significantly to the final distribution.

Participant 22 is working as head of production in a company that is specialised in frozen bread dough. He is in charge of a team of five persons on the supply chain department. He is working here for three years and has experienced four different ICT implementation processes. His background is in business administration as he has graduated as a bachelor in business administration four years ago. The four ICT implementation processes had to do with a new planning system, telephone software and a new ERP system. Two of these were successful rounding up to 50% success rate. He named nineteen success factors and eleven fail factors, making this participant one of the biggest contributors to the factor distributions.

Participant 23 is a sales employee at a local installation company that specialises in solar panels and boilers. He contributes to the whole sales department and contributes were necessary. He is also still studying and doing his masters in business administration. He has been working here for four years and has experiences eight different ICT implementations of which one was not successful. He mentioned nine success factors and eight fail factors during the interview.

Participant 24 is currently working as an EPA advisor for a local installation company. He has been working in this function for two months now, but has been working for the company for more than 6 years. His tasks are to label houses based on their emissions

and provide consult in how to decrease emission rate of houses. His background is as an ICT controller on MBO level. He has witnessed ten different ICT implementation during his working career of which eight were successful. He named ten different success factors and eight fail factors during the interview.

Participant 25 is an information security consultant and works for a consultant firm that focuses on providing businesses with handles on how to control their online information and secure these. The participant is currently working here for six months, but has witnessed four ICT implementations during that time. His background is as a master in business administration. All four ICT implementation processes are considered to be successful. He named 13 different success factors and seven fail factors during the interview.

Appendix 4: Characteristics participants

Characteristics participants:	
Male/Female	84% / 16%
Average ICT implementation per participant	8.1
Average ICT implementation success percentage per participant	70.9%
Average age of participants	31.1

Appendix 5: Overview participant

Table 7. Overview participants

	Success factors	Fail factors	Total factors
Participant 1	6	5	11
Participant 2	4	11	15
Participant 3	12	6	18
Participant 4	11	5	16
Participant 5	4	3	7
Participant 6	3	4	7
Participant 7	8	3	11
Participant 8	7	2	9
Participant 9	5	4	9
Participant 10	9	7	16
Participant 11	6	2	8
Participant 12	6	4	10
Participant 13	9	6	15
Participant 14	7	7	14
Participant 15	8	8	16
Participant 16	10	6	17
Participant 17	8	7	15

Participant 18	9	6	15
Participant 19	9	10	19
Participant 20	9	7	16
Participant 21	13	12	25
Participant 22	19	11	30
Participant 23	9	8	17
Participant 24	10	8	18
Participant 25	13	7	20
Total:	**214**	**159**	**373**

Appendix 6: overview success factors in practice

Success factor	**X of participants**
1. Good education (manuals)	1, 7, 10, 12, 17, 18, 20, 21, 22, 23, 24, 25
2. (Online) Training	1, 4, 5, 7, 10, 12, 16, 17, 18, 21, 22, 23, 24, 25
3. Training for new updates/aftercare	1, 3, 4, 7, 10, 20, 22, 25
4. Good communication	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 25
5. Adaptive/innovative culture	1, 2, 16, 17
6. Involve employees/users/the right persons	1, 2, 3, 4, 10, 11, 15, 16, 19, 21, 22, 23, 24
7. Good estimation of time	2, 3, 14, 15, 16, 19, 21
8. Guidance	3, 18, 21, 22, 23
9. Presence of knowledge (essential persons)	3, 4, 9, 10, 13, 17, 24, 25
10. Good estimation of (user) needs	3, 10, 12, 16, 19, 20, 21, 22, 24
11. Support base users/employees	3, 7, 11, 12, 13, 16, 17, 18, 19, 20, 22, 23, 24, 25
12. Pronounce expectation clearly	3, 13, 14, 22, 25
13. Focus on users/usability	3, 5, 7, 11, 16, 19, 21, 22, 23, 24
14. Involvement experts	3, 22
15. Good estimation of budget	3, 6, 14, 15, 21
16. Clarity	4, 15
17. Small changes per time	4, 22
18. Presence of “change board”	4
19. Responsibility essential persons	4, 13
20. Expectation management	4, 13, 14, 22, 25
21. Clear division of roles	4, 14, 25
22. Substantiated timing	5, 20
23. Personal assistance employees	5, 12, 22
24. Integrating systems	6, 21, 23
25. Conducting pre research	7, 9, 16
26. Having a good manual	7, 10, 11, 17, 18, 20, 22, 24
27. Smooth process	16
28. Information provision (oral)	8

29. Involving people with experience	9, 13, 15
30. Testing	10, 11, 22
31. Clear planning	12, 14, 15, 19, 21
32. Manage external factors	13
33. Transparency	13
34. Alignment between departments	14, 21
35. Good estimation of activities	15, 20, 22
36. Intermediate monitoring	15, 20, 22
37. Stability	15, 19
38. Healthy pressure	17, 24
39. Document the changes	18
40. Point of contact	18, 23, 25
41. Employees are up-to-date	18, 19
42 well functioning system	20, 21, 24, 25
43. Efficiency	21, 24
44. Good introduction towards employees	21, 22
45. Information easily accessible	25
46. Affinity with the implementation	25

Appendix 7: overview fail factors in practice

Fail factors	**X of participant**
1. Manual actions	1, 6, 21, 24
2. Incomplete communication	1, 2, 4, 5, 6, 7, 9, 10, 11, 13, 14, 15, 17, 18, 19, 21, 23, 25
3. Conservative culture	1, 2, 16, 17
4. Lacking knowledge essential individuals	1, 3, 5, 10, 13, 17, 24, 25
5. Wrong estimation budget	1, 2, 3, 4, 10, 14, 15, 21
6. Incomplete planning	2, 14, 16, 19, 21, 25
7. Wrong estimation of time/time pressure	2, 14, 15, 16, 19, 21
8. Lacking input of (key) users	2, 16, 19, 21, 22, 23, 24
9. To many external persons involved	2, 13
10. Lack of usability	2, 7, 16, 19, 21, 22, 23, 24
11. Knowledge gap between developer and user	2, 19, 23, 24
12. Wrong estimation user needs	2, 16, 19, 20, 21, 22, 23, 24
13. Lack of (inclusive) pre research	2, 9
14. Align different departments	3, 6, 14, 21
15. Wrong estimation of necessities	3, 20, 22
16. Divergent interest of departments/employees	3
17. Lacking support base/resistance	3, 7, 11, 12, 13, 16, 17, 19, 20, 22, 23, 25
18. Lacking overview implementation	4, 15
19. Employees are not up to date	4, 18, 25
20. Miscommunication inter & extern	4

21. Lacking experience	5, 10, 17
22. Wrong team formation	15, 25
23. Human mistakes	6
24. Complexity	8, 12, 21, 22
25. (Dis) Integrating systems	9, 18, 21, 23
26. No manuals/bad manuals	10, 12, 17, 20, 22, 24
27. Lack of training	10, 12, 17, 20, 22, 24
28. Lack of support	10, 22
29. Lack of expectation management	13, 14, 22
30. Manage external factors wrongly	13
31. Bad performance of idea	14, 19, 23
32. Wrong estimation of activities	15, 20
33. Detect issues not in time	15, 20
34. Wrong estimation of scope of project	15
35. Lack of continuity	18
36. Delays	18, 19, 21, 22
37. Loss of data	18
38. Bad functioning system	24, 25

Appendix 8: overview success factors in literature

Succes factors	**X of paper**
1. Senior Management commitment/support	1, 3, 7, 8, 9
2. Staff involvement	1, 7
3. Training and mentoring	1, 7, 8, 9
4. Staff time and resources	1, 7,
5. Creating process action teams/change agents and opinion leaders	1, 7,
6. Reviews/testing	1, 7, 8
7. Experienced staff	1, 7, 9
8. Clear and relevant implementation goals	1, 7,
9. Process ownership	1, 7,
10. Encouraging communication	1, 6, 7, 8
11. Tailoring improvement initiatives	1, 7,
12. Reward schemes	1, 7,
13. Managing the implementation project	1, 7,
14. Providing enhanced understanding	1, 7,
15. Internal leadership	1, 7,
16. Implementation people well respected	1, 7,
17. Clear standards and procedures	1, 7,
18. Good selection and justification (system)	3, 9
19. Clear project definition	3,
20. Clear project plan	3, 7,

21. Clear project team	3, 8,
22 Proper project resources	3, 6, 7
23 Change management	3,
24 Managing relationships	3, 6
25. Cooperative culture	6, 7, 8, 9
26. Motivation	6, 8
27. Teamwork	6, 7, 8
28. Regular meetings	6, 7, 8
29. Understanding process and issues	6
30. Awareness for ICT implementation	7
31. Visible success	7
32. Defined implementation methodology	7
33. Continuous process improvement	7
34. Analysis	7
35. Facilitation	7
36. Usability	7
37. Implementation management	7
38. High staff moral	7
39. External implementation agents	7
40. Team member with competence	8
41. Knowledge of management	8
42. ICT requirements management	8
43. Project requirement management	8
44. User involvement	8
45. User influence	8
46. Post budget evaluation	8
47. Post risk analysis	8
48. Skilled personnel	9
49. Knowledge among personnel	9
50. Monitoring	9

Appendix 9: overview fail factors in literature

Fail factors	**X of paper**
1. Lack of (human) resources	1, 2, 4
2. Time pressure / unrealistic time schedules /	1, 2,
3. Inexperienced (IT) staff	1, 2, 6, 9
4. Lack of knowledge	1, 5, 6, 9
5. Organizational politics	1,
6. Implementation gets in the way of real work / ignoring organizational objectives	1, 4,
7. (IT) Staff turnover	1, 2
8. Lack of support (from top management)	1, 2, 4, 8, 9
9. Changing the mind-set of management	1, 6, 9

and technical staff	
10. Too much paperwork required	1,
11. Negative/bad experience	1,
12. Poor communication	2, 6
13. Failure to identify all stakeholders	2,
14. Misunderstanding requirements	2, 8
15. Lack of (weak) planning	2, 4, 6, 8
16. Unclear (cost) estimates initial stage	2, 6, 9
17. Unclear objectives	2,
18. Lack of user participation	2, 6, 8
19. Conflict between users	2,
20. Resistance to change	2, 8, 9
21. Using inappropriate testing tools	2,
22. Using new technology	2,
23. Poor quality code	2,
24. Size of project	2,
25. Lack of consensus among managers	4,
26. Weak rules and regulations	4,
27. Lack of attention to organizational behaviour	4,
28. Lack of awareness in management team	4, 9
29. High expenses	4, 9
30. Instability in executive team	4, 6
31. Inappropriate implementation	4, 8
32. Complexity of the system	4,
33. Lack of good infrastructure	4,
34. Financial limitations/ lack of funds	4, 5, 9
35. Conflict in executive team	4, 6
36. Lack of agreement with organizational needs	4, 9
37. Insufficient suppliers	4,
38. Difficulty in justifying expenses	4,
39. Endangering job security	4,
40. Lack of long-term vision/strategy	4, 5
41. Lack of intention to change	4, 9
42. Lack of understanding of business processes	5,
43. Lack of skilled employees	5, 8
44. Lack of standard operating procedures	5,
45. Lack of suitable software	5, 9
46. Lack of an information system plan	5, 8
47. Organizational culture (traditional)	6, 8, 9
48. Lack of clear project scope	6, 8
49. Organisation size	8
50. Lack of project management competence	8
51. Lack of teamwork	8

52. Lack of interest in changing	9
53. Lack of flexibility	9

Appendix 10: distribution factors among the stages

Distribution 1: success factors in literature

1.1 Recognition factors

1.4.3 providing enhanced understanding
1.4.6 Awareness for ICT implementation
1.4.7 Analysis
1.4.10 Knowledge of management
1.4.14 Knowledge among personnel

1.2 Preparation factors

1.1.2 Creating process action teams/change agents and opinion leaders
1.1.3 Clear and relevant implementation goals
1.1.7 Clear project definition
1.1.8 Clear project plan
1.1.9 Clear project team
1.3.2 Good selection and justification (system)
1.3.3 ICT requirements management
1.3.4 Project requirement management

1.3 Pre-implementation factors

1.1.12 Defined implementation methodology
1.4.5 Understanding process and issues
1.5.2 Tailoring improvement initiatives

1.4 Implementation factors

1.1.5 Managing the implementation project
1.1.10 Proper project resources
1.1.15 Implementation management
1.5.1 Staff time and resources
1.5.3 Implementation people well respected
1.5.6 Usability

1.5 Sustainment factors

1.1.13 Continuous process improvement
1.2.3 Reward schemes
1.2.7 Visible success
1.3.1 Reviews/testing

1.3.5 Monitoring
1.4.11 Post budget evaluation
1.4.12 Post risk analysis

1.6 Overlapping concepts

1.1.1 Senior management commitment
1.1.4 Process ownership
1.1.6 Internal leadership
1.1.11 Change management
1.1.14 Facilitation
1.2.1 Staff involvement
1.2.2 Encouraging communication
1.2.4 Clear standards and procedures
1.2.5 Cooperative culture
1.2.6 Motivation
1.2.8 High staff moral
1.4.1 Training and mentoring
1.4.2 Experienced staff
1.4.4 Regular meetings
1.4.8 External implementation agents
1.4.9 Team members with competence
1.4.13 Skilled personnel
1.5.4 Managing relationships
1.5.5 Teamwork
1.5.7 User involvement
1.5.8 User influence

Distribution 2: Fail factors in literature

2.1 Recognition factors

2.1.10 Lack of attention to organizational behaviour
2.1.11 Lack of awareness in management team
2.4.3 Lack of knowledge
2.4.4 Lack of understanding of business processes

2.2 Preparation factors

2.1.4 Misunderstanding requirements
2.1.5 Lack of planning
2.1.6 Unclear (cost) estimates in initial stage
2.1.7 Unclear objectives
2.1.18 Lack of long-term vision/strategy
2.1.19 lack of an information system plan
2.1.20 Lack of clear project scope
2.1.21 Lack of project management competence
2.5.2 Changing the mind-set of management and technical staff

2.3 Pre-implementation factors

2.1.3 Failure to identify all stakeholders
2.2.8 Insufficient suppliers
2.3.4 Poor quality code

2.4 Implementation factors

2.1.8 Size of project
2.2.7 Lack of good infrastructure
2.3.3 Using new technology
2.3.5 inappropriate implementation
2.3.7 Lack of suitable software
2.4.1 Lack of (human) resources
2.4.2 Inexperienced (IT) staff

2.5 Sustainment factors

2.1.1 Implementation gets in the way of real work / ignoring organizational objectives
2.1.16 Lack of agreement with organizational needs
2.3.1 Too much paperwork required
2.3.2 Using inappropriate testing tools
2.3.6 Complexity of the system
2.5.4 Conflict between users

2.6 Overlapping concepts

2.1.2 Lack of support (from management)
2.1.9 Lack of consensus among managers
2.1.12 High expenses
2.1.13 Instability in executive team
2.1.14 Financial limitations/lack of funds
2.1.15 Conflict in executive team
2.1.17 Difficulty in justifying expenses
2.2.1 Time pressure/unrealistic time schedules
2.2.2 Organizational politics
2.2.3 Negative/bad experience
2.2.4 Poor communication
2.2.5 Resistance to change
2.2.6 Weak rules and regulations
2.2.9 Endangering job security
2.2.10 Lack of intention to change
2.2.11 Organizational culture (traditional)
2.2.12 Organisation size
2.2.13 Lack of flexibility
2.4.5 Lack of skilled employees
2.4.6 Lack of standard operating procedures
2.5.1 (IT) staff turnover

2.5.3 Lack of user participation
2.5.5 Lack of teamwork
2.5.6 Lack of interest in changing

Distribution 3: success factors in interviews

3.1 Recognition factors

3.4.1 Good education
3.4.2 (Online) training
3.4.8 Conducting pre-research
3.4.9 Having a good manual
3.4.10 Information provision (oral)
3.4.12 Employees are up-to-date
3.4.13 Good introduction towards employees
3.4.14 Information easily accessible

3.2 Preparation factors

3.1.1 Good estimation of time
3.1.2 Good estimation of (user) needs
3.1.3 Pronounce expectations clearly
3.1.4 Good estimation of budget
3.1.7 Expectation management
3.1.8 Clear division of roles
3.1.9 Clear planning
3.1.10 Good estimation of activities

3.3 Pre-implementation factors

3.1.5 Presence of change board
3.3.3 Testing
3.4.4 Guidance
3.4.6 Involvements experts
3.5.4 Point of contact

3.4 Implementation factors

3.2.4 Substantiated timing
3.2.6 Manage external factors
3.2.11 Affinity with the implementation
3.3.2 Integrating systems
3.3.4 Alignment between departments
3.3.7 Well functioning system
3.4.4 Guidance
3.4.7 Personal assistance employees

3.5.3 Focus on users/usability
3.5.4 Point of contact

3.5 Sustainment factors

3.3.5 Intermediate monitoring
3.3.6 Document the changes
3.4.3 Training for new updates/aftercare

3.6 Overlapping concepts

3.1.6 Responsibility of essential persons
3.2.1 Good communication
3.2.2 Adaptive/innovative culture
3.2.3 Clarity
3.2.5 Smooth process
3.2.7 Transparency
3.2.8 Stability
3.2.9 Healthy pressure
3.2.10 Efficiency
3.3.1 Small changes per time
3.4.5 Presence of knowledge (essential persons)
3.4.11 Involving people with experience
3.5.1 Involve the right persons (users, employees)
3.5.2 Support base users/employees

Distribution 4: Fail factors in interviews

4.1 Recognition factors

4.1.4 Lack of (inclusive) pre research
4.4.3 Employees are not up to date
4.4.5 No manuals/bad manuals
4.4.6 Lack of training

4.2 Preparation factors

4.1.1 Wrong estimation of budget
4.1.2 Incomplete planning
4.1.3 Wrong estimation of time/time pressure
4.1.5 Wrong estimation of necessities
4.1.6 Lacking overview implementation
4.1.7 Wrong team formation
4.1.8 Lack of expectation management
4.1.9 Wrong estimation of activities

4.1.10 Wrong estimation of scope of project
4.5.4 Wrong estimation user needs

4.3 Pre-implementation factors

4.4.2 Knowledge gap between developer and user
4.4.7 Detect issues not in time
4.5.1 Lacking input of (key) users

4.4 Implementation factors

4.3.2 Align different departments
4.3.3 Complexity
4.3.4 (dis) integrating systems
4.3.6 Delays
4.3.8 Bad functioning system
4.5.5 Divergent interest of departments/employees

4.5 Sustainment factors

4.3.1 Manual actions
4.3.5 Bad performance of idea
4.3.7 Loss of data
4.5.7 Human mistakes

4.6 Overlapping concepts

4.2.1 Incomplete communication
4.2.2 Conservative culture
4.2.3 Miscommunication inter & extern
4.2.4 Lack of support
4.2.5 Manage external factors wrongly
4.2.6 Lack of continuity
4.4.1 Lacking knowledge essential persons
4.4.4 Lacking experience
4.5.2 To many external persons involved
4.5.6 Lacking support base/resistance