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Coping with technology heritage

A case study of a large telecommunications organization

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Abstract

The digitalization of society has become apparent with technology entering previously non-digital contexts, resulting in new opportunities for organizations to exploit and explore. Technology plays a part in enabling organizations to explore new possibilities. However, with the furthered use of technology, a heritage is also built, which could materialize as a constraint for organizations. The purpose of this study is to investigate how managers act to deal with the constraints of technology heritage. The study is conducted as a case study with a qualitative approach to identify patterns of how managers cope with the constraining effects of technology heritage, within a telecommunications organization. As the findings show, there are six strategies of coping that managers employ to confront the constraints of technology heritage: *Process* - coping through relying on an established approach or the assigned responsibility of the manager; *Ignore* - coping through accepting the constraint by choosing not to act or due a lack of known possible actions to take; *Sponsor* - coping through the aid of key individuals; *Information seeking* - coping through the gathering of knowledge; *Quick fix* - coping through the employment of temporary solutions; and *Leadership* - coping through the motivating of others or leading through action.

Keywords: Technology heritage, Technology debt, Coping strategy, Path dependency, Installed base, Institutional logic, Telecommunication, Manager.

Abstrakt

Den fortsatta digitaliseringen av samhället gör att teknik används i tidigare icke-digitala sammanhang. Digitaliseringen har resulterat i nya möjligheter för organisationer att exploatera och explorera. För organisationer spelar tekniken en möjliggörande roll för att kunna explorera nya möjligheter. Den utökade användningen av teknik för dock med sig ett arv, som kan utgöra en begränsning för organisationer. Syftet med denna studie är att undersöka hur chefer agerar för att hantera det teknologiska arvets begränsande effekter. Studien utfördes som en fallstudie med ett kvalitativt tillvägagångssätt för att identifiera mönster i chefers hanteringsstrategier när de möts av de begränsande effekterna av teknologiskt arv inom ett telekommunikationsföretag. Resultatet demonstrerade sex hanteringsstrategier som chefer använder för att möta begränsningarna av det teknologiska arvet: *Process* - hantering genom att förlita sig på ett etablerat tillvägagångssätt eller personens ansvarsområde; *Ignore* - hantering i form av att acceptera begränsningen, eller genom att välja att inte agera på grund av brist på kända åtgärder att vidta; *Sponsor* - hanteringsstrategi där stöd söks hos nyckelpersoner; *Information seeking* - hantering genom kunskapsuppbyggnad; *Quick fix* - hantering genom tillfälliga lösningar; och *leadership* - hanteringsstrategi där chefen motiverar andra eller leder genom handling.

Denna studie är skriven på engelska.

Nyckelord: Teknologiskt arv, Teknologisk skuld, Hanteringsstrategi, Spårbundenhet, Installerad bas, Institutionell logik, Telekommunikation, Chef.

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1.0 Introduction

Digitalization is the process of combining technology with previously non-digital contexts, which impacts the social aspect of how people interact (Yoo, Lyytinen, Veeresh Thummadi, Weiss, 2010). It creates new revenue and value-producing opportunities, and shapes businesses (Gartner, 2017). It is a pervasive phenomenon that permeates all spheres of life (Yoo, Lyytinen, Veeresh Thummadi, Weiss, 2010) which brings with it major consequences for organizations (Yoo, Henfridsson, Lyytinen, 2010; McAfee & Brynjolfsson, 2008).

Governance is an important part of organizational work to provide structure in determining objectives and monitoring the performance to ensure that they are achieved. Furthermore, governing the use of IT is of significance (Weill & Ross, 2004). The role of IT Governance is related to the performance and transformation of IT to meet the existing and future demands of the business and its stakeholders (De Haes & van Grembergen, 2004).

Digitalization has brought with it an emphasis on how to utilize IT governance effectively to balance both improvements in efficiency and further innovation (Xue et al., 2012). This balancing of short and long term interests, by both following proven methods of business and investing in exploiting new opportunities by being creative and adaptable, has been called ambidexterity (March, 1991; Tushman & O'Reilly, 1996; Raisch et al., 2009). If either of these two areas are left neglected, negative consequences may materialize. If organizations fail to allocate sufficient resources to exploration they incur the risk of stagnating, since they are not adapting or innovating for future capitalization on investments. While an organization that do not exploit their current position, risk being unable to capitalize on their exploration efforts, since they have neglected to profit on current investments (March, 1991; Tushman & O'Reilly, 1996; Raisch et al., 2009). Sambamurthy et al. (2003) have argued that IT provides organizations with flexibility, new options and competitive actions to undertake. Furthermore, Mithas and Rust (2016) have emphasized that IT as a general-purpose technology can be viewed as having the ability to both capitalize on short and long term goals.

Within IT, the concept of ambidexterity involves the ability for organizations to explore and exploit IT resources and practices. To balance two contrasting positions is needed to concurrently provide short term IT enabled contributions and progress in IT projects while also conducting a transformation toward future IT enabled business (Gregory et al., 2015). IT ambidexterity has been argued to be an applicable solution to organizations in dynamic environments, since it allows for flexibility (Lee et al., 2015). However, Zhou and Wu (2010) argued that there is special concern when organizations have high technological capabilities. Reaching such technological capabilities enable the improvement of an organization's current products for further exploitation, however, this may lead to them becoming stuck in this technological trajectory, making it more difficult to consider other alternatives.

Kallinikos (2010) has also cautioned on the effects of technology. Kallinikos argues that the effects of technology are regulative in its nature. Technology is constraining in how it in conjunction with social structure and culture becomes rigid. Additionally, it is fundamentally regulative because technology is embedded with characteristics to conduct certain tasks in

its very creation. Organizations may find that they are constrained when they decide to bring changes to their information infrastructure because of these regulative regimes (Kallinikos, 2010). Hanseth (2000) has argued that organizations through their development of existing information infrastructure have sizeable resources tied up in, which is referred to as an installed base. Hence, the installed base is what already exists; e.g. technical standards, technological artefacts, work practices and organizational processes. The installed base therefore change with the development of the organization (Grisot et al., 2014). Magnusson and Bygstad (2014) have argued that the installed base acts as a technology heritage which impacts what decisions organizations can make.

Since organizations are influenced by information technology, they are facing issues of pursuing options that involve change since their technology heritage constitute constraints. Hence, it is of interest to research how organizations manage technology heritage. Exploring as a part of being ambidextrous places importance for organizations to successfully utilize IT. Yet, in their endeavour they may find that technology heritage is constraining their options. Hence, the constraining factors of technology heritage are an important factor for organizations to manage and for academia to research. Managers impact the decision making process of organizations, and are subject to governance, hence their role in impacting the organization is an area of importance to research (Jacobsson & Sahlin-Andersson, 2006). To study managers' coping in organizations when they are constrained by technology heritage is therefore of interest. This study thus asks:

How do managers cope with technology heritage?

This study aims to contribute to the research topic of technology heritage through the identification of managerial coping strategies. Coping is a term used in psychology (Lazarus, 1966) however, in this study we utilize the use of 'cope' by for example Lee, Delone and Espinosa (2006) who uses it to describe how practical coping strategies can be applied to solve organizational tensions. We define coping as different from managing, in that managing is a conscious approach to resolving issues, while coping is the everyday dealing with situational tensions. Data collection occurred in the form of semi-structured interviews, which was analysed through the application of the technology debt theory as presented by Magnusson and Bygstad (2014).

Disposition

The study is structured according to the following disposition: section 2 presents existing research of constraining aspects of information infrastructures and how institutional logics can impact organizations. Additionally, the theory of Technology debt is presented as a framework which is used as a lens to study technology heritage. Section 3 presents the study's research design. This section describes the chosen method, the empirical selection and the iterative process of collecting, analysing and presenting the data. Section 4 presents the case study, structured according to the three main categories of Technology debt. Section 5 presents the analysis of the data, which is discussed on the basis of theory. Additionally, implications, limitations, and future research is presented. Section 6 presents the conclusions of the study.

2.0 Theoretical foundation

This section consists of two parts. The first contain the concepts which constitute constraining aspects of technology heritage. The second part presents the theory of Technology debt, which is the framework of this study.

2.1 Constraining aspects of technology heritage

Organizations are subject to technology heritage (Magnusson & Bygstad, 2014). Focus has been put on the impact of information infrastructure in how mechanisms influence the shaping of an organization's path due to technology (Hanseth, 2000). This section therefore forms a foundation from which to study how such mechanism can influence and constrain changes.

Installed base

Hanseth (2000) argues that infrastructures are never developed carte blanche, instead they are always pre-existing. Information infrastructures are therefore developed through extending and improving the old, which is what is termed the installed base (Aanestad & Jensen, 2011). Star (1999) argues that since information infrastructures are never created without an installed base, the development of the information infrastructure will have to contend with the inertia in the installed base and inherits strengths and weaknesses that exist within it. The installed base always exists, interwoven with internal information and external information, not necessarily in the form of IT. An information infrastructure is therefore “an evolving shared, open, and heterogeneous installed base” since they are not developed from scratch (Hanseth, 2000, p. 60). A large installed base will lead to more complementary products which increases the credibility of the standard, which together makes the standard more attractive to new users. Leading to more adoptions which increases the size of the installed base (Hanseth 2000).

Following Hanseth’s (2000) argument, Bygstad (2010) argues that this reinforcing mechanism of the installed base, is a key attribute of successful information infrastructures. Additionally, he argues that the triggering of external mechanisms in the form of an innovation mechanism and a service mechanism, will lead to an increased installed base. The innovation mechanism is argued to trigger with the existence of a space of possibilities between the information infrastructure and an external component, which allows for new ideas of new services that together with external partners can lead to innovations complementary to the information infrastructure (Bygstad, 2010). The service mechanism is the attraction of more users and partners that follows with the innovation of a new service. These partners will in turn increase the value of the information infrastructure with complementary addons, which will attract more users. This growth generates profit for further innovations and an increase of the installed base. The relation between these two mechanisms is described to be symbiotic: the innovation mechanism increases the installed base with new services which in turn triggers the service mechanism to increase the installed base with users and partners, and thus creating a space of possibilities (Bygstad, 2010).

Switching cost

Switching costs are a result of the installed base, which is a mechanism that all users of information technology will be facing (Shapiro & Varian, 1999). Switching costs have been described to be any cost related to the switching of from one thing to another (Hanseth, 2000). Examples of this include switching from a technology to another (Hanseth, 2000) or switching vendors, with the implication of perceived loss of benefits (Chen & Forman, 2006). Switching costs pertain to primarily the monetary costs that are associated with the replacement of technology, such as the cost of replacing, acquiring and installing the necessary hardware (Hanseth, 2000). Additionally, switching costs are represented as risk, in the sense that an eventual switch risk disrupting the organization's operations. Hanseth (2000) argues that changing software or standards will present an organization with such a risk. Furthermore, organizations will also face an increasing switching cost in relation to information, since the organization's information will evolve into more complex networks and databases over time. Switching costs therefore influences whether a collective is able or willing to undergo a switch, since it would implicate a large coordination challenge (Hanseth, 2000; Shapiro & Varian, 1999).

Whitten and Wakefield (2006) argue that organizations and managers should consider switching costs as multi-dimensional second-order factors. Managers that strongly focuses on single aspects of switching costs, i.e. economic costs, risk overlooking different cost aspects that may intertwine with each other. The underlying argument is that different factors of switching costs, have strong relationships with each other, and contributes to the formation of switching costs (Whitten & Wakefield, 2006). Furthermore, Polites and Karahanna (2012) argue that switching costs are not exclusively materialized in economic or organizational terms, but also psychological.

Eight factors are argued to have importance when managers consider and estimating the switching costs of a situation (Whitten & Wakefield, 2006). *Uncertainty costs* pertain to when the performance level of a service provider is unknown. *Post-switching behavioural and cognitive costs* pertain to the costs associated with investments of time and effort in learning and adapting to new service processes and routines. *Set-up costs* pertain to the costs associated with direct expenses preceding the switch, such as human resource investments or acquisition of durable assets. *Hiring and retraining costs* pertain to the costs associated with personnel investment in specific competence not currently existing in the organization and absent in alternative service providers, which is vital for successfully implementing the alternative. *Management system upgrade costs* pertain to costs associated with acquiring new systems or changing management practices in order to manage with a more complex business relationship that a switch may result in. *Lost benefits costs* pertain to the costs associated with losing access to benefits such as discounts, loyalty points with a particular service provider or moving away from a high trust relation with a partner. *Search and evaluation costs* pertain to the economical and cognitive costs an organization face before switching, in the process of identifying appropriate alternatives (Whitten & Wakefield, 2006). *Sunk costs* pertain to the costs associated with the psychological attachment managers have with specific projects or clients (Whitten & Wakefield, 2006). Managers that have invested time, money, and effort into a matter, will face the psychological cost of switching, which in turn may affect their decision making (Polites & Karahanna, 2012; Samuelson & Zeckhauser, 1988; Whitten & Wakefield, 2006).

Lock-in

Hanseth (2000) describes lock-ins to be the effect that may emerge when technology is adopted and becomes difficult to replace. Lock-ins usually occur when considerable investments have been made into technology, products or accessories to a specific technology. Arthur (1989) argues that under increasing returns, lock-in effects can lead to an outcome that is not necessarily superior to other options. Hanseth (2000) has further emphasized that even in situations where a switch to a new technology would have significant benefits, the cost of switching may prove too strong for a change to occur, and hence a lock-in exists.

Lock-ins can arise during different circumstances including: contractual situations, where the organization have committed itself over several years, loyalty programmes in the form of credit systems, brand-specific education in the form of education and experiences of a specific product-family, as well as being dependent to suppliers whom are in a leading market position. Lock-in effects are common in the use of information systems (Hanseth, 2000). Since systems have to be compatible with each other, organizations usually buy the information systems from the same supplier (Shapiro & Varian, 1999; Hanseth, 2000). Lock-ins can also emerge due to the amount of information that an organization has in the form complex networks of databases. Situations in which lock-ins are in effect prove to be difficult coordination challenges for many organizations when they are to transition from their current technology to newer (Hanseth, 2000). When such behavioural lock-ins have occurred it establishes a situation where individuals will not migrate to new systems even though it may provide additional usefulness (Polites & Karahanna, 2012).

Institutional logics

Institutional theory concern the regulation of human activity by systems of structural rules i.e. institutions (Friedland & Alford, 1991; Thornton & Ocasio, 2008). Institutional theories have taken different approaches on how to analyse institutional functions. Parsons (1956) has focused on how universalistic rules, contracts, and authority shape organizations while others have emphasized the role of culture and cognition (Meyer & Rowan, 1977; Zucker 1977). From this the concept of new institutionalism arose which internalizes both of these approaches (Friedland & Alford, 1991). Friedland & Alford (1991) therefore argue that organizing structures are institutionally formed by external and internal factors. However, rejecting both individualistic and structural viewpoints, they argue that each of the institutional orders that form the systems which impact human activity follow different logics. These logics constrain and enable the behaviours of those whom are impacted by these institutions. However, the logics are not fixed and are transformed in “the creation of new social relationships and new symbolic orders” (Friedland & Alford, 1991 p. 250).

Information technology plays an active role in social systems, in which it embodies a guiding and constraining factor (Winner, 1977; Huber, 1990). Information technology is not merely created through human action, but also shaped by the human context in which it is employed. IT is therefore the result of how different actors and socio-historical contexts create social order with technology. Hence, in the interaction with human agents technology may be socially changed. This occurs through the use, interpretation, appropriation and general manipulation of the technology, in conjunction with the influence of social factors. Therefore, technology forms a part of the institutionalization of organizational work through

structural rule-sets, both materially and socially (Orlikowski, 1992). In organizations it has been highlighted that the different roles of staff is a source of tension. There is a gap between how managers and users perceive the IT department and vice versa. The business side generally view the IT department to lack a strategic vision for the use of information systems, while the IT department view the business side to fail in their construing of specifications of requirements (Boddy et al., 2008).

Path dependency

Path dependency can be described as the impact past events have on future developments (Hanseth, 2000). There are two ways path dependence emerges according to Hanseth (2000 p. 65) either through "early advantage in terms of numbers of users leads to victory" or through "early decisions concerning the design of the technology will influence future design decisions". The first form is the result of the positive feedback loop in network effects, where an early advantage in the number of users of a standard makes it more valuable for future users leading to more users and the eventual diffusion of the standard. In comparison the second form is the result of the design of a technology. This occurs since past decisions on the design on a technology will frequently have implications on how it may be used and in terms of its compatibility with other technologies (Hanseth, 2000). Zhu et al. (2006) similarly considers path dependence to be the result of the strength of the network effects, since path dependency entails that the ability to adopt new technology depends on previous experiences and technologies. Hence, since the bigger the size of the network, the larger the value of being associated with it, the result may be path dependency and lead to the rejection of employing superior technology, due to the value of being connected to the bigger network. Furthermore, when migrating to another standard they posit that difficulties in doing so may be the result of "non-obvious and intangible costs related to relationship-specific investments, standards change, process reengineering, and associated managerial complexity" (Zhu et al., 2006 p. 531).

Sydow, Schreyögg and Koch (2009) argue that organizations develop path dependency through three phases (Figure 1). Organizations initially exist in the preformation phase, which is characterized as an open situation where a broad array of alternative options are available. The organization's position is always impacted by the installed base, mainly through the existing institutions, which reflects the rules and culture within the organization. However, the preformation phase is not deterministic for an organization, and an organization is thusly not dependent to a certain path. In order for organization's to become path dependent, a critical event, such as a decisive action or accident juncture must be reached. Sydow et al. (2009) describes critical junctures as the point where a triggering of a self-reinforcing process of social practices takes place. This event marks the transition from the preformation phase to the formation phase, emphasizing that an organizational path has been formed and a pattern of social practices becomes persistent. The formation phase is characterized as a situation where an organization's scope of actions has become narrowed in relation to a certain organizational path. As a particular path or solution gains an increasing amount of positive feedback, it becomes more and more irreversible, since investments and/or the fixed costs are at a high level. Sydow et al. (2009) emphasize that an organization's scope of actions in the formation phase is constrained, although not at the level where choices are impossible. The focal action pattern can reach a level where it is replicated constantly, which further restricts an organization's scope of actions, and

eventually results in a lock-in situation. When this occurs, an organization has entered the third phase, namely the lock-in phase. In this phase, the scope of alternative actions is close to none, mainly because of the high switching costs. The lock-in situation in an organizational setting, can however be viewed as not fully deterministic, since organizations are of a social character. The core path that the organization is locked-into is deterministic, but the underlying organizational patterns could allow for variation in practice, since the organization members will individually interpret the path and act in various ways. Organizations that stay in the lock-in phase risk becoming dysfunctional in the long term. They risk becoming too rigid when faced with internally and/or externally changing circumstances that motivates new alternative solutions. Additionally, the lock-in state caused by being path dependent may hinder the organization from pursuing a path that does not align with the existing path of action already in place (Sydow et al., 2009).

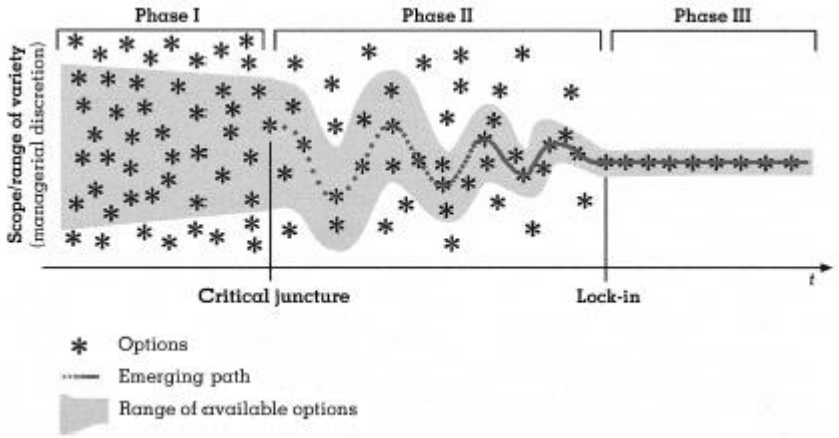

Figure 1. The Constitution of an Organizational Path (Sydow et al., 2009)

To conclude this chapter, the assumptions included are that an organization always has an installed base which is the sum of IT systems and connected processes, stakeholders and their setting. Technology heritage stems from this concept in that what already exists will have an impact on current and future developments. Mechanisms which arise in organizations due to their installed base include switching costs, the mechanism of any perceived cost of switching from ‘X’ to ‘Y’. When switching costs are perceived as too high for a change to occur then organizations are locked-in and cannot make the change. Institutional logic is something that permeates organizations and influences behaviour and practices and is therefore an important part to recognize in analysing technology heritage. These concepts form an organization's path dependence, an overarching concept of how previous events constitute an organizational path which is hard to divert from. These concepts are central parts of organizations’ realities which organizations and their managers have to cope with.

2.2 Theoretical framework

The theoretical framework utilized as a foundation for researching technology heritage in this study is the theory of Technology debt by Magnusson & Bygstad (2014). It is a broad perspective of three research stream, network economics, information infrastructure and institutional theory to which they add economics and finance theory. We found it pertinent to

use an all-encompassing theoretical framework since the constraining factors of technology relate to any perceived cost to switch. Although the theory is created from interviews of CIO's, and hence may not be fully applicable to a micro perspective of managers, it is a useful instrument from which to research technology heritage.

Technology debt

Technology heritage is the aggregate of all parts of an organization's installed base. Magnusson & Bygstad (2014) proposes the concept of Technology debt, a theoretical approach for organizations to manage technology heritage, and for researchers, a framework to understand technology heritage. They argue that Technology debt, as a metaphorical debt, impacts the organization's scope of options to act upon. If organizations have sufficient amounts of options available then they have the manoeuvrability to act accordingly. The four assumptions which underlies the theory are: (Magnusson & Bygstad, 2014 p. 5)

1. "Debt is accumulated over time as a consequence of decisions"
2. "Debt is associated with a cost of interest"
3. "The cost of interest and the total amount of debt influences prospective decisions, through limiting the amount of funds available"
4. "Debt is a necessary element of the capital structure of the firm"

Technology debt is the form of debt that the IT function of organizations always carry. The result of the four assumptions is that organizations will find that the decisions the IT function makes impacts an organization's technology debt, by either increasing and/or decreasing the accumulated debt (Magnusson & Bygstad, 2014).

Investment decision factors

Magnusson & Bygstad (2014) argue that the investment decisions of an organization could be influenced by three primary factors (see Figure 2). The first factor pertains to fads and fashions in an organization's surrounding, as well as the organization's history, which reflects the institutional heritage or "technology past". They argue that the institutional heritage can materialize as a perception of IT as a supporting function, and as a discontent with the quality of the existing IT. The second factor pertains to the organization's currently dominating institutional logic, which is referred to as: "technology future". They argue that this may materialize in the form of an institutional logic with a strategic intent to standardize and consolidate IT systems. The third factor reflects the organizations installed base, which consists of the infrastructure in place, and the supporting resources and processes. Magnusson and Bygstad (2014) argue that technology heritage can materialize as a diverse collection of systems that have been developed internally.

Loan and Amortization

The model of the process of technology debt shows that investment decisions impact an organization's technology debt, by either increasing and/or decreasing the accumulated debt (Magnusson & Bygstad, 2014). Organizations can either increase or decrease their technology debt through investment decisions, as either metaphorical "loans" or "amortizations". Loans pertains to investment decision that increase the accumulated debt,

which results in less manoeuvrability. Amortizations pertains to investment decision that decrease the accumulated debt, which results in higher manoeuvrability.

Technology debt manifestation
Technology debt materializes as a direct cost in the form of constrained manoeuvrability (cost of interest) and as a repeated impact on the three primary factors influencing the investment decision (Magnusson & Bygstad, 2014). Institutional heritage includes organizational consequences, such as a negative perception of the IT organization's ability to deliver. Institutional logic includes organizational consequences, such as necessary strategic changes pertaining to previous failures. Technology heritage includes organizational consequences, such as an increased level of complexity of the organization's installed base (Magnusson & Bygstad, 2014).

Organizations can increase the level of manoeuvrability (Amortization), e.g. by replacing a substantial amount of the existing IT with a new IT solution. The level of manoeuvrability is likely to decrease (Loan) when organizations are affected by lock-in effects, when the required investment is too sizeable, or when the implementation will put stress on the organization. Assessing the effects for the technology debt balance in the form of the cost of decreased manoeuvrability (cost of interest) is done by comparing the increase and decrease in manoeuvrability gotten from decisions. This shapes the three primary factors of investment decisions (Magnusson & Bygstad, 2014).

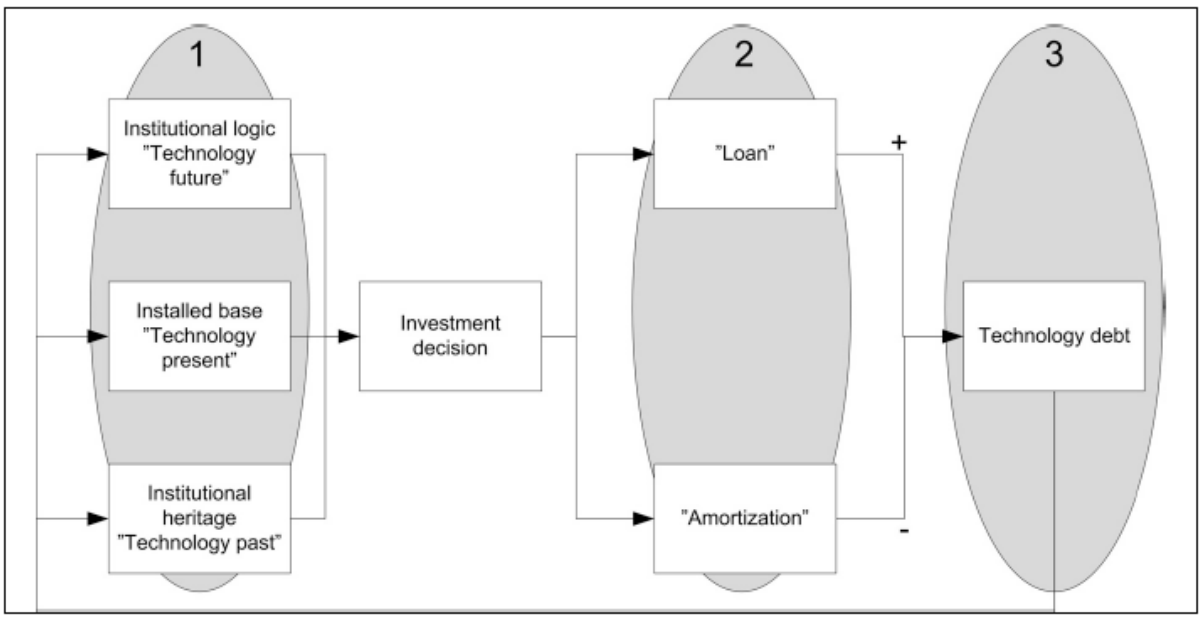

Figure 2. The process of Technology debt, focused on the ex-ante and ex-post of investment decisions (Magnusson & Bygstad, 2014).

Typology
Magnusson and Bygstad (2014) presents a typology of technology debt (figure 3), which represents several areas that can affect organizations' manoeuvrability. These factors are categorized in three main areas, Staff, Users and Systems.

Staff is made up of three sub-areas (Ideology, Competence, and Working environment) and

refers to the accumulated debt that pertains to the workers within an organization's IT function.

Users is made up of two sub-areas (User satisfaction and Reputation) and refers to the accumulated debt that pertains to customers and/or users of the IT function. The user area comprises both an organization's internal users and the potential collaborating inter-organizational partners supported by the IT function.

Systems is made up of four sub-areas (Infrastructure, Shadow IT, Technical, and Governance) and entails the organization's technology and how it is governed.

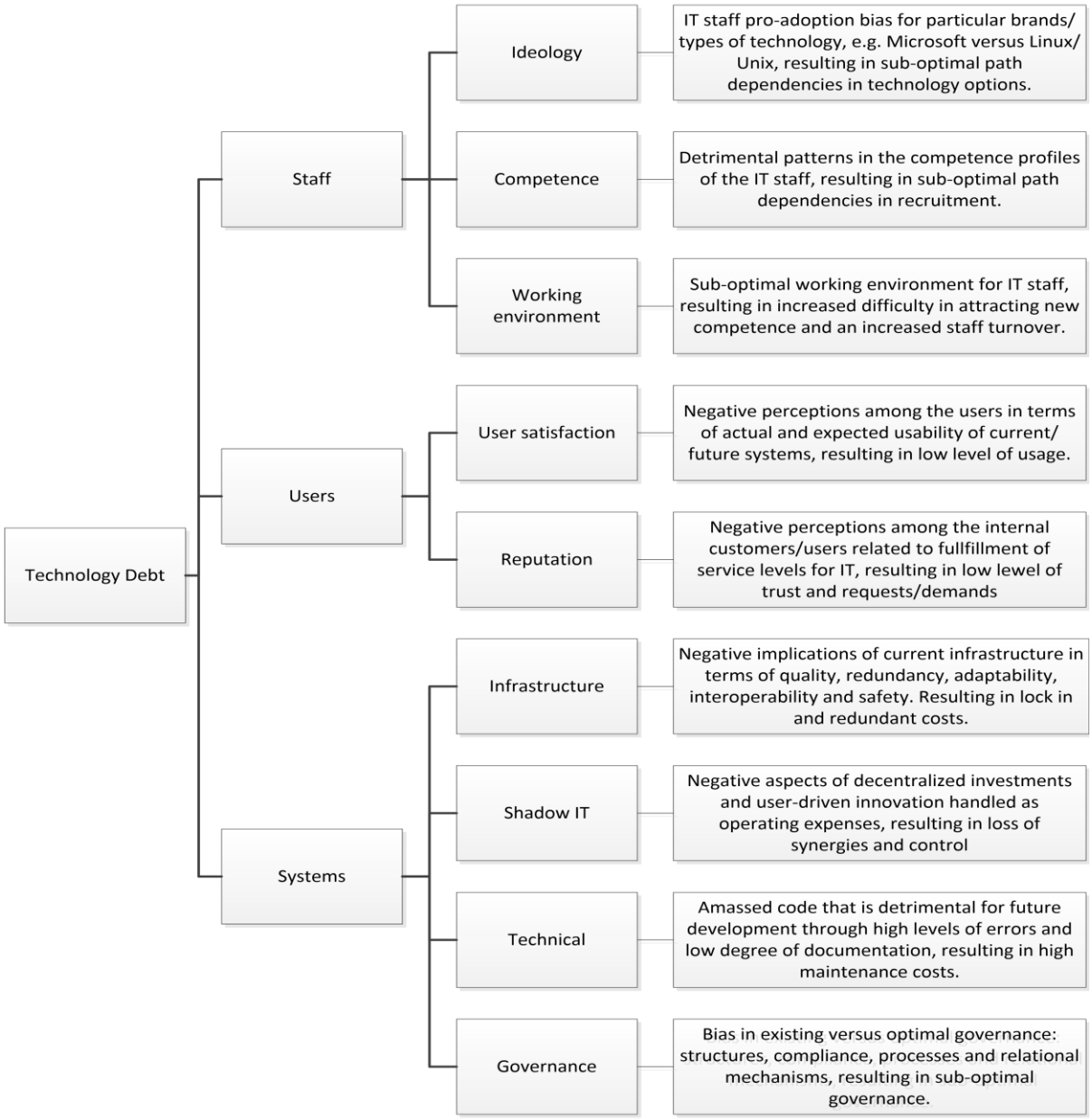

Figure 3. Remodelled version of the typology of Technology debt (Magnusson & Bygstad, 2014)

The assumption underlying the theoretical framework is that organizations are subject to the sum of Technology Debt. Manoeuvrability entails that an organization can make changes. However, this may be hindered by an organizations Technology Debt.

3.0 Research design

In the following section the research methods of choice for this study is described. The study was conducted through a qualitative case study of the technology heritage of an established telecommunications organization, with more than 1000 employees, through the interviewing of 12 managers at the organization whom interact and are affected by technology in various forms when dealing with change.

3.1 Empirical selection

The choice of a telecommunications organization was made due to the telecommunications industry being a digitally mature sector with extensive use and experience of technology, a relevant quality in a study of technology heritage. The telecommunications industry placed second highest in a study of digital maturity in different sectors. It is one of two sectors that placed top five in all of the research' criteria for digital maturity (Kane et al., 2015). Therefore, an established organization in this industry should have extensive use of technology and experience in utilizing it.

The decision to conduct a case study of the technology heritage of an established organization further stem from the need for Technology debt to exist, an accumulative process over time (Magnusson & Bygstad, 2014). Technology debt should be present in an established organization. Since, established organizations in comparison to smaller or new entrants, often exhibit inertia and a need to promote continual experimentation (Markides, 1998). These organizations often have an understanding of where they need to go, yet struggle to understand how previously successful practices would hinder them in their response to the change (Sull, 1999). This strengthens the advisability to conduct a case study of technology heritage, since the case study allows for an intensive examination of the setting associated with an organization (Bryman, 2012). The chosen case of this study is meant to be a representative case. The representative case can be utilized to learn from the experiences of people or institutions in commonplace situations (Yin, 2007). In this circumstance, how managers strategically cope with technology heritage within the setting of the telecommunications industry is the level of analysis.

We take an interpretative approach to the research, which emphasizes the significance of the social world as socially constructed. The epistemological position of interpretivism is useful for qualitative research, and the interpretivist approach strengthens research interest in how people interpret their social world (Bryman, 2012). This study's focus on technology heritage makes it suited for an interpretivist approach since the theory implicitly takes its foundation in interpretivist epistemology due to the inclusion of constructed behaviours of individuals e.g. through the inclusion of institutional logic in the theoretical foundation. Additionally, the research question's emphasis on the coping strategies of managers, positions the managers understanding of their situation prominently.

3.2 Data collection

The data collection was conducted through a series of qualitative interviews, 12 semi-structured interviews were conducted with managers within a telecommunications

organization. Semi-structured interviews was the chosen method, based on its flexible and qualitative nature, meaning that it allows the interviewer to explore the topics which the interviewee deemed important based on their respective backgrounds and perceptions (Bryman, 2012). Semi-structured interviews are a preferable choice of method when the interest of the research lies in understanding what the interviewees "view as important in explaining and understanding events, patterns and forms of behaviour" (Bryman 2012, p. 471). The interviews emanated from a guide (see Appendix A) comprised by open questions which gives the respondent the opportunity to freely answer, while supplementary questions were asked in order to gain clarification or to explore specific topics further. The interviews were recorded and lasted approximately sixty minutes each, and later transcribed, resulting in 105 pages.

To gain access to interviewees, a connection at the organization was contacted whom was tasked with finding relevant managers for interviewing. Their roles were defined to involve investment decision making, and that they should have responsibilities to govern IT or have a strong relation to technology. Sampling from the recommended managers was made based on their different positions and subsequent viewpoints of how technology heritage impacts them to gain a broad perspective of how technology heritage impacts the organization. Purposive sampling is a non-probability method that, as its name suggests, is not random. It is a sampling method where the goal of the research is central to the selection of participants. The participants are selected strategically based on the defined criteria (Bryman, 2012), which this study entailed. The interviewees that accepted to be interviewed, were contacted to set an appointment through an email which explained the context and purpose of the study.

The questions that were used to interview, were generated from the theoretical components of technology debt. The guide was structured according to the typology of Technology debt, containing the areas: Ideology, Competence, Working environment, User satisfaction, Reputation, Infrastructure, Shadow IT, Technical, Governance and an additional general area which was added as a form of summation of the interview. The data collection and analysis was conducted as an iterative process, to be able to gather data and understand it, in order to improve the data collection instruments by adding more questions and refining the existing (Eisenhardt, 1989). In this study the instrument for data collection was the interview guide.

When constructing and conducting the interviews, the guidelines of the dramaturgical model (Myers & Newman, 2007) was heeded to. We as the interviewers situated ourselves as the actor by asking the interviewee several demographic questions (See Appendix A). In order to make the interviewee feel comfortable being interviewed, several ethical points were addressed. These points were addressed to ensure the interviewee that detailed or sensitive information regarding both the organization and the individual would be anonymized. The interviewee was also informed that they were free to ask questions during the interview and if there were specific questions which they did not want to answer for various reason, they had the right to refuse. Additionally, if the interviewee experienced any discomfort during the interview, they had the opportunity to end it at that point. The interviewees were asked for their permission before the interviews were recorded, as well as informed that the recordings would not be accessible to none other than the interviewer. Furthermore, interviewees were chosen from management working at different organizational units within the organization, to

ensure that various voices were included in the study. During the interviews, when the interviewee brought up an experienced based example from their specific context, we asked supplementary questions regarding that specific context to steer the direction of the interview while allowing the interviewee to answer with their own words and language (Myers & Newman, 2007).

Interviewee	**Title**
Manager 1	IT Manager
Manager 2	Group Manager
Manager 3	Product Manager
Manager 4	Support Manager
Manager 5	Support Manager
Manager 6	Group Manager
Manager 7	Group Manager
Manager 8	Business Manager
Manager 9	Product Manager
Manager 10	Business Manager
Manager 11	Project Manager
Manager 12	Solutions Manager

Table 1 - Summary of the interviewees.

3.3 Method of analysis

When taking a micro perspective in research by focusing on managers, the area of interest is what managers actually do (Jacobsson & Sahlin-Andersson, 2006). To not be influenced extensively of preconceived coping strategies, this study conducted a thematic analysis. Thematic analysis has the goal to find patterns in the data collected from which to draw conclusions (Braun & Clarke, 2006). Using thematic analysis is pertinent, since although the framework of Technology debt allowed us to study technology heritage, it does not encompass how managers themselves approach issues of heritage. However, this concludes that the study is not free from preconceptions since its foundation is an abstraction of technology heritage in the form of Technology debt and the theoretical underpinnings included in this study.

The collected data was analysed with Braun and Clarke's (2006) guide for thematic analysis in mind. During the initial phase, we familiarized ourselves with the data by transcribing the interviews, returning to the audio files to correct the transcriptions, as well as reading through the transcriptions. By taking these measures, we were able to gain an initial understanding of the essential meaning among the interviewees' views. The following step involved structuring the data in Microsoft Excel, according to what constraint the interviewee experienced, as well as how the interviewee described to cope with the constraint. Each interview was given a separate worksheet to enable us to make comments and code the responses. The coding that took place, pertained to the different ways or factors that

constituted the constraint, and the different measures, activities and actions taken to cope with the constraint. In the following step, called searching for themes (Braun & Clarke, 2006), we compared the different responses and codes across the interviewees in order to find patterns of the interviewees' approaches. This comparison resulted in seven potential themes that reflected the patterns of coping.

The emphasis of the following step was on reviewing and refining (Braun & Clarke, 2006) the seven candidates for themes. One of the candidates for themes, was considered to be too closely related to another theme, as well as having insufficient data to support it, and was therefore removed. This was done to ensure that the themes were distinct and relevant for the study's purpose. With the initial refinement behind us, we gave the themes temporary names and summarized them according to the strategy used, by which manager in what subcategory of Technology debt (Magnusson & Bygstad, 2014). This served as a thematic map (Braun & Clarke, 2006), which gave us an overview of the themes and their practical use, which indicated that every theme had their distinct meaning. This thematic map was later refined by returning to the structured data of the transcriptions to ensure that the claims were supported and by the addition of the final names for the themes. These themes reflected the six identified coping strategies and is presented in "Table 2" in the discussion section (see section 5.2). We reached the final names by discussing the essence of the themes by defining their characteristics, scope and utilization. The last step of the thematic analysis involves the writing up of the report itself. The themes are presented as part of the discussion, both as an analysis and as a discussion in relation to existing research. The presentation of themes draws upon the illustrative examples and data extracts presented in the results to showcase the prevalence of each theme.

4.0 Results

This section presents the findings of the study. The structure follows the main categories of the typology of Technology debt (Magnusson & Bygstad, 2014). The findings are presented to describe how change alternatives are perceived as constrained, and how the managers coped, in the respective sub-category.

4.1 Staff

The answers that were given to the questions corresponding to the category of Staff, showcased that the subcategories are relevant concerns for managers to be able to conduct changes.

Ideology

The majority of the 12 interviewees described that culture and technology preferences can constrain their ability to conduct changes in their unit.

Culture was said to be a limiting factor by all of the interviewees except for Manager 4 who emphasized that it only has minor effects on decision-making. The ways that culture was viewed to be constraining were quite differentiated. Two interviewees highlighted that groups in their unit impacts the ability to conduct changes, through the technically adept who have strong opinions of the IT services that the organization delivers (Manager 1) and that some do not want to be subject to control functions in systems (Manager 7). Three interviewees underlined that some groups were less prone to change and that this constrains the success of the change (Manager 5, 7 & 11). The Managers 6 and 8 highlighted issues related to the organization as a whole as constraining. The organization's culture encourages individual initiatives which may desynchronize work (Managers 6 & 10). Additionally, the impact of units' language and behaviour constrain the ability to conduct change when they do not understand each other (Manager 8).

The interviewees described several approaches in order to address the constraining effect of culture. One approach described by Manager 1 and 6 was that they sought more information to deal with the situation through pre-studies or a general search for information. Manager 1 described that strong preferences of certain groups needed to be taken into consideration before making a decision. Manager 10 described that he/she informally tries to convince others to have a long term perspective when taking initiatives. Manager 5's approach involved finding ambassadors for the change to act as mediators and drivers for the actual change. This approach was elaborated on by Manager 9, who spoke of the importance of "building relations" with the persons that were important for the change's success. Another approach as described by Managers 7 and 11, was to emphasize the importance of the change for employees by showcasing how it will impact the larger picture of the organization. Manager 8 broke down larger changes into more easily digestible parts for employees to work with in order for diffusion of language and behaviour.

Technology preferences was described as a constraining factor by a majority of the interviewees. Managers 3 and 9 emphasizes that technology preferences may constrain due to staff's unease with using other technology than the ones they subscribe to.

"[...] there are those who would not think about using anything other than Cisco and if we move forward with something other than Cisco products then people take their hands off it" - Manager 3

Similarly, Managers 4, 5, 7 and 11 highlighted that employees prefer continued use of the systems that they are used to, when faced with a decision to move to other systems, which constrains this move. Furthermore, Manager 9 describes that when a certain technology is "preferred" by a large population, their understanding of which issues they seek to resolve is biased towards the specific technology, which will need to be addressed before any change can be conducted.

The approaches to coping with the constraining factors of technology preferences centred on trusting in their position in the organization, searching for information to understand the reason for the preference and motivating people to conduct the change even though they may be against it. Manager 1 seeks out the different technology preferences of staff which is then taken into consideration in the decision-making. Similarly, Managers 5, 7, 8, 9 and 11 try to gain a better understanding of the concerns of employees, yet they also lift the importance of motivating personnel to go through with the change. E.g. Manager 5 described this of managerial importance:

> *"Showcase the background and show that, of course, there are good reasons for me to conduct this change in the form of profitability, effectiveness, or other reasons - which allows me to motivate the change"* - Manager 5

Furthermore, Manager 4 emphasizes that managers in these situations have to divert from comfortable decision and instead dare to make tough changes and keep up his/her motivation. Additionally, Manager 9 describes that vague and contrasting preferences may be managed through the organizing of a workshop in order to identify a suitable solution. Lastly, Managers 2, 3, and 6 follow their respective positions' assignments, by governing the services that are delivered to his/her unit (Manager 3) or scoped the technological change into smaller parts (Manager 6), while trusting in the governance of the organization. This may occur due to decisions on technology suppliers is placed higher up in the hierarchy (Manager 2).

Competence

The IT department was primarily viewed as skilled and able to support the work the manager needed done to conduct a change. However, in a few cases they experienced a constraining effect related to a lacking degree of competence. Manager 1 was the single interviewee who said that a lack of skills may constrain the ability to change. The others who argued that competence may hinder change focused on a different aspect entirely, namely the IT department's understanding of the business-side of the organization (Managers 3, 5, 6, 7, 8, 9, 10, 11 & 12). Manager 6 describe this in terms of seeking to create too complex solutions which in practice results in failed projects. Manager 7 emphasizes that the lack of understanding leads to IT making misdirected purchases of technology for something that they do not understand. A more contrasting view was the one presented by Manager 8 who described that the IT department is subject to a heritage in how they view themselves and

the processes of which they are a part. Hence, they do not proactively engage the business-side to solve issues, when conducting changes, and instead wait for units to order specific solutions from them.

Manager 1 explain that when there is a lack of internal IT competence, after evaluating the situation one way is to turn to employ consultants with the specific expertise needed. Manager 6 similarly, argues that the complexity that occurs due to the misunderstanding that may arise due to the IT department's lack of understanding of the business-side, may lead to resources having to be placed in gaining new skills through the hiring of new employees or consultants. When faced with an IT department that does not fully understand the business side of the organization, and thus either hinder or slow down change initiatives, three managers try to act proactively to resolve the issue. Manager 5 did this by motivating and convincing IT staff that the effects of the change will be positive for the overall business. Manager 8 and 11 informally tries to get the IT department to work together with their units and instead try to get IT to be a part of the change. Another approach as described by Manager 9 was that the central needs must be visualized to the IT department or to people higher up in the organization's hierarchy, through either informal or formal communication channels. This puts an emphasis on identifying individuals suitable for the specific issue, which in some cases could be decision makers outside the IT department. Manager 3 brought up a similar approach to managing a lacking knowledge or understanding of the business, by identifying an individual within the organization, with enough influence to pursue the issue at a higher organizational level and a different angle. Lastly, Manager 12 did not recognize a path of action to resolve it and accepted the constraint, due to budget concerns, while Manager 10 worked with these issues in his role to coordinate the departments.

Working environment

The majority of the interviewees did not have the insight into the working conditions of the IT department to feel comfortable answering the question or did not find that there was a problem with the turnaround or recruitment of personnel. Manager 2, 7 and 9 described the main issue to be not one of retaining or acquiring competent personnel but rather that IT may not always have enough resources to successfully manage. Manager 6 did however mention the concern of the quick pace of change, which may lead to a situation where personnel may never feel that they are done with a project, which may lead to a lack in motivation and energy.

Because the managers' generally did not see any issues with the IT department's working environment, the concern of retaining personnel or hiring new competences was not seen as something that is necessary to manage. However, Manager 6 who emphasized the pace of change as a stressful moment argued that he/she has to understand the people whom he/she works with, and what competences and what motivates them to do their work. Furthermore, that he/she recognizes the ability of others to handle stress and appoint the persons to suitable work in accordance to their ability to manage the stress level in that situation.

4.2 Users

The answers that were given to the questions corresponding to the category of Users, showcased that the subcategories are relevant concerns for managers to be able to conduct changes.

User satisfaction

The majority of the interviewees responded that they had experienced the constraining effect of dissatisfied users in regards to expected and actual usability of IT. However, Managers 1, 11 and 12 argued that the use was as intended. The interviewees who found the usage a constraining factor were divided into two approaches. They viewed the specification of requirements to be at fault, if what was delivered did not live up to expectations (Managers 2, 3, 4 & 8). Manager 2 emphasized that an insufficient specification of requirements would result in a misdirected system which would not only, not serve users, but could also force them to establish workaround processes. Additionally, Manager 4 pointed to the efficiency being harmed in such situations. The other approach was that they considered that from the user perspective of employees they would never fully be able to utilize everything the systems allow for (Managers 5, 7, 9 & 12). One issue concerning a specific type of solution was described as being used correctly by those who adopted it, but the solution never reached mass acceptance. Instead, co-workers continued using other more inefficient solutions (Manager 9 and 10). Manager 9 described this:

> *"Every day, I sit with this sort of digital [edited] solution, but I can't get my co-workers and colleagues to always use these solutions, instead we use ineffective conventional [edited] solutions."* - Manager 9 (Quote has been edited for reasons of anonymity)

The managers who find themselves in situations where the resulting solution did not live up to the expectations due to misdirected specifications had differing approaches to manage the situation. Manager 2 described that when a system was implemented, but did not live up to expectations, he/she went along with it. Yet, tried to fix it by evaluating alternative paths of actions to correct it, such as requesting more capital. Another approach was similarly to go along with the situation, although when possible Manager 8 chose to divide a larger change into smaller subprojects to retain control. Manager 4 accepts the solution provided, and utilizes the experiences of what went wrong to create better specifications going forward. Another approach that was conducted to alleviate the hindrance to change was to order that those involved in the process is to be educated accordingly (Manager 3).

The alternative view of user satisfaction constraining change, concerning systems that were not used to their potential, had similarities but also differences from the above mentioned approaches. Managers 5, 7 and 12 described that education of how to get started is an imperative when ensuring that users can smoothly transition to a new system. Emphasis was also put on motivating the occurring change from a holistic perspective (Managers 5, 7 & 9). Manager 10 described that he/she in the role of manager either advocates new solutions or ensures through formal action that his unit embrace the solution. Additionally, one approach which was used to facilitate the change was to identify ambassadors or super users who could act as drivers in the change (Manager 5). This was considered to be an

important success factor, since a passionate leader of the systems could demonstrate an interest and an understanding of the issues users are faced with. Manager 7 highlighted that manual workarounds may be necessary for users to successfully utilize the systems. Lastly, Manager 12 created key measurements to steer others to commit to his/her change and utilize the IT objects.

Reputation

All of the interviewees described that there exists negative connotations with the IT department's ability to deliver solutions to support the internal users in their daily work. These perceptions were primarily agreed upon to be a hindering factor in change initiatives, although three interviewees (Managers 8, 11 & 12) deemed them not to have a noticeable impact. Manager 3 also had a diverting opinion, although recognizing the hindering factor of a lack of trust in the IT department's ability to successfully deliver the proper solution in time, he/she argued that this is due to the co-workers may have unreasonable expectations on what the IT department can deliver.

The negative perceptions among users were characterized as the IT department's inability to deliver solutions within three dimensions: time, quality and cost (Manager 1). While, Managers 2 and 4 described that users could feel that the IT department did not fulfil their expectations upon delivery. Manager 2 described that he/she has encountered situations where people would think "oh well, I'll believe it when I see it". This was elaborated on by Managers 5, 6, 7 and 9 who described it to arise from the perception that the project that a specific individual or group is working on will not be prioritized. It occurred, they argued, due to budgeting concerns for the IT department making it difficult to conduct change. Another issue that was emphasized to have an impact on users' perceptions, was that solutions which the IT department provided didn't correspond to the wants of the requester. The reputation that the IT department may not deliver on time or in sufficient quality leads to people in the organization becoming hesitant in requesting solutions from the IT department (Managers 5 & 7). Manager 5 expressed this issue as:

> *"Of course, you may be put off from involving IT. Since you know that it may be a protracted process. Hence, you think twice before you start something that involves IT [department] directly."* - Manager 5

Three of the interviewees described that they either in some cases had no approach to managing the negative perceptions among users (Managers 3, 5 & 7) or altogether did not have an approach to deal with the issue (Manager 9). A single manager in some cases forwarded the concern in the corporate hierarchy (Manager 5). Unifying a multitude of the interviewees' courses of action to solve the issue of negative perceptions was to discuss how to solve the issue to ensure that the wants are met in that situation (Managers 1, 3, 4, 5, 6 & 7). Three of the managers (1, 3 & 7) confronted this issue by involving users to be a larger part of the decision to order the solution from IT, and through this manage the wants and expectations of the users. Showing to users that there is a possibility to actually influence the solutions that the IT department provides (Manager 7). Another approach was to acquiesce the IT department to fulfil the wants of users. Managers 4 and 6 did this by engaging in the process more directly, by establishing contact with the IT department and users, e.g. through meetings, e-mail messages and phone (Manager 4). While, Manager 5

tried to establish manual workarounds of their process to aid the IT department's delivery. Lastly, taking it upon themselves to influence the perception of the IT department in a positive direction some managers attempted to alleviate the concern of trust between users and IT (Managers 1, 2 & 7). Manager 1 transparently explained the prioritizing concerns that the IT department are subject to, being the reason for the occurrence. Manager 2 demonstrated previous success stories to focus the energy into something positive. Lastly, Manager 7 went ahead to engage with the IT department and from this position involved his own personnel with them to build a relationship between them.

4.3 Systems

The answers that were given to the questions corresponding to the category of Systems, showcased that the subcategories are relevant concerns for managers to be able to conduct changes.

Infrastructure

All of the interviewees acknowledged that the existing infrastructure was an obstacle to certain change initiatives, mainly focused on three concerns: the complexity of the infrastructure, the adaptability of systems, and the interoperability of systems. In regards to the complexity of systems, Managers 7, 8, 9, 10 and 12, described that the architecture of the systems could hinder change. Manager 9 exemplified this by highlighting that the process of introducing new products to the existing systems can be tedious. Although complexity was lifted as an issue, another viewpoint was that some systems did not allow for enough flexibility for added functions, hence they were not complex enough in certain situations. This view was described by Managers 3 and 7 who said that the systems had a too rigid focus on a specific short term solution, which therefore could not be adapted to future change needs. Manager 3 described it:

> *"The thing is that they have a narrow design. The IT development has been a little bit too goal oriented, and only noticing what is critical for the moment."* - Manager 3

Insufficient interoperability between systems was concerned as a constraining factor when conducting change (Managers 3, 4, 5, 6, 9, 11 & 12). Manager 5 described that many of the existing systems in use, which interoperates with other systems, could lose a functionality when the other system is updated. An additional problem was that when a change initiative affects the interoperability between two systems, it might not be technically possible or too expensive to develop a module to establish interoperability between the systems (Manager 7).

The security aspect of information systems had a stark impact on the available change options available for managers. They all found it to be a central aspect that they could not workaround. However, Manager 9 further described that sometimes the security policies could be ambiguously interpreted to circumvent the hindering aspect. Additionally, Manager 9 ensures that if the security policy in question hinders a change, that his/her understanding of the constraint is correct by seeking out the source of the policy.

Regarding the complexity of the infrastructure, Managers 8 and 10 described that making changes is a major challenge and that they simply accepts that the change initiative will be time consuming, due to the complexity. Similarly, Manager 7 considers it something that he/she will have to live with. One approach on how to deal with complexity that was raised was to adapt the change to how the system functions. Managers 9 and 12 does this by contacting experts on the system in question to understand it, in order to recognize the system's qualities in supporting a change. Manager 2 described that he/she took a general approach in regards to the organization's infrastructure, by trying to understand the limitations and evaluating if he/she could take a certain action to facilitate a desired change initiative. Additionally, Manager 10 in his/her role, challenges the specifiers of the infrastructure to reduce their demands that would increase the complexity of the infrastructure.

The issue of inflexibility as a constraining factor in systems ability to support change was dealt with through the role the two interviewees (Managers 3 & 7) have. Manager 3 utilized his/her ability to partake in long term planning of technological development to establish a future where the issue is lessened. Manager 7 comparatively, formally meet with the person who has ownership over the decision-making of the system, to influence the systems development in a more flexible direction.

The issue of interoperability between systems was managed through different approaches. When the interoperability is insufficient between two systems, two managers ordered manual solutions to bridge the systems. For example by transferring data through a third party application (Manager 7) or by manually ensuring that the information has been transferred correctly (Manager 6). Managers 3, 5 and 11 incorporates their reaction to this in their roles as managers. Manager 3 chooses to focus on larger structural changes in terms of interoperability while manager 5 contacts the supplier of the systems to reach a solution. Three managers choose to approach the issue of interoperability by enduring the constraint (Managers 3, 4 & 12) and one (Manager 7) did that sometimes. Manager 3's enduring of the situation is made with the intent to await the effect of insufficiency in interoperability to become dire, for the organization to be forced to address it. Lastly, Manager 9 did not have an answer on how to deal with it.

Shadow IT

The majority of the interviewees described that they had encountered the negative implications of decentralized investments in IT and user driven innovation. Managers 1 and 2 described that these solutions lead to difficulties especially when the ones who created it or had experience using it left the organization or changed assignments. Hence, when a change is made and is impacted by the solution the expertise of how to manage this is lacking. The main reason that was highlighted as problematic was the loss of synergy between the organization's systems (Managers 2, 4, 5, 6, 8, 9 & 11). Manager 9 describes this situation as:

> *"[...] departments purchase their own specific solutions to fill their needs, but does not communicate well with other systems, and all of a sudden we have 10 of those who may even overlap each other. After that it becomes very difficult to*

> *merge systems to make it more efficient since they fill different needs."* - Manager 9 (edited for clarity)

Furthermore, Managers 5, 6 and 12 elaborated on this concern by explaining how even smaller solutions can make changes to a more uniform solution to become difficult. Especially when the offending application fulfils a valuable role (Managers 5 & 12).

Managing the constraining effects of decentralized decisions proves difficult according to Manager 4:

> *"[...] you have to accept the situation sadly. [...] You have to live with the existing systems, and manage them all."* - Manager 4

Others sometimes did not have a path of action to deal with the constraint (Managers 9 & 12). Yet another contended that sometimes, the value of leaving the solution in place was higher than the cost of replacing it (Manager 5). Manager 12 further tried to strengthen the urgency of removing the IT object by locating and influencing key individuals who also are influenced by the decentralized solution, to make the change occur.

Manager 5 further argued that the experience of dealing with this issue lead him/her going forward to direct all development of new solutions to involve the IT department to prevent the issue from arising again. This is done to ensure that their paths of change would have sufficient support from the IT department. Manager 1 in loose terms described that when a decentralized solution is discovered, he/she orders the identification and mapping of decentralized solutions. Next, an evaluation is done to establish if there is a need for any of them. Finally, a decision is made to terminate or accept the existence of the solution, while making it clear that he/she is forfeiting any responsibility of it. Manager 8 surveys the situation to gain an understanding of the reasoning behind the solution. He/she then evaluates if there is a need for it, and if so, accepts the solution. But if there is not, then the decision to terminate it, is made. Furthermore, Manager 11 views the concern to be one of governance. Manager 2 approaches the situation by increasing his/her own knowledge by undertaking a search for the decisions that led up to this solution. Lastly, Manager 6 description focused on the importance of quickly trying to solve the constraints of a decentralized solution by involving stakeholders of it to create processes and work routines that work in tandem with the solution.

Technical

Three managers expressed that they did not have knowledge or experience of change being constrained due to technical elements (Managers 2, 5 & 8). Several managers described situations where errors could either slow the pace of the change effort or increase the costs (Managers 1, 6 & 7). Manager 6 described that defects could lead to frustration among staff and that the overall quality of systems could be affected, which would require attention before new development takes place. Five managers (3, 4, 9, 10 & 12) emphasized issues related to the documentation of IT objects. Manager 3 explained that redundant documentation could occur where an IT object had two separate documentations which leads to discrepancies in how up to date the information is. Manager 4's answer related to the constraining effect of having to manage an object that had lacking documentation due to

the uncertainty of how it would impact the change. Manager 9 although mentioning that errors and documentation could have an impact, it is to a lesser extent.

While realizing the issue of lacking documentation of certain systems, Manager 4 described that even though the instructing plan is to remove the technology lacking documentation, this is often not made due to a lack of resources and the level of complexity involved. Manager 10 argued that the concern of lacking documentation was the responsibility of the organization, hence he/she accepted their solution. Managers 1 and 3 did not mention taking a course of action to alleviate the present situation. Yet, moving forward highlighted that they form formal analysis of the reasons the issue arose, to prevent it from happening again. Manager 6 assessed the risks related to technology itself when deciding upon a change. If the risk of bugs is too severe then this would disqualify the change as an option. Another thing he/she mentioned was that quality assurance forms a part of reducing this concern, which Manager 9 also brought up. Manager 12 described that he/she tried to pursue development of this issue in her work by conveying the risk this entails to others.

Governance

The majority of the interviewees argued that aspects of the organization's governance could be a constraining factor (Managers 1, 2, 3, 5, 6, 7, 8, 9, 11 & 12). The amount of resources that is assigned to units was described as an influencing aspect when a change initiative is considered (Managers 5, 6 & 7). Manager 5 described that in order to achieve successful sharing of economic resources between units, it is vital to have IT which can support this. Several managers emphasized that the organizational structure and processes could have a constraining effect (Managers 1, 3, 5, 6, 8, 9 & 11). Manager 1 described that the organizational structure became a hindrance when conducting change since shortcomings of the structure becomes apparent during the change and require amendment. The goal of a streamlined organization further emphasizes the constraints of structure since different parts of the organization optimizes locally instead of as an overall organization (Managers 8 & 12). Manager 9 highlights that a lack of flexibility in structure and processes have led to the IT department to have issues to fully provide support. He/she described that the IT department has the financial power over IT projects that they are involved in, yet they do not have additional resources for specific development to aid other units nor can they receive financial support for said projects from other units. Manager 10 described that the governance function is sub-optimal since the processes are too complex for the organization to govern successfully, causing inertia.

Manager 5 described that to achieve the desired effect of a change initiative, work routines and processes would have to be adjusted according to the change or otherwise result in a sup-optimal situation. Indistinct processes was argued to have a constraining effect on change initiatives (Managers 3, 5, 6 & 8). Manager 3 described that the process of initiating a change to the IT department is too vague which leads to difficulties in understanding which unit is responsible for what task. Furthermore, Manager 6 expressed that obscurity in the handing over of work between departments was a constraint. A similar concern was raised by Manager 8 who described that during the implementation of a change initiative, it is unclear which unit is responsible for what task.

To manage the difficulties that arise due to structure or processes the main focus of the interviewees was placed on relying on existing work channels (Managers 1, 5, 6, & 8). Manager 1 described that as an organization that is undergoing continuous change, he/she attempts to identify areas where defects occur to correct them in a swift manner. Generally, Manager 5 tried through formal meetings to collaborate with stakeholders to adjust processes in accordance to the change. Similar approaches were used to solve issues related to change initiatives that involve process interaction between departments, to find a consistent solution. This was done by workshops (Manager 6), forums for dialogue (Manager 11) or coordination meetings (Manager 8). Manual workarounds could sometimes be necessary to manage the obstacles that constrained a change initiative. When Manager 3 found that vagueness in responsibilities hindered change he/she tried to find paths forward. Similarly, Manager 5 described that when processes were the subject of adjustment, he/she would attempt to find alternative fixes. Manager 8 also described that he/she motivate units by imposing the importance of viewing the change from a larger perspective. This is done to solve the issues that arise of locally optimizing instead of optimizing as a part of the entire organization. Manager 10 tries to solve the issue by escalating it in the corporate hierarchy to people who have the responsibility to manage these issues. To deal with the issues of inflexible funding for projects involving the IT department, Manager 9 tried to seek out support among the executives to carry through a change. However, he/she admitted that in smaller projects this might not be possible and they will have to accept that the support will not be there. While, Manager 12 seek support from executives to mandate his/her change initiative to change the issue of local optimization.

5.0 Discussion

This section is a discussion of the findings of the result section. The analysis of the results showcased six different coping strategies that managers employ to cope with technology heritage. The section is structured on the basis of the identified themes which analyse the specific coping strategy.

The use of the different coping strategies that the interviewees showcased approaches to coping with technology heritage that there were a number of ways managers could do this.

5.1 Strategies of coping

From the results of the subcategories it can be discerned that managers showcase six coping strategies to manage the exhibited concerns of technology heritage.

Process

When managers described that they carry out a systematic approach that is already established in their organization to cope with technology heritage or in moving forward preventing certain parts of the heritage's limiting effect, we call it a coping strategy of Process. This is because it is their assigned responsibility to manage the concern, or if it is not, then they escalate the issue through official channels upwards in the hierarchy. It can also take the form of providing resources to increase people's' capabilities.

The data shows that there exists an adoption bias toward specific technology providers. Managers who seek change acknowledges this relationship that exists to brands, therefore sometimes the managers take heed to pro adoption bias. This is the coping strategy of Process since they have a process of integrating the wishes of co-workers in decision-making.

The coping strategy of Process was also showcased in the interviewee's description of their approach to the category of Users. The constraints are showcased in the use of technology and the relationship between units and the IT department. Managers demonstrated the utilization of the coping strategy of Process, since they in their role often have the responsibility to analyse information and set a course of action, depending on the context. Thus, if a manager find that he/she do not have the responsibility to manage the concern and if the constraint is pressing, it is escalated in the organization. Hence, the managers acquaint themselves with the situation, from which they find a course of action, by utilizing their position to bridge departments.

In response to the management of the category Systems, the coping strategy of Process was used. The managers sought to understand the situation and from that position, devised responsive actions, such as meeting with others to solve the situation, or following established practices. Furthermore, the deferring of the managing of a constraint into the future was made, by not taking a direct action to solve it. Instead, tries to incorporate a change into a systematic approach is made to prevent the constraint from featuring again.

Ignore

As evidenced by the results, managers sometimes chose not to act to deal with the technology heritage. When managers described that they were aware of a constraint but did not take an action to resolve the issue, we call it a coping strategy of Ignore. This was due to a lack of known possible actions to take, or a lack of will to do it due to the manager's role assignment, or as from a view of resignation confronted with the issue - that this is what they have to co-exist with.

None of the interviewees described that they coped with the constraints in the category of Staff by choosing to accept or ignore the constraint.

The coping strategy of Ignore was apparent in situations where the managers considered the lack of successful diffusion of system use, due to them viewing the issue arise from the fault of the specifications delivered. In the subcategory of reputation managers raised the concern of users having unreasonable expectations on the IT department, or that the IT department would not prioritize their project. In these situations the coping although similar seem to be the result of two different strains of thought. When the issue is native to the manager's themselves the reaction was to accept the occurrence constraints of user satisfaction. The concerns of negative perception in regards to the IT department was sometimes coped with by ignoring the issue.

The coping strategy of Ignore showed its width in the category of systems. In the subcategory of infrastructure, coping by accepting the status quo was common. Mainly due to the options available being difficult to recognize, although one case was due to reluctance to manage it due to his/her role. Within shadow IT the coping strategy is discerned due to the same logic of finding it difficult to find options available. Yet, one case highlighted that the manager was forced to accept the situation due to a lack of resources to tackle the issue. Similarly, the subcategory of technical also had this issue. A corresponding issue in governance is that low prioritization of smaller projects situates the manager to accept as is.

Sponsor

When managers described that they seek out specific individuals to enable them to carry through a change, we call it a coping strategy of Sponsor. The coping strategy of Sponsor was showcased in situations when managers either identified individuals who are positive to a change, to reduce others negative perceptions of the change, or through establishing relationships to and between relevant stakeholders.

In the category of Staff, to solve the difficulty of making co-workers adopt new technologies, the coping strategy of Sponsor was used to build relations with and between key individuals and to seek out super users who can act as ambassadors of the new technology. In regards to the issue of competence, the interviewees emphasized that the IT department sometimes lacked an understanding of the business. This issue was coped with, by identifying key individuals who have the formal mandate to allocate the required capital for the change or to mandate their change initiative.

Facing the issue of low usage of the organization's system, the coping strategy of Sponsor was utilized to locate potential leaders of specific systems. By employing these leaders as

either ambassadors or super users, the constraint of low usage is addressed through informal means.

To manage the constraints that the difficulty of changing organizational processes exhibit, which are large projects, the seeking out of sponsors was conducted in the form of finding managers or executives who could enable, through their mandate, the change initiatives to be carried through.

Information seeking

Evidenced from the results is that managers sometime sought information to cope with a constraint that they encountered. This we call the coping strategy of Information seeking. Information seeking was utilized to either better the manager's own understanding of the situation or constraint, contacting experts of the situation to tap into their knowledge to find a solution, or by conducting pre-studies to test solutions or ideas.

In the category of Staff, the interviewees description of the issue, regarded strong technology preferences and culture. The managers coped with the situation by a general search of information related to the cultural aspect or conducted a pre-study in order to generate knowledge of how a full scale change initiative would be received by the IT staff. A complementary approach of the coping strategy of Information seeking was described, with the goal of envisioning the concerns related to a change initiative amongst co-workers, to gain a better understanding of their perspective.

The constraints of technology heritage in the category of Users was not coped with through information seeking means.

To manage the constraints that form the category Systems, the coping strategy of Information seeking was used. Managers who sought out information as an approach to coping with infrastructure tried to understand the systems' technical limitations and possibilities for the change they wanted to make. Furthermore, a manager argued that he/she could manage the concern of security by seeking out the source of the security policy to make sure it indeed unauthorized the change initiative. Regarding shadow IT, managers showcased a reactive approach by attempting to understand the reasoning behind the IT object's existence. A manager argued that if there is no value in its continued existence, the decision was made to terminate it. While another's description focused on the acquirement of knowledge of the paths that lead to its existence.

Quick fix

The results showed that managers took measures to temporarily circumvent constraints. We call this the coping strategy of Quick fix. It was with no particular focus that the coping strategy of Quick fix was utilized, due to the malleability of our definition of it as a temporary solution making it become applicable to numerous contexts. Quick fixes manifested as either informal coordination initiatives, acquiring temporary expertise or by creating a workaround to circumvent a technical or process inefficiency.

In the category of Staff, one interviewee described an approach to solving vague and contrasting technology preferences by utilizing the coping strategy of Quick fix, in form of

informal workshops with the purpose of coordinating groups and identifying a satisfactory solution. Furthermore, when faced with a lacking competence or knowledge to conduct a certain change initiative, several managers described that they coped with the situation by either allocating extra resources temporarily, to enable people to use the respective systems, or by hiring temporary consultants to fill the void of specific expertise.

Furthermore, the coping strategy of Quick fix was showcased when the interviewees described their approach to the category of Users. One highlighted that manual workarounds may be necessary for users to successfully utilize the systems. While others in their need to solve the issue of negative perceptions of the IT department's ability to deliver according to the wants of their co-workers tried to aid the IT department to deliver according to these wants. This was done by establishing informal contact with the IT department.

To manage the constraints exhibited in the category of Systems, the managers either solved it through technical workarounds or by adjusting work routines in accordance to the technical object. The constraints in infrastructure was managed through either incorporating a new application to transfer data to solve interoperability or by manually transferring data. The issue of shadow IT hindering change was coped with by a manager by involving stakeholders to create new routines that support the object's task. Lastly, governance hindrances was coped with on a case-by-case basis through contextually determined fixes.

Leadership

When managers described that they carry out a leading response to cope with the effects of technology heritage, we call it a coping strategy of Leadership. This they either did by motivating the change's necessity from a larger perspective, ensuring others stay motivated or by pioneering a certain solution by assuming a leading part. While managing and leading may seem similar. Managing in the form of the coping strategy of Process consists of controlling as a part of managers' work, while leading is concerned with the individual's inspiring of change.

In the category of Staff, managers commonly utilized the coping strategy of Leadership. When faced with constraints regarding technology preferences and culture, the interviewees described that they coped with the situation by motivating either individuals or groups to endure or to motivate the change itself from a larger perspective. One interviewee also emphasized that managers must act as leaders and make tough decisions. Furthermore, when coping with the constraints of competence, the interviewees elaborated on the application of the coping strategy of Leadership by highlighting that when the IT department lacks an understanding of the organization's business side, leadership activities are of key importance. These mainly focused on motivating the positive effect of the change initiative, from an organizational perspective, by verbally convincing others to pursue certain goals or by enabling inclusion of IT staff and the concerned parties in the early phases of a change initiative.

The coping strategy of Leadership was often showcased in the category of Users. It took the appearance of motivating change from the overarching goal of the organization to cope with users' dissatisfaction of the IT objects they work with. When faced with constraints in the form of the reputation of the IT department being lacking managers showcased a coping

strategy of Leadership by trying to either motivate users to carry through changes in spite of the constraints, or by pioneering a certain tool, and/or contact between departments.

The constraints of technology heritage in the category of systems, was coped with leadership activities by one manager who did it to solve the concern of local process optimization at the expense of organizational optimization, by motivating the change by highlighting the change's need from a larger perspective.

5.2 Summary of coping strategies

The managers' responses are coded in correspondence to the coping strategies that is discerned, for reasons of transparency.

		Process	Ignore	Sponsors	Information seeking	Quick Fix	Leadership
Staff	Ideology	1, 2, 3, 6, 8.		5, 9.	1, 5, 6, 7, 8, 9.	9.	4, 5, 7(x2), 8, 9, 10, 11(x2).
	Competence	10.	12.	3, 9.		1, 6.	5, 8, 11.
	Working environment						6.
Users	User satisfaction	2, 4, 5, 7, 8, 10, 12.	2, 8.	5.		7, 12.	5, 7, 9, 10.
	Reputation	5.	3, 5, 7.			4, 6, 5.	1(x2), 2, 3, 7(x2).
Systems	Infrastructure	2, 3(x2), 5, 7, 10, 11.	3, 4, 7(x2), 8, 10, 12.		2, 9(x2), 12.	6, 7.	
	Shadow IT	1, 5, 8, 11.	4, 5, 8, 9, 12.	12.	2, 8.	6.	
	Technical	1, 3, 6, 9, 12.	4, 10.				
	Governance	1, 5, 6, 8, 10, 11.	9.	9, 12.		3, 5.	8.

Table 2 - Summary of responses. The numbers showcased corresponds to the managers' assigned number (see Table 1).

5.3 Theoretical significance of coping strategies

In this part the study discusses the proposed coping strategies in relation to the theoretical foundation of the research.

Coping strategy of Process

The coping strategy of Process was used quite frequently in all of the categories of Technology Debt (Magnusson & Bygstad, 2014). The coping strategy of Process is focused on issues which the organization manages, or issues that someone in a position of power would manage. This leads us to argue that certain issues are viewed to be a part of the IT

governance of the organization (De Haes & van Grembergen, 2004). Hence, the organization have already established measures, processes and structures to cope with these issues. Leading to managers coping with it through either their work-responsibilities, or by escalating it to others in power.

When managers used the coping strategy of Process to cope with constraints in the category of Staff they do not amortize technology debt (Magnusson & Bygstad, 2014). Since they either do not take an action to reduce the bias of pro adoption, leading to continued increase of interest (Magnusson & Bygstad, 2014), or they indebt the organization further by taking the bias into consideration increasing switching costs. When managers utilize the coping strategy of Process to cope with constraints in the category of Users and escalate issues to someone with the formal responsibility to mandate a change, the level of debt is unaffected, yet may increase or decrease, depending on how the concerned part manages it. Furthermore, when the coping strategy of Process is used in the form of managers incorporating the experiences in future projects the debt stays unchanged. Instead, they rely on governance functions and structure for solutions. The effects of the coping strategy of Process neither results in an increase nor decrease of the amount of debt (Magnusson & Bygstad, 2014), but rather to establish measures within the organization to minimize the risk of increasing debt in the future.

The analysis suggests that the coping strategy of Process was used frequently in situations where the primary constraints were switching costs in the form of a set-up costs, post-switching behavioural and cognitive costs, Management system upgrade costs (Whitten & Wakefield, 2006), and risk of disrupting performance (Hanseth, 2000). Switching costs derived from a lack of willingness among personnel to change away from their preferred brand or provider (Chen & Forman, 2006). This lack of willingness we argue exists as a cognitive switching cost (Whitten & Wakefield, 2006) or as Polites & Karahanna (2012) described as an unwillingness to adapt to new products, which may be an example of how the extensive use and experience of a product could make organizations path dependent (Zhu et al., 2006). Additionally, this may take the form of uncertainty costs (Whitten & Wakefield, 2006) from the user's' perspective since the new products performance level is uncertain. When managers were themselves the reason for the lack of usage of systems or applications due to poor specification of requirements another switching cost occurred. It arose when the new system or application was delivered and showcased insufficiencies compared to the previously used system. Thus, the fear of disruptions of operations, as a switching cost (Hanseth, 2000), materialized when users viewed the new system or application as insufficient and hence, the adoption of it struggled. The coping strategy of Process was further used to cope with switching costs in the form of set-up costs (Whitten & Wakefield, 2006), primarily in the subcategories of systems. The costs existed due to the direct investments needed to make changes to the infrastructure. Which seem to be the result of path dependence (Hanseth, 2000) in that they have been designed with short term considerations. Additionally, reluctance to making changes to the infrastructure existed since there are risks of loss in performance, which might disrupt operations (Hanseth, 2000) which is an uncertainty cost (Whitten & Wakefield, 2006). Regarding the constraint of shadow IT, the switching cost of search and evaluation (Whitten & Wakefield, 2006) is apparent since the described loss of synergy is in fact a lack of control due to decentralized decisions. Hence, when a change that affects these IT objects is made, it will require the searching for and evaluating of them. When the managers were constrained by the processes and

structures within the organization, the coping strategy of Process was used when they faced switching costs in the form of management systems upgrade costs (Whitten & Wakefield, 2006). This was since they would have to adjust processes in order for the change initiative to be effective.

Coping strategy of Ignore

The coping strategy of Ignore was utilized frequently in the category of Systems and Users (Magnusson & Bygstad, 2014). The coping strategy of Ignore concerns issues in which the manager chooses to not act to resolve the issue of technology heritage. This may be due to them viewing it as something that they should not do, or could not do. Hence, they accept the constraint.

When managers use the coping strategy of Ignore to cope with constraints, they neither decrease nor increase the amount of Technology debt (Magnusson & Bygstad, 2014) - since there is no action taken. Yet, since the constraint remain, the interest will continue to accumulate, leading to a higher debt (Magnusson & Bygstad, 2014).

The analysis suggests that the coping strategy of Ignore was used frequently in situations where the primary constraints were the switching costs of set-up costs, behavioural and cognitive costs, search and evaluation costs (Whitten & Wakefield, 2006), and risk of disrupting performance costs (Hanseth, 2000). Some managers coped by ignoring the effects of technology heritage in the form of negative perceptions of the IT department, which was constituted as post-switching behavioural and cognitive costs (Whitten & Wakefield, 2006) among co-workers. When the managers faced changes they found that they were constrained by their co-workers not trusting the IT department, constituting a cognitive switching cost since the managers would need to shape behaviours. However, this proved too difficult, leading them to ignore the concern. In regards to decentralized IT investments, the managers coped by ignoring the issue when the switching costs were too high. It could be due to the value provided by the decentralized application was considered higher than the risk of disrupting the unit's operational performance by removing it (Hanseth, 2000). In another case, the set-up costs (Whitten & Wakefield, 2006) of replacing such a solution were higher than the cost of leaving it in place. Both these cases resulted in a lock-in (Hanseth, 2000), as evidenced by the managers responses of it as something that they have to accept. The utilization of the coping strategy of Ignore regarding the issue of interoperability in the subcategory of infrastructure was not due to the managers being locked-in (Hanseth, 2000) and therefore unable to change. Rather, it seems to be because they have not recognized a path forward. However, one manager chose to ignore the issue until the situation became dire, to eventually be in a situation where the challenge to commit the organization to the change is lowered. Although, while the coordination to solve the issue will still be high the switching cost will be lowered (Arthur, 1989). The complexity of the infrastructure emphasized another switching cost, arising from as Hanseth (2000) describes that the information have evolved into complex networks which take considerable coordination to solve.

Coping strategy of Sponsor

The coping strategy of Sponsor was utilized frequently in the category of Staff (Magnusson & Bygstad, 2014). The coping strategy of Sponsor concerns issues in which the manager chooses to seek out others to aid them in resolving the issue of technology debt.

The coping strategy of Sponsor can nullify situations' instances of Technology Debt (Magnusson & Bygstad, 2014), acting as a workaround. It may also subsequently lead to a weakening of the Technology Debt when institutionalized behaviour acts as a switching cost, if the change initiative leads to a change in behaviour.

Switching costs in the form of post-switching behavioural and cognitive costs, management system upgrade costs (Whitten & Wakefield, 2006), as well as switching costs originating from institutional logics (Friedland & Alford, 1991) of co-workers being reluctant to change, were coped with by the coping strategy of Sponsor. Reluctance to change has been argued to be a behavioural lock-in by Polites and Karahanna (2012). Regarding the cultural aspect of the organization, managers acknowledged an existing reluctance to change amongst certain groups, which could be a result of existing institutionalized logics (Friedland & Alford, 1991). The situation indicated that they faced a post-switching behavioural and cognitive switching cost, if they are to resolve it. This issue was coped with by identifying individuals to act as mediator and drivers for the change initiatives in order to lower the perceived cost (Chen & Forman, 2006) of changing. Similarly, this occurred in the managing of co-workers usage of systems. Furthermore, as evidenced by the empirical data, a common constraint is the current the institutionalized behaviour of the business and IT departments, with the IT department tending to view IT as a service to the business side instead of an integrated strategic part, aligning with the research of Boddy et al. (2008). This institutional logic forms a switching cost of cognition (Whitten & Wakefield, 2006), since the managers would have to change the behaviour of co-workers in the IT department. Yet, instead of doing so they circumnavigate the concern by localizing people to strengthen their mandate when they make demands. In the issue of inflexible processes and structure for IT project funding, one manager expressed the wish to be able to transfer funding from different units to the IT department in order to fund specific projects. Making these changes would position the organization to face a switching cost in the form of management system upgrade costs (Whitten & Wakefield, 2006) since their governance function would have to be adjusted accordingly. However, the manager described that this switching cost could be circumvented by utilizing the coping strategy of Sponsor in instances which involved highly prioritized projects.

Coping strategy of Information seeking

The coping strategy of Information seeking was utilized frequently in the category of Staff and Systems (Magnusson & Bygstad, 2014). The coping strategy of Information seeking concerns issues in which the manager seek additional knowledge from which to act. This coping strategy was often used in unison with another strategy. This probably occurs since gaining knowledge does not resolve the issue, but is used as a tool to uncover what paths the manager has available. Therefore, after knowledge has been gained, a new strategy is sometimes utilized with the aid of the information gained.

When managers used the coping strategy of Information seeking to cope with constraints in the category of they do not necessarily amortize technology debt since they do not take a

direct action to reduce it, leading to continued increase of interest (Magnusson & Bygstad, 2014), however, if they subsequently act upon the information they may reduce the amount of technology debt.

The analysis suggests that the coping strategy of Information seeking was used frequently in situations where the primary constraints were switching costs in the form of a switching costs stemming from institutional logics, set-up costs, post-switching behavioural and cognitive costs, search and evaluation costs (Whitten & Wakefield, 2006). It was used to deal with technology heritage in the form of ideology where culture and technology preferences constituted switching costs. Culture is a part of what is considered the institutional logic (Friedland & Alford, 1991) and guides human behaviour. Hence, when culture proved a hindrance to change the coping strategy of Information seeking was undertaken by managers to understand and internalize the result in their work. When information seeking was further undertaken to cope with technology preferences derived from co-workers preferring to keep using technology that they are used to, thus showcasing a cognitive switching cost (Whitten & Wakefield, 2006). It further derived from a pro-adoption bias, either through cognitive costs or uncertainty costs (Whitten & Wakefield, 2006). Cognitive switching costs involves cases where co-workers preferred a certain brand leaving them reluctant to adopt to new products. While, uncertainty costs may exist since users may fear a loss in performance (Whitten & Wakefield, 2006). This may stem from an institutional logic of socially structured meaning (Orlikowski, 1992) of these products. With the exception of the safety aspect of the subcategory of infrastructure the managers who employed an Information seeking coping strategy tried to uncover if the set-up costs (Whitten & Wakefield, 2006) to change the infrastructure would be too extensive for them to conduct a change involving these systems. The constraints that Shadow IT can prove to be, either had the set-up costs of replacing the object, which was a concern that the coping strategy of Information seeking was used to realize if the organization was locked-in to using the system - or, the cost of hiring and retraining (Whitten & Wakefield, 2006) someone to be able to utilize the IT object proved a hindrance. The coping strategy of Information seeking was conducted by managers to cope with these switching costs.

Coping strategy of Quick fix

The coping strategy of Quick fix was utilized throughout the categories of Technology Debt (Magnusson & Bygstad, 2014). This coping strategy means that managers employ temporary solutions making it become applicable to numerous contexts. The coping strategy of Quick fix manifested as either informal coordination initiatives, acquiring temporary expertise or by creating a workaround to circumvent a technical or process inefficiency. Hence, the coping strategy of Quick fix may be used to circumvent the organizations path dependence by individual managers. This aligns to the view of Sydow et al. (2009) that path dependence is not necessarily deterministic, since organizations are of a social character.

When managers used the coping strategy of Quick fix to cope with constraints the resulting effects on Technology debt (Magnusson & Bygstad, 2014) are numerous. Since the coping strategy of Quick fix is not a systemized process, its effects on the categories of Staff and Users are dependent on how the manager utilize it. Hence, the amount of Technology debt is not amortized in its strict sense, but rather alleviated by the managers coping strategy. Yet, the interest (Magnusson & Bygstad, 2014) keeps increasing and therefore, if the

manager is not there to sustain the Quick fix coping strategy the Technology debt will make itself known again. The coping strategy of Quick fix proves problematic from a Technology debt perspective in the category of Systems where it is used to adapt to current sub optimized solutions or to sub optimize by creating a solution that adapts to the issue instead of resolving the issue. Hence, the amount of Technology debt could increase due to the employment of the coping strategy of Quick fix in the category of Systems.

The coping strategy of Quick fix was used to circumvent the switching costs of hiring and retraining (Whitten & Wakefield, 2006), since the managers chose to employ consultants to fill a competence gap instead of training current or recruiting new personnel. When the switching cost was due to their adopted products, the managers were faced with psychological sunk costs (Whitten & Wakefield, 2006). Which may be a result of contrasting institutionalized perspectives (Friedland & Alford, 1991). These costs were coped with through the coping strategy of Quick fix, by establishing an informal contact between the groups that held contrasting views, in order to reach a unified view. Furthermore, the coping strategy of Quick fix, presented itself in the form of manual workarounds in the category of Systems. It was used to cope with switching costs such as set-up costs and management system upgrade costs (Whitten & Wakefield, 2006). In situations where the existing IT objects proved to be the constraint, it was due to set-up costs which were circumvented by technical workarounds. In the subcategory of governance, the results show that managers employ Quick fix coping strategies. This occurs when the cost of conducting change becomes too high if the organization's processes need development in accordance to the change. Hence, a switching cost in the shape of management system upgrade costs (Whitten & Wakefield, 2006) is circumvented by creating informal process workarounds.

Coping strategy of Leadership

The coping strategy of Leadership was primarily used in the categories of Staff and Users in the typology of technology debt (Magnusson & Bygstad, 2014) where it was used to coping with constraints that were the results of negative perceptions and behaviour, by shaping these into enabling versions. The strategy means that managers motivate co-workers or assume a leading part by action. While managing and leading may seem similar, managing in the form of the coping strategy of Process consists of controlling as a part of managers' work, while leading is concerned with the individual's inspiring of change.

The impact that the coping strategy of Leadership has on the amount of technology debt could have various results. Ideally, leading could amortize (Magnusson & Bygstad, 2014) the amount technology debt, by inspiring a change in behaviour or perception. In the worst-case scenario the change is carried through by circumventing the effects of current behaviour by motivating a short term change, but with the constraint remaining since the change in behaviour may not be sustained.

Changes that involved moving away from the preferred vendor or brand of technology, indicates that managers faced either uncertainty costs, since users may fear a loss in performance, or cognitive costs, due to users being reluctant to adapt to new products (Whitten & Wakefield, 2006). Among users of said brands, this forms a lack of willingness (Polites & Karahanna, 2012), stemming from the socially structured meaning that they have placed on certain vendors or brands, i.e. an institutionalized logic of a technical nature

(Orlikowski, 1992). This was dealt with, through using the coping strategy of Leadership, by motivating the change from a larger perspective. Leading by example or motivating change from a holistic view was done when faced with switching costs of cognitive concerns (Whitten & Wakefield, 2006) in the subcategory of competence. The cognitive concerns stemmed from an institutionalized behaviour (Friedland & Alford, 1991) where the IT department still viewed itself to be a in a service providing role rather than a strategic part (Boddy et al. 2008). Lastly, the category of Users showcased a strong presence of the coping strategy of Leadership. Motivating further usage of systems was a central part of this strategy, when users themselves became cognitive switching costs (Whitten & Wakefield, 2006) in their difficulties in adopting new systems. Furthermore, leading by example was done to bridge the gap between the IT department and the manager's unit. The switching cost present in this situations of is also one of cognition (Whitten & Wakefield, 2006). Although due to the constraint that manager's face with their co-workers not trusting the IT department, which is linked with Boddy et al.'s (2008) view, that there are issues of synchronization between business and IT staff - which is coped with through the shaping of users perception of the IT department. Hence, they showcase that it possible to bridge the gap between departments.

5.4 Implications for practice

This study offers three main contributions to practice by providing insight into how technology heritage constrains managers change initiatives and how they strategically cope with it.

Based on the identified coping strategies organizations and managers are able to analyse how their organizations manage technology heritage. Consequently, the first contribution is to individual managers themselves who are provided insight into the different coping strategies that they employ to deal with change when constrained by technology heritage. The resulting insight will lead to increased awareness of the implications their actions have for their organization on technology heritage.

Secondly, executive management are provided a basis from which they may evaluate their organizations managers coping strategies to find areas of concern where lack of support need to be resolved, or new processes have to be created. When the concern is a lack of support executives can evaluate whether managers in the organization require additional support in form of power, resources or other conditions, to be able to successfully cope with the effects of Technology Debt. Process development could be used to either internalize positive strategic behaviour that individual managers exhibit that resolve issues of technology heritage, or to develop processes that restrict individual managers from technology heritage creating strategies.

Thirdly, less digitally mature industries are given an introduction to how managers in a digitally mature organization copes with Technology Debt. Hence, conclusions on pitfalls and opportunities in the micro-perspective of managers may be drawn and proactively managed to reduce the risk of the negative effects materializing.

5.5 Implications for research

This study embraced the theory of Technology debt, utilizing the concept and typology to research technology heritage. It offers three main contributions to research.

Firstly, this study makes contributions to the research topic of technology heritage by contributing empirical data. It provides a perspective of the challenges managers are faced with, due to how the installed base (Hanseth, 2000; Bygstad, 2010), and switching costs (Hanseth, 2000; Whitten & Wakefield, 2006; Polites & Karahanna, 2012) influence managers. Secondly, this study contributes to the concept of Technology debt by reinforcing the applicability of Magnusson & Bygstad's (2014) framework when researching technology heritage. Thirdly, the proposed theory of six managerial coping strategies offers the possibility of a complementary theory to the concept of Technology debt.

5.6 Limitations and future research

This study has three main limitations. Firstly, since this study aim to contribute to the theory of Technology debt by introducing a theory of managerial coping strategies, it emphasises a need for validation by further research in different contexts. Additionally, although one of the strengths of the study is that the focus is on managers' strategies for coping with technology heritage, at a digitally mature organization, it may also be a limitation of our study. While we expect that digitally mature organizations would showcase comparable responses from their managers, the coping strategies of managers in less digitally mature industries may prove to be used differently or be more focused on a specific type of strategy. This limitation motivates further research in industries that are less digitally mature, possibly through comparative case-studies to uncover if the technology heritage and strategies employed to cope with it are dependent on the level of digital maturity.

Secondly, another limitation of the study is that the area of study is the entire set of categories of Technology debt, leaving distinctions of constraints and coping strategies less discernible. Future research should focus on extensively researching a specific category to identify the extent of constraints and the nuances of the coping strategies, and contrast these to existing literature.

Thirdly, another limitation concerns the choice of method for data collection since the coping strategies are observed through the description of the managers rather than analysing their behaviour when they employ coping strategies in practice. The choice of managers as objects of study delimits the view of coping to concern managers instead of incorporating users of systems, informal leaders and other personnel as actors of influence in organizations managing of technology heritage. Additionally, the view that managers have of the users perceptions, may differ from the actual perceptions users have. These limitations motivates additional research incorporating other actors as objects of study and by research methods where actors are observed exhibiting their coping actions in practice, instead of explaining them.

6. Conclusions

This study set out to answer how managers cope with technology heritage. To enable the study's research a qualitative case study at a telecommunications organization with semi-structured interviews of managers was conducted.

Six strategies of coping have been identified that the managers of an organization, working in a digitally mature industry, have utilized to cope with the constraints of technology heritage; Process - coping through relying on an established approach or the assigned responsibility of the manager; Ignore - coping through accepting the constraint by choosing not to act or due a lack of known possible actions to take; Sponsor - coping through the aid of key individuals; Information seeking - coping through the gathering of knowledge; Quick fix - coping through the employment of temporary solutions; and Leadership - coping through the motivating of others or leading through action.

Furthermore, the coping strategies have varying impact on the amount of Technology debt of the organization. The coping strategy of process' impact on the amount of Technology debt is highly dependent on the context. The coping strategies of Ignore and Information seeking have no direct effect on Technology Debt. By employing the coping strategies of Sponsor, Quick fix and Leadership, it is possible to circumvent the constraints of Technology heritage, however Sponsor and Leadership can reduce the amount of debt by concluding in institutionalized behaviour while Quick fix can increase the amount of debt by adding technical solutions to the installed base.

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Appendix A - Interview guide

Demographical questions

1. What is your name and role in the organization?

2. Please describe your role in short, for example which areas do you work with?

3. For how long have you been working at the organization?

Staff

Ideology

Is there a consensus amongst co-workers of what internally used technology or product series is, so to speak, the best?

- Does this influence what changes you are able to make?
- How do you cope with that?

When conducting changes, are you influenced by units or the organization's culture?

- Does this influence what changes you are able to make?
- How do you cope with that?

Competence

Have you experienced that the knowledge or competency of the IT department has not been sufficient for you to conduct changes?

- Does this influence what changes you are able to make?
- How do you cope with that?

Working environment

Have the working environment of the IT department, in the shape of difficulties for them to gain new competency or a high turnover of personnel as a result of the working environment, constrained change initiatives?

- Does this influence what changes you are able to make?
- How do you cope with that?

Users

User satisfaction

Does the intended use of systems correspond to the actual use that occurs?

- Does this influence what changes you are able to make?
- How do you cope with that?

Reputation

How do you think the internal users of IT perceive the IT department's ability to sufficiently support their work?

- Does this influence what changes you are able to make?
- How do you cope with that?

Systems

Infrastructure

Can the organization's systems constrain your ability to make changes or influence changes?

- In the form of architecture?
- Transfer to a new system?
- Merging?
- Interoperability?
- Security?
    - Does this influence what changes you are able to make?
    - How do you cope with that?

Shadow IT

Have decentralized IT decisions in the form of individual solutions for specific units influenced the ability for you to conduct changes?

- Does this influence what changes you are able to make?
- How do you cope with that?

Technical

Have bugs, documentation, or in general the use of applications constrained your ability to conduct changes?

- Does this influence what changes you are able to make?
- How do you cope with that?

Governance

Have the organization's structure, agreements, handoffs, processes and other mechanisms, constrained your ability to conduct changes?

- Does this influence what changes you are able to make?
- How do you cope with that?