# Prime your way to IT project success: How to increase user congruency in Technological Frames of Reference

A quantitative survey based on a quasi-experimental study

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**Abstract**

Technological Frames of Reference (TFR) is a concept within Information System and Technology research considering how humans interact and perceive an IT system. Users TFRs have a significant impact on the outcome of IT system implementation projects and the usability of the system. The objective of understanding TFR is to recognize the implications of individuals' perception on IT change projects. Previous research has put a great deal of effort into mapping TFRs existence and its effects on the success of IT implementations. Although this research has been extensive, this thesis argues that the business value rests in how one can intently modify TFR to influence the outcome of IT implementation projects. The thesis aims to study how user TFR can be shifted and if TFR can be shifted so that a user group becomes more congruent in IT change projects. As a TFR shifting tool, we apply the concept of priming from psychological research, intervening on a group of 36 individuals experiencing IT change in a publicly traded multinational company. Through a survey based quasi-experiment, the thesis finds that users' TFR can be shifted with priming. Furthermore, the thesis finds that a user group subjected to priming increases their TFR congruency in three TFR domains, namely those who can be associated with *System Unique* characteristics. Therefore, a division of *System Unique* TFRs whom can be converged with priming, and *Underlying Values* TFRs which can be shifted but not converged can be inferred. The findings contribute to the current research body on TFR by combining two hitherto separate areas of research and proving that TFR can be moved deliberately to increase user congruency in a group.

Keywords: technological frames of reference, priming, information system implementation, IT implementation, shifting, congruency

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# Acknowledgements

We would like to thank the participating research company denoted as Swecorp as well as the company supervisor granting us access to means to acquire data. Although the company and supervisor remain anonymous, their contribution has been essential in the creation of this thesis.

Further, we would like to express our gratitude to our academic supervisor Magnus Mähring for providing us with insight and guidance.

Finally, we would like to thank Emilia Gjurovska, Johan Lindbäck and Tim Biskup for valuable feedback in the writing process.

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# Definitions

| | |
|---|---|
| **Contextual Frames** | Individuals cognitive knowledge and interpretation of contextual information to facilitate understanding. |
| **Frames** | Individuals cognitive knowledge and interpretation of ambiguous social and situational information to facilitate understanding as defined by (Gioia & Sims 1986). |
| **Information Technology (IT)** | An information system impacting or working in tandem with organizational processes. |
| **IT change project** | An effort to implement a new IT system which jointly leads to changed organizational processes for the user groups of the IT system. |
| **Priming** | The categorization of procedures that increase the accessibility of knowledge and concepts in memory, in the context of IT implementation. |
| **Technological Frames of Reference (TFR)** | Users cognitive interpretation, or sense-making of an IT system in conjunction with organizational processes as defined by (Orlikowski & Gash 1994). The TFR concept has been denoted as several different terms by previous research, for simplicity we detonate them as TFR, although some exact definitions may differ slightly. |
| **Technological Frames of Reference domains (TFR domains)** | A field of thought within the TFR concept; *Nature of Technology, Technology Strategy, Technology in use, Assumptions, Expectations* and *Knowledge*. |
| **User** | An individual participating in an IT change project who need to adapt his or hers work processes. |
| **User group** | Users that are impacted by the IT change project and need to adapt their work processes. Our definition of user group is the individuals participating in the project. |

# 1 Introduction

*In organizations today, Information Technology (IT) is becoming ever increasingly important and is involved in most processes in a firm. Therefore, IT change projects are becoming more important in organizations. However, IT-projects are notorious for their proneness to failure and inability of living up to expectations. At the same time, practitioners and researchers' knowledge about how to manage the outcome of IT implementation projects is limited. The following section addresses the current state of IT implementation research, the empirical and theoretical problematization, as well as the aim, purpose, contribution and research outline of the thesis.*

In the modern era, IT investments are at the heart of many organizations competitive capabilities. In manufacturing industries, investments in Enterprise Resource Planning Systems are generally the largest single investment and therefore a central part of firms competitive resources (Elbanna 2006). One of the most predominant interpretations of how a firm competes is the Resource Based View (RBV) (Grant 1991). RBV states that the resources and capabilities of a firm are central considerations in formulating the firm's strategy. Resources and capabilities are the primary constants on where a firm establishes its core identity and structure its strategy, and this, in turn, is the core of the firm's profitability (Grant 1991).

> *"(..)Business strategy should be viewed less as a quest for monopoly rents (the returns to market power) and more as a quest for Ricardian rents (the returns to the resources which confer competitive advantage over and above the real costs of these resources)."* (Grant 1991, p.117)

IT systems are in literature seen as improving a firm's processes by encouraging organizational changes, increasing interdisciplinary work procedures (Brynjolfsson et al. 1998), increasing decision-making autonomy and supporting worker training (Vargas et al. 2004). Previous research on the competitiveness of IT investments has yielded ambiguous results. Hunter (2003) argues that functioning IT systems have a large impact on the market value of firms as it indicates how efficiently a firm operates. Barney (2002) argues that IT in combination with the firm's other resources enhances competitiveness and is more difficult for other firms to imitate. Therefore, conducting successful IT change is essential for an organization's long-term competitiveness (Brynjolfsson et al. 1998). Other researchers conclude that well-functioning IT systems increase the likelihood of long-term survivability of firms (Tarafdar & Gordon 2007; Vargas et al. 2004). Some researchers also claim that IT investment is a

necessity but not sufficient condition to achieve competitive positions on the market. Instead, IT systems must be accompanied by organizational capabilities such as management, economic and human resources (Vargas et al. 2004; Clemons & Row 1991). IT change efforts are however inherently complex and uncertain because of their limited observability and intangibility of work processes (Mähring & Keil 2008). Additionally, IT projects need to combine diverse types of knowledge residing in different stakeholders into one project which makes governance of IT change projects a challenging task (Mähring & Keil 2008).

Due to the complexity of IT changes, many IT change efforts fail, and the failure has negative organizational consequences (Jiang & Klein 1999; Bharadwaj et al. 2009). Some researchers argue that failures could be characterized as organizational failures (Goulielmos 2005; Goulielmos 2003) and that they have lasting consequences for organizational learning abilities (Lyytinen & Robey 1999). Given IT change efforts impact on company performance and its proneness to failure researchers have been interested in studying the phenomena of IT implementation and its effect on areas such as financial performance (Holland et al. 1992; Sabherwal & King 1991; Kettinger et al. 1994; Powell & Dent-Micallef 1997; Bharadwaj et al. 2009).

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*"Achieving business transformation and competitiveness requires the organizational capability to implement IT transformation programs, defined as concerted IT-dependent strategic efforts to increase the ability of an organization to address its future business environment and compete more effectively with IT. Unfortunately, we know little about the nature of the challenges involved in IT transformation programs and how to manage them."* (Gregory et al. 2015, p.57)

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## 1.1 Problematization

When studying the IT change literature, there are three common explanatory themes in most failed IT projects; (i) *Uncontrollable events*, (ii) *Organizational factors* and *(iii) Individual factors*.

Research has concluded that some IT efforts fail purely because of chance or (i) *Uncontrollable events*. These events consist of issues such as virus attacks or hardware failure, which are difficult to assess in beforehand and difficult to plan for (Vaughan 1999). Although often occurring, these issues are highly difficult to manage in a consistent manner. Research, however, suggests that the most important method to manage uncontrollable events in any change project is to allow for slack in the term of excess resources (Thomke & Reinertsen 2012).

Another common view in the IT literature is that failure is caused by (ii) *Organizational factors* such as shortage of organizational competencies, knowledge, and abilities concerning processes of IT (Fitzgerald & Russo 2005; Irani & Love 2001; Keil 1995; Markus, Lynne & Keil 1994; Sauer & Chris 1993; Vaughan 1999). Where corporation characteristics such as organizational processes and structures, networks and problem-solving patterns interact and produce failures (Elsbach & Sutton 1992). The deduction of this has in previous research been that the reason behind symptoms of failing IT system efforts might be the organizational tendency to engage in escalation of commitment to failing courses of action (Shapira & Staw 2002; Bharadwaj et al. 2009).

(iii) *Individual factors* in itself have multiple legs of explanatory research. In Davis (1985) Technology Acceptance Model (TAM) system implementation success is intermediating dependent on individuals perceived ease of use of the IT system. Davis (1985) focus on the system characteristics as a proxy to measure individual motivation and perceived usefulness of a system. Although the TAM has received wide attention, the model neglects to include variables for system success such as human and social factors and has therefore been argued to not fulfill its purpose (Legris et al. 2003).

Venkatesh, Morris, Davis, & Davis (2003) Unified Theory of Acceptance and Use of Technology (UTAUT) emphasizes the individual in the context of the project. Four key variables, *Performance expectancy, Social influence, Effort expectancy* and *Facilitating conditions* are identified as representations for a successful acceptance and use of new IT systems. The UTAUT model has been empirically proven to adequately assess the outcome of IT change (Venkatesh, Morris, Davis, & Davis 2003). However, the individual's perspectives of the model dominantly focus on non-amendable factors such as age or gender. Providing a useful tool for assessment but providing a limited contribution to advance an existing setting.

Orlikowski & Gash (1994) argues that users interpretation of technology is highly important to understand users interaction with IT systems, building on Daft & Weick's (1984) research on individuals sense making in situations affecting their subsequent actions. This, in turn, means that to understand why an IT implementation is successful, users perspectives and interpretation of IT systems should be studied, an area they denote as Technological Frame of Reference (TFR). Orlikowski & Gash (1994) argue these interpretations to be key to understand why actors act as they do during the course of IT change efforts. Extensive research has been conducted of the natural movement of TFR during IT change efforts as it is argued to impact the outcome of IT change projects (Azad & Faraj 2008). Equally, various researchers have concluded that the congruency of TFR amongst stakeholders is an important factor for successful change (Young et al. 2016; Azad & Faraj 2008). However, even though the IT change literature agrees on the impact of TFR on implementation outcome, the study of deliberate TFR manipulation is largely absent.

> *"Such interpretations of technology (which we call technological frames) are central to understanding technological development, use, and change in organizations. We suggest that where the technological frames of key groups in organizations-such as managers, technologists, and users—are significantly different, difficulties and conflict around the development, use, and change of technology may result."* (Orlikowski & Gash 1994, p.174)

Although the concept of TFR shifting during projects is established, prior research has however not made an effort to present empirical evidence of how frames can be shifted with intention (Orlikowski & Gash 1994; Young et al. 2016; Azad & Faraj 2008; Davidson 2002; Gregory et al. 2015). In a nascent research field, psychology research, Nobel prize winning theorist Kahneman (2003) argues that contextual frames can be moved in a particular direction through contextualization of evaluations. Priming, defined as the categorization of procedures that increase the accessibility of Knowledge and concepts in memory, have in psychological research been a popular tool to shift the context of individuals and thereby their frame of reference (Wyer 2016; Kahneman 2003).

> *"In summary, prior information systems (IS) research since the early 1990s has established why IT transformation programs are important (i.e., for achieving IT-enabled business transformation and competitiveness) and has identified their key characteristics (i.e., IT-business partnering, IT-*

*based competitiveness, IT-enabled change, and IT program complexity). However, we still have a significant gap in our understanding of the specific managerial challenges and complexities involved in executing IT transformation programs."* (Gregory et al. 2015, p.58)

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Utilizing the categorisation of (i) *Uncontrollable events*, (ii) *Organizational factors* and *(iii) Individual factors,* various arguments can be made for the explicit importance of each area when studying the relative success of IT implementation projects. *Individual factors* are an extensively studied field in the IT implementation area (Lin & Silva 2005). However, existing studies are foremost limited to pure observational studies and provide limited guidance into how managers can act to establish more beneficial conditions for change and implementation success in IT implementation projects. The focus of this study is, therefore, the area of *Individual factors* as we have identified a research gap in how to deliberately shift users TFR to make a user group become more congruent.

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*"It is widely accepted that the successful adoption of an information system depends to a great extent on users' perceptions of the information system. It follows then that an understanding of users' cognitive frames should be a key factor in managing the adoption of information systems."*(Lin & Silva 2005, p.49)

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## 1.2 Purpose, Aim & Contribution

The aim and purpose of the thesis is to asses if a priming intervention, a concept from psychological research, can shift Technological Frames of References and increase congruency in a user group.

The contribution will, if proven successful, be a tool for managers to consult in IT change or implementation efforts. Furthermore, the thesis will contribute to the current research body on TFR by combining two hitherto separate areas of research, psychological research and IT implementation research.

### 1.2.1 Research Question

1. Can Technological Frames of Reference be shifted with priming in IT change projects?

2. Can the congruency of Technological Frames of Reference in a user group be increased through priming in IT change projects?

## 1.3 Delimitations

The perspective of deliberately shifting TFR represent a new line of research within the area of TFR, accumulating to the understanding of how to successfully conduct IT change and implementation. Several perspectives of how to affect or shift an individual's TFR could be of interest for the research area. The study is however delimited to studying the implication of priming, defined as the categorization of procedures that increase the accessibility of knowledge and concepts in memory (Wyer 2016; Kahneman 2003), in the context of IT implementation.

Equally, the aim is not, as suggested by (Dagwell & Weber 1983; Ginzberg 1981; Hirschheim 1986; Hirschheim & Klein 1989), to study specific groups TFR but rather the TFR amongst the whole group of participants in an IT change projects. Consequently, the denotation of a user group of this thesis considers the entire user group and not a separate internal group within the change project.

## 1.4 Research Outlines

To successfully explore the thesis research question, we will utilize a survey based method with a quasi-experimental design. We will investigate if the priming intervention can successfully shift the TFRs of users. The results are presented, and their implications discussed, thematically in accordance to each hypothesis; the first considering if TFR can be shifted for the users, and the latter if the shift results in the user group becoming more congruent in their TFRs. Lastly, the main findings are tied back to the aim of the thesis, and the main conclusions are presented together with their impact for further research highlighted. The study is divided into six sections *(i) Introduction (ii) Theory (iii) Method (iv) Results & Analysis (v) Discussion (vi) Conclusion*.

# 2 Theory

*The basis of this chapter is formed into two parts, namely Literature Review and Theoretical Framework & Hypothesis Generation. The first section of the Literature Review will consider TFR. In the second section, considering priming, we aim to disclose how previous research considering frames in the area of psychological research have been able to shift the nascent notion to TFR, namely contextual frames. Lastly, the generated theoretical framework together with the thesis generated hypothesis is presented.*

## 2.1 Literature Review

### 2.1.1 Technological Frames of Reference

With the aim of synthesizing earlier research on IT change Orlikowski and Gash (1994) developed a theoretical perspective on IT-change research concentrating on the concept of TFR. Orlikowski and Gash (1994) establish the concept TFR as a denotation of frames in an IT context that involves the assumptions, expectations, and knowledge of how members of an organization understand technology. The concept of frames is broader than the role of technology itself and includes the conditions surrounding it, its applications and organizational processes, and consequences of technology in particular contexts (Orlikowski & Gash 1994; Davidson 2002). The basis of Orlikowski and Gash (1994) theory consist of the idea that human features are one of the most important factors for the outcome of IT change in organizations, and that TFRs are one of the most important features in how to understand humans and their actions in regard to IT change.

The existence of TFR can be related to the perspective of social cognitive research, which is the perspective that people act based on their interpretations of the context of reality and when they do so enact social realities and endow them meaning (Smircich & Stubbart 1985; Weick 1979). TFR equally serve to help individuals interpret events and organizational phenomena and give these events meaning (Bartunek & Moch 1994; Daft & Weick 1984).

TFR is further argued by researchers to subliminally guide individuals into what actions to take and how to make sense in organizations (Moch & Bartunek 1990; Bartunek 1984). They operate in the background and have both facilitating and constraining effects. For example, Gioia & Sims (1986) argues that TFR can help reduce uncertainty in otherwise ambiguous or complex situations, structure knowledge and provide a basis for acting. However, Gioia & Sims (1986) also mentions that TFR can have adverse effects such as reinforcing unreflective reliance on assumptions and knowledge, distorting information to make it fit within frames and inhibit problem-solving.

Equally, researchers argue that the concept of TFR is useful for analyzing how and why people and groups act as they do around IT systems. The concept of TFR can advise and anticipate outcomes of organizational change processes that are not reflected by other perspectives such as political or contingency models. For example, it is argued that while the political perspective can explain outcomes that are due to power shifts within a group and that has an impact on the organizational process. The political perspective cannot explain contradictory outcomes due to different interpretations of a technology independent of political division (Grudin 1988; Kling & Iacono 1984; Markus 1983). According to Davisson (2002), the TFR concept also constitutes an analytical tool to understand how IT change participants draw knowledge and understanding from their TFR to make sense of contextual information and its implications for their understanding of the IT project.

In a group context, TFR provides an array of filters for interpreting contextual information and requirements (DiMaggio & Powell 1991). Shared TFRs of a group act like framing systems of social rules and conventions that structure social thought and action (DiMaggio & Powell 1991). Social cognitive research literature has argued that these mental models are salient sense-making devices during processes of organizational change. Bartunek & Moch (1994) and Isabella (1990) argues that differing TFR amongst groups and stakeholders are a possible source of disturbance in IT change (DiMaggio & Powell 1991; Davidson 2002; Bolman & Deal 1991).

### 2.1.2 The domains of Technological Frames of Reference

Orlikowski & Gash (1994) identify three central domains, or dimensions in TFR called *Nature of technology, Technology strategy,* and *Technology in use.*

> *"The three domains reflect what the technology is (nature of technology), why it was introduced (technology strategy), and how it is used to create various changes in work (technology-in-use)."* (Orlikowski & Gash 1994, p.184)

i. *Nature of technology* is referring to people's perception of the technology and their understanding of its capabilities and functionalities.

ii. T*echnology strategy* refers to people's views of why their organization acquired and implemented the technology. This point also includes people's understanding of management's vision or motivation behind the technology adoption decision and the technology's possible value to the organization.

iii. T*echnology in use* refers to people's views of how the technology is going to be used daily and the probable or actual conditions and consequences associated with such use.

Furthermore, there are three more deeply held domains, namely TFR in the form of *Assumptions, Expectations,* and *Knowledge* that Orlikowski & Gash (1994) theorize to be essential for the formation of TFRs, but does not empirically establish.

*iv. Assumptions*

Sund et al., (2016) argue that a known phenomenon in business research called the obfuscation of uncertainty makes *Assumptions* important for how humans interact with systems and organizations. This denotation builds on the argument that people pretend to know or to be able to estimate things that cannot be known, for example, the future value of stocks, or in this case assuming how a system will play out in an organization. Lipshitz & Strauss (1997) use the term *assumption making* for this phenomenon to describe *Assumptions* importance in how humans enact decisions, as they argue that overweight is placed on *Assumptions* given the actual uncertainty of the *Assumptions*.

> *"Tacit Assumptions of confidence can lead to believing that we know things that we do not know and to thinking that we are making decisions under conditions of risk rather than decisions under the conditions of uncertainty, which in turn can lead to poor quality and dangerous decisions." (Sund et al. 2016, p.5)*

*v. Expectations*

Sund et al. (2016) argue that the *Expectations* of users are important in forming TFR during an IT implementation. Individuals' *Expectations* based on past experiences from initial decisions in interaction with colleagues considering how to use the new system and take new decisions. Sund et al. (2016) claim that *Expectations* contribute to a more detailed view of how TFR are formed and its recursive nature forms cognitive processes.

*vi. Knowledge*

Chiu et al. (2006) argue that the biggest challenge in fostering IT change is the supply of *Knowledge* and the willingness to share *Knowledge* between members. Serna E., Bachiller, & Serna A. (2017) also claim that *Knowledge* creates the foundation for requirements stakeholder puts on a system and hence has a high impact on the IT change process.

#### *2.1.2.1 Technological Frames of Reference exists in a group context*

TFR in a group context is recognized to be individually held, and hence varies between individuals (Davidson 2002). TFR can also be used to distinguish cognitive elements that trough socialization, interaction, and negotiation are mutually shared by individuals in a group. These group frames or collective cognitive elements is then used by individuals to construct and reconstruct a social reality (Orlikowski & Gash 1994).

Previous literature (Baden-Fuller et al. 1989) have suggested that while members can have individual TFR, a group also have a set of core beliefs in common. A frequent argument in socio-cognitive literature is the strong effect of group membership, which influences the systems of meaning, knowledge, and norms to which members are exposed and influences how members interpret and interact with the world, and that this differs between communities (Daugthery 1992; Gregory 1983; Shibutani & Rose 1962; Maanen & Schein 1979). The idea of individual cognitive structures to include TFR of groups and organizations is frequently supported in the previous literature (Sund et al. 2016; Calder & Schurr 1981; Gray 1985). The argument that people tend to share assumptions, knowledge, and expectations with others, with whom they have community feelings with is supported by several authors (Salancik & Pfeffer 1978; Gregory 1983; Schein 1985; Gray 1985; Isabella 1990; Dagwell & Weber 1983; Davidson 2002)**.**

Researchers discuss the concept of internal groups within an IT change project (Dagwell & Weber 1983; Ginzberg 1981; Hirschheim 1986; Hirschheim & Klein 1989; Bostrom & Heinen 1977). They highlight that TFRs of subgroups, such as technologist, can be of importance to study as the TFR of different stakeholder groups have differing impact on implementation outcome. “Such research complements and extends technology-based or methodological approaches by addressing social, learning, and negotiation processes in ISD (IT System Development)*”* (Davidson 2002, p.331)

Orlikowski & Gash (1994) importantly points out that the concept of TFR differs from the similar concept subcultures, although the concepts are acknowledged to be similar. TFRs are cognitive structures or mental models that are held by individuals that can be shared by individuals when there is a significant overlap of cognitive categories and concepts. The notion of subcultures*,* however*,* is not purely cognitive but refers to the product of group problem

solving (Maanen & Barley 1985). In other words, subcultures are enacted social realities, while TFR focuses specifically on how people make sense of particular aspects of the world (Orlikowski & Gash 1994).

#### *2.1.2.2 Incongruence in Technological Frames of Reference is problematic in change efforts*

According to Orlikowski & Gash (1994), incongruence in the TFR of a group is negative to organizations as differing TFR pose alterations in key aspects of technology. One example, described by Azad & Faraj (2008), is the divergence between the manager's expectations and the end users. For example, the expectation of a manager is that a certain technology should transform the business model, while users only see or expect increased supervision of their work. The implication of the divergent TFR can span various results. Some cases might only result in resistance, while in some extreme cases in a stalemate of entire projects (Azad & Faraj 2008). However, the overall effect of group incongruence of TFR in IT implementation projects is according to Azad & Faraj (2008) of negative nature.

Orlikowski & Gash (1994) give several examples of when differing and incongruent TFR create organizational issues. For example, by disrupting internal communication, lack of participation, social clashes, Union blockades and allocation of resources. Therefore Orlikowski & Gash (1994) argue that incongruent TFR in an organization is negative for organizational development especially in connection to IT implementation projects.

> *"We posit that inconsistencies can contribute to unproductive conflict and confusion during IT-enabled change projects and that inter-group incongruences may interact with intra-group inconsistencies to shape the trajectories and outcome of IT-enabled change."* (Young et al. 2016, p.496)

However, due to its nature of determining social interaction within the organization, the implication of TFR congruency must not always be positive (Pyrko et al. 2017; Chiu et al. 2006; Palvia et al. 2017; Aguilar Alonso et al. 2017). Some researchers argue that differences in the TFR may have positive outcomes such as improving group decision making through a more diverse interpretation of information (Fiol 1994; Walsh 1988; Walsh 1995). One example of negative implications of TFR congruency is illustrated by Starbuck (1989). Starbuck (1989) shows that the existing TFR of the executive team at Facit AB, a mechanical calculator company, hindered them from realizing the potential in new electronic calculators, ultimately leading to company failure. Bolman & Deal (1991) argue that frames can create "psychic prisons" that prevent learning as individuals cannot look at problems in differing ways, and thereby fails to handle challenges successfully.

#### *2.1.2.3 Technological Frames of Reference fluidity*

The contextual nature of TFR, founded in both individual and group aspects, is argued to be able to shift (Orlikowski & Gash 1994). El Sawy & Pauchant (1988) argue that TFR shifting is possible, although previously formed TFR are resistant to change (Walsh 1995). Contextual changes can generate shifts that brings new sense-making to contexts of individuals and groups (Bartunek 1984; El Sawy & Pauchant 1988; Gioia & Sims 1986).

> *"Changes that trigger a shift in salient technology frames could lead to reinterpretation of information and lead to new understandings of IT requirements."* (Davidson 2002, p.332)

Further, Walsh et al. (1988) also argue that TFRs of individuals who are seen as influential have a tendency of influencing other people's TFRs, and that TFRs of more influential people are more prominently weighted in group decision-making tasks. This can be put into relation to central stakeholders impacting a project's requirements and direction (Curtis et al. 1988; Newman & Sabherwal 1996; Reich & Benbasat 1990; Walz et al. 1993). Therefore, TFR of dominating individuals can become a filter that shapes how projects are understood and legitimized by other participants in IT change projects. Hence if the power relationship between stakeholders changes during a project (Robey & Newman 1996), the TFR of the participants in IT change projects might shift (Davidson 2002; Sillince & Mouakket 1997).

> "Over time, the Assumptions and categories of shared cognitive structures are often externalized and institutionalized." (Orlikowski & Gash 1994, p.200)

Tyre & Orlikowski (1994) argue that initial interpretations of technology by users are more influential and critical because of TFR becoming institutionalized when organizational routines are created around the IT system. Orlikowski & Gash (1994) further argue that these early

interpretations later become hard to change when institutionalization has taken part in the system and the organization.

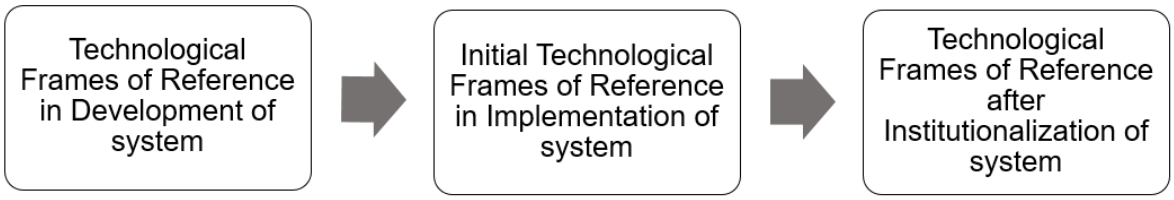


*Figure 1.The different phases of TFR in system implementation*

### 2.1.3 Priming

#### *2.1.3.1 How contextual frames can be shifted*

The notion of influencing frames stems from the research of Noble price winning psychological researchers Kahneman and Tversky's (1979) Prospect theory. Prospect theory is built on the concept that humans tend to be non-rational in their evaluations by using limited sets of information to evaluate decisions (Kahneman & Tversky 1979). The criticism that Kahneman & Tversky (1979) provided to the otherwise widely acknowledged Bounded Rationality Theory (Simon 1957) is that individuals tend to be conflicting in their evaluations in an equal situation with the same set of information. Kahneman & Tversky (1979) proved that contextualizing for example evaluation questions can affect individuals' accessibility of different contextual frames influencing the outcome of their decision making. By for example contextualizing a question of equal odds in a positive, chance of surviving, or negative, the risk of succumbing, profoundly affected the evaluation of the decision and which choice that was selected.

In more recent research Kahneman (2003) argues that the notion of frames exists as a tool to save resources by making low energy judgments built on "shallower" information such as visual reference. Frames are, according to Kahneman (2003), highly contemporary and based on associative information influenced by access. Kahneman (2003), as well as other psychology researchers, argue that accessibility is a dominant part of an individual's frames and through stimuli, one can shift the relative accessibility of different framesets (Kahneman 2003; Higgins & Kruglanski 1996).

> "The central concept of the present analysis of intuitive judgments and preferences is accessibility - the ease (or effort) with which particular mental contents come to mind. The accessibility of a thought is determined jointly by the characteristics of the cognitive mechanisms that produce it

and by the characteristics of the stimuli and events that evoke it."
(Kahneman 2003)

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In other research areas, such as marketing literature, the concept of frames is also highly recognized. Frames as schemas is a popular annotation of how frames and context effects modify both goals and evaluation of decision making (Bargh & Pietromonaco 1982). The research of frames in marketing literature differs from the area of IT change in the intent of the explorations. While IT change literature has focused on how TFR affects IT change projects and shift organically (Azad & Faraj 2008; Young et al. 2016). The research in marketing has focused on how one can shift these frames deliberately, with the purpose of more favorable evaluations (Yi 1990). The concept in marketing literature focuses on shifting the context of an object to ensure more favorable associations leading to a more favorable evaluation of the evaluated object (Yi 1990).

The notion of shifting frames through preceding exposure is called *priming*. The term is defined as the categorization of procedures that increase the accessibility of knowledge and concepts in memory (Wyer 2016). These procedures have been used to identify effects of trait notions and understanding and more complicated depiction of knowledge on judgment and behavior (Wyer 2016). For example, performing a behavior in a situation, such as grocery-shopping, can commonly activate a goal concept associated with that behavior, "saving money," increasing its accessibility in memory (Kruglanski et al. 2002). The intention of priming is to shift the goal concept to a more favorable goal, for example, "health," moving the frame from a less favorable goal, "saving money," into a more favorable one, "buying high-quality food."

The effects of priming have also been explored in groups. In research experiments where individuals are exposed to priming as part of a group instead of individually has shown that individuals have a tendency to drift towards a compromising mindset that affects their decisions in unrelated product choice tasks (Briley & Wyer, Jr. 2002). The effect of priming in groups has also proven to have long term effects. Dong, Dai, & Wyer (2015) find that the concept that is activated by copying others behavior can also become part of a precondition that is activated in distant situations. Equally, Wyer (2016) finds that participants in synchronous exercises were more likely to conform to unknown persons preferences in a product choice, leading to long-term effects on frames congruency.

### 2.1.4 Theoretical research Gap

Reviewing the literature, there is little doubt over the importance of TFR in IT change projects. The original findings of Orlikowski & Gash (1994) are confirmed by multiple nascent studies in the field (Azad & Faraj 2008; Davidson et al. 2007; Davidson 2006; Sund et al. 2016). The

uniform theme of the finding is that TFR of users has an important influence on the outcome of the IT change project and are subsequently important to consider in the change process. However, even though the field of TFR is extensively studied the current empirical contribution consist mainly of explorative research contributing to the understanding of their existence. The concept of utilizing TFR positioning as a managerial tool lacks empirical support in established research. Further, even though previous research has determined the importance of TFR and its ability to shift as part of the project phase (Young et al. 2016), no research has been conducted on trying to shift these by intent.

Earlier research also agrees that discrepancies in TFR amongst user groups in IT change projects is an influential factor of change outcome. More precisely, the relative congruence amongst users in groups, in IT implementation, will have a positive or negative effect on IT change outcome (Orlikowski & Gash 1994; Azad & Faraj 2008; Young et al. 2016). However, similarly to the lack of support of intentional TFR shifting, limited research has focused on the ability to deliberately shift TFR of user groups to become more congruent.

> *"In contrast to frame incongruence between groups, frame inconsistency in groups—a possibility that Orlikowski and Gash (1994) note—has received little research attention."* (Young et al. 2016, p.496).

Summarizing our findings, we have concluded that even though TFRs importance to IT change outcome have been defined, there exist is a gap in empirical knowledge of how to shift TFR. Equally, even though the importance of TFR congruency amongst participants in IT implementation projects is recognized, the research of methods and tools to increase group congruency seems to be lacking.

Through answering the research question; if a priming intervention, a concept from psychological research, can shift Technological Frames of References, and subsequently increase user congruency in a group. The thesis aims to deliver essential findings for managers dealing with organizational change that in any way is touched upon with IT and IT change. The thesis findings will be relevant to researchers who study the borderland of organizational processes and IT, an area which is perceived as generally understudied given the importance it has for organizations (Bharadwaj et al. 2009; Gregory et al. 2015; Jiang & Klein 1999).

## 2.2 Theoretical Framework & Hypothesis Generation

Although there is extensive research on the importance of TFR this thesis aim is to assess if an intervention can shift TFRs and increase congruency in a user group. Subsequently, from

what we have identified as a research gap in the current literature, the aim of our research is to answer this gap with the concept of priming from psychological research. Moreover, we also aim to show that congruence of TFR can be increased in a user group subjected to priming.

The objective of understanding TFR is to recognize the effect of individuals' perception of IT change projects (Orlikowski & Gash 1994). Previous research has put a great deal of effort into mapping TFRs existence and their effects on the success of implementations (Young et al. 2016). Although this research has been extensive, we argue that the contribution to the business management community has been limited as insufficient effort has been put into understanding how to manage TFRs. The notion of their existence is important, but we argue that the business values rests in how one can intently modify TFR to influence the outcome of IT implementation projects. In other research fields, such as psychological research, the understanding of how one can influence people's contextual frames is extensively studied. The notion of priming has proven effective for changing individuals' cognitive structure, evaluation and sense making of situations (Kahneman 2003; Wyer 2016).

### 2.2.1 Priming and shifting TFR

The reviewed literature clearly argues that TFRs exists in a fluid state and naturally shift during the implementation process of IT systems (El Sawy & Pauchant 1988). Equally, the findings of Gioia & Sims (1986) and Bartunek (1984), that the change in contextual setting can generate shifts in TFRs opens for a deduction that manipulation through contextualization can be achieved. Similarly, Walsh (1988) findings, that TFRs of individuals who are seen as influential have a tendency of influencing other participants and to be more prominently weighted in group decision tasks, suggest that external influences also can have an effect on the direction of TFR. Connecting this knowledge to that of psychological research it is reasonable to argue that the proven effects of priming by researchers Kahneman (2003) and Wyer (2016) should have similar effects on TFR as contextual frames. Besides the fact that both TFR and contextual frames are developed out of social cognitive research and share an argued common purpose of endowing meaning and sense-making (Smircich & Stubbart 1985; Weick 1979), our interpretation is that the two areas share many common traits. The fluidity of TFR is akin to that of Contextual frames, and the impact of contextual changes can argue to be highly similar in both areas (El Sawy & Pauchant 1988; Wyer 2016). Equally, like the findings of Walsh (1988), bias towards influential participants TFRs is nascent to the findings of the contextualization of evaluations (Kahneman & Tversky 1979). Our argument is thereby that the effect of priming on TFR should logically result in a similar effect like that on contextual frames. The suggested hypothesis is thereby:

*Hypothesis 1: User Technological Frames of Reference in IT change projects can be shifted with Priming.*

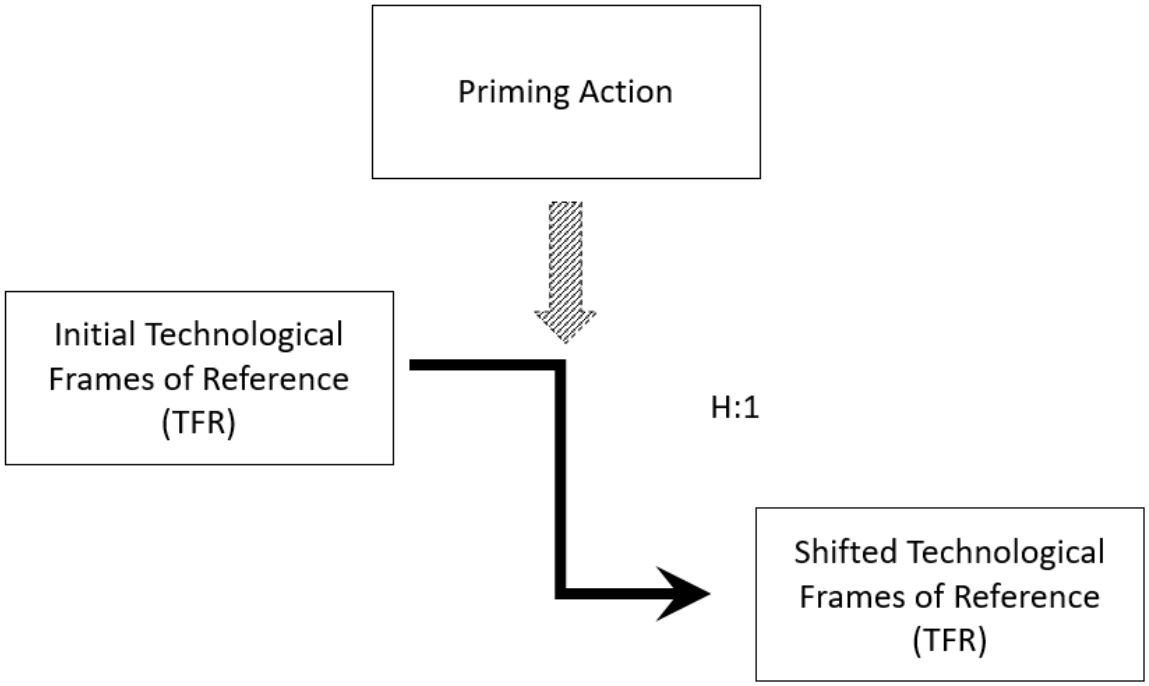


*Figure 2. Illustration of Hypothesis 1*

Figure 2 illustrates our first hypothesis that Users Technological Frames of Reference in IT change projects can be shifted with Priming.

For research and analytical discussion, we divided the TFR domains into six separate research variables rather than having one large TFR variable as described in the Literature Review. The six domains *Nature of technology, Technology strategy, Technology in use, Assumptions, Expectations* and *Knowledge* will be measured separately through six sub-hypotheses for the overlying Hypothesis. The operationalization of these domains is described in Survey item.

*1a: User Nature of technology can be shifted with Priming in IT change projects*

*1b: User Technology Strategy can be shifted with Priming in IT change projects*

*1c: User Technology in use can be shifted with Priming in IT change projects*

*1d: User Assumptions can be shifted with Priming in IT change projects*

*1e: User Expectations can be shifted with Priming in IT change projects*

*1f: User Knowledge can be shifted with Priming in IT change projects*

### 2.2.2 Priming and user group congruency

As the TFR of individuals exists in a cognitively interpreted state, the positioning of a set of TFR between beneficial and non-beneficial lays in the context of the interpreter. Thereby, a specific set of frames cannot be categorized as negative or positive without being related to an intended goal or outcome (Azad & Faraj 2008). Instead, what is known is that widely discrepant TFR of IT project participants can have a negative effect on the overall project performance (Young et al. 2016). Some researchers even argue that for a project to be conducted successfully the TFRs between stakeholders need to align (Azad & Faraj 2008).

Assuming the prerequisite of Hypothesis 1 to be supported, we argue that priming can have an increasing effect on congruency amongst individuals TFR in a group. Building upon the same argumentation for priming's effect on TFR shift, and extending it with Briley & Wyer, Jr.'s (2002) research. Suggesting that exposing a group to priming have a positive correlation with an increased compromise mindset and congruency amongst participants (Briley & Wyer, Jr.'s 2002). Equally, Dong et al. (2015) findings, that effects of coping with other behavior in groups can become a precondition that is activated in distant situations, proposing that a congruency increase from priming should have long term effects. The suggested hypothesis is thereby:

*Hypothesis 2: A user groups' Technological Frames of Reference congruency can be increased through Priming in IT change projects.*

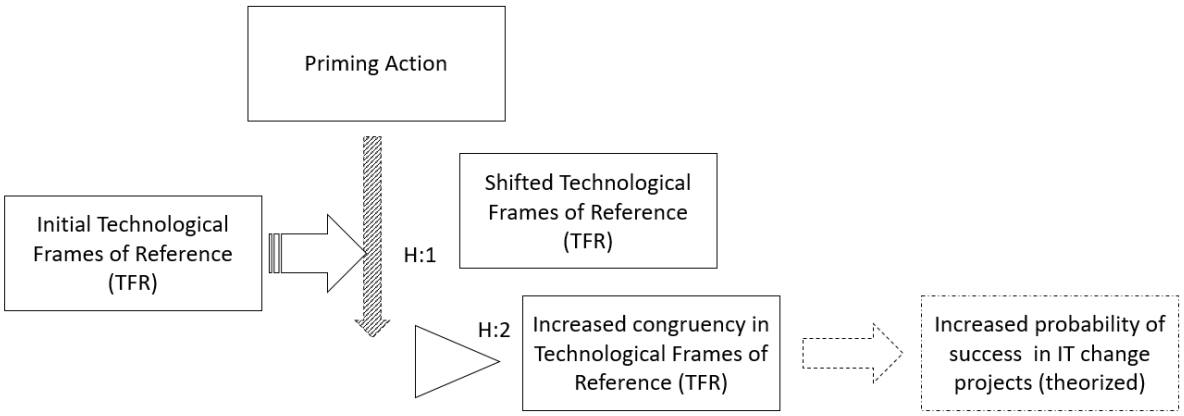


*Figure 3. Illustration if Hypothesis 2*

Figure 3 illustrates our second hypothesis "*A user groups' Technological Frames of Reference congruency can be increased through Priming in IT change projects."*

For research and analytical discussion, we divided the TFR domains into separate research variables rather than having one large TFR variable. The six domains *Nature of technology, Technology strategy, Technology in use, Assumptions, Expectations* and *Knowledge* will be measured separately through six sub-hypotheses for the overlying Hypothesis. The operationalization of these domains is described in the section Survey item.

*2a: A user groups' Nature of technology can be increased through Priming in IT change projects.*

*2b: A user groups' Technology Strategy can be increased through Priming in IT change projects.*

*2c: A user groups' Technology in use can be increased through Priming in IT change projects.*

*2d: A user groups' Assumptions can be increased through Priming in IT change projects.*

*2e: A user groups' Expectations can be increased through Priming in IT change projects.*

*2f: A user groups' Knowledge can be increased through Priming in IT change projects*

# 3 Methodology

*This chapter will explore the thesis methodological approach. The following section will describe the research approach in contrast to previous literature. The subsequent sections will describe the research subject, project, and system. The succeeding section will describe our main study established in the generated hypothesis. Finally, the last section will describe our sample strategy and data quality.*

## 3.1 Scientific Research Approach

The thesis research strategy is based on a deductive approach with the generated hypothesis building on existing research in the fields TFR and psychological research. Utilizing a quantitative approach rooted in the epistemological consideration of positivism[1], the choice of the research approach deliberately differs to most existing research considering TFR. As TFR studies typically focus on the individual and her impact on the organization as a social actor (Bryman et al. 2010) and often employ an epistemological consideration of interpretivism (Azad & Faraj 2008; Orlikowski & Gash 1994; Davidson 2002). The natural selection of approach has thereby predominantly been of qualitative nature. We, however, argue that the concluded research gap is correlated with the interpretivism perspective and that there can be more to gain in the field through a positivist consideration. Connecting this to our aim and purpose, our argumentation is that connecting TFR with psychological research on priming and taking a quantitative approach, offers an opportunity to learn new things about TFRs as well as how they can be employed for normative aims. To move from the qualitative approach of existing TFR research into a quantitative approach, the framework of Lee (1991) have been utilized.

Lee (1991) suggests that both interpretive and positivist research can seek to benefit from one another through drawing support and provide control of the findings in the respective area. According to Lee (1991), to go from *the subjective understanding* of qualitative research into *the positivist understanding* of quantitative testing, the test needs to fulfill three criteria's. Firstly, the test needs to (i) be referable back to our interpretation of the qualitative research. Secondly, the questions must (ii) be proven to be correctly understood by the researched subject. Lastly, the generated test needs to (iii) be logically valid and able to be retested.

To fulfill the criteria's suggested by Lee (1991) we have firstly provided our (i) interpretation of the original qualitative research is provided via our literature review and hypothesis generation. Secondly, the survey question is designed and tested for (ii) comprehensions with nascent stakeholders inside the studied organization via a pre-study. Lastly, the questionnaire, as well

[1] Philosophical stance of the natural scientist (Saunders et al. 2008).

as an extensive depiction of the studied subject, is provided for the possibility of (iii) retesting of findings.

### 3.1.1 Research Design

The quantitative approach utilized to test the generated hypothesizes resulted in the use of a survey-based method. More specifically, the conducted survey consisted of a pre- and post-survey as part of a naturally occurring workshop at the studied subject. The chosen methodology assimilate that of a cross-sectional quasi-experiment (Bryman et al. 2010). According to Bryman et al. (2010), the quasi-experiment consist of naturally occurring events and randomization of sampling is ignored in favourability for natural selection.

## 3.2 The research subject

### 3.2.1 Swecorp

The research subject, from here on referred to as Swecorp, is a publicly traded company acting in the markets of civil engineering (CE) and industrial productivity enhancing instruments (IPEI). With over 40 000 employees across 120 countries, Swecorp has outperformed the Swedish stock market index in the last six years. The company is famous for being at the forefront of industry development and at the same time delivering high-quality products. From an investor perspective, the company's financial performance derives from their ability to persist a high volume in a lagging market in tandem with an increase in profit margin.

### 3.2.2 The project

The study took place in Swecorps sub-divisions IPEI and was conducted as the division was in the process of implementing a new Cost Management System, Swecorp Cost Reduction Application (SCRA). The SCRA project was initialized at the executive level of IPEI and given as responsibility to the IPEI Business Administration area. The assignment was lead and run by the Vice President of Finance but included stakeholders from all IPEI areas such as Sourcing, Production and Business Administration. SCRA was stated by IPEI management to be implemented as of equal importance for all business areas meaning that even though Business Administration was given the responsibility of the project, the initiative was a cross-section collaboration resulting in a tool providing daily value to all business areas. As part of the project plan, SCRA was only planned to be implemented in one of the Swedish factories in the first part of the project and, after success in testing and implementation, later be implemented in the rest of IPEI factories. As part of the implementation of SCRA the Business Administration division conducted a seminar including all involved stakeholders. This provided users and other stakeholders an opportunity to be educated in and test the system.

The workshop was initialized by the IPEI Business Administration area, but all involved business areas were obliged to participate. The intended purpose of the workshop was to give stakeholders an opportunity to educate them self about existing accounting practices in the company and get an introduction to the new SCRA tool. In the written invitation to the workshop, the introduction of the SCRA was highlighted as the big and anticipated part of the workshop and the reason for managers to bring affected stakeholders. The participation of managers was expressed as mandatory and affected stakeholders were asked to participate as well. The workshop took place at one of Swecorps IPEI factories in the northern part of Sweden with partakers flying in from production facilities in the origins of Germany, Spain, Poland, Hungary, Japan, and the UK. Participants at the workshop ended up as all factory managers for IPEI factories, as well as stakeholder predominantly consisting of Controllers, Production Managers and Sourcing responsible. The overall count of participants being 53.

The workshop was divided into two sections; one-morning section focused on reviewing the IPEIs standardized accounting practice, and one afternoon section focused on the presentation and demonstration of the new SCRA system.

### 3.2.3 The Cost Management System (SCRA)

SCRA was developed as a cross-division method to calculate and report cost development in production. The method of SCRA had its history in one of the acquired companies in Swecorps CE division. The implementation of the SCRA was, after the acquisition, an initiative from the global executive team of Swecorp. Each division had to report cost savings in production via the SCRA method. How each division computed the numbers was left up to respective area, and a certain level of freedom of conformity was given. For example, not all products needed to be included in the report. The IPEI division had early realized that they, given their substantially larger diversity of products compared to other areas, needed to find a more sustainable method than manual calculation. The need of computing a large number of cost components sprung the SCRA project.

## 3.3 Preparatory work

### 3.3.1 Survey pilot test

Before the gathering of data in the main study, a pilot test was conducted. The objective of the pilot-test was to ensure unambiguousness and precision of scales. The pilot-test was initially distributed to a professional market researcher to provide feedback on the experience of participating in the survey. The responder was selected based on his professional experience of conducting online based surveys. Subsequently, the pilot was distributed to a selection of four, all non-native English, respondents working at Swecorp. The respondents were selected based on their similar background and experience as that of the main study respondents. The

respondents were asked to give feedback on the clarity of the question and ensure that all company terminology was in line with their general interpretation.

## 3.4 Main Study

### 3.4.1 Survey Design

The main studies consisted of an online survey containing a total of 36 questions; 17 questions relating to Orlikowski & Gash (1994) three domains of TFR; *Nature of technology, Technology strategy* and *Technology in use*, and 13 questions related to *Assumptions, Expectations,* and *Knowledge*. Finally, the survey also contained six questions commonly used by Swecorp to measure the success or relative failure of the of the evaluated subject.

Given the multinational background of the participants, and the official business language of Swecorp being English, the preferred language for the survey was chosen to be English. Reflecting over validity, the chosen language may have had an effect on the interpretation of the respondents, as only three respondents were native English. However, as the main language of the workshop, as well as the working language of all respondents, was English, we saw a limited risk of interpretation affecting the outcome of the survey. Further, to avoid bias towards promoting dishonest responses, the surveys was distributed in an anonymised manner and clarification was made to all participants that no answer could be traced back to a respondent.

#### *3.4.1.1 Survey item*

As TFR is not previously quantified in research, the questions were, to ensure validity, deduced through the qualitative based framework of Orlikowski & Gash (1994). See Appendix 1 for the full questionnaire and Appendix 2 for Orlikowski and Gash (1994) framework.

The survey Items consisted of three to six questions for each TFR domain.

**a) Nature of technology**

Was measured with six survey questions such as *The SCRA will help us reach our cost target* and *The SCRA reduce the total time spent on cost analysis.*

**b) Technology Strategy**

Was measured with six survey questions such as *The SCRA will improve our ability to manage our resources* and *The SCRA will improve our ability to interact correctly.*

**c) Technology in use**

Was measured with five survey questions such as *The SCRA will make it easier for new employees to understand cost development* and *I feel that the SCRA is designed with my usage in thought.*

**d) Assumptions**

Was measured with five survey questions such as *Cutting costs is easy* and *A X % yearly cost cutting target is realistic.*

**e) Expectations**

Was measured with three survey questions such as *Technology can help us understand our cost development* and *Technology can help us cut cost.*

**f) Knowledge**

Was measured with five survey questions such as *I have sufficient knowledge of how to cut cost* and *IPEI is successful in cutting cost every year.*

### 3.4.2 Sampling strategy & Sample

The sample and sampling strategy is based on a mixed approach of non-probability made sampling techniques (Saunders et al. 2008). At the subject level, the population consists of the general field of publicly traded companies. The population definition is acknowledged to be broadly defined, but given our review of the literature we find little support for discrimination by for example industry or company size and has therefore retained a wide definition. Given our quantitative approach, a probability sampling of units would provide a higher validity, providing for greater interpretations through statistical inference (Bryman et al. 2010). However, given the limitations of time, resources and accessibility to publicly traded companies, sampling even a limited selection of the population would prove too big of a task. The choice of sample was instead utilized through a self-selection sampled based on the accessibility and the opportunity Swecorp provided us.

At respondent level, the sampling was conducted through a purposive sample (Saunders et al. 2008), by limiting the sample to only employees of Swecorp participating in the implementation project. The total numbers of survey respondents were 44. However, because of loss of respondents between the pre- and post-test only 36 responses were tested. The number of respondents was sufficient for obtaining normal distribution (Newbold et al. 2012) and thereby providing the ability to make statistical inference if proven significant. The sampled partition consisted of a mix of managers with various roles in the company such as Controllers, Production engineers, and Sourcing. The sample was further diversified through participant's

representing factories from six different nations, providing a sample that represents a ratio of the company's global presence.

### 3.4.3 The priming intervention

The experiment was conducted as part of the IPEI workshop. For more detailed description of both background and workshop see The research subject section.

The priming action was conducted by the SCRA project responsible together with the Production Manager of IPEI. It consisted of a presentation about the background to SCRAs initiation and the reasons for its existence, as well as the opportunity for participants to test the system. The overall aim of the presentation was to put emphasis on SCRAs ability to help IPEI perform in the mission of Swecorps stated goals. The presentation also contained examples of everyday uses for the system and how the aggregated result of the usage would come to benefit the overall IPEI result. The intention of the SCRA project responsible and the production manager was to communicate SCRA in the context of an opportunity for all users, and that it would help factories long term in both performance and ease of reporting. Towards the end of the workshop, all partakers were given the opportunity to test the SCRA system individually. The live testing was conducted in union with a demonstration where the production manager had picked out a selection of cases deemed similar to those he saw as everyday usage for the respective business area. Each case was carefully designed to highlight the leverage of simplicity and accuracy the SCRA provided comparative to existing manual methods. The participants were asked to follow along with their versions of the system, providing them with a first-hand experience of the tool.

The priming evaluated by us was recognized as the background contextualization of the SCRA presentation as well as the possibility for individual users to contextualize it in their daily usage via the demonstration.

### 3.4.4 Data collection

The surveys were distributed in conjunction with the workshop with the pre-test distributed just before the start of the SCRA presentation, and the post-test directly after the end of the live demonstration. To minimize the risk of other factors than the priming affecting the participants all participants of the workshop were asked to respond to the pre-test survey on their computer before the start of the workshop. In a similar manner, to avoid lag, the post-test was conducted after the end of the live demo, and all participants were asked to respond before leaving the workshop. To minimize the risk of dishonesty and maximize participation all respondents were ensured that their partaking in the survey were completely anonymous.

The pre-test had (N=44) complete respondents, however, only (N=36) respondents completed both the first and second survey and consequently, the thesis sample became (N=36). The reason for the drop of respondents between the pre- and post-test was varying, and hence no skewness should have occurred in the sample from the loss of respondents. None of the respondents were excluded due to bias or other reason as partakers that were argued to be biased, such as responsible management, were instead excluded from participating in the survey.

## 3.5 Data Quality

Performing a quantitative study the importance of data quality in terms of reliability, validity, and replicability is highly important (Bryman et al. 2010). The three measurements are reflected upon in this section with a prime perspective on validity and replicability.

### 3.5.1 Reliability

Reliability represents the accuracy of the measurements and reflects it through (i) stability (ii) internal reliability and (iii) inter-observed consistency (Bryman et al. 2010).

#### *3.5.1.1 Stability*

Stability reflects if the measurements used are stable within time and does not fluctuate with the timeframe and contextual conditions (Bryman et al. 2010). As TFR is a concept of interpretation, our only real possibility to ensure stability was to minimize external influences through minimizing the time between the two measured occasions. As we measured both tests in conjunction with the beginning and end of the workshop, minimizing both time and outside influences, we argue the measurement as stable. It is, however, important to acknowledge that because of the brief time between the first and second survey respondents might have been influenced by remembering their first response.

#### *3.5.1.2 Internal reliability*

Internal reliability determines if the items within a multi-item scale are consistent in measuring the intended variable (Bryman et al. 2010). To ensure internal reliability, the measures were tested using Cronbach's Alpha, and a general rule for >0.7 was used to conclude significant internal reliability (Newbold et al. 2012).

| Domain/ Variable | Cronbach's Alpha | Number of questions | Conclusion |
|---|---|---|---|
| **Nature of technology** | 0.97 | 6 | Significant |
| **Technology strategy** | 0.94 | 6 | Significant |
| **Technology in use** | 0.81 | 5 | Significant |
| **Assumptions** | 0.53 | 5 | Insignificant |
| **Expectations** | 0.45 | 3 | Insignificant |
| **Knowledge** | 0.71 | 5 | Significant |

*Table 1. Cronbach's alpha test statistic signifying internal reliability in the TFR domain variable*

*Assumptions* (0.524) and Expectation (0.479) lacks internal reliability and should, therefore, be excluded due to a lack of internal consistency. All other variables are internally reliable according to Table 1, and hence they are considered internally reliable in measuring the same phenomena.

#### *3.5.1.3 Inter-observer consistency*

As all data collection was executed on the same occasion with the same observers and studied objects, the inter-observer consistency is considered high (Bryman et al. 2010).

### 3.5.2 Validity

Validity is central to establish the integrity of the conclusions that are drawn. To determine the validity of our thesis four concepts has been evaluated (i) measurement validity (ii) internal validity (iii) external validity and (iv) ecological validity (Bryman et al. 2010).

#### *3.5.2.1 Measurement validity*

Measurement validity is important as a construct to determine if a utilized measurement captures the intended concept (Bryman et al. 2010). Our approach to ensuring measurement validity was a development of questionnaire based on Orlikowski & Gash (1994) framework of TFR. A post-review through Cronbach Alpha later confirmed the existence of the suggested TFR dimensions. The conclusion is therefore that the utilized measurements capture the intended concept.

#### *3.5.2.2 Internal validity*

Internal validity mainly relates to the issue of causality in between measured variables (Bryman et al. 2010). This notion relates back to our reasoning of stability. As the TFR are socially constructed possible independent variables can take many forms, which makes guaranteed isolation of one variable is impossible. Our argument for achieving internal validity is, therefore, equal to that of stability as the stability suggest that a similar interpretation is made over time.

Due to the minimized time between the workshop and the test it can be argued that the possible other independent factors influencing TFR were kept to a minimum.

#### *3.5.2.3 External validity*

External validity questions the ability of the findings to be generalized to the larger population (Bryman et al. 2010). The utilized sampling, as well as sampling size, results in a restricted level of external validity. Being a quasi-experiment with a single research subject, the possibility to infer conclusions to the general population is imperfect. The utilized sample size is due to the limited possibility to obtain access to an actual situation of system implementation. However, even though the size results in a limited possibility to infer the findings to the general population, no previous findings have suggested that TFR should differ between industries or demographics.

At the respond level, the utilized natural selection method of participants in the workshop is deemed as sufficiently randomized given the intent of the study. The participants of the workshop were deemed to be important stakeholders by the organization and thereby are judged to represent common participants in an IT implementation project. Acknowledging the limits of the studied sample, the external validity is limited but sufficient to the claims of this thesis findings.

#### *3.5.2.4 Ecological validity*

Ecological validity considers the distance between the findings and the everyday natural and social setting of individuals (Bryman et al. 2010). Being a quasi-experiment, the Ecological validity is argued to be high as we as researchers have minimized our mediation through surveying a naturally occurring event. However, taking a critical standpoint, reasons to question the ecological validity in our quasi-experiment exists. Firstly, the use of survey as a tool for of measurement have limitations, and earlier research has indicated that there is a risk for a discrepancy between the intent and action of survey respondents (Saunders et al. 2008). Equally, the participation of a manager lead event might have influenced the answers of respondents (Walsh 1988). Further, even though all participants were given complete insurance that the survey was anonymous, the risk of being associated with a negative mindset might have affected the chosen responses. Considering the strength and weakness of the results ecological validity, we argue that the closeness of the “real life” setting together with the width taken measures to ensure an honest response, results in findings with high ecological validity.

### 3.5.3 Replicability

Replicability is the consideration of the ability to replicate the study to support or disprove the findings (Bryman et al. 2010). Given the quasi-experiment approach, some limitation of

replicability will naturally exist. Redoing the same study would entail studying the same object. However, the researched company have been masked to ensure anonymity, given that information obtained may be sensitive to partakers. Else we have taken measures to ensure as high transparency of both method and conducted research. The developed questionnaire is provided in Appendix 1, as well as the underlying framework of (Orlikowski & Gash 1994) in Appendix 2. The theoretical foundation for the research question as well as the survey is explicitly reviewed in the thesis. We, therefore, deemed the replicability being sufficient.

# 4 Results & Analysis

*In this chapter, the thesis descriptive data will be presented, what analytical tools are used to handle data as well as the results and finalizing conclusion.*

## 4.1 Descriptive data

| Variable | Mean (N=36) | Std. Dev. | Min | Max |
|---|---|---|---|---|
| **Nature of technology 1** | 4.12 | 1.64 | 1 | 6.6 |
| **Nature of technology 2** | 5.34 | 1.17 | 2.5 | 7 |
| **Technology strategy 1** | 4.24 | 1.70 | 1 | 7 |
| **Technology strategy 2** | 5.45 | 1.12 | 3 | 7 |
| **Technology in use 1** | 2.93 | 1.44 | 1 | 7 |
| **Technology in use 2** | 4.8 | 1.09 | 2.8 | 7 |
| **Assumptions 1** | 3.27 | 0.83 | 1.4 | 5 |
| **Assumptions 2** | 3.74 | 0.69 | 2.2 | 5.4 |
| **Expectations 1** | 5.81 | 1.32 | 1 | 7 |
| **Expectations 2** | 5.97 | 0.96 | 3.5 | 7 |
| **Knowledge 1** | 4.64 | 0.94 | 2.8 | 6.4 |
| **Knowledge 2** | 5.1 | 0.88 | 3.6 | 7 |

*Table 2. Descriptive data for pre (1) and post (2) test*

Table 3. describes our sample data (N=36) for both test occasions for each variable. Minimum and Maximum refers to the minimum and maximum value of what the respondents have answered on the seven-point scale of the survey.

## 4.2 Analytical tools

The thesis survey was conducted in the online survey tool Qualtrics, and the following data handling was done in IBM SPSS Statistics. The data checks of distribution and internal reliability were done in IBM SPSS Statistics while the hypothesis testing was conducted in Stata. The graphical content was conducted in Excel. Raw data was always kept in the same format, ".xls," aiming to eliminate human error in the transfer of data.

### 4.2.1 Data checks

#### *4.2.1.1 Test of Normality*

Both the t-test and f-test used in this thesis, rely on the assumption of a normally distributed sample (Newbold et al. 2012). Provided the relatively low number of respondents the central limit theorem for normality is not fulfilled. To conclude that normality in the sample was obtained a Shapiro-Wilk test, suitable for smaller populations, was conducted. The Shapiro-Wilk test cannot reject the null hypothesis that the sample variable is normally distributed if the significance is above 0.05. Therefore, any value above 0.05 is argued to be normally distributed (Newbold et al. 2012).

| Test for Gaussian normality distribution | Shapiro-Wilk test | | | |
|---|---|---|---|---|
| | Statistic | df | Sig. | Normality distribution |
| Nature of Technology 1 | .953 | 36 | .124 | X |
| Nature of Technology 2 | .954 | 36 | .139 | X |
| Technology strategy 1 | .940 | 36 | .055 | X |
| Technology strategy 2 | .941 | 36 | .056 | X |
| Technology in use 1 | .973 | 36 | .524 | X |
| Technology in use 2 | .970 | 36 | .413 | X |
| Assumptions 1 | .974 | 36 | .531 | X |
| Assumptions 2 | .987 | 36 | .937 | X |
| Expectations 1 | .820 | 36 | .000 | - |
| Expectations 2 | .868 | 36 | .001 | - |
| Knowledge1 | .972 | 36 | .491 | X |
| Knowledge 2 | .975 | 36 | .573 | X |

*Table 3. The Shapiro-Wilk test statistic for normality*

Both the t-test and f-test builds on the assumptions of the generalized linear model, which assumes continuity, and is fulfilled by the utilized interval scale (Newbold et al. 2012).

### 4.2.2 Recoding of variables

To eliminate score bias, questions included reverse score items. Equally, for the TFR domains, the survey questions were combined into one index for each specific TFR domain through computing the average of each respondent (Pedhazur & Schmelkin 1991).

## 4.3 Hypothesis testing

### 4.3.1 User TFR in IT change projects can be shifted with Priming

To test if the hypothesis stating that TFR can be shifted with priming two surveys were conducted for the same sample group (N=36), one survey before the priming action and one survey after. As suggested by Newbold et al. (2012) a paired t-test was made as the same group was tested for the two occasions. All tests were made are on a 95 % significance level (t=2.03) for a two-tailed hypothesis (Newbold et al. 2012).

| Hypothesis | Test |
|---|---|
| **1)** ***User Technological Frames of Reference in IT change projects can be shifted with Priming.*** | **Supported** |
| **1a:** ***User Nature of technology can be shifted with Priming in IT change projects*** | **Supported** |
| **1b:** ***User Technology Strategy can be shifted with Priming in IT change projects*** | **Supported** |
| **1c:** ***User Technology in use can be shifted with Priming in IT change projects*** | **Supported** |
| **1d:** ***User Assumptions can be shifted with Priming in IT change projects*** | **Supported** |
| **1e:** ***User Expectations can be shifted with Priming in IT change projects*** | **Excluded** |
| **1f:** ***User Knowledge can be shifted with Priming in IT change projects*** | **Supported** |

*Table 4. Summary t-test*

| Hypothesis | Paired t-test | N | Difference Mean[2] | Std. deviation[3] | t | p |
|---|---|---|---|---|---|---|
| **1a** | **Nature of technology** | 36 | 1.21 | 1.56 | 4.64 | 0.00* |
| **1b** | **Technology strategy** | 36 | 1.21 | 1.54 | 4.71 | 0.00* |
| **1c** | **Technology in use** | 36 | 1.87 | 1.15 | 9.78 | 0.00* |
| **1d** | **Assumptions** | 36 | 0.46 | .67 | 4.19 | 0.01* |
| **1e** | **Expectations** | 36 | 0.16 | .99 | 0.92 | 0.18 |
| **1f** | **Knowledge** | 36 | 0.45 | .70 | 3.90 | 0.02* |

*Table 5. Summary of t-test comparison for differences in TFR shifting within the group after Priming. Significant differences are marked with **

| | |
|---|---|
| 1a: *User Nature of technology can be shifted with Priming in IT change projects* | SUPPORTED |

As shown in Table 5 row 2 the first test's mean (M= 4.12, Sd=1.64) has significantly, at the 95 % level, been shifted to the second test (M= 5.34, Sd=1.17). The hypothesis "User Nature of technology can be shifted with Priming in IT change projects" is thereby concluded to be supported (t=4.64, p=0.00).

| | |
|---|---|
| 1b: *User Technology Strategy can be shifted with Priming in IT change projects* | SUPPORTED |

As shown in Table 5 row 3 the first tests mean (M= 4.24 Sd=1.7) has significantly, on the 95 % level, been shifted to the second test (M= 5.45, Sd= 1.12). The hypothesis "User Technology Strategy can be shifted with Priming in IT change projects" is thereby concluded to be supported (t=4.71, p=0.00).

[2] The difference in mean between sample 1 and 2= $\mu_1$- $\mu_2$. For sample 1 and 2's mean see descriptive data
[3] The interpolated standard deviations Stata uses to calculate the t-test. See descriptive data

| | |
|---|---|
| 1c: *User Technology in use can be shifted with Priming in IT change projects* | SUPPORTED |

As shown in Table 5 row 4 the first tests mean (M= 2.93 Sd=1.44) has significantly, on the 95 % level, been shifted to the second test (M= 4.80, Sd=1.09). The hypothesis “User Technology in use can be shifted with Priming in IT change projects” is thereby concluded to be supported (t=9.78, p=0.00).

| | |
|---|---|
| 1d: *User Assumptions can be shifted with Priming in IT change projects* | SUPPORTED |

As shown in Table 5 row 5 The first tests mean (M= 3.27 Sd=0.83) has significantly, on the 95 % level, been shifted to the second test (M= 3.74, Sd=0.69). The hypothesis “User Expectations can be shifted with Priming in IT change projects” is thereby concluded to be supported (t=4.19, p=0.01).

| | |
|---|---|
| 1e: *User Expectations can be shifted with Priming in IT change projects* | EXCLUDED |

*Expectations* is excluded from the conclusion of the study due to non-normality and lack of internal consistency. However, the results are presented for the interest of analytical discussion. Important to note is that due to non-fulfillment of the statistical assumptions of the t-test the results should not be interpreted strictly. As shown in Table 5 row 6 the first tests mean (M=5.81 Sd=1.32) has not been proven to be shifted to the second test (M= 5.97, Sd=0.96). As this result rest on non-reliable data, the result of the hypothesis test of *Expectations* is excluded.

| | |
|---|---|
| 1f: *User Knowledge can be shifted with Priming in IT change projects* | SUPPORTED |

As shown in Table 5 row 7 the first tests mean (M= 4.64 Sd=0.93) has significantly, on the 95 % level, been shifted to the second test (M= 5.1, Sd=0.87). The hypothesis “User Knowledge can be shifted with Priming in IT change projects” is thereby concluded to be supported.

#### *4.3.1.1 Conclusion Hypothesis 1*

The sub-hypothesizes for that TFR can be shifted with priming is supported in all cases on a 95 % significance level**.** One sub-hypothesis *Expectations* is however excluded from the study as it does not adhere to the assumption of normal distribution and internal consistency. The conclusions from this is that hypothesis 1 “User Technological Frames of Reference in IT change projects can be shifted with Priming.” is supported.

| | |
|---|---|
| 1: *User Technological Frames of Reference in IT change projects can be shifted with Priming* | SUPPORTED |

### 4.3.2 A user groups’ Technological Frames of Reference congruency can be increased through Priming in IT change projects

To test if the second hypothesis “A user groups’ Technological Frames of Reference congruency can be increased through Priming in IT change projects” we conducted two surveys for the same sample group (N=36). One survey before the priming action and one survey after. According to Newbold et al. (2012), an f-test should be made when congruency of a group is the subject of interest. The f-test studies the standard deviation difference between the two samples and gives a p-value <0.05 if the test significantly shows that the standard deviation has changed between the two samples. The test relies on the assumption that the variables are normally distributed, and therefore *Expectations* is not able to be evaluated (Markowski & Markowski 1990). Furthermore, the f-test is not affected by pairing data (Gastwirth et al. 2009). If a decrease is achieved, a significant result would, in our case, show that the standard deviation has decreased in the sample group due to the priming action, implying that the group has become more congruent. All tests are at a 95 % significance level (f=1.75) and the f-statistic needs to be above 1.75 for the hypothesis to be supported (Newbold et al. 2012).

| Hypothesis | Test |
|---|---|
| **2) *A user groups' Technological Frames of Reference congruency can be increased through Priming in IT change projects.*** | **Partly Supported** |
| **2a: *A user groups' Nature of technology can be increased through Priming in IT change projects.*** | **Supported** |
| **2b: *A user groups' Technology Strategy can be increased through Priming in IT change projects.*** | **Supported** |
| **2c: *A user groups' Technology in use can be increased through Priming in IT change projects.*** | **Supported** |
| **2d: *A user groups' Assumptions can be increased through Priming in IT change projects.*** | **Not Supported** |
| **2e: *A user groups' Expectations can be increased through Priming in IT change projects.*** | **Excluded** |
| **2f: *A user groups' Knowledge can be increased through Priming in IT change projects*** | **Not Supported** |

*Table 6. Summary findings for Hypothesis 2*

| f-test | N | Std. dev. Sample 1 | Std. dev. Sample 2 | f | p |
|---|---|---|---|---|---|
| **Nature of technology** | 36 | 1.65 | 1.17 | 1.97 | 0.02* |
| **Technology strategy** | 36 | 1.71 | 1.12 | 2.32 | 0.01* |
| ***Technology in use*** | *36* | *1.44* | *1.09* | *1.75* | *0.05** |
| **Assumptions** | 36 | 0.84 | 0.69 | 1.46 | 0.13 |
| **Expectations** | 36 | 1.32 | 0.96 | 1.89 | 0.03[X] |
| **Knowledge** | 36 | 0.94 | 0.88 | 1.13 | 0.35 |

*Table 7. Summary of f-tests considering hypothesis 2. *= significant signifying increased congruency. X= excluded because of lack of normality and internal consistency[4]*

| | |
|---|---|
| 2a: *A user groups' Nature of technology can be increased through Priming in IT change projects* | SUPPORTED |

As shown in Table 13 row 2 the hypothesis "A user groups' Nature of technology can be increased through Priming in IT change projects." is supported as the standard deviation in test 1 is (Sd= 1.65) and in test 2 (Sd=1.17) which gives a p-value of 0.02, or an f-statistic of (f=1.97).

| | |
|---|---|
| 2b: *A user groups' Technology Strategy can be increased through Priming in IT change projects* | SUPPORTED |

As shown in Table 13 row 3 the hypothesis "A user groups' Technology Strategy can be increased through Priming in IT change projects." is supported as the standard deviation in test 1 is (Sd=1.65) and in test 2 (Sd=1.12) which gives a p-value of 0.01, or an f-statistic of (f=2.32).

[4] For mean see descriptive data

| | |
|---|---|
| 2c: *A user groups' Technology in use can be increased through Priming in IT change projects* | SUPPORTED |

As shown in Table 13 row 4 the hypothesis "A user groups' Technology in use can be increased through Priming in IT change projects." is supported as the standard deviation in test 1 is (Sd=1.44) and in test 2 (Sd=1.09) which gives a p-value of 0.05, or an f-statistic of (f=1.75).

| | |
|---|---|
| 2d: *A user groups' Assumptions can be increased through Priming in IT change projects* | NOT SUPPORTED |

As shown in Table 13 row 5 the hypothesis "A user groups' Assumptions can be increased through Priming in IT change projects." is not supported as the standard deviation in test 1 is (Sd= 0.84) and in test 2 (Sd=0.69) which gives a p-value of 0.13, or an f-statistic of (f=1.46) which is below the required f-statistic.

| | |
|---|---|
| 2e: *A user groups' Expectations can be increased through Priming in IT change projects* | EXCLUDED |

The variable *Expectations* lack internal reliability and normal distribution. However, for the interest of analytical discussion, we select to test the variable. As shown in Table 13 row 6 the thesis hypothesis "A user groups' Expectations can be increased through Priming in IT change projects." is supported as the standard deviation in test 1 is (Sd= 1.32) and in test 2 (Sd=0.96) which gives a p-value of 0.03, or an f-statistic of (f=1.89). The hypothesis is thereby concluded to be supported. However, as the f-test relies on the assumption of a normality distributed sample, and as it cannot be assumed for our sample, the finding is excluded.

| | |
|---|---|
| 2f: *A user groups' Knowledge can be increased through Priming in IT change projects* | NOT SUPPORTED |

As shown in Table 13 row 7 the hypothesis “A user groups’ Knowledge can be increased through Priming in IT change projects” is not supported as the standard deviation in test 1 is (Sd= 0.94) and in test 2 (Sd= 0.88) which gives a p-value of 0.35, or an f-statistic of (f=1.13).

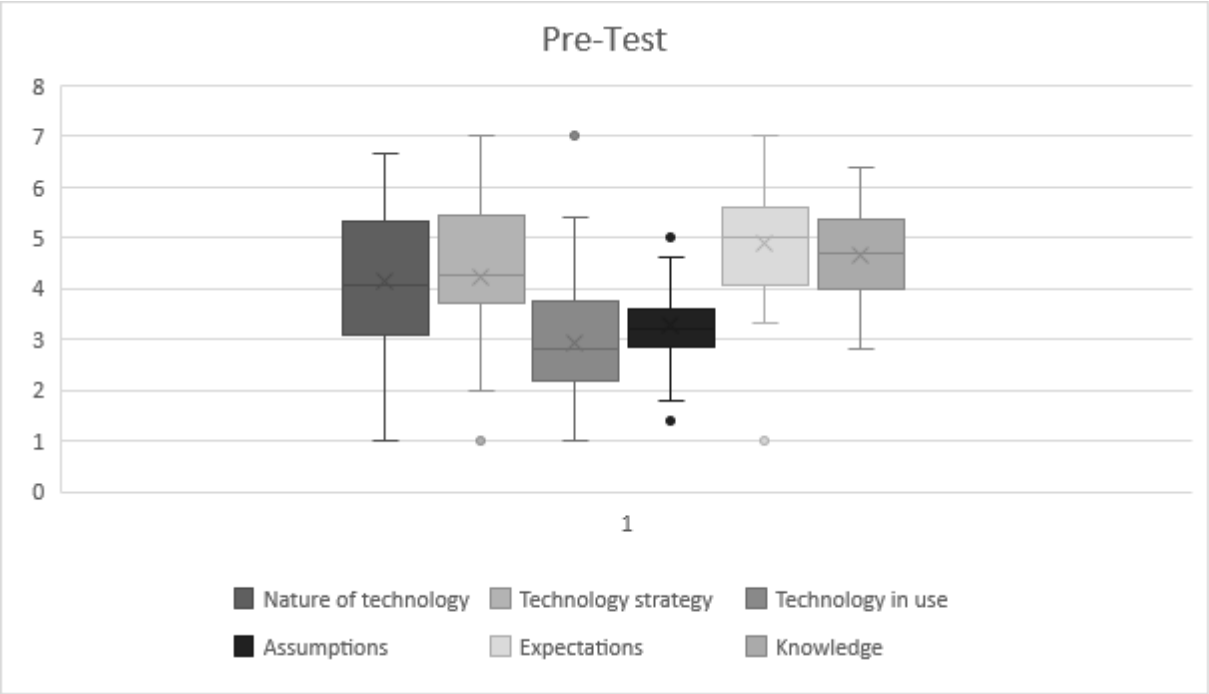


*Figure 4. Boxplot of the sample distribution in test 1*

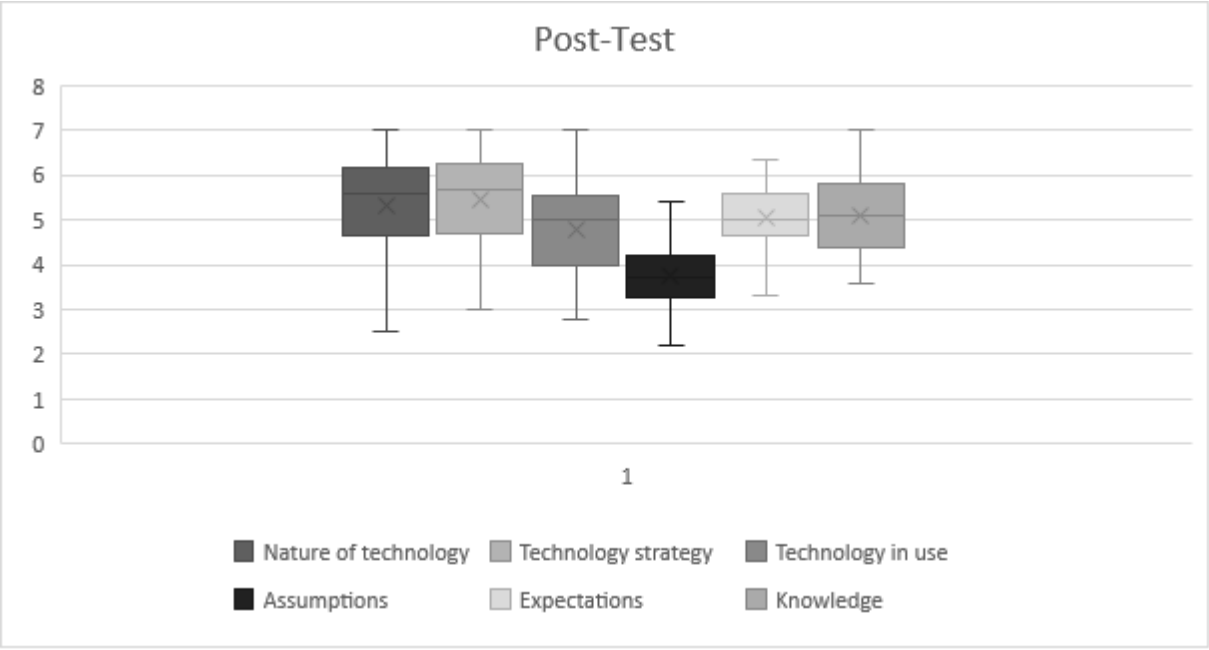


*Figure 5. Boxplot of the sample distribution in test 2*

Considering the graphical spread as shown in Figure 4 and Figure 5 it is graphically inferred that the tails of the box plots have decreased in size for all variables between test 1 and 2,

which means that outliers have converged towards the mean in test 2. This supports the results in Table 13 and strengthens the argument that Hypothesis 2 should be considered supported.

#### *4.3.2.1 Conclusions Hypothesis 2*

Three of five hypothesis are proven to be supported (*Expectations* excluded due to lack of normality). As for whether hypothesis 2 should be considered supported or not can be argued to be ambiguous, we want to acknowledge that although two sub hypothesizes are not supported initial data can provide an explanation. There exists a possibility that Hypothesis 2d) is not supported as the technological subframe *Assumptions* was highly congruent in the first test (Sd= 0.83). It can suggest that the variance was simply too small to significantly show any difference between test 1 (Sd= 0.83) and 2 (Sd=0.69). However, Hypothesis 2f) insignificance is due to the small changes in standard deviation, as can be seen in Table 7. For the sake of analytical discussion, we will consider hypothesis 2) as partly supported although all sub hypothesizes are not concluded to be supported.

| | |
|---|---|
| 2) *A user groups' Technological Frames of Reference congruency can be increased through Priming in IT change projects.* | PARTLY SUPPORTED |

# 5 Discussion

*In this thesis, we focus on understanding how TFRs can be shifted and how a user groups TFRs can be shifted to become more congruent. As TFR shifting tool we leverage the concept of priming, used in the field of psychological research* (Kahneman 2003; Wyer 2016)*. We utilized the tool priming on a user group experiencing IT change in Swecorp and measured the shift with the TFR theory framework formulated by* Orlikowski & Gash (1994)*. Through the analysis as summarized in Table 4, we can find that TFR can be shifted with priming and that the congruency of a group can be increased. In this section, we will discuss our findings in two parts, firstly that TFR can be shifted with priming and then that this shift creates increased congruency in the studied user group.*

## 5.1 Priming and Technological Frames of Reference shifting

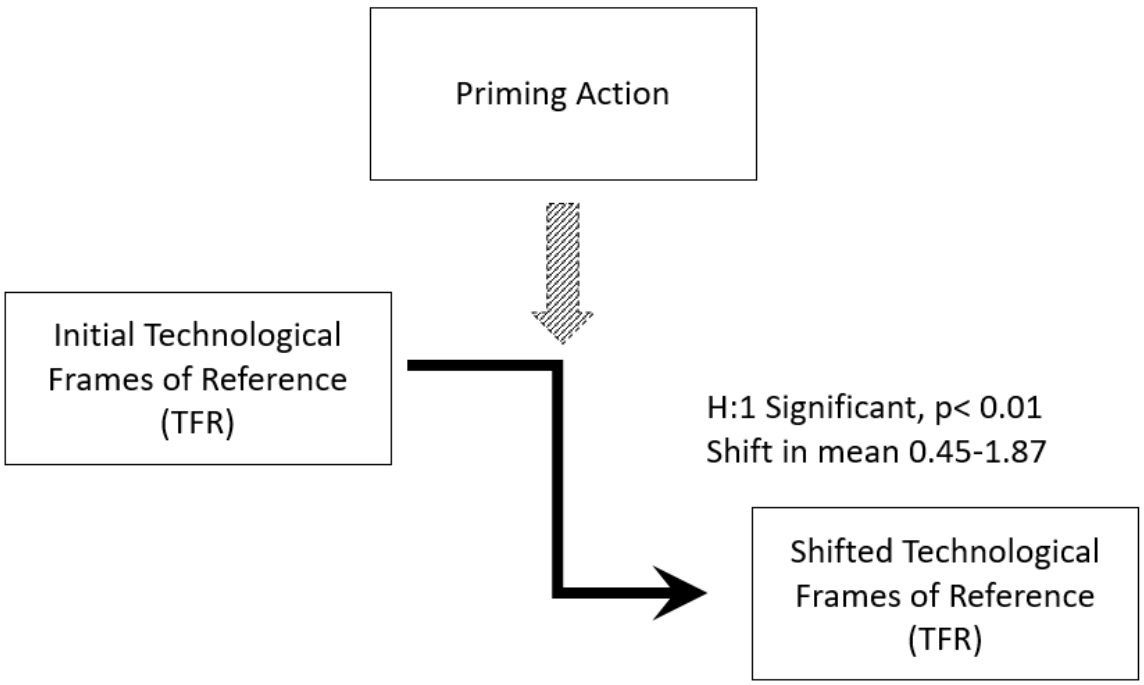


*Figure 6. Hypothesis 1 with significance level and average shift in mean*

### 5.1.1 Priming can shift Technological Frames of Reference amongst users in an IT change setting

Our interpretation of the result of a supported hypothesis 1, as shown in Table 4, is that TFRs including the TFR domains can be shifted by external forces. This result is in line with the findings of Orlikowski and Gash (1994) and Davidson, (2002). Equally, we conclude that the

previous research suggested effects of priming on contextual frames can also be assimilated on TFR. The argument that context affects TFR were already established through Gioia & Sims (1986) and Bartunek (1984) research. However, our findings contribute to the understanding of TFR shifting by intention and open for TFR shifting to be utilized as a tool for normative objectives in organizations.

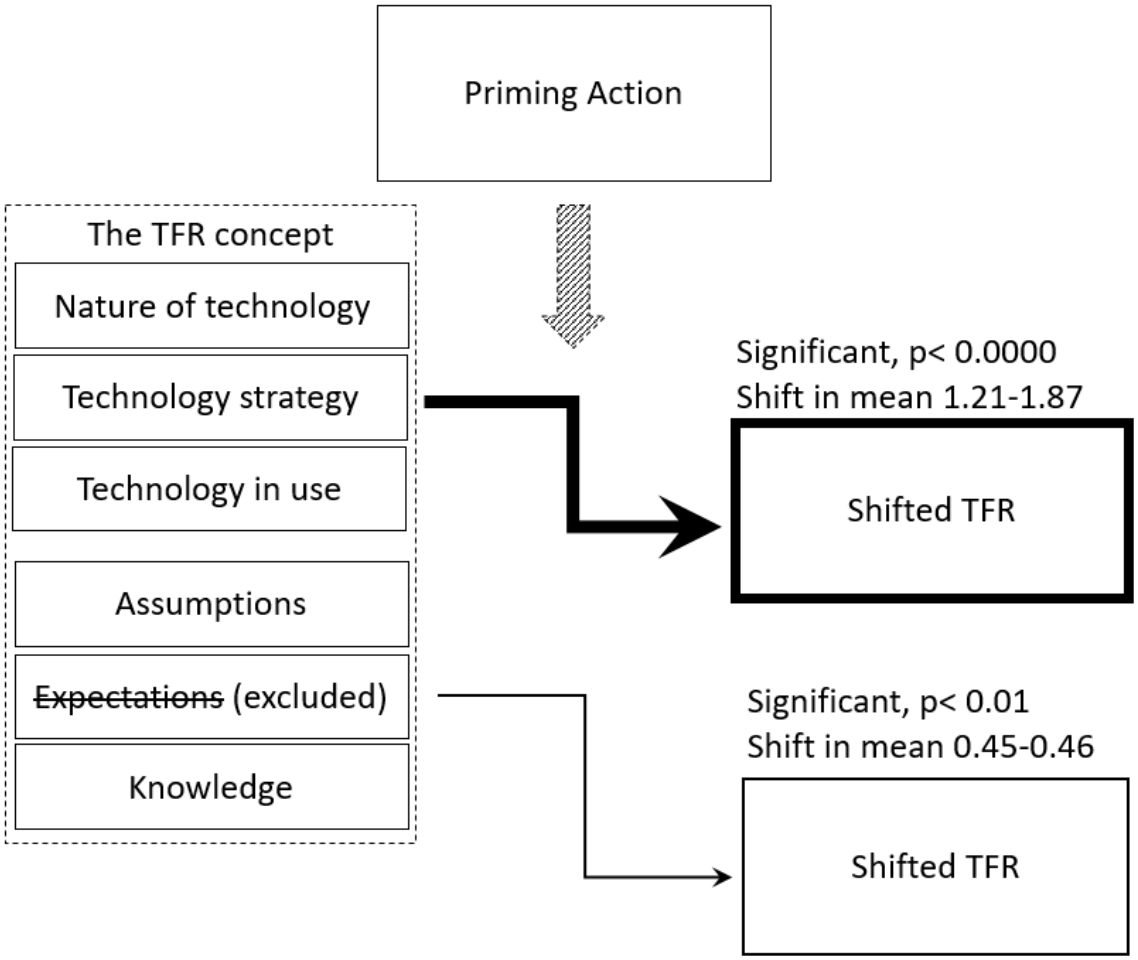


*Figure 7. Priming's different effects on TFR domains*

### 5.1.2 Priming had different effects on different Technological Frames of Reference

The internal reliability and significance in the domains *Nature of technology, Technology strategy* and *Technology in use* proved to be high. Especially for *Nature of technology* and *Technology strategy* with a Cronbach's alpha of over 0.9. The domains *Assumptions, Expectations,* and *Knowledge* showed both lower internal reliability, weaker normality distribution and less significant results compared to the domains *Nature of Technology, Technology in Use* and *Technology Strategy* as can be seen in Figure 7. The outcome may have multiple explanations. Both internal reliability and normality could likely be increased through a bigger sample. However, relating these findings to previous literature the outcome

is reasonable as the latter domains are not as widely acknowledged as the former TFR (Orlikowski & Gash 1994; Davidson 2002; Young et al. 2016). Equally, exploring our results and highlighting the small changes between the pre- and post-test in combination with previous literature (Davidson 2006; Tyre & Orlikowski 1994; Young et al. 2016), lead us to believe that besides being more resilient to the effects of priming, the latter domains could also be a more difficult phenomenon to study as they consist of a more deeply held personal nature (Davidson 2002). Thereby respondents might have chosen to respond in accordance with social expectations instead of their opinion. For the domains *Assumptions* and *Knowledge* we obtain significant normal distributed results, suggesting that although the phenomena might be more difficult to study, it can be sufficiently studied.

### 5.1.3 Priming have different effects on Underlying Values and System Unique TFRs

The TFRs *Assumptions* (Difference in mean= 0.46) and *Knowledge* (Difference in mean=0.45) differences in mean between the pre- and post-test was smaller than the differences of *Nature of Technology* (Difference in mean=1.21), *Technology strategy* (Difference in mean =1.21) and *Technology in use (*Difference in mean=1.87). As stated earlier, the discourse provides weaker support for the TFRs *Assumptions, Expectations* and *Knowledge*. Orlikowski and Gash (1994) hypothesizes about their existence, something that also later research restricts themselves to (Azad & Faraj 2008). Therefore, a line between the three TFRs empirically established by Orlikowski and Gash (1994) and the hypothesized TFRs *Assumptions, Expectations* and *Knowledge* seems to be apparent in our findings. Although the support for all hypothesis is remarkably strong ($p<0.01$), the absolute shift in TFRs differs notably. The priming action shifted the mean of *Nature of technology, Technology strategy* and *Technology in use* more than 1.43 on average, which we argue to be a large shift. However, the shift in mean for *Assumptions* and *Knowledge* was on average only 0.46, approximately 1/3 of the average shift in mean observed in the former TFR group. Therefore, we argue that priming is much more efficient in shifting the TFR domains of *Nature of Technology, Technology strategy,* and *Technology in Use* than *Assumption* and *Knowledge*.

Our interpretation of this is twofold. Firstly, Orlikowski and Gash (1994) empirically established definitions of *Nature of technology, Technology strategy* and *Technology in use* are robust and supported by our findings. Their reasoning about *Expectations, Assumptions,* and *Knowledge* is supported by the findings for *Assumptions* and *Knowledge.* However, these TFRs seem to be of another type than the three established TFRs, as the difference in the average shift in respective group is large. Given these findings, we argue that TFR should be divided into two divisions due to what we see as their difference in nature and of how they seem to affect cognitive structures. We claim that *Nature of technology, Technology strategy,* and *Technology in use,* due to their close linkage to the actual system studied, could be denoted as *System*

*Unique* variables. While the TFRs of *Assumptions, Expectations,* and *Knowledge,* which show more inertia for shifting, could be denoted as *Underlying Values*.

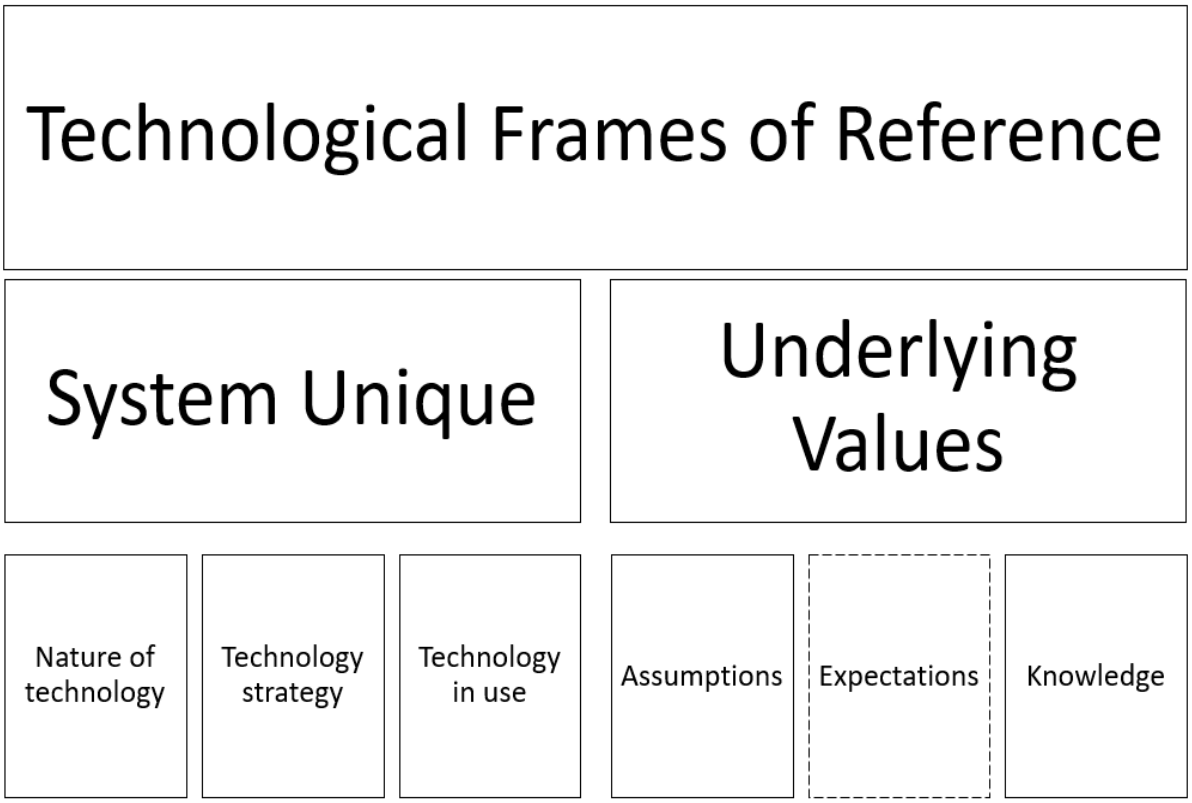


*Figure 8. Illustration of TFR divisions System unique and Underlying values compromising of three TFR dimensions respectively according to their perceived characteristics*[5]

The argument for denoting the variables as *System Unique* is that with a priming action these TFRs could be shifted extensively, between 1.21 and 1.84 on a 7-degree scale. This indicates that when users in the IT change efforts were exposed to priming, they quickly changed their *System Unique* frames on a substantial scale. Connecting this to Tyre & Orlikowski (1994) findings, that it is easier to change TFRs that are in their initial stages of development, while TFRs that have become more institutionalized in the organization are more definite. Our findings, which can be seen in Figure 9, that *System Unique* TFRs are easier to change, could arguably support this as *System Unique* TFRs are created in the initial phase of the IT systems implementation. However, the TFRs of *Underlying Values* could instead be in a more mature, general and institutionalized phase, explicative to our findings. The reason for why *Underlying Values* could be in a more mature state is that those TFRs were created earlier in other IT system implementations and are transferred or projected onto this project by users. The distinction of effects by priming is important as the effects result in different implications for

[5] The inclusion of Expectations cannot be supported by this thesis however previous literature supports it existence.

managers. Our findings suggest that priming has a lower absolute effect on *Underlying Values,* however, with the possible benefit that the increase incongruency in one IT change project could be leveraged in subsequent IT change efforts. So even though the priming actions effect on *Underlying Values* is weaker than the effect on *System Unique* TFR, the benefits of priming could be leveraged in multiple IT change projects and result in a long-term benefit with higher overall firm impact.

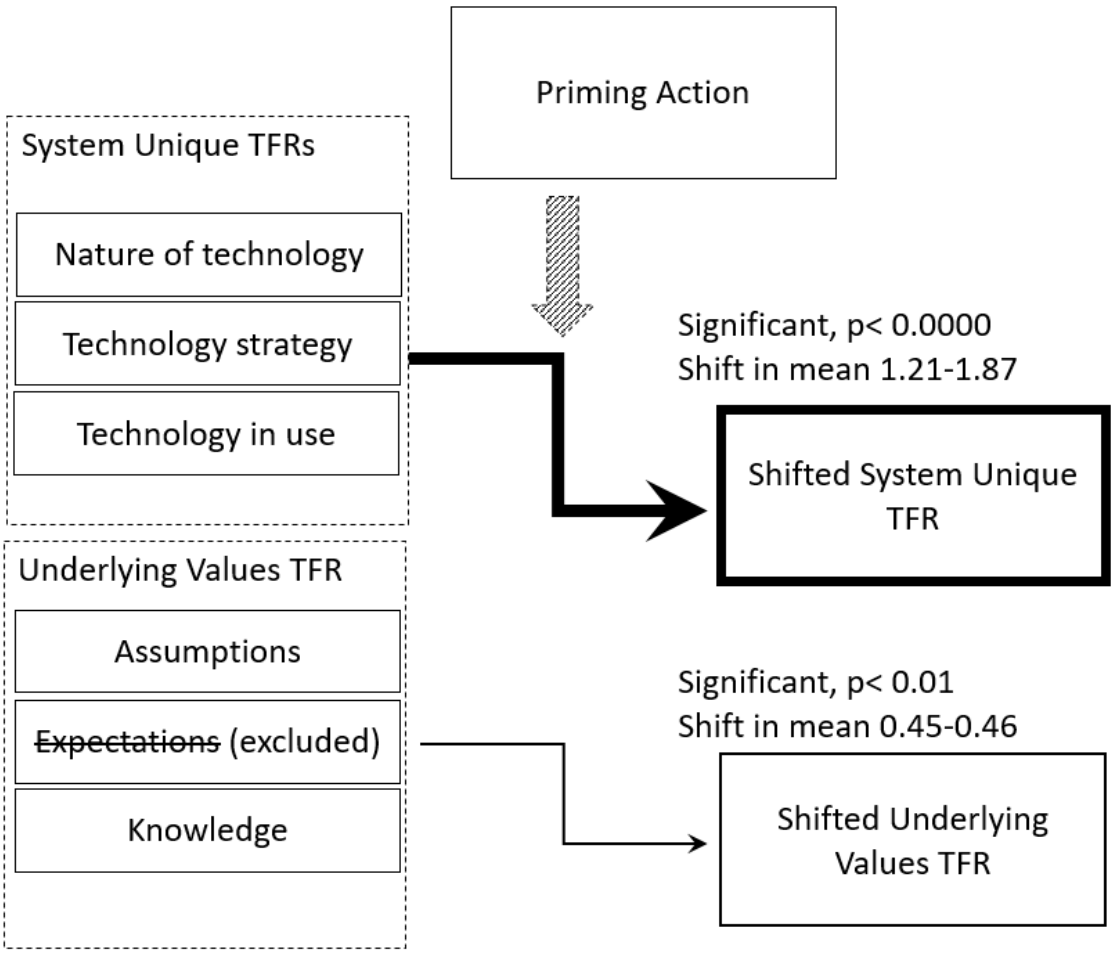


*Figure 9. TFR split into two larger divisions of TFR, System Unique and Underlying values*

### 5.1.4 Underlying values and Subcultures

Orlikowski & Gash (1994) argue that the lines between the different TFR domains are not always clear. Instead, they acknowledge that the TFR domains likely overlaps and affects each other. Our findings indicate that *System Unique* TFRs appear to be relatively similar in shifting pattern to each other and that the domains of *Underlying Values* also appear to be relatively interdependent. Notably, the internal reliability of *Nature of technology* (0.968) and *Technology strategy* (0.942) is very high, and therefore our denotation of these variables can be argued to be successful and a good example for future replication. *Technology in use* (0.815) and *Knowledge (0.709)* shows a significant but limited internal consistency.

The correlation between the two TFR groups *Underlying Values* and *System Unique* is not as evident. The two divisions of TFR are moving in the same direction though the *System Unique* TFRs, as shown in Table 5, shift almost three times as much on average as the *Underlying Values*. The explanation could be that one of these two groups should be part of some other denotation than the TFR concept. A possible perspective is that *Underlying Values* may be more related to subcultures than the TFR concept. According to Van Maanen & Barley (1985), the difference between the two similar concepts is that subcultures consist of enacted social realities such as common corporate conduct. This is a concept we would like to reason about, considering that TFR and subcultures can be related concepts. We propose that a subculture of deeply held TFR, with additional enacted social realities, can be created in groups at a company that impacts IT change efforts in the long term. This subculture could be created from and consist of the general social reality amongst for instance factory workers. For example, as production is generally perceived as being moved from the country to other countries a subculture of that "all change is negative" can occur amongst production workforce in factories still locally present. This enacted social reality would suggest that the TFR domains *Assumptions, Expectations,* and *Knowledge* is negative, as the workforce's *Underlying Values* suggests that the factory is interpreted to be moved abroad. In such a setting workers might resist change unrelated to management's aim of the IT system change. A possible interpretation of this for managers is to search for patterns of groups where the *Underlying Values* TFRs are similar, which might indicate that a specific department has created a subculture like approach to IT change projects.

## 5.2 Congruency can be increased with priming

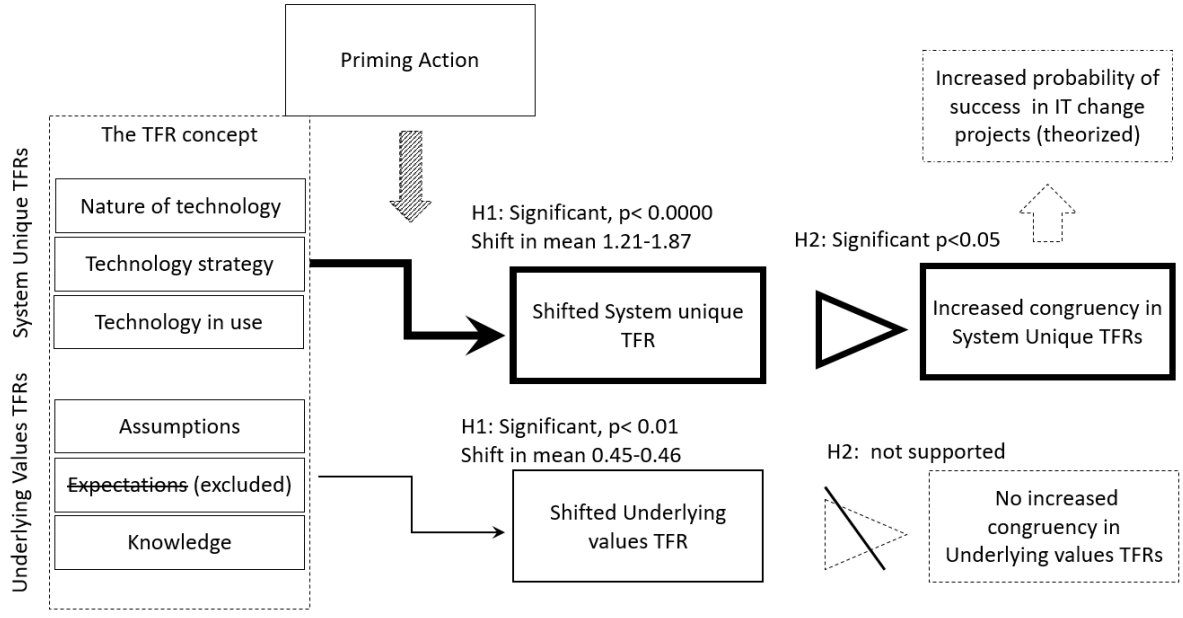


*Figure 10. Illustration of how hypothesis 2 is partly supported and the difference between TFR domains*

### 5.2.1 Priming increase congruency in System Unique TFRs

As seen in Figure 10, our results indicate that when TFR have been shifted with priming, the frames of the group also become more congruent. However, the domains of TFR *Assumptions* and *Knowledge* are not significantly converged which implies that these do not respond to priming as well as *Nature of technology, Technology in use* and *Technology strategy*. Our interpretation of this result is that priming is a suitable tool to shift *System Unique* TFR. However, priming does not show significant results in increasing congruency in *Underlying Values*. Extending this reasoning, our suggestion is that the hypothesis does not hold true for the *Underling Values*. An alternative explanation could be that the operationalization of these TFR is inconsistent with reality, or that the survey design is lacking for these TFR domains. The Cronbach alpha does, however, signify internal reliability for *Knowledge*. Yet, it shows insignificance for the variables *Assumptions* and *Expectations.* As these three variables have a weaker support in earlier literature than *Nature of technology, Technology strategy* and *Technology in use,* a possible explanation for the lacking significance in hypothesis 2 is that the *Underlying Values* should be denoted in some other way than as a part of the TFR concept. Tying this back to the earlier discussion of *Underlying Values* as a part of subcultures, the explanation could be that *Underlying Values* should be studied as a different concept than pure TFR. As the TFR domains constituting *Underlying Values* is not empirically established in the same way as *System Unique TFRs*, denoting it as a different concept could be a possible explanation for the lacking significance in this thesis as well as the previous literature's inconsequential empirics.

There exists a possibility that the *Assumptions* would have been significantly converged if a larger discrepancy between initial participants would have existed before the priming action. As the sample group is congruent in their initial TFRs of *Assumptions* in test 1 (Sd= 0.83) and that the variance decrease to (Sd=0.69). The shift is not sufficient to provide significance for the tested hypothesis. A possible explanation for the initial high congruency between respondents might be due to the sample consisting of experienced managers who possesses experience and knows what expect of IT systems in the studied company. We can unfortunately not, based on our findings, support that *Assumptions* could be made more congruent through priming. However, we want to acknowledge that a likely explanation for the insignificant result is the initial high congruency in the sampled group, rendering too low variation for displaying a significant result, for what might be a significant result in another population.

### 5.2.2 The excluded variable Expectations

The variable *Expectations* did not fulfill the requirements of the t- and f-test of normality and internal reliability. Hence, our findings cannot support the sub-hypothesis that *Expectations*

can be made more congruent trough priming. As shown in Table 5, the first tests mean (M=5.81 Sd=1.32) could not be shifted by the priming action (M= 5.97, Sd=0.96). A possible explanation is that priming cannot shift *Expectations*, however, previous literature does not argue that shifting of *Expectations* should deviate from other TFR (Orlikowski & Gash 1994; Davidson 2002). As with other TFR domains, the shifting ability of *Expectations* is a requirement to increase groups TFR congruency. However, the previous research on this subject is qualitatively exploring and argues that TFR should be able to be shifted, but cannot present replicable evidence of such a case (Orlikowski & Gash 1994; Davidson 2002; Azad & Faraj 2008). Hence earlier research is not something we can rely on to argue that the sub-hypothesis would be supported. Furthermore, it is possible that *Expectations* cannot be shifted with the frame-shifting tool priming but other frame shifting methods (Kahneman 2003; Wyer 2016). In the f-test shown in Table 13. the shift of the standard deviation in *Expectations* is of significance. Although this result is non-conclusive due to the non-normality of the variable we want to highlight the shift in the standard deviation that is observed. As the standard deviation in test one is (Sd= 1.32) and in test 2 (Sd=0.96) with a p-value of 0.03, a congruency increase which could also be seen in Figure 4 and Figure 5, have occurred in the sample. Although the f-test is non-reliable due to its Assumptions not being fulfilled, an increase incongruence can be observed as the standard deviation is decreasing.

### 5.2.3 Polarization of expectations - why congruency is important in change projects

As the variable *Expectations* is, as seen in the section Data checks, shown to be non-normally distributed, a possible explanation is that *Expectations* is distributed in another manner. The measurement might not converge around one mean. Instead, the distribution could, for example, be bimodal. If such a distribution of the TFR domain *Expectations* exists, there would be two different peaks of clusters where participants in the IT change effort converge around (Newbold et al. 2012). This would imply that with a two-peaked bimodal distributed population in IT change efforts, the TFR domain *Expectations* would consist of two polarized groups with either negative or positive *Expectations*. This could be related to the explanation for why incongruency is by Azad & Faraj (2008), and Orlikowski & Gash (1994) argued to be a common reason to IT change efforts failure. *Expectation* could thereby be argued to be an important source for the incongruence that creates issues in IT change efforts. Our findings indicate that priming made the TFR domain *Expectations* standard deviation decrease, which can be interpreted as that individuals move from their respective negative or positive group towards a mean, as would be the case of a normality distribution. However, they did not move enough, and therefore the sample is still not normally distributed and the finding statistically insignificant. This could be because priming converges the TFR of *Expectations* towards the mean, but not sufficiently to break the bimodal distribution of two groups. We would like to tie

this back to the earlier discussion of *System Unique TFRs* and *Underlying Values TFRs*. If a bimodal distribution exists in *Expectations,* it is an indication of that two-polarized sense-makings clusters of an IT system exists in the organization. This might be a plausible explanation of why congruency is identified by previous research (Young et al., 2016) as an important factor for IT success. Perhaps congruent TFR of the domains *Underlying Values* indicates that the bimodal distribution of polarized clusters with differing sense-making of the IT system does not exist, and hence the polarized settings for a severe conflict are missing.

Another possible explanation of the observed change in *Expectations* is to consider the TFR domain *Expectations* be more effective in moving outliers of a group towards the average than moving the group average itself. Therefore, our findings can be interpreted as showing a non-significant shift of the mean but significantly moving variances between the tests. This is an important interpretation with patterns that can be seen in Figure 4 and Figure 5.

#### *5.2.3.1 Priming can increase the likelihood of IT implementation success*

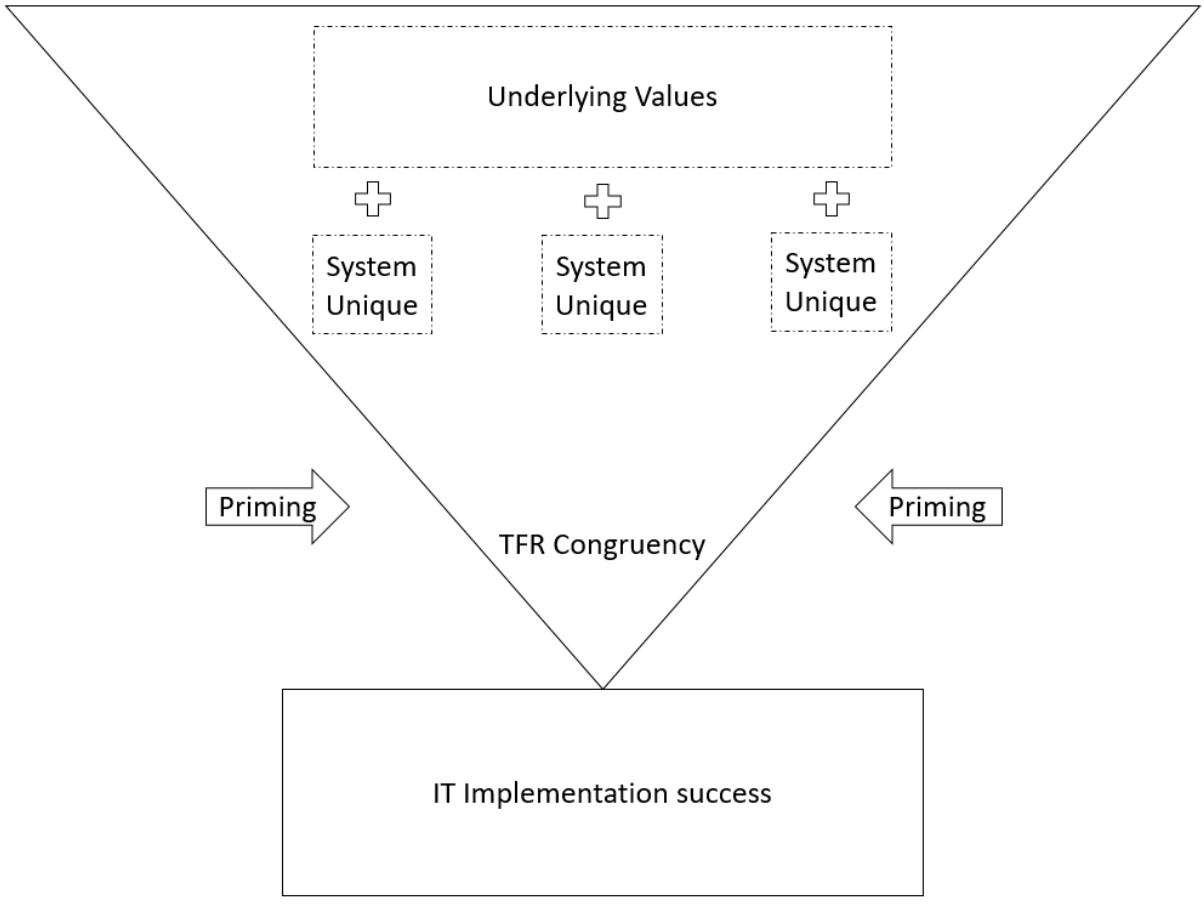


*Figure 11. Illustration of how Underlying values constitutes a general body of TFR while system Unique TFR is unique for a system, and in extension, priming's indirect effect on implementation outcome*

Figure 11 summarize the common view amongst researchers (Orlikowski & Gash 1994; Azad & Faraj 2008; Davidson 2006) that increased TFR congruency should have a positive effect on IT Implementation outcome. As this thesis can show, a priming action shifts TFR in such a

way that user groups become more congruent in their *System Unique* TFRs. This thesis can also show that a priming action increases the likelihood of IT implementation success. Importantly Figure 11 does describe the TFRs twofold nature where priming is more efficient in affecting the *System Unique* TFRs and less effective, in affecting the general TFR affecting several systems, *Underlying Values.*

To provide a more nuanced picture, it is important to highlight that other researcher's, as Starbuck (1989), argues that high TFR congruency must not always be positive for an organization. In the long-term congruent TFRs might blind-sight people by locking them into a sense-making of truth that does not match reality. We would like to build on this argument and mention that IT implementation success is not always the ultimate goal for a company. As Starbuck (1989) argue, divergence can be beneficial when companies face disruption. The failure of an IT project can be necessary, and sometimes even desirable in the long term for a firm. For example, Keil & Mähring (2010) argue that a core organizational capability can be to stop IT projects that will not be beneficial to the organization's goals before they ramp up costs. Therefore, an important insight a manager should recognize is that when developed IT systems are in line with the organization's goals, increased TFR congruency in IT projects is desirable. And in those situations, priming can be a powerful tool to achieve IT implementation success.

# 6 Conclusion

Technological Frames of Reference (TFR) is a concept within Information System and Technology research considering how humans interact and perceive a system. Users TFR have a significant impact on the outcome of IT system implementation projects and the IT systems usability. Previous research has put a great deal of effort into mapping TFRs existence, and their effects on the outcome of IT change. Although this research has been extensive, this thesis argues that the business values rests in how one can intently modify TFR to influence the outcome of IT implementation projects. The thesis aim has been to study how user TFR can be shifted and if TFR can be shifted so that a user group becomes more congruent. As a deliberate TFR shifting tool the concept of priming, from psychological research, have been applied by intervening in a user group of 36 individuals experiencing IT change in a publicly traded multinational company. Through a pre-and post-test, the thesis finds its hypothesis "*User Technological Frames of Reference in IT change projects can be shifted with Priming*," supported since the TFR domains *Nature of technology, Technology in use, Technology strategy, Assumptions,* and *Knowledge* can be shifted with priming. Furthermore, the thesis finds its second hypothesis "*A user groups' Technological Frames of Reference congruency can be increased through Priming in IT change projects.*" partly supported. Hypothesis 2 was proven supported for the domains of; *Nature of technology, Technology in use* and *Technology strategy*. However, the domains *Assumptions* and *Knowledge* were not significantly converged. The suggestion is that the domains of *Nature of technology, Technology in use* and *Technology strategy* can be categorized as a division of *System Unique TFR* and that those are easier to shift and can be made more converged with priming. While the domains *Assumptions* and *Knowledge* can be categorized as *Underlying Values* TFRs, which can be shifted but are not supported to be converged with priming. Consequently, the thesis analysis shows that user TFR can be deliberately shifted and that the congruency of a user group experiencing IT change can be increased through intervention.

## 6.1 Theoretical Contribution & Managerial Implication

The research questions provide important contributions to the literature of TFR as empirical evidence of how TFR can be shifted is previously lacking. Our findings conclude that TFR can, in fact, be deliberately shifted. Additionally, priming can shift and create more congruent TFR.

One of the thesis most important contributions relates to its high ecological validity as the finding have a high impact on managers' everyday conduct. The concluded finding of TFR shifting is important as previous research have highlighted the relation of TFR, and TFR congruency on IT change (Orlikowski & Gash 1994; Davidson 2002; Azad & Faraj 2008; Young

et al. 2016). Managers and other entities involved in IT change can utilize priming action as an efficient tool in shifting individuals' opinions of IT systems.

Our contribution also consists of the division of TFR into two groups; *System Unique* and *Underlying Values*. Where the former is unique for the system and relatively easy to shift, while the latter is more rigid and may present a general attitude towards IT change. The implication of this contribution is that managers should evaluate the investment of TFR shifting and congruency differently depending on the category. Our findings suggest that the shifting of *Underlying Values* is more prone to inertia in comparison to *System Unique TFRs.* However, the *Underlying Values* might have an impact on the implementation of multiple systems. The concluded finding is that investment into *Underlying Values* might need to be larger as they are more rigid. However resulting effects can be leveraged more extensively. Evaluating of the investment into *Underlying Values* should thereby be made over multiple projects, as they effect the evaluation of several IT change projects.

Finally, it is important to highlight that this is also the first study in the area of TFR that shows that the TFR domains formulated by Orlikowski & Gash (1994) *Nature of technology, Technology strategy, Technology in use, Assumptions* and *Knowledge* can be measured quantitatively, providing an important contribution to the empirical field of TFR research.

## 6.2 Limitations

When conducting a quantitative study the issue of validity is always highly imperative. As reflected on in the Methodology chapter, the use of a qualitative framework limits some of our findings by an issue of interpretation. As the area of TFR has never been quantified before our survey questions used to measure TFR has solely been deduced through the previously conducted qualitative research. The personal deeply held nature of TFRs makes them hard to study effectively, and it is difficult to reliably ensure that we can study the intended phenomena. The internal reliability of the created TFR has however been high which we argue is a sign of that we are at least in the vicinity of studying the intended phenomena. We also recognize that the lines between these variables are not always clear and that they might in fact overlap. A sound argument to be made is therefore that this thesis cannot ensure that the domains are reliable regarding specific domains such as *Assumptions* or *Expectations*. However, we can measure if the TFR as an aggregate has been shifted or become more congruent, in line with the aim of the thesis.

As the research is quantitatively based on a quasi-experiment design, the paper is further delimited through the studied sample (N=36). Although the studied respondents are of sufficient numbers, the considered subject sample is only one, providing an array of limitations as a consequence. Through the sample, the research is delimited to only a multinational

company of Swedish origin, active in the manufacturing industry. This sample restriction limits the ability to infer greater generalization outside of the organizational or industrial context. We do however want to acknowledge that the selected subject is chosen at random and that no previous research supports that interpretations of results should vary by industry or origin. Further, the studied implementation is not valued as industry specific in terms of characteristics, implying that the functionality of the study subject could exist in another industry setting, which in turn should provide an opportunity to interpret the result outside of the studied context. Importantly, it could be of interest for future research to have samples that include non-managerial individuals involved in IT-change projects. Further, this study was not able to include any control group due to lack of resources in the studied company.

Furthermore, it is important to highlight that even though the TFR domain *Assumptions* lacks internal reliability (Cronbach's alpha = 0.524), we chose to include it in our hypothesis testing for the sake of analytical discussion and further research. However, it is important to mention that the test statistic for this TFR domain might be lacking in reliability. Further, even though we discussed Expectations, it is important to highlight that the variable lacks internal consistency and normality distribution and therefore the interpretation of the hypothesis tests is perilous.

Finally, Orlikowski & Gash (1994) and Tyre & Orlikowski (1994) argue that the initial TFR becomes more persistent and difficult to change as institutionalization has taken part around the IT-system and the organization. We acknowledge that our methodology only allows us to draw conclusions of the implementation stage of the user experiences of IT implementation projects and that the concluded effect of priming may deviate in both earlier and later stages of a systems lifetime.

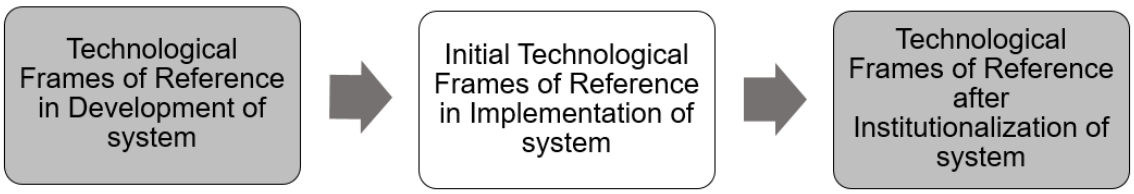


*Figure 12 Illustration the studied TFR during the implementation phase of an IT system*

## 6.3 Suggestions for Further Research

We argue that the findings of this study open for an array of new interesting research areas in the TFR field. In this thesis, we have chosen to single out priming as the most suitable tool for shifting TFR in IT change project. In our review of the literature, we have however found further indication for other contextualization methods that can arguably have a similar effect to priming.

For example, Narratives is argued by Wyer (2016) to provide a similar effect as priming and have a long term effect on memory structures. The establishment of multiple methods for shifting TFR could lead to a more robust framework of TFR management as well as the possibility to leverage multiple tools at the same time.

Furthermore, our findings are limited to test priming's ability to shift TFR and increase their congruency amongst a user group. Research, however, suggests that congruency of TFR is not necessarily beneficial in all situations. In IT implementation project the congruency of user groups commonly leads to better outcomes (Orlikowski & Gash 1994; Young et al. 2016). However, in areas such as IT development the incongruency can prove beneficial through providing more exhaustive views of a system (Starbuck 1989). We would urge further research to test priming in a comparable manner but as a tool to increase incongruency in groups. Reasoning deductively, priming subparts or individuals of a group with different context could prove to decrease congruence. Proving reliable, this could be a suitable method to manage TFR of groups in a development process.

Moreover, the suggested division of TFR into two sub-categories; *Underlying Values* and *System Unique* should be tested further. Foremost we encourage further research to explore these findings in further settings. This would indicate if the different categories might have diverse implications in different areas. As reflected in the Discussion chapter, the two categories might have different importance in different industries. If proven, it could prove an important finding for approaches of IT implementation in different industries.

Lastly, some of our results consist of theorized findings that could not be proven. Regarding the domain *Expectations,* our study did not achieve a satisfactory internal consistency and normality distribution. Therefore, we excluded the variable even as previous literature argued the measurement being important in the creation and enforcement of TFR. There exists a possibility that *Expectations* is not as important as previous literature has argued. However, a possible explanation is that *Expectations* is distributed in a different way than normality. As echoed in the Discussion a different distribution than normality can be of important contribution to understand how one can influence IT change outcome. A, for example, bimodal distribution would indicate *Expectations* to be a polarizing TFR for IT projects. We thereby suggest that further research should try to understand the distribution of *Expectations* and provide guidance to its importance in IT implementation projects.

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# 8 Appendix

## Appendix 1- The survey item

| Questions | TFR Domain |
|---|---|
| **IPEI have a cost cutting target** | Knowledge |
| **IPEI is successful in cutting cost every year** | Knowledge |
| **I have sufficient Knowledge of how to cut cost** | Knowledge |
| **I have sufficient support to cut cost** | Knowledge |
| **I have previous experience with cost management** | Knowledge |
| **The SCRA will help us reach our cost reduction target** | Nature of technology |
| **The SCRA reduce the total time spent on cost analysis** | Nature of technology |
| **The SCRA will help us make a more accurate estimate of PK** | Nature of technology |
| **The SCRA will increase our understanding of PK development over time** | Nature of technology |
| **The SCRA will reduce our overall workload** | Nature of technology |
| **The SCRA will improve our operational excellence** | Nature of technology |
| **Technology can help us cut cost** | Expectations |
| **Technology increases our costs** | Expectations |
| **Technology can help us understand our cost development** | Expectations |
| **The SCRA will improve our cost control** | Technology strategy |
| **The SCRA will improve our ability to make correct decisions** | Technology strategy |
| **The SCRA will improve our ability to manage our resources** | Technology strategy |
| **The SCRA will improve our understanding of where changes in cost appears** | Technology strategy |
| **The SCRA will improve our ability to act on changes** | Technology strategy |

| | |
|---|---|
| **The SCRA will improve our ability to interact correctly** | Technology strategy |
| **I feel prepared to use the SCRA** | Technology in use |
| **I have been given sufficient training to use SCRA** | Technology in use |
| **I feel that the SCRA is designed with my usage in thought** | Technology in use |
| **The SCRA will make it easier for new employees to understand cost development** | Technology in use |
| **The SCRA will give us the possibility to act more proactively** | Technology in use |
| **Cutting costs is easy** | Assumptions |
| **Cost cutting is prioritized in my daily work** | Assumptions |
| **We focus too much on cost cutting** | Assumptions |
| **I currently have the necessary tools to reach our cost cutting target** | Assumptions |
| **A 3 % yearly cost cutting target is realistic** | Assumptions |
| **The SCRA will improve our understanding of what has happened** | Company Unique |
| **The SCRA will improve our understanding of why it has happened** | Company Unique |
| **The SCRA will improve our understanding of how we can improve** | Company Unique |
| **In a week, how much time would you estimate you spend on overall cost controlling?** | Time |
| **In a week, how much time would you estimate that you use to get the information that the SCRA provides** | Time |
| **In a week, how much time would you estimate you can save working with the SCRA?** | Time |

# Appendix 2 Orlikowski & Gash (1994) Original framework of TFR domains

Table II. Contrasting Technologists' and Users' Technological Frames around the Notes Technology

| Domain | Technologists | Users |
|---|---|---|
| Nature of Technology | Focus on technological capabilities in isolation, without reference to specific uses in particular contexts:<br>"I knew in an hour that it was a breakthrough product, a revolution. I played with it for just two days and was really impressed."<br>Value of technology seen as obvious, hence formal assessment, justification, or implementation plan not required:<br>"But if you believe that Notes is a competitive technology you have to . . . put it in the hands of the users as fast as possible."<br>"The faster we could get to critical mass, the sooner people would use it." | Misunderstanding or confusion about the technology:<br>"I know nothing about it."<br>"I still don't know what it is."<br>"I am not very clear about what it is exactly."<br>Interpreting new technology in terms of old:<br>"I believe Notes is putting word processing power into spreadsheets."<br>"Is it a new version of 1-2-3?"<br>"It's big email"<br>Comparing to computers in general:<br>"I see computers as black and white, and so as not really suitable to my work." |
| Technology Strategy<br>• *Motivation*<br>• *Criteria of success* | Motivation for technology adoption envisioned in terms of major changes in the way of doing business:<br>"Notes gives us a competitive advantage."<br>"We want to transform the way we deliver service."<br>Technical criteria of success, focused on deployment:<br>"One measure of success is that we have 6000 users and 100 servers worldwide."<br>"Indicators of success? That we need to add resources."<br>"We've deployed 7000 copies in two years. I think we have done very well." | Motivation for adoption of technology seen as facilitating incremental changes to the firm:<br>"... it is an efficient tool, making what we do now better. But it is not viewed by the organization as a major change."<br>"Notes will do to fax what fax did to telex, replace it"<br>Technology viewed with skepticism:<br>"But some [of us] are skeptical. ... I have [heard that] there is no value in information technology so you can imagine how I feel!"—<br>"I don't believe that Notes will help our business that much, unless all our business is information transfer. It's not." |

Table II. (Continued)

| Domain | Technologists | Users |
|---|---|---|
| | | Business criteria of success:<br>"...increased fees or brought in new clients."<br>"...added to our competitive advantage." |
| Technology-in-Use<br>—*Priorities and resources*<br>—*Training*<br>—*Ease-of-use*<br>—*Policies for security, quality, etc.* | Installation is critical, hence it is the primary focus:<br>"[The technologists] focus in life is to keep it going. ...So they are purely focused on the technical implementation."<br>Users will learn to use the technology on their own:<br>"Notes does not require formal end user training. So we minimized training to reduce the period of trial. We didn't want them [the users] to think they had to learn to use Notes."<br>Users will build their own applications:<br>"Application development is so easy, the average Joe can build his own applications."<br>"People are smart, they'll figure out what to do."<br>Technology does not raise any new issues about the confidentiality, security, or quality of data:<br>"Client confidentiality is a cultural value for our firm, so those norms will be extended to Notes."<br>"As for the problem of obsolescence, if they [the users] don't know it by now it is not my job to tell them. These are not new issues. We have the same issues with paper." | Lack of training seen as an inhibitor to understanding and using technology:<br>"If I had more formal training, the product might be more useful."<br>"Training here is so basic it doesn't tell you much."<br>Lack of understanding seen as an inhibitor to using the technology:<br>"It's no good just putting the technology on our desks. You have to show us practical applications, something with real value to my work."<br>Concern about confidentiality and security of data in the databases:<br>"We need to worry about who is seeing the data."<br>"I have concerns about what goes into the databases and who has access to them and what access they have."<br>Concern about data quality, personal liability, and control over data in databases:<br>"I would be careful what I put out on Notes, though. I like to retain personal control so that when people call me I can tell them not to use it for such and such. But there is no such control within Notes."<br>"I'd be more fearful that I'd put something out there [in a Notes database] and it was wrong and somebody would catch it." |

# Appendix 3 Example of survey questions in Qualtrics

| | 1 = Disagree | 2 | 3 | 4 | 5 | 6 | 7 = Agree |
|---|---|---|---|---|---|---|---|
| Technology can help us cut cost | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The SCRA will increase our understanding of PK development over time | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Technology increases our costs | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The SCRA will improve our understanding of where changes in cost appears | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Cost cutting is prioritized in my daily work | ○ | ○ | ○ | ○ | ○ | ○ | ○ |