Technology Trust Antecedents: Building the Platform for Technology-Enabled Performance

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ABSTRACT

TECHNOLOGY TRUST ANTECEDENTS:

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Research Objectives and Methods

The key objective of this research was to give predictive information on what areas of human life and external influence affect technology trust. This objective was achieved first by theoretically discussing the foundations of technology trust and its antecedents and secondly by empirically assessing the relevance of the theoretical findings through partial least squares (PLS) analysis. Simultaneously, the relational importance of each antecedent and technology trust was observed. The secondary objective of this research was to propose a conceptual model that outlines the relation of technology trust, technology acceptance and technology-enabled performance. This conceptualization is presented in accordance with the theoretical framework of this research.

Summary of the Findings

It was discovered that the *individual disposition to trust* has the most significant impact on technology trust. This indicates that it is always a long-term commitment for organizations to begin the work to improve the level of technology trust among their employees. Minor effects were observed with the following antecedents: *organizational encouragement, advantage to use, expectation of technology usability* and *perception of user skills*. The importance of these four antecedents is that through them it is possible to propose more concrete activities for organizations to increase the level of technology trust also within a shorter timeframe. Finally, a conceptual model is presented in the theoretical framework of this research that is targeted to clarify the relation of specific trust-creation activities and technology-enabled task performance for carrying technology trust research forward in the future.

Keywords: Technology trust, technology acceptance, technology-enabled performance, Partial Least Squares, Structural Equation Modeling

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TIIVISTELMÄ

TEKNOLOGIALUOTTAMUKSEN EDELTÄJÄT:
Perustan luominen teknologian mahdollistaman suorituskyvyn rakentamiselle

Tutkimuksen tavoitteet ja tutkimusmenetelmät

Tutkimuksen ensisijaisena tavoitteena oli ennakoivasti kuvata, mitkä ihmisten sosiaalisen kanssakäymisen osa-alueet ja ulkoiset tekijät vaikuttavat teknologialuottamuksen syntymiseen. Tavoite saavutettiin teknologialuottamuksen edeltäjien teoriapohjaisella läpikäynnillä sekä näiden löydösten arvioinnilla empiirisesti. Tutkimusmenetelmänä käytettiin PLS-menetelmää (engl. Partial Least Squares). Tutkimuksen toissijainen tavoite oli laatia käsitteellinen malli teknologialuottamuksen, teknologian hyväksynnän ja teknologian mahdollistaman suorituskyvyn välisistä suhteista. Malli on esitettynä tämän tutkimuksen teoreettisen viitekehyksen pohjana.

Yhteenveto löydöksistä

Tutkimuksessa havaittiin, että yksilökohtainen ennakkoasenne luottamiseen vaikuttaa eniten teknologialuottamuksen syntymiseen. Tämä osoittaa, että teknologialuottamuksen lisääminen organisatorisessa ympäristössä vaatii ensisijaisesti pitkäjänteistä sitoutumista yleisesti luottamusta lisääviin toimintoihin. Tutkimuksessa nousi myös esille neljä muuta edeltäjää, joiden vaikutukset teknologialuottamuksen lisäämiseen ovat edellistä vähäisempiä: organisatorinen rohkaisu, teknologian käytön hyödyt, odotukset teknologian käytettävyydestä ja näkemys yksilökohtaisista teknologian käyttötaidoista. Koska näitä edeltäjiä voidaan kehittää lyhyemmän aikavälin puitteissa kuin ennakoasennetta luottamukseen, ne tarjoavat organisaatioille konkreettisia mahdollisuuksia teknologialuottamuksen lisäämiseen työntekijöiden keskuudessa. Tutkimus esittää myös käsitteellisen mallin tutkimustyön jatkamiseksi, jotta yksittäisten luottamusta lisäävien aktiviteettien ja teknologian tuoman suorituskyvyn välistä suhdetta voitaisiin kuvata aiempaa selkeämmin tulevissa tutkimuksissa.

Avainsanat: teknologialuottamus, teknologian hyväksyntä, teknologian mahdollistama suorituskyky, PLS-menetelmä, rakenneyhtälömalli

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1 INTRODUCTION

Trust is one of the most interesting occurrences of human behavior, as in a social sense it pertains to accepting the seemingly harmful position where one is willing to act in a certain way only because trust exists. In fact, when trust is observed in a wider context, it can be noted that there are few aspects in human life where trust does not have a role. Therefore studying and measuring the formation and dependencies of trusting relationships is vital in addressing situations where answers would otherwise be scarce regarding the ways humans behave. After all, trusting is a form of behavior that has few downsides and many benefits both in an individual and in an organizational context. To begin dwelling on the realm of technology trust, it is useful to introduce the possibilities that high levels of trust produce in an organizational context.

1.1 Background

Several positive attributes have been found to correlate with high levels of trust in organizational scope: According to many researchers, high trust levels have possibilities to increase organizational performance and commitment as well as to enhance leadership (Dirks & Ferrin 2002; Mayer et al. 1995; see also Fukuyama 1995). An increase in cooperation between individuals, teams and departments and reduced need to monitor the employees to do the tasks dedicated to them are key elements that trust affects, helping the organization in developing their intrapersonal effectiveness (Costa et al. 2001).

With regard to leadership enhancement, having trust between individuals can augment the acceptance of leader's decisions and increase the leader's overall influence among subordinates and peers (Tyler & Degoey 1996). Within the realm of economics, trust is seen as a utility, a way to lower the transaction costs of value exchange between two entities (Williamson 1993; Fukuyama 1995). High levels of trust have also contributed to the success of multiple partnerships as well as to enabling strategic organizational operations such as mergers and acquisitions (Dodgson 1993). When implementing information technology, higher trust levels ultimately lead to increased acceptance of new technology, effectively increasing the probability of conducting a successful IT program (Pavlou & Gefen 2004).

From a more economic point of view, Powell (1996) relates trust to a type of *social capital* that increases when it is utilized and may become extinct when it is not used at all (see also Coleman 1998, 300). For him, trust is a form of cooperation that draws its power from various kinds of reciprocal activities. He divides organizations into four different kinds of business environments which all have different sources of trust: First, the cooperation of *industrial districts* enhances the development of trust with strong geographical centralism and through personal relationships. Second, *research and development partnerships* experience trust through belonging to a dedicated group of professionals. Third, *business groups* such as the strongly-connected web of Japanese conglomerates (keiretsu) base trust in municipal past experiences as well as in the spoken and unspoken norms of the tight social group membership. Fourth, the *strategic alliances and collaborative manufacturing* environments gather the trust from dependencies to other entities.

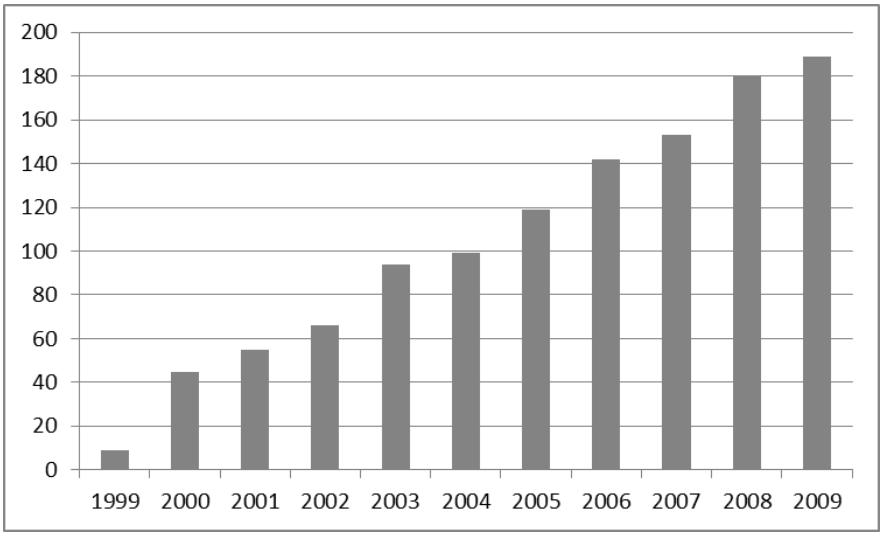
As discussed above, academic research has proven that when trust exists, it positively affects both individuals and organizations. Nevertheless, what if the trust is not there in the first place or there is very little of it? How can trust be created or increased? Although for the general public, trust might often be perceived as a feeling that guides an individual's actions towards another, trust can also be discussed on a wider basis as an essential element of any relationship, affecting decisions that humans make – even regardless of the counterpart's physical stature. In fact, trust in information technology is an area of interest that has been addressed by many scholars throughout the last decade (see for example Baba 1999, Baldwin et al. 2006, Thomas & Bostrom 2008). It has gathered researchers from multiple disciplines to converge and discuss the issue, each according to their own specialty area. Next the relatively recent emergence of the concept of technology trust is discussed in more detail to outline this particular area of research.

1.2 Research Gap

While technology trust is not the most common topic even within the information systems science, the results from an analysis using "technology" and "trust" as topic criteria indicate how drastic the increase of research concerning technology trust has been during the last ten years. The tool for this analysis was the ISI Web of Knowledge, the results being depicted in Figure 1 below. As the total amount of academic information systems science publications

between the years 1999 and 2009 was 1,151, it can be observed that the interest towards technology trust has been on a continuous growth, highlighting the increasing importance of this particular area of research.

Figure 1: Number of academic papers with words "technology" and "trust" in topic by publishing year (1999-2009).



Source: Adopted from ISI Web of Knowledge, http://pcs.isiknowledge.com/analyze/ra.cgi

The contemporary research of technology trust is concentrated on the following four domains:

1) Technology as a *platform* of trust
    - Trust in IT system security (Baldwin et al. 2006; Crane et al. 2006)
    - Trust in online IT systems (de Laat 2005; Schmidt et al. 2007; Grabner-Krauter & Kaluscha 2003)
2) Technology as an *actor* of trust
    - Trust between man and machine (Reeves & Nass 1996)
3) Technology as a *mediator* of trust
    - Trust in technology-enabled organizational learning (Dodgson 1993)
    - Trust between members of virtual teams with the help of IT systems (Jarvenpaa & Leidner 1998; Thomas & Bostrom 2008)
    - Trust in customer-partner relationships regarding IT system outsourcing agreements (Karabulut et al. 2007)
4) Technology as a *substitute* for trust
    - Information technology replacing trust in organizations (Baba 1999)

This research will take on a targeted view on the topic, covering the first two domains described above to determine, what is it that drives individuals to trust technological advancements. In a business setting, the research of technology trust antecedents is significant as it provides directions on concrete activities for increasing the level of technology trust in organizations, thus enhancing the speed of technological implementations and lowering the risk of failure for these projects. After all, information technology has an increasingly important role in the fast-moving world of business today: Organizations are constantly implementing new IT systems to increase performance, to allow their employees collaborate more effectively and to automate otherwise routine worker tasks. However, even though a considerable amount of investment is directed towards the implementation of the new IT systems, the success of these projects has not been guaranteed. In fact, the majority of all IT projects have been either total or partial failures in terms of budget, time and scope (Standish Group 2009, see also Kemerer & Sosa 1991). While there are undoubtedly many reasons for these mishaps, the academic research on the individual use of technology suggests a strong driver for the IT project failures arise from users simply not using the new system (Venkatesh & Davis 2000). In order to shed more light on the founding elements of this conundrum, this research will take a social sciences approach, namely by exploring the technology trust antecedents that are theorized to ultimately affect the user acceptance of new technology.

Regarding the previous studies of technology trust antecedents, conceptual propositions have been made by Misiolek et al. (2002) and Lippert & Forman (2006) but no empirical validations have been done to support these conceptualizations. Given that the authors above as well as Lippert & Swiercz (2005) all suggest that more research ought to be done towards the quantification of technology trust antecedents, it can be stated with relative confidence that the findings of this research can be seen as a useful addition to the more theoretical models. Regarding related studies that contribute to this particular area of research, Li et al. (2008) do present an empirically tested model for initial trust regarding organizational information systems. However, their theoretical representation as well as their empirical study of trust antecedents limit to assessing one's trust towards a fictive information system and to utilizing university students as the survey population. Moreover, while Venkatesh & Davis (2000) give a very holistic view on eight models relating to technology acceptance, they completely disregard the notion of trust. To overcome the limitations of the aforementioned publications, this research will combine both theoretical and empirical research regarding technology trust antecedents first by discussing the relevant theoretical background and

secondly by conducting an empirical assessment of the proposed model with a population consisting of employees of an anonymous high-technology company. Next, the research objectives and research questions are presented to detail, how the technology trust antecedents as well as the relation of technology trust and technology-enabled performance will be studied.

1.3 Research Objectives and Questions

The primary objective of this research is to determine, which specific antecedents affect technology trust. This objective is achieved first by theoretically discussing the foundations of technology trust and secondly by empirically assessing the relevance of the theoretical findings, simultaneously outlining the relational importance of each antecedent to technology trust. The secondary objective of this research is to propose a conceptual model to outline the relation of technology-enabled trust, technology acceptance and technology-enabled performance.

The research questions of this research are:

1. What are the antecedents of technology trust?
2. How do technology trust antecedents affect technology trust?

1.4 Definitions

In order to induce further understanding of the specific concepts of trust that are widely utilized in this research, it is beneficial to discuss the definitions of these terms by beginning with trust itself: Trust is a broad and multi-faceted concept that has been widely studied in many disciplines, thus multiple definitions exist for the word “trust”. For some researchers, trust is defined as a somewhat negatively biased situation, where individuals are acting against their rationale, willingly becoming vulnerable to their counterparts’ actions (Mishra 1996; Coleman 1998; Baier 1986). With regard to the organizational studies of trust, it is often described as a means to reduce the observation of employees and to enhance cooperation. For example, Mayer et al. (1995, 217; see also Gambetta 1988) define trust as ‘‘the willingness of a party to be vulnerable to the actions of another party based on the

expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party".

Trust can also be seen as a more positive trait, where trust is "a state involving confident positive expectations about another's motives with respect to oneself in situations entailing risk." (Boon & Holmes 1991, 194). For this research, we adopt this definition of trust as it suitably defines trust with regard to general positive expectations and risk, not relating to particular actions or to the assessment of vulnerability. As this research discusses the general concept of trust on a more abstract level than what exists in typical individual relationships, particularly with regard to technology, individual expectations of the target of trust and the environment become increasingly important. For the same reasons, the element of risk is a vital part of defining trust for this research, since most organizational activities can be understood through the rational, calculative context of risk.

Two specific variants of trust exist in this research, first of them being "organizational trust": Organizational trust is most suitably defined by Cummings & Bromiley (1996, 303) as "an individual's belief or a common belief among a group of individuals that another individual or group a) makes good-faith efforts to behave in accordance with any commitments both explicit or implicit, b) is honest in whatever negotiations preceded such commitments, and c) does not take excessive advantage of another even when the opportunity is available".

The other variant of trust, "technology trust" is a more intricate term that has not received many definitions so far. As this research suggests, technology trust consists of three elements: an individual, a technology and an organization. Therefore the definition incorporates these three aspects and the basis for this definition is derived from the previously discussed Boon & Holmes's (1991, 194) definition of trust. Ergo, the definition of "technology trust" is as follows: *Technology trust is an individual state involving confident positive expectations about a technology and an institution's motives offering that technology with respect to oneself in situations entailing risk*. It is also noteworthy that, as defined above, technology trust pertains to the expectations and perceived motives of entities. Therefore, the concept of technology trust does not directly relate to the term "trust" with its more typical technological counterparts, security or privacy.

Next, an alphabetical list will be presented to cover the essential definitions of six trust-related terms utilized in this research:

Distrust	*Confident expectation that another individual's motives, intentions, and behaviors are sinister and harmful to one's own interests. (Lewicki & Tomlinson 2003)*
Technology Trust	*An individual state involving confident positive expectations about a technology and an institution's motives offering that technology with respect to oneself in situations entailing risk (Boon & Holmes 1991, 194; modified by author)*
Technology Trust Antecedent	*A technology trust antecedent is an item that affects the individual trusting beliefs towards technology. (defined by author)*
Trust	*A state involving confident positive expectations about another's motives with respect to oneself in situations entailing risk. (Boon & Holmes 1991, 194).*
Trustee	*The party that receives trust. (Li et al. 2008, 4)*
Trustor	*The party that grants trust. (Li et al. 2008, 4)*

1.5 Research Limitations

Trust can be observed, evaluated and studied with a plethora of ways; therefore limitations exist in order to offer a concise view regarding the notion of technology trust and its antecedents. First, while trust as a social phenomenon undoubtedly has a connection to the cultural background of an individual, this research does not focus on discussing the possible

cultural implications of technology trust. Second, technology trust is theorized to depict the relationship of an individual, a technological innovation and the organization proposing that technology to be implemented. This description does not take into account situations where an individual is faced with a new technology in a non-organizational setting. Thus, the findings are not relevant for research areas such as consumer buying behavior nor should they be generalized to apply to more vast theoretical frameworks such as the concept of social exchange. Third, regarding the secondary objective of proposing a model for assessing the relation of trust and technology-enabled performance, this research aims to deliver only the initial point of study for ultimately detailing the full trust-to-performance process where trust could be directly linked to particular performance improvements occurring from new technology implementations. Some suggestions on how this research could be carried on towards that goal are included in part 5.3.

As stated in part 1.2, out of the four main research categories of trust, this study does not concentrate on how technology could be setup to replace trust: Because of the size and growing complexity of intraorganizational activities, information technology systems have been stated to produce the same benefits than trust in form of enhancing coordination regardless of the physical location of the entities (Baba 1999). This statement is based on Kanter's (1994) suggestion on trust-based collaborative advantage. In this sense, information technology could be seen ultimately as yet another way to replace trust, although that kind of remark should not be taken as a generalization but more as a possibility for specific scenarios such as virtual team interaction. Ergo, while technology replacing trust can well be a valid topic for research, the discussion regarding this area is not included in this study.

A final note regarding the limitations of the general applicability of the research results is that trust is not theorized to be the only predecessor for increasing the amount of successful technology implementations: Indeed, while trust is a verified lubricant of dependencies in various networks, lack of trust does not stop all cooperation (Bateson, 1988) – it simply enhances it. Therefore there can be also other aspects of organizational behavior and structures that assist in realizing more benefits from technology deployments. Ergo, this research simply sheds more light on the less-researched area of technology trust for enabling the organizational decision-makers and academia to understand better, what could be the main drivers for technology deployment success from a social point of view. Moreover, this research aims to answer, what are the particular antecedents of technology trust that cater for positive beliefs of technology for individuals in an organizational context. Now, after the

main concepts, objectives and limitations have been stated, it is beneficial to continue deepening the understanding of technology trust, its antecedents and the technology trust formation process through a review of academic literature.

2 THEORETICAL BACKGROUND

The theoretical background is targeted to form a clear presentation on both technology trust and its antecedents. This objective is achieved by discussing three areas of research: First, the technology trust foundations section depicts the three underlying theories within the information systems science context that conceptualize how humans understand and adopt technology. Second, the trust formation section describes four relevant approaches on how trust relationships develop. Finally, the technology trust antecedents section outlines ten antecedents that are theorized to affect technology trust. Thus the discussion will begin with the founding elements of technology trust.

2.1 Technology Trust Foundations

Technology has become an integral part of organizational activities, touching upon almost every area of an individual's working life. While it may seem that many of the technological advancements are introduced and taken into use at relative ease in organizations worldwide, the truth underneath the surface is that those who are behind the decisions of implementing technology are not content with the results as the usage of the technology does not carry sufficient performance improvements: As Goodhue et al. (2006) state, technology-related projects are mostly targeted to reach a single goal: to increase the performance of employees. The expectation of performance increase arises through an individual activity which is technology usage. However, individuals need to accept the new way of work that requires using the technological tool before actual technology usage can occur and that acceptance is based on forming a trust relationship, named as *technology trust.*

From a social sciences point of view, technology trust encompasses the positive individual expectation of having a beneficial trusting relationship, following after a brief set of observations and evaluations that are either self-obtained or received from external sources in a short period of time. As a form of trust, it precedes interaction, thus the lack of it can deteriorate all efforts directed to technological implementations driven by organizations. Therefore, it is an imperative to study the elements of technology trust to first detail its individual constructs and second to classify and quantify them. As a longer-term objective, this research ought to be conducted in order to begin building the foundations to achieve more

rapid and positive technology acceptance and thus more successful technological implementations across organizations.

Next it will be discussed how people view, assess and accept new technology in their lives. There are three underlying propositions: First, in many occasions humans tend to view technology-enabled media through social interaction, therefore trust as a form of social interaction is relevant also in human-computer interaction. Second, it is proposed through relevant theories that the notion of technology acceptance is a process that can be defined, described and measured. Third, when taken to a larger context, new technological implementations are strong examples of innovations that are diffused in groups interacting with each other; thus the diffusion is also relevant to the organizational acceptance of new technology.

2.1.1 Technology and Social Interaction

Although it is a general belief that humans very distinctly understand the relation between technology and themselves as something that has nothing to do with social interaction, Reeves & Nass (1996) bring up some very interesting findings in their book outlining a theory known as the *media equation*. While they agree that in conscious decisions humans are well aware of the distinction, they state that media equates life in settings where humans need to respond to external stimulus, the reason to this behavior relating to the fact that most human responses are based on unconscious brain activity. The unconscious state of mind thus avoids the chance to consider the aspect of having the information exchange with a virtual counterpart instead of a living one. Based on empirical evidence, their theory hypothesizes that humans do treat technology as if it was a living and breathing creature. By crafting several experiments where humans were requested to interact with computer systems and media such as television, the authors discovered that expressions of social behavior where easily observable. To further illustrate the specific flavors of media equation, the authors separate five concept areas where the need to social interaction presents itself during computer interaction: *manners*, *personality*, *emotion*, *social roles* and *form*. These categories are elaborated next by explaining some of the findings the authors concluded after empirical tests.

Manners are an important part of the contemporary normative structures that guide human activities from various different perspectives. Interestingly, the notions such as politeness and

flattery apply also when interacting with computers. As an example, it has been found that when tested, an individual gives a more honest opinion on the performance of a particular computer unit to another unit than the one performing the activity. Similarly, as with human counterparts, people like those computers more that praise them than those who offer some criticism. Furthermore, when an individual is working with a computer, an activity that is positively commented by the computer will be seen as a superior to an activity that is criticized by one. (Reeves & Nass, 1996)

Although technology does not possess a will of its own, the perceived behavior and the personality of technology also affects the general likeability of it. It is well recognized that humans tend to prefer those individuals that fit into their own characteristics. Moreover, in case a division is done regarding behavioral traits of humans into dominant and submissive categories, some studies have shown that when a computer displays information in a more dominant form such as telling the user what to do next, the computer is liked by those identifying themselves as dominant persons and vice versa. However, in case a computer first indicates to be submissive and after a moment poses itself as dominant, it is even more liked by the people in the dominant category. The human response to this kind of imitational behavior indicates a high consistence of the human-computer and human-human interaction, as the same effect occurs in social relationships. (ibid)

Emotion is the third concept area of social interaction that humans express and experience both with humans as well as with technology. A fundamental classification of whether the received information is good or bad occurs in both circumstances. Moreover, people tend to assimilate negatively biased information far better than positive one, let it be a real-life situation or a mediated experience such as a newscaster explaining recent developments concerning a hostage crisis. Similarly, computer games arouse people comparably to situations in the real life. Moreover, technology can also act in several different social roles in a community. If cooperation with a computer system is given as a prerequisite for conducting successful team work, humans will also show signs of treating the computer as a fully accomplished member of a team. If computers are equipped with voice of their own, those systems with male voices practice a greater authority than those with female voices, while female voice computer systems are seen as more adept to discuss social relationships and strong feelings such as love. (ibid)

Source orientation research presents the reasons why humans set technology into the same social setting than people: After empirical research it is notable that it is the presence of the technological medium, not its resemblance to a real-life person that makes people act with them in accordance to typical social norms. For example, it is normal for a person using a computer to naturally orient to the most present social actor within their immediate vicinity. Therefore, although being sometimes a generally stated fact, people do not actually think of computer software or hardware manufacturers when using computers. Programmers are thought of most when the computer system is not functioning as it should, thus the discussion of technology trust should concentrate more on how technology could itself convey and induce trust. (ibid)

2.1.2 Individual Acceptance of Technology

Technology Acceptance Model (TAM) was originally developed by Davis (1986; 1989) as an effort to depict how technology is accepted by an individual. By acceptance the author means the use of an information technology system, given that the individual also has a positive attitude towards using it. The model is proposed from a social sciences perspective with socio-cognitive attributes, thus the underlying theory is the theory of reasoned action (see part 2.2.1 for more information), where individual perception leads the process forward. The founding assumption of the model is that an individual's attitude towards a specific technology will largely determine whether he or she will use it. The *perceived usefulness* and the *perceived ease of use* present the two specific beliefs that have the greatest impact regarding the formation of the *attitude toward using,* which is the causal consequence of the two beliefs. Moreover, the attitude is the key determinant for forecasting the individual's *actual system use*. (Davis 1986).

The Technology Acceptance Model includes four linear relationships that describe the flow of behavior within the realm of belief, attitude and behavior (see Appendix 1d). In addition to the impacts, the social network surrounding the individual has an effect to the acceptance decision. Davis further elaborates on four cognitive processes that also take part in shaping the technology acceptance: job relevance, output quality, result demonstrability and perceived ease of use. Because the ultimate objective of technology acceptance model is to gain

measurable information from research subjects, the author also proposes a calculative base for determining the relation between the aforementioned four relationships[1]. (Davis 1986)

Although being heavily based to Ajzen's & Fishbein's (1975) theory of reasoned action, the original TAM does not include all of the proposed components: The *subjective norm* element is omitted because in the model the individuals do not have access to receiving preferential information from persons with authoritative power, thus they cannot form expectations based on assimilating other individuals' wishes relating to the usage of the technology. In addition, the *behavioral intention* component is not included, since according to the author the relationship between attitude and behavior is more widely understood and thus easier and more meaningful to measure. (Davis 1986)

To include more common social phenomena into the original conceptualization of TAM, Venkatesh & Davis (2000) propose an extension called TAM2 to support the original model (see Appendix 1e). To achieve greater consistency with the theory of reasoned action, the *subjective norm* element is now included, affecting directly to the perceived usefulness of the technology, to the intention of use and to the overall image the individual has of the technology. The inclusion of the subjective norm is further justified by the need to observe how social interaction affects human behavior, specifically in adoption-related situations. Although Venkatesh & Davis (2000) refer to mixed empirical findings regarding the effects the subjective norm has in technology acceptance, they do recognize the need to evaluate its validity in an organizational context.

2.1.3 Organizational Acceptance of Technology

Tarde (1903) originated the discussion around diffusion of innovations in a social context by stating that all social discoveries tend to extend themselves in their social environment. Consequently, Pemberton (1936) found that diffusion of cultural norms and traits also follows a gradient-like pattern, where the two key variables are interpersonal contact and

[1] Technology acceptance model incorporates four equations:

1) $EOU = \sum_{i=1,n} \beta_i X_i + \varepsilon$ 2) $USEF = \sum_{i=1,n} \beta_i X_i + \beta_{n+1} EOU + \varepsilon$
3) $ATT = \beta_1 EOU + \beta_2 USEF + \varepsilon$ 4) $USE = \beta_1 ATT + \varepsilon$

Where: X_i = design feature i, i = 1,n ; EOU = perceived Ease Of Use ; USEF = perceived USEFulness ; ATT = ATTitude toward system ; USE = actual USE of the system ; β_i = standardized partial regression coefficient ; ε = random error term (Davis 1986, 25)

communication. He also proposed that in case other kinds of characteristics would be analyzed similarly, a very same kind of a gradient would be deemed to appear. After decades of growing interest towards that statement, Rogers presented the consolidation of the research efforts in his publication "Diffusion of Innovations" in 1962. Nowadays, *diffusion of innovations* is a widely researched and empirically confirmed theory that has spun studies across a plethora of disciplines.

In his revision of the original publication, Rogers (1995) defines diffusion as a time-requiring process that describes the flow of an innovation throughout a social system containing two or more members. To complete the diffusion, communication between the entities is needed. The diffusion itself is a special mode of communication that relates to expressing information relating to a new idea. Diffusion thus entails four elements: *innovation, communication channels, time* and a *social system* with multiple members, whereas an innovation in this scope is defined as an idea, operational change or an object that is seen as new for an individual or another group. Regarding the area of technological innovations, Rogers continues that although technology in a sense can mean various different kinds of methodologies and items that do computations, the typical case under discussion is a combination of software and hardware items.

Diffusion is based on information exchange, as information is both given and received to diminish the uncertainty that an individual might have towards adopting the innovation. Specifically, Rogers states that it is the uncertainty that prevents an individual to adopt an innovation, thus removing that uncertainty is the key to enhancing adoption. An important step carrying out the change of mind towards adoption is the potential reduction in uncertainty that a technological innovation could possess. He divides the information needs into software information and innovation-evaluation information, where the former describes the pre-emptive information available on the technology before actual adoption and the latter the information regarding the technology's observable behavior when using the system. It is also notable that in most occasions individuals assess innovations they are about to adopt through the experiences of their peer adopters, thus the information they receive is often biased. (Rogers 1986)

The adoption of an innovation is a result of a decision-making process that follows a five-step path: First, *knowledge* about the innovation is required to understand the basic functionality of the solution. Second, *persuasion* follows when positive or negative attitude is formed towards

the innovation. Third, *decision* takes place when activities targeted at adoption or rejection of the innovation is conducted. Fourth, *implementation* depicts the step of taking the innovation into use. Fifth, *confirmation* occurs when the decision is reconsidered, with or without new evidence regarding the innovation. All in all, this path leads to either adoption or rejection, but either one of the results may be revised at a later point of time. (Rogers 1995)

Rate of adoption is a value for measuring the diffusion of innovations. The rate typically follows an S-shaped curve as individuals differ in their willingness to adopt novelties; thus the level of individual innovativeness has to be detailed more carefully. Rogers (1995) divides the adopters to five categories: *innovators, early adopters, early majority, late majority* and *laggards*. From the viewpoint of information gathering, the innovators represent the ones who are eager to find information regarding new possibilities and from them the eagerness gradually diminishes, the laggards ultimately comprising of individuals who actively seek to sustain the status quo rather than to adopt any novelty.

On a more recent note, Wejnert (2002) proposes a conceptualization of a diffusion of innovations framework. She presents a consolidated view of several societal, environmental and demographic traits that affect the adoption decision and she continues by stating that these variables often overlap with each other which makes it difficult to observe and analyze large groups of actors as a whole. In consequence, she proposes that it would thus be beneficial to focus on the characteristics that a single actor possesses. The specific set of characteristics often is the key to account for the adoption time gap between the innovators and the laggards, thus the diffusion of innovation is in the end much dependent on the individual stance towards the adoption decision.

2.2 Trust Relationship Formation

The formation of trust is generally approached from four perspectives: First, trust can be seen as a social decision-making process where the trusting relationship is a form of behavior, resulting after a reasoned action has taken place. Second, trust may be stated to be even a more calculative choice, following a careful rational pondering of the associated risks and benefits of initiating the trusting relationship. Third, it is possible to view trust as means to conduct economic value exchange in a social setting. Last, trust may be observed as a psychological state of affection that goes beyond the three more straightforward views,

touching on the fiduciary side of human behavior. However, even when trust is discussed from an affective starting point, feelings per se are still to support the rationalizations that individuals make, not to be the sole basis for trust. To increase understanding on how trust relationships are formed and developed, these four approaches are elaborated next.

2.2.1 Trust as Reasoned Action

Fishbein & Ajzen (1975; 1980) present the foundations and elaboration on the *theory of reasoned action*. The authors determine humans as rational beings who utilize available information for evaluating, justifying and making decisions: According to the theory trust is a special occurrence of a typical process, where an entity makes a decision to enter into a trusting relationship with another at a certain point in time, given that the entity's prior understanding of another person, situational factors and events that led to that situation do not imply otherwise. The authors present the fundamental division of four attributes to depict human behavior: *Beliefs, attitudes, intentions* and *behaviors* form the basis of the framework and it is depicted more detailed in Appendix 1a.

According to the framework, beliefs develop either through direct or indirect assimilation with multiple observation processes. Hence, an individual associates objects with a myriad of characteristics and similarly he also fabricates beliefs about himself, about various organizations, occurrences, observed behaviors and so on. Beliefs are the most important part of the framework, as they lay ground for the rest of the three attributes. As with the formation of beliefs, attitudes are also created by processing information. The information is initially deducted from the individual beliefs; therefore attitude is based on one's general beliefs toward the object. In case the beliefs contain mostly positive characteristics, the attitude will also form to be positive and vice versa. Ergo, attitude is based on beliefs that an object possesses certain attributes and on the assessment on those attributes. As with beliefs and attitudes, attitudes and intentions are also related to each other: An individual creates a stack of intentions to conduct certain behavior based on his or her attitude towards an object. Thus every intention is related to a specific behavior, because in a social setting people tend to behave in the way they intend to. (ibid)

Out of the brief description of the framework it is observable that although beliefs form attitudes, attitudes intentions and intentions behaviors, it is not predetermined that in case a

person has a certain attitude, he or she would behave exactly according to the tone of that attitude. Nevertheless, the framework does not suggest a static path from beliefs to behaviors; the human mind is constantly developing as new information is being processed, thus for example an attitude towards a certain object may be the founding element for a new set of beliefs. (ibid)

In the context of *game theory* and especially regarding private games, trust emerges when the expectation of future interaction brings in the incentive to cooperate even when there would be a greater benefit for the trustee to renounce the exchange in a single play. Furthermore, the past exchanges of the players carry a notable reason to prove one as trustworthy, as the benefits of the municipal history would be destroyed, should either one of the individuals break the relationship. Therefore trust in game theory is created with a two-fold cycle: First, the repetition of cooperation heightens the probability of a trusting relationship between the two players. Secondly, the trusting relationship makes the cooperation in the future more probable. Although this brief description seems to be elusively altruistic and inclusive of the trust element, game theory can well be discussed without an optimistic view or the term trust: Because game theory is based on multi-party exchanges and calculating the probabilities of the outcomes, the economic way of describing the associated probabilities could simply be risk, not trust. While trust rarely is a completely irrational choice, a completely rational decision does not necessarily entail the creation of, or the need for, a trusting relationship. (Burt & Knez 1996)

Coleman (1998) unifies the social and economic views with regard to the cognitive processes of social behavior. He discusses Weber's (1947) *theory of action*, according to which individuals have a goal towards which they strive for, that goal being continuously shaped by specific values or one's personal likings. This is the typical form for humans to understand each other's actions: First people see the activities out of which they convey the reasons behind the actions and thus their final objective can be inferred. To continue the conceptualization of behavior models, Coleman combines the previously discussed rationality-driven individual from the context of economic theory by presenting the *theory of action* to further sketch out a utility-based format of trust. He assumes that in a two-party trust relationship, both of the agents possess the decision-making power of whether or not to initiate or continue trusting. The approach is relatively opportunistic, as he continues by stating that positioning oneself into a trusting relationship relates to giving out resources to

the hands of another party who has the possibility to use them for his own gain, the trustor's gain or for municipal gain.

The four cognitive reasons for entering into a trusting relationship are first that trust enables an action for the trustee that could not occur without it. Secondly, in case the trustee proves to be a trustworthy person, the trustor benefits more from having the relationship than without it and consequently, in case trustworthiness was misevaluated, the trusting will be the worse alternative. Third, placing resources in the hands of the trustee is a voluntary decision that does not require any previous commitment or confirmation from the trustee. Fourth, time is strongly associated in engaging into a trusting relationship, as decisions cannot be made instantly. (ibid)

2.2.2 Trust as Economic Transaction

Trust has been widely researched as being an end result of a *rational decision-making* process both from an individual and from an organizational perspective, thus much of the economics research in trust relies on the assumption that trust is the result of a calculated exchange (see for example Williamson 1993). On an individual level, a basic model for rational behavior contains six elements: First, *behavior alternatives* comprise of the available choices for the individual. Second, out of these options an individual has a *preferred subset* that he or she perceives as viable. Third, the various *future outcomes* of the choices are understood. Fourth, the *payoff* for each outcome or their relation is known. Fifth, the *knowledge that a best possible utility is accomplishable* by making the right choice exists. Last, the individual should possess the *probabilistic information for each future outcome* to calculate the expected total utility. (Simon 1955)

Being a starting point for many rational views, *transaction cost economics* relates to the fundamental reasons on how those organizational structures and functions are formed that create the maximum output with minimum input, ergo where the total efficiency is the greatest (Williamson 1981). Although the key tenet of this organizational theory is to optimize activities in an enterprise scope, on a microeconomic level the discussion very swiftly turns to organizational behavior and thus into the consideration of individual peoples' activities in creating and eroding the efficiencies. Zucker (1986; see also Zucker et al. 1996) argues that from a social sciences perspective the process can prove to be costly. Even though

some authors such as Granovetter (1985) have discussed this kind of social activity as a costless human action, the amount of requirements for trust creation make it clear that people will have to make investments of time, perception and other immaterial resources for the trust creation to succeed. Therefore, a decision has to be made to give up other actions in exchange for the trust-enhancing ones. In economic terms, trust creation has an opportunity cost of lost options for the investments, and thus it may be sometimes difficult to justify one's reach for trust creation.

Williamson (1981) discusses rational trust transactions in the light of contract-making, as it contains the elements that require a mutual agreement on future actions. Furthermore, as two separate entities are involved in signing a contract, both of them are required to perform according to the agreement. Thus trust emerges as a form of cooperation that relies on acting as if an agreement would be in place. (Williamson 1981; see also Axelrod 1984). According to Simon (1955), humans are indeed rational but even when they attempt to produce purely rationality-based decisions, they lie far from the deterministic probabilities of all variables available. Since it is impossible for the human mind to ponder all of the aspects for each single decision one has to make, the *bounded rationality theory* is a firm conceptualization for the rational decision-making power of humans. Furthermore, as activities they care of and decide upon become vaster and more complex in an organizational setting, the cognitive capabilities of human beings are even more overrated. Williamson (1981) agrees with Simon, stating that both the bounded rationality and an expectation of individual self-interest-seeking behavior, that is, opportunism differentiates individual trust from contract-making. Thus, because of the first limitation, the closest relevance for an individual-level agreement is *limited contracting*, albeit it still lies in the realm of feasibility only if the second limitation does not occur. Contractual transactions are then determined with the amount of *uncertainty*, transaction *frequency* and *asset specificity*, which describes the amount of minimum requirements for the transaction to occur.

Continuing on observing the organizational activities of individual agents, Williamson (1993) states that the term *calculative trust* contradicts itself, because in economic transactions one should not use the word *trust* but *risk.* He concurs that trust is simply a type of a risk that can be considered as calculative economic reasoning where the calculations ought not to exceed a rationally sufficient level of understanding. As Williamson states (1993, 254): "Taken together, the lessons of bounded rationality and opportunism lead to the following combined

result: organize transactions so as to economize on bounded rationality while simultaneously safeguarding them against the hazards of opportunism."

Following the thought of Williamson, in the simplest of forms trust comes into place when two separate entities reach a point in their collaborative activities where one of them has to give out something of value before being certain of getting something back that is of value to them (Güth et al. 2000; Luhmann 1988). However, because a full return of the value handed out depends on the moral of the entity that is trusted by the other (Güth et al. 2000), this uncertainty results in a risk of not getting the full value back from the other. Thus the trusting decision is affected by both the counterpart's knowledge of the other and the possible incentives that the trustee will gain in case the trust relationship remains intact (Hardin 1992).

Williamson (1993) also explains *competent calculativeness* as a special occurrence of trust creation with four preconditions. For that transaction situation to be created, the parties first know the possible results of the transaction and their respective probabilities. Second, the parties conduct cost-effective efforts to minimize the results of opportunistic behavior as well as to maximize the expected gains. Third, the parties proceed in transaction only when a benefit can be projected. Fourth, in case there are multiple counterparts available, the one with the greatest gain associated is chosen. Seeing that this four-step path to a transaction does not reflect much of the tenets of simple economic reasoning discussed above and even less trust as a social phenomenon, the author asks to differentiate between the terms "trust" and "risk" in economic transactions. He further separates personal trust from economic exchange by stating that personal trust is characterized by three non-calculative measures: The inexistence of monitoring, expected benevolence and discreteness create the special environment for trust, which according to the author is reserved only for family members and close friends. Thus in his opinion, the notion of personal trust is, by that statement, difficult to research for example in an organizational context.

2.2.3 Trust as Social Value Exchange

George Homans (1958) initiated the discussion on unifying the different concepts around social behavior in small-group research to connect the findings from both laboratory-based studies and field research. His underlying principle for research was that every social interaction could be considered as a value exchange, thus being comparable to any other value

like economic utility. The value in this case is an immaterial cue, indicated by a human being that drives the counterpart's social behavior to take a specific direction even though multiple options would be available. However, like in economic transactions, in case one gets too little or too much value out of his or her current behavior, the individual may experience either fatigue or saturation, leading to diminishing or even changing his or her behavior. Learning is also part of Homans's proposition, as humans tend not to repeat or amplify the behaviors they do not find valuable enough for themselves.

From the perspective of trust research, empirical findings that Homans (1958) cites prove to be interesting: It was found that persons who have the tendency to give much value to others try to acquire as much value from others. Likewise, persons who get much from other individuals are under pressure to give much back. This strongly indicates that in case trust is considered to be a value and trust relationship a situation where value exchange occurs constantly, individuals who trust others are more likely to receive trust back than those who expect the other to reciprocate without any value given out to them. On the other hand, determining trust purely as a value to be exchanged creates a rather paradoxical situation, since trust, by definition, entails individual action and risk-taking without being sure of a definite positive response. To help solving this conundrum, Nooteboom et al. (1997) discuss trust as a part of a relationship's total utility. In their view, trust extends beyond the social exchange threshold which typically only considers the contractual element of the reciprocal relationship to be of value. Surely trust brings utility as an intrinsic value but it also affects the whole transaction process and even future exchange. As a consequence, the authors state that non-contractual tenets of trust should thus not be neglected in further studies.

It is notable that more recent empirical research reinstates Homans's theorization, according to which social exchange relationships are not formed automatically nor do they last unless value is constantly recognized. Ahuja et al. (2007) note that typical company employees formulate and upkeep these relationships as long as they feel benefits are reciprocated fairly among the members of the relationship. In a wider scope, social exchange thus affects the level of commitment that these employees have on the organization.

2.2.4 Trust as Affection

Hupcey et al. (2001) suggest a less calculus-based trust model that is composed of three distinct levels: Firstly, *antecedents* meaning a requirement that an individual has, which cannot be satisfied without the help from anyone else. The second level being *attributes* which is further divided into being dependent from another to meet the aforementioned need, readiness for risk-taking, expectation of the trusted entity behaving in a certain way, focus to the activities towards the need and finally test to observe the entity's trustworthiness. Thirdly, *boundaries* set the limits of trust in case a choice perception is nonexistent or the associated risks simply overrule the possible benefits.

From an individual standpoint trust may be perceived as a *psychological state* that draws its origins from interpersonal dependencies. This perceived trustworthiness of an entity serves as the main point of consideration when the decision on whether to trust is being made (Tyler & Degoey 1996). Even though trust as a purely rational choice might seem as a very suitable conceptualization of trust as a foundation for theoretical and especially quantitative research, in practice it is very difficult to set boundaries for the human mind. In his research on organizational trust March (1994) challenges the trust rationalization scope. He cites empirical evidence that implies both the decision maker's knowledge of the trustee and the level of the trustee knowingly and continuously calculating trust incentives is exaggerated. In addition to this he questioned the basic assumption of both the trustor and the trustee holding a neutral preference and value base towards each other. To support this thought, March & Olsen (1989) distinct trust from a basic exchange of value, stating that trust research ought to take into account the emotional base of the two entities in question as well as the various social attributes the trust relationship is being affected by.

Kramer (1999) also notes that those models seem to fit the reality best where trust is conceptualized more from a social and relational orientation point of view than purely from presenting the associated risk as a mathematical calculation. He continues by stating that the origins of these models can be found within the research of social linkages on economic exchange. For this reason he concludes that a trust model that would take into account the social, situational and quantitative factors would depict the totality best.

While Hupcey et al.'s (2001) previously discussed trust model represents more of an abstraction of the trustor's choice process than a full rational model, a useful bridge towards

rationalization could be Hardin's (1992) three-tier relational division. To overcome the seemingly overwhelming complexity of trust creation, he states simply that trust could be conceptualized with properties of the trustor, certain attributes of the trustee and with a particular situation where the trust relationship is being established. This framework could then account for adjustments according to the specific approach currently at hand, as for example an organizational setting would increase the amount of long-term, rational and calculative reflection.

Cummings & Bromiley (1996) present a tool called the Organizational Trust Inventory (OTI) for quantifying the level of trust between organizational units or between different organizations. Trust is defined by the authors as a type of an optimistic belief; therefore the framework has been built from a social sciences standpoint, assuming that organizational trust arises from the benevolence of individuals acting in an organizational setting. Trust measurement stems from observing the differing amounts of activities done in good faith, integrity and self-limited opportunism.

The goal in utilizing the OTI tool is to measure the overall trustworthiness of a unit or an organization by surveying the levels of trustworthiness. The trustworthiness is achieved by acting according to the three values mentioned above. Measurements are conducted for individual persons in three dimensions of trust: First dimension assesses, whether the individual is behaviorally reliable toward the given organizational commitments. Second dimension determines that the individual's behavior and sayings in the organizational context consistently meet his or her own desires, thus expressing honesty. Third dimension evaluates whether the individual understands and acts for the benefit of the organization by abandoning options for short-term individual gains that would harm the organization or another person. (ibid)

This multidimensional model incorporates also another facet in addition to the three dimensions discussed above: Since trust was defined by the authors as a belief, it is possible to take a look at how this kind of a belief is constructed for each individual. The scholars utilize a three-tier componentization developed by Creed et al. (1996), where belief is a factor of an *affective state, cognition* and *intended behavior*. Accordingly, the dimensions of trust and these three components of belief form a matrix, which is the basis for the measurement of trust. Furthermore, the authors widely criticize the rational approach by stating that in transaction cost based economic theory originally presented by Williamson in 1975. They

argue that according to this theory, the agents are assumed to behave in such a way that their own risks and losses are always minimized, ergo, that the agents are willing to sacrifice another individual's well-being in exchange for their own benefit. While this naturally does not contrast the reality in every case, one should be aware of the fact that Cummings & Bromiley (1996) propose an approach that assumes *exactly otherwise* than what Williamson proposed. While this perspective does not interfere with the research in hand, it is good to mention Williamson's (1993, 253) statement regarding the assumed opportunistic behavior of agents: "Note, however that Machiavellian grabbing is not implied if economic agents have a farsighted understanding of the economic relation of which they are a part". Ergo, even from a transaction cost economics point of view, benevolence and optimism are not deemed infeasible and consequently, trust has its place even within the most rationalized of theories.

2.2.5 Relation of Trust, Distrust and Mistrust

Distrust has been discussed in the context of *economic exchange theory*, originally introduced by Sahlins (1968) and later elaborated by Hosmer (1995). Luhmann (1979; 1988) originally classified distrust as a social alternative or an equivalent to trust since both trust and distrust reduce social complexity. He also mentions that distrust can follow trust in case repeated trust-reducing actions are conducted. As a more focused term, Kramer & Messick (1998) conclude that distrust is an active psychological state that is determined by a group of expectations and beliefs concerning the lack of trustworthiness towards other persons, groups or institutions. Regarding organizational distrust, Burt & Knez (1996) found that distrust tends to behave with more catastrophic consequences than trust. Especially when a social relationship is weak, level of distrust can rise very sharply, quickly removing the weak linkages of trust. Furthermore, third parties tend to appreciate more negative information when deciding which kind of communication they want to pass on to others.

In his research of distrust, Cofta (2006) conceptualizes trust and distrust as two opposite constructions. Hardin's (2004) three dimensions of trust outline the model: First, *continuity* assures the trustor that no force majeure situation will occur to disrupt the reciprocal trust relationship. Second, *competence* ensures the trustee possesses the professional expertise with which to act to the trustor's benefit. Third, *motivation* of the trustee indicates that he or she is willing to benefit the trustor. All of the three dimensions contribute to the creation of trust as

well as distrust, which signify the counterbalancing state of a trust relationship – even a single act of illness towards a trusting individual has an effect to the overall trustworthiness, either by decreasing trust or in worst case, increasing distrust. Moreover, because trust and distrust represent total opposites, Cofta (2006) argues that in addition to distrust, there is another important flavor for the inexistence of trust or *untrust* – mistrust. He further explains this distinction by offering three different possibilities for the lack of trust which have typically automatically pertained to distrust: The lack of expectation, the expectation of a harming behavior and the lack of expectation of harming behavior all support the idea of lacking trust, although their meanings differ from each other.

Two general approaches have been utilized widely in quantifying distrust and mistrust: Firstly, when constructing models of initial trust formation, distrust has been handled simply as *negative trust* (Gans et al. 2001; Grandison 2003). According to the models they have developed, a trust model including the elements of distrust should plainly have the possibility to quantify distrust as a value similar in amount but negative in contrast to the positive value of trust. Simply put, if quantified, both the antecedents of trust as well as the resulting value of trust can be negative, reflecting distrust. If a trust model is such to measure distrust as a negative trust, the notion of mistrust would in this case simply correspond to no trust at all, i.e. a trust value of 0 (Cofta 2006). Secondly, in discussing the probabilistic calculations of trust and distrust, Gambetta (1988) values complete trust as a probability of 1 and complete distrust as a probability of 0. Thus the mid-point, a value of 0.5 depicts uncertainty which in more contemporary terms would contribute as mistrust in the initial trust model. Both of these approaches seem to represent relation between trust and distrust so that the terms are recognized as two separate objects since one does not follow the other but they coexist. All in all, as it is without a doubt impossible to begin a trusting relationship precisely without any previous contact, evaluation or prejudice, it is at least the bits and pieces of information an individual gathers about the other that affect the disposition to trust in such a way that the initial point of trust versus distrust emerges.

Discussing their serendipitous findings regarding a study of Total Quality Management in organizations, Sitkin & Stickel (1996) argue that distrust dominates the organizational atmosphere in case the individuals do not reciprocate of how one brings value to the task in hand. This *value congruence* grasps the emotions of pride and self-worth, that both contribute to the basic maslowian need of self-actualization. Secondly, an individual needs to have positive, rational expectations of the future to be able to build trust. When both of these

aspects of organizational trust are missing, distrust is very likely to develop. This finding emphasizes the need to concentrate on the dynamics of the system where trust is needed for the organism to work properly.

Kramer (1998) states that distrust may arise from the municipal history of the trustor and the trustee. This seemingly chronological nature of distrust and trust has been further discussed by Baba (1999), according to whom distrust is a state of a failed trust relationship. In this way distrust could be considered to be a consequence of a non-successful trust formation process where distrust has not acted as an antecedent of trust per se, but the stated antecedents of distrust such as the trustee's interest for opportunistic behavior or risk of negative reciprocity have affected in the trust relationship creation. This argument has even more foundations when it is considered on a larger scale, meaning that an individual who has had experiences of failing trust relationships would be more inclined to distrust any new contact. Kramer (1998) cites Deutsch (1973) in stating the difference between nonpathological and pathological forms of distrust and also trust: Nonpathological distrust corresponds to Baba's proposition as the previously discussed form of distrust which is based on expectations in light of historical information, yet still acknowledging the situational factors. Pathological distrust presents itself as an inflexible and non-situational state where possible consequences of not trusting are not taken into account. Nevertheless, should the initial trust creation process end with trust or distrust, these two notions are always the consequences of the process and neither of them can exist before the other as an antecedent of the process or any other way.

While discussing the elements and origins of pathological distrust, Kramer (1998) presents the *paranoid social cognition model* that portrays the often slight adjustments of suspicion when an individual is faced with a disturbing social environment. The antecedents that induce paranoid behavior are perceived social difference or distinctiveness, expectations of evaluative inspection and uncertainty of one's own social standing in contrast to other actors. Thus, with regard to his research it is possible to state that distrust can be the end result while the person is already engaging in a trusting relationship if the situational factors incline the individual to do so.

2.3 Technology Trust Antecedents

After reviewing the academic literature concerning change of human attitude, trust and distrust in relation to technology, Misiolek et al. (2002) suggest that technology trust research should incorporate the following three distinct dimensions of trust: *social trust, institutional trust* and *trust in technology*. Social trust embeds the trusting relationships that are formed both in situations where individuals interact with each other with the help of information technology and in circumstances where more technology-enthusiastic or otherwise authoritative users act as opinion leaders regarding the usage of the information system. Institutional trust corresponds to the organization's general support for information technology utilization as well as to the managerial capabilities of the institution. Finally, trust in technology entails a looser set of studies regarding the role of technology in creating a direct trusting relationship with an individual. While empirical, closed-environment studies exist regarding the similarities of media and humans acting as counterparts in a communication situation such as the research done by Reeves & Nass (1996), real-life research is much more intricate and thus scarce as the complexity of relations between the entities increases significantly.

Lippert & Swiercz (2005) also utilize a similar three-tier division of areas that influence an individual when technology trust relationship is considered. Their proposal of dividing the technology trust influences into *user, organizational* and *technological* categories both confirms Misiolek et al.'s structural approach validity and also allows for a more in-depth overview of the areas. The underlying method of the authors is to state specific elements of these three areas that, if considered as an abundantly available resource, contribute to a higher level of technology trust. Next, the fundamental theoretical conceptualizations regarding the technology trust antecedents within these three dimensions are discussed in more detail.

2.3.1 Social Dimension

While interpersonal trust is indisputably the most traditional view of trust in general, it still is not completely clear, what is it that drives humans to trust others. One view of this occurrence is that because of the myriad of social connections a contemporary individual needs in order to act as a social being, trust is vital. In fact, life without trust could be considered extremely complex as it is increasingly difficult for individuals to keep track on their own relationships.

Thus if trust is considered this way as a social phenomenon, it becomes invaluable as there is simply no possibility in evaluating every possible option, suggestion or entity: In fact, trust could be ultimately seen as an element that exists to make it possible for an individual to *handle the freedom of others* (Luhmann 1979).

As discussed previously in this section, trust can on the other hand be seen as a result of a rational benefits calculation procedure or on the other as an affection that is something that contrasts the individual's fiduciary wishes as an appropriate behavior. Nevertheless, while each of these definitions may not suffice alone to define interpersonal trust, it is well understood that it is the individual value base, personality and personal experiences that affect to the formation of an interpersonal trusting relationship. Next, the following four distinct areas of interpersonal trust are discussed more elaborately: disposition to trust, perceived trustworthiness, situational factors and shared attributes.

2.3.1.1 Disposition to trust

Disposition to trust depicts the initial willingness of an individual to engage in a trusting relationship based on one's inherent beliefs. While these beliefs might seem as irrelevant on a larger scale, McKnight et al.'s (1998) research originated from the very fact that in many cases they studied, the previously proposed trust models did not correlate with reality regarding initial trust as individuals expressed very high initial trust without previous experience or knowledge of their counterpart. To explain this paradox, they state that the main differentiators between initial trust and a continued relationship is the lack of previous experiences, driving the trustor to pick up cues from the surrounding environment and situation. Thus it is the disposition that acts as a fundamental factor in initiating the trusting relationship.

McKnight et al. (1998) state that the disposition to trust element depicts the trustor's own willingness to be dependent on others, further determined by *trusting stance* and *faith in humanity*. Trusting stance refers to a state of mind where a person engages in interpersonal activities regardless of the inherent reliability of his or her counterparts. Faith in humanity assumes a general acknowledgement on the reliability and goodwill of human behavior. Rotter (1971) mentions that the disposition to this goodwill arises from extrapolations from earlier trust-concerning confrontations with people, the summation creating a more general

belief of the mankind. Boon & Holmes (1991) agree by describing how individual's *chronic disposition* toward trust sets the expectations of the individual on trustworthiness in general. Moreover, McKnight et al. (1998) continue that it is notable to mention that even though there are mixed empirical findings concerning the direct correlation regarding the disposition to trust element and high initial trust, it is generally accepted that disposition definitely affects the formation of initial trust.

Mayer et al. (1995) discuss the trust disposition as the *propensity to trust*. The authors propose that the propensity to trust can be considered to be a relatively stable variable that each individual possesses and it simply describes the probability that the individual trusts others. Moreover, the propensity accounts for the amount of trust one has towards another individual before any information regarding the counterpart's trustworthiness can be extracted. Propensity is a factor that widely differs based on past experiences, personality and cultural value bases. The differences can be so wide that some people may even be considered to trust blindly in situations that do not encourage trusting, and conversely others can express extreme unwillingness to trust even in surroundings enhancing trust.

2.3.1.2 Perceived Trustworthiness

In their model of initial trust, Mayer et al. (1995) depict *perceived trustworthiness* as the initial point of trust creation, where the individual evaluates the level of positive affective and cognitive characteristics of the counterpart in the form of benevolence, integrity and ability. Perceived trustworthiness is naturally affected by the trustor's own general judgment towards trusting. Interestingly, trust is stated to be formed at this point and after the initial trust creation the individual evaluates, whether it is beneficial to take the decision to continue trusting. This risk-taking in the relationship is formed based on initial trust as well as the perceived risk regarding the counterpart. Finally, when the decision regarding trust has been made, the outcomes of that decision lay the foundations for future interactions, affecting to the perceptions of trustworthiness, thus initiating a new cycle.

According to McKnight et al. (1998), to compose a construct that describes the areas of trustworthiness which the trustor knowingly or unknowingly assesses, one should include four categories of trusting beliefs: *benevolence, competence, honesty and predictability*. Benevolence belief assists the individual to be confident in the overall goodwill among

humans. Competence belief assures that the counterpart possesses the professional skills required to master the tasks given by the trustor. Honesty belief reflects an atmosphere where truthful information is delivered in all circumstances regardless of the consequences. Predictability belief offers the trustor a valid forecast of future activities based on both the current actions as well as on the general reliability of the trustee.

Sutcliffe (2006) proposes an elaboration of Briggs et al.'s (2002) *cognitive phase model*, considering also the notion of reputation. In this four-level model, rationality clearly carries the process onward, as the trustor initiating the relationship first assesses the need for a trust relationship based on existing risk, level of motivation and personal goals. Second, the trustor evaluates the trustee's reputation arising from ethical attributes such as benevolence and also values based on proof, for example competence and history of actions. Thirdly the trustor considers the importance of power relations between the two entities as well as the authority the trustee is holding. Finally, the trustor monitors and assesses the experience, which in this case arises from positive or negative events and vulnerabilities associated with beginning the trusting relationship. Interestingly, Sutcliffe states that even though this model is aimed to give insight to the process of trust formation with individuals and organizations, it is also possible to assess an entity's trust relationship to products, processes, data, information and artefacts through the same model.

Moorman et al. (1993) underline the importance of skills and abilities in the interpersonal evaluation of trustworthiness. According to their research, in a workplace setting the individual considering engaging in a trusting relationship often bases the initial trust on three main areas: *credibility*, *ability* and *skill*. First, both the counterpart's actual working experience as well as his or her tenure in the same organization enhance trusting because the perceived job seniority hints an individual has more credibility in the organization. Second, the abilities include the perceived motivational expressions of the counterpart. Third, the perceived fluency of work-related tasks counts towards trust regarding the skill area.

In their research on individual trust towards online banking, Benamati et al. (2006) discuss the perceptions of trustworthiness by dividing the concept into *benevolence*, *integrity* and *ability*. It is notable to mention that in this case, the counterpart of the individual is the organization offering the online banking system, not the system itself. Therefore the aforementioned three elements of trustworthiness target the well-meaning efforts and honesty of the organization as well as their physical skills in establishing and maintaining the online system for secure

access and transactions. According to them, trustworthiness thus forms a foundation for trust which further advances into an *intention to use* the online banking system.

Schoorman et al (2007) agree to the point by stating that in addition to the more discussed affective antecedents – human *benevolence* and *integrity – ability* should be considered as a critical antecedent of trust. Whereas the affective antecedents form a more general basis for the trusting relationship, the more rationally determined evaluation of ability is situation-specific. Consequently, one can approximate the counterpart's abilities on multiple levels: a co-worker can possess an excellent ability in individual research but not on team leading; therefore the formation of a trusting relationship in this context allows for a more fine-tuned evaluation of the trustee.

Initial trust formation is an end-result of beliefs and both structural and cognitive understanding. According to McKnight et al. (1998), within the cognitive scope the trustor engages into cognitive processes of *categorization and illusions of control*. Illusions of control process occurs when one is unsure on whether to initiate trust or not, thus the individual advances with small steps by first forming a tentative belief towards the trustee, then looking for clues to confirm that belief. The authors argue that this activity often increases the trusting belief disproportionally as positive findings tend to overcome the originally neutral stance. One good empirical example of overconfidence is the situation where an individual is allowed to choose his or her own lottery ticket – this small occurrence of control illusion dramatically increases one's expectations of winning even though the odds stay exactly the same.

Appropriate categorization processes direct the trustor towards the initial trust formation by allowing the individual to compare and contrast the trustee to previous experiences on a relatively rough scale. Three categorization processes are in place for developing the needed trusting beliefs: Firstly, *unit grouping* is done when the trustor puts the trustee to a category similar to oneself, like belonging to a same team. Secondly, by conducting *reputation categorization* the trustor evaluates the trustee's competencies in the light of second-hand information. Thirdly, *stereotyping* occurs when the trustee is put to a more general category of individuals. By performing the categorization, the trustor is able to move on with the formation, generating trusting beliefs towards the trustee. (ibid)

2.3.1.3 Situational Factors

Both Moorman (1993) and Purser (2001) agree on the vast impact of the situation where the trust formation is taking place by stating that models for describing trust formation should never be built without taking the appropriate context into account. Even though the characteristics of an entity do have an effect, the situational factors take part in setting the framework for trust. As an example of an adept conceptualization of situational factors, McKnight (1998) describes the *situational normality belief* in his model of initial trust. Situational normality is a factor that relates to the individual evaluating the situational factors regarding the surrounding environment, particularly the organizational context. In case the situation seems normal, the individual can be assured that there are no external discrepancies harming the forming of the trust relationship. Boon & Holmes (1991) also propose *situational parameters* depict the environmental hints for trustworthiness and trust or the lack of it.

Johns (1996) depicts the *process-outcome trust model*, which describes the flow of trust formation in basic person-to-person relationships. According to the model, entities collect information from both the personal characteristics of their counterpart and the current situation where the trust formation is taking place. The perception of risk is observed with the situation, chronologically after the evaluation of individual characteristics. Consequently, individuals are able to evaluate the validity of the trust relationship by themselves by observing these two aspects. Thus the situational setting is also an important element for the trust relationship to be created.

2.3.1.4 Shared Attributes

To bring the effect of past social interactions into the trust setting, Boon & Holmes (1991) state that *municipal history* of the trustor and the trustee is an important antecedent of trust: past exchanges are strong antecedents of trust, from a social sciences point of view. Sutcliffe (2006) supports the importance of experience in his process model for trust-related decision making by also stressing out the continuous nature of shared experiences. He theorizes that while a high initial trust level withstands a few negative experiences, a low trust level will require several positive experiences in order to improve.

As Hupcey et al's (2001) trust model proposes, there is a need to share attributes with the trusting partner in order to build a working trust relationship: Common motivations, objectives, risks, evaluation possibilities as well as the amount of delegation are combined with situational factors and individual's experience. Approaching the topic from a social perspective, Creed & Miles (1996) propose that it is possible to have a positive impact on the amount of trust by knowingly increasing both identified similarities within one's characteristics and the amount of positive exchanges. This means that by for example having a high-level manager mingling with floor-level employees would make it possible to increase both the feeling of similarity as well as the possibility for positive reciprocal experiences.

When there is no third party present to monitor the two-party transport of social influence, it has been found that the best way to create trust is to repeat the information exchange and to emphasize individual expectations that a future exchange will be necessary (Zucker et al 1996). Powell (1996) also recognizes that when it is probable that two agents will need mutual information exchange in the future, cooperation is more likely alongside with punishing the counterpart for faulty behavior. Also in organizational situations one of the outcomes of having a trusting relationship is anticipated cooperation with repeated experiences continuously shaping the relationship. As the trusting relationship is created and continues to develop, the counterparts grow to understand the importance of trust. Moreover, should either one renounce the trust, the mutual history of having that trust can be seen as an investment that would suffer damages or be totally lost. The upcoming outcomes also affect the interest to maintain the trusting relationship intact, in view of the fact that attempting to achieve short-term wins will be penalized in the future (Burt & Knez 1996).

2.3.2 Institutional Dimension

As interpersonal trust lays foundation for all trust relationships, intergroup trust essentially forms similar to interpersonal trust. Institutional trust deals with one party being initially willingly vulnerable to the counterpart's actions (Mayer et al. 1995). The complexity of organizational trust becomes reality when a third party enters into the trusting relationship. When the organization size increases and levels of hierarchy are added to the structure, trust can no more be studied as a construct where simply two agents form an opinion on each other.

The following three parts of this research will describe what antecedents form the basis for technology trust from an institutional point of view.

2.3.2.1 Power Relations

In their study on the importance of trust in organizations, Tyler & Degoey (1996) define three separate models of trustworthiness: First, the *calculative model* which corresponds to the previously discussed rational models of individual trust. Second, the *instrumental model* assumes that people are interested on trustworthiness when they have a dependency to the organization or when they feel exposed to threats. Third, the *relational model* proposes that trustworthiness becomes important when an individual has a social relationship with another individual who has a position of authority within the organization. Based on studying empirical data the authors propose that the closest match to the real world is the relational model as people value trustworthiness most in situations where social connections are also present. Thus as members within an organizational team develop social relationships between each other, the willingness to hand over the control largely depends on the overall trustworthiness of the authoritative individual.

Zucker (1986) emphasizes the importance of trust in information exchange, where the value of information determines the expectations of trustworthiness. Her study outlines trust production as an occurrence when an individual opens up to social influence that is being provided by another individual. In an organization, a third party can also participate in *social influence transport*, either directly by mediating or indirectly by mere presence. Because grouping determines the majority of the trust-creation events, the scope of studying trust in organizations mostly focuses on looking at the mechanisms and processes which contribute to the individual's openness to the social influence or to the lack of it. Boundaries of trust define the level of information, which can then be enforced and enhanced by organizational activities.

Similar views of the organization affecting the individual stance towards others has also stemmed from intergroup conflict research: Tajfel & Turner (1979) formulated a theory to combine research in more specific areas of organizational psychology and behavioral sciences such as intergroup behavior, social change and social conflict. The authors suggest that when individuals are engaged in a wider social context than that of their own immediate vicinity,

they stop interacting just as individuals by assimilating the behavior model from the group they belong to. This behavior is then reflected towards the other groups within the organization. The authors later formulated their views into *social identity theory*, which in short describes the tendency of people seeing their own identities through their memberships in various groups they belong to.

Another related approach for the emergence of organizational trust is the *group value model*, according to which people are observed to value their membership to a group more from psychological and social reasons than economic ones through receiving positive impulses for one's identity and self-esteem (Lind & Tyler 1988). This behavior implies that people tend to be very cooperative even in problematic situations when they feel they receive fair treatment from the organizational authorities. Consequently, persons who think they are getting treated unfairly by their authorities are more likely to negate the organizational well-being through malevolent acts (Smith et al. 2003).

Lewicki & Bunker (1996) as well as Sheppard & Tuchinsky (1996) propose two very similar organizational trust models, where organizations can move on to the next level of trust by being successful in the first one. They both identify three levels of organizational trust, where the first level initiates when the counterparts do not have an earlier trust relationship existing. Calculus-based or deterrence-based trust relies on a consistent behavior, that is, one does what one says he or she will. The consistency is created out of fear of the consequences if one does not act as promised, thus the negative connotations of the punishment pose a greater incentive to act as discussed than the expected reward for a consistent action. Knowledge-based trust steps in as the second trust level, where understanding of the other individual paves the way for developing the trusting relationship by hinting that the other individual's behavior can be anticipated from his or her historical activities. As the amount of confrontations increase, so does the knowledge of the other, thus amplifying the anticipated expectations and augmenting trust. The final level is the identification-based trust, when the counterparts mutually understand the other's intentions and desires. This level of trust removes the need for monitoring, as both counterparts know they will get what is best for them.

Based on their research on trust in social care facilities, Costa et al. (2001) also state that trust ought to be considered as a multi-dimensional construct, where perceived trustworthiness represents only one of the factors that have an effect on the forming of a trust relationship. They suggest that the other dimensions of trust are cooperative behavior, inexistence of

monitoring and the tendency to trust. These four aspects extend across the different views on trust, touching areas such as organizational behavior, leadership practices and individual relationships. Tyler & Degoey (1996) continue by stating that the willingness of an individual to give control to an organizational authority lies in the foundations of all organizational activities. This is also the reasoning behind why trust plays a significant role in organizations, since voluntary acceptance of the hierarchy and organizational rules pose a much stronger basis for actions than an involuntary one. That is why the authority such as a team leader should show positive signs of conforming to the organizational structure and processes for enhancing his or her trustworthiness to raise the authoritative decision point, where the team members still accept the decision without having to question its validity.

2.3.2.2 Organizational Structures

Institution-based trust describes the organizational-level phenomena affecting the overall trust formation. This organizational trust is more explicitly detailed as *structural assurance* belief in McKnight's initial trust model (1998). Structural assurance contains the assumption that organizational structures such as rules and regulations ensure successful activities. Powell (1990; 1996) mentions that because trust and cooperation increase personal vulnerability, hierarchy and organizational rules are an absolute necessity for allowing continuous monitoring and peer assistance. All in all, the authors conclude that organizational structures are built for sustaining and enhancing trust. It is also notable that even though hierarchical relations from the viewpoint of trust may seem to hold a less important position than trust itself, Fukuyama (1995) states that hierarchical structures are necessary to enforce the relatively small portion of people who do not automatically align themselves to the needs of the community but seek ways to take advantage of it.

Kramer (1996) differentiates the organizational scope from the individualistic approach by discussing the importance of hierarchical relationships in an organizational context as a widely acclaimed enabler of intricate organizational structures. According to Dodgson (1993), organizations have constructed various policies and hierarchies to overcome the constant need for trusting in unknown entities; rules, laws and regulations have been put in place in order to lessen the complexity of governance. Based on the author it would initially seem that from a social science point of view that hierarchy in this context aims to deliver somewhat similar

advantages in institutions than trust does between individuals, which are both to reduce the social complexity of the organizational relations and to remove the constant need for information exchange. However, Kramer's research reveals that trust relationships are indeed required in addition to the hierarchy, thus the organizational structure per se is not a sufficient substitute for trust. Moreover, even if hierarchy and organizational structure would be studied as substitutes for trust, any substitute to a trusting relationship can carry heavy transaction costs and the effectiveness is never guaranteed (Hosmer 1995). Furthermore, Kramer (1996) continues by noting that individuals sometimes experience difficulties because of the hierarchical structure: Lower-tier individuals may have fears of receiving unfair treatment by the ones in the top tier, whereas the upper echelon individuals can worry about whether their subordinates complete the assigned tasks as requested, constantly acknowledging the avoidance of malfeasance to the organizational well-being.

As with most governed structures with socially active individuals, hierarchical relations are under constant evolution: In addition to the key position of trust and trustworthiness within an organizational business setting today, the future of business networks poses new expectations for the proper functioning of social relationships. Research has revealed that organizational hierarchy is diminishing in importance (Kramer 1996) as organizations are reaching out to their partners and clients to create a network for business where entities are able to create trustworthy business relations without the cumbersome limitations of hierarchical relationships (Sheppard & Tuschinsky 1996). Thus as the way of work changes towards a looser setting of organizational borders both horizontally inside the organization and vertically across partners and customers, having trust between the business counterparts eases the ambiguity of having to work in such an unstructured manner.

Institutional trust can take forms that assist in embedding the aforementioned trust complements and the social trust between individuals into a more complete trust-harnessing organizational environment. Dando & Swift (2003) present a new assurance-based standard to bridge the gap between individual trust and the legally required documentation concerning the social, ethical and environmental activities. They state that a stakeholder's ability to trust the observed information can be considered as a key indicator of the legitimacy of the generally required documentation. Moreover, they argue that moving towards a more transparent information base alone does not fulfill this gap. Values such as organizational learning, continuous performance improvement, responsiveness to failures and harnessing internal

innovation prove themselves as tools to harness this trust. Therefore the assurance standard consists of three principles: completeness, materiality and responsiveness.

2.3.2.3 Organizational Encouragement

Another significant contributor to the rate of technological adoption is the preferences of the social system in which the individual or the adopting group participates in. Venkatesh and Davis (2000) state that an important characteristic of technology acceptance is the notion of *internalization*. By internalization the authors mean the individual's tendency to take note of their peer and superior evaluations regarding the technology in question. In case the adopter receives positive information on how their coworkers experience on the technology, the individual stance towards the perceived usefulness of the technology positively correlates with their coworkers' experiences. These experiences also entice the possibility that using the technology lifts one's stature, thus indicating a positive effect on the individual's *image* in the group. Moreover, the image also positively affects the perceived usefulness. Both internalization and image contribute to the acceptance, even when the system use is seen as voluntary for the individual. Rogers (1995) has a similar view for the positive effect of encouraging through *observing* coworker activities with the new technology.

According to Rogers (1995) the social system can either enhance or impede the adoption, depending on the normative structure that system possesses. The system may also contain two types of individuals who practice authoritative power over innovation-related decisions, even if they don't have that authority in the organizational hierarchy: *Opinion leaders* can influence the individuals' attitudes and behaviors towards an innovative solution with their social and technical skills either to an adoptive or a rejective direction. Moreover, the opinion leaders often serve as a general indication of the overall tendency of the system towards innovations. Another type of an influencer is a *change agent* whose objective is either to speed up or slow down the adoption. A change agent is an external entity to the organization that is typically considered as an expert regarding the topic. Because many adopters within the organization may not perceive themselves as professionals, the individual differences between the agent and the adopter may be a difficulty regarding the communication effectiveness, albeit the agents can also utilize a more down-to-earth individual, that is, an *aide* in confronting the adopters with a more approachable information exchange proposition.

According to Rogers (1995), the decisions made towards adopting a technology are divided into four categories: *optional*, *collective*, *authority* and *contingent*. Optional innovation decisions are made by a professional authority but the actual adoption may still be affected by each member of the social system. Collective innovation decisions require a unitary stance towards adoption by the members of the social system. Authority innovation decisions are made by those who are in possession of hierarchical authority, technical expertise or some other skill that gives them adequate power to control others in the innovation perspective. It is noteworthy to mention that the innovation decisions made with authority are typically those which are made with least time, whereas the collective decisions tend to take more time. The last category, the contingent innovation decisions concern decision-making that follows after either of the ones mentioned above. For example, an employee cannot make an optional decision to start using a customer relationship management system for managing his clients at work, unless the employer has made an authoritative innovation decision initially to purchase that system for their employees.

Venkatesh & Davis (2000) cite a finding by Hartwick & Barki (1994), according to which the effectiveness of the subjective norm element is greatly increased when the technology acceptance is not *voluntary* but *mandatory*; When an individual is faced with an agent that has the power to either reward or punish the activities the individual practices towards complying or denying to accept the technology, the subjective norm always affects the acceptance decision. Nevertheless, it cannot be stated which stance the individual will take as some persons wish to act exactly otherwise than what the organizational rules imply. In contrast, when the individual perceives the technology acceptance as voluntary, individual disposition towards the organization does not significantly impact the acceptance decision.

In case organizational encouragement is not part of a technology implementation project, the technology implementations in general may incur negative connotations regarding trust formation, effectively impeding also the formation of technology trust. During an extensive study on social relationships regarding new information system deployment projects, Baba and her team identified three issues that indeed had an effect on the initial trusting stance towards the employees' colleagues, their management and other work teams in the light of this upcoming project: First, the employees were negatively biased on the new possibilities for the management to control or misuse information that previously was available only for the employees. Second, the teams were pessimistic towards the diminishing social boundaries across the organization because of the new system that allowed individuals to access data

more widely. Third, the employees expressed concern regarding the changing power relations, as the new system would be controlled and managed by a team outside their own domain. (Baba 1999).

As the example above suggests, regarding boosting trust, managers hold an important position within an organization, as they are responsible for specifying the overall strategy of the organization, the tactics for executing the strategy as well as looking onto delivering on specific goals through operational-level organizational activities. Managerial actions have a direct impact on many levels of trust, thus the elements of the organizational trust function pose both a responsibility and an opportunity for the managerial decision-makers of the organization: Firstly, the *embedded predisposition* can be thought of as an outcome of the management philosophy and its execution within the organizational environment. Secondly, the *characteristic (dis)similarity* is directly influenced by the organizational activities as well as the overall hierarchical structure. Thirdly, the *experiences of reciprocity* arise from the organization's inclination to leverage the inherent reciprocity and mutuality. (Creed & Miles 1996)

2.3.3 Technological Dimension

While technology certainly plays a crucial role when assessing technology trust, the technological dimension antecedents actually rise from the individual perceptions and assessments of technology-related issues and not so much from the technological innovation being the object for trust. As previous experiences have a significant role in defining the initial point of evaluation regarding a specific technology, technology trust may take form already before no significant impact with technology is realized. Furthermore, the technological dimension antecedents are namely those constructs that relate to the evaluation of a given technology in a particular organizational setting. These antecedents are next discussed more elaborately.

2.3.3.1 Advantage to Use

As Goodhue et al. (2006) state, the requirement for implementing an information system often rises from expectations to increase task performance. Venkatesh & Davis (2000) discuss these expectations as *job relevance* which depicts the perception the individual has on how applicable the particular system is for that individual's job role. Therefore, although the fit of technology requirement might most often resonate in the decision-maker level of an organization, individual users are also constantly making selections regarding what best suits for their actual task at hand. Second, *output quality* demonstrates the individual consideration on how well the technology performs the tasks that are relevant for that individual's job role. Third, *result demonstrability* contemplates on how content the individual is with the immediate effects that result when using the system. Rogers (1995) discusses the importance of a technology conveying an individual perception of a benefit that sets the innovation apart from the previous solution in the form of *relative advantage.*

The *theory of cognitive fit* was originally developed and later extended by Vessey (1991; 2006; see also Umanath & Vessey 1994) to explain, how users perceive the usefulness of an information system for problem solving tasks. She found out firstly that when a user is given a problem solving task, that user's performance solving the problem is dependent on the representation of the original problem. The problem solving performance is thus the outcome of task and representation. The application of this theory comes in place when there is a plethora of different information system tools to choose from for beginning to solve a certain problem. Moreover, the theory partially explains a possible user problem solving performance decline after deploying a new information system tool for dealing with certain problems.

Continuing on how users perceive the concept of fit with information systems, Goodhue & Thompson (1995; see also Goodhue et al. 2006) reiterate the importance of *task-technology fit* within information systems context. Similarly to the theory of cognitive fit, task-technology fit depicts how well an information system assists a user in completing tasks, effectively increasing that user's task efficiency. Although task-technology fit is typically separated from the more utilization-based research, the authors state that the fit should not be considered as a distinct area of research but a combined structure with utilization, the latter preceding the former causally (see Appendix 1g for the authors' representation for combining these two areas of research as well as their relation to overall technology-enabled performance).

2.3.3.2 Expectation of Technology Usability

The term *usability* generally points to two interrelating directions: First, usability can be considered as what Davis (1986) describes as the *perceived ease of use* that corresponds to user's initial presumption on what using the technology will be like. Second, usability can be seen as a set of objectives and guidelines for information system designers and software developers to create devices and applications that take minimal effort for the users to approach and use. It is beneficial to note that although usability in the second sense mostly pertains to the designers of the particular technology, it is notable that organizations considering adopting a certain technology should also consider the designer point of view as a way to enhance the user's perception towards technology usability.

According to Shneiderman & Plaisant (2005), developers should address three distinct areas for making systems usable: Firstly, the system should respond to the users' needs in a specific context for assisting them in completing tasks. Secondly, the systems should be made reliable so that they display, assess, gather and process data correctly and securely. Third, usability should be considered from the scope of the total set of information systems a user has an access to, thus appropriate effort should be put on ensuring a harmonized usage experience as well as provide integration to other systems.

From a software design point of view, Sutcliffe (2006) continues that the possibilities of embedding trust elements into technology have two dimensions in the scope of usability: firstly, software release designers ought to aim for trustworthiness-by-design and thus for a positive user experience. The experience can be enhanced through better usability, functionality, a more appealing aesthetic look and feel as well as offering easy ways for personal customization. Secondly, technology should convey trust by openly communicating the intent, status and processes and by inducing information accessibility. Thus he proposes to consider competence factors, benevolence, integrity and predictability into the design process. Furthermore, attributes such as predictability, personalization possibilities, brand and source credibility have been identified as crucial by Briggs et al. (2002; 2004). Moreover, both Corritore et al. (2003) and Nielsen (2000) suggest guidelines for enhancing individual trust in websites by assessing usability in contrast to the risk making transactions online.

Regarding enhancing the user perception of an innovation, Rogers (1995) discusses three factors affecting the usability: First, *compatibility* determines, how well the proposed

innovation integrates to the existing habits, operations and systems. Second, the level of *complexity* details how easy and approachable a technology is for the individual. Third, he states that *trialability* describes the options to test out the innovation on a limited scope before actual adoption.

2.3.3.3 Perception of User Skills

Variated from the notion of self-efficacy in Bandura's (1986) *social cognitive theory*, *computer self-efficacy* points to an individual's perception of the capabilities and motivation to use a computer or an information system. Compeau et al. (2006) consider it as a separate construct from both competence and outcome expectations, as with this scope the former depicts the cumulated cognitive knowledge about a specific topic and the latter describes a belief on what happens in consequence with the computer usage. Computer self-efficacy is strongly affected by user's related experience, environmental factors such as organizational persuasion to utilize the information system as well as the user's own personality. Therefore these realms of both internal and external attributes may either enhance or dilute the user's computer self-efficacy level. The authors name proper training and support as the two key elements for establishing a solid level of computer self-efficacy for enterprise users.

Receiving appropriate training for a new technology is a natural way for enhancing the user's determination towards technology adoption as training is one of the most relevant antecedents in enhancing user's perceptions of the technology. Empirical findings state that training programs and ongoing mentoring reduce the user resistance and increase the chances of making the new technology implementation a success. (Misiolek et al. 2002; Lippert & Swiercz 2005). These factors also contribute to the continued use of the technology after the original implementation has been completed (Lippert & Davis 2006).

To be successful, training requires the users to be initially motivated for receiving the guidance: Research suggests that although training is essential, it is not sufficient alone for user behavior to change towards technology adoption. Furthermore, the positive effects of training are – even though benefits being often apparent – not equally applicable to large user groups due to variance in intrinsic motivation, skill level and demographical status. Tailoring the training sessions according to more specific user groups and constructing additional

training-related incentive programs are presented as possibilities to extend the benefits of the training. (Agarwal et al. 2000)

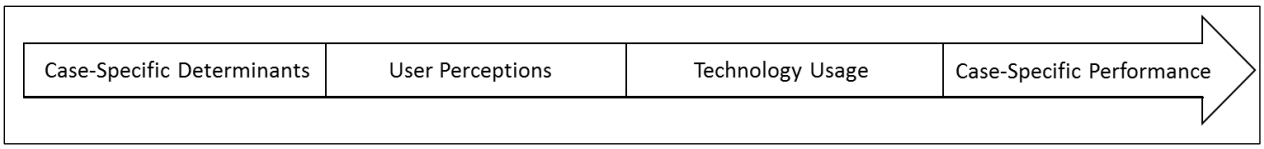
2.4 Theoretical Framework

As mentioned in the introductory part of this study, the main business reasons for conducting research regarding trust in technology are first to explain the relation trust has to user performance when utilizing technology and second to assist discovering concrete measures for increasing the level of technology trust. While empirical research regarding these areas is still scarce, it is crucial to have these objectives in mind when detailing technology trust antecedents and their relation to technology trust. Therefore this research will propose a theoretical framework that extends beyond the trust antecedent relations to technology trust, proposing direction for future areas of technology trust research.

2.4.1 Perception-to-Performance Process

Seven models were reviewed and synthesized to reveal the unifying elements of the multi-disciplinary research areas of trust, organizational behavior and technology acceptance (please see Appendix 1 for a presentation of the models with regard to their position in the general perception-to-performance process). It is beneficial to observe the common elements of these models in more detail to build a comprehensive understanding of the nature of trust in technology acceptance. Therefore, for setting the proposed theoretical framework to the appropriate research context the discovered unifying elements of the related models can be depicted as a process:

Figure 2: Perception-to-performance process



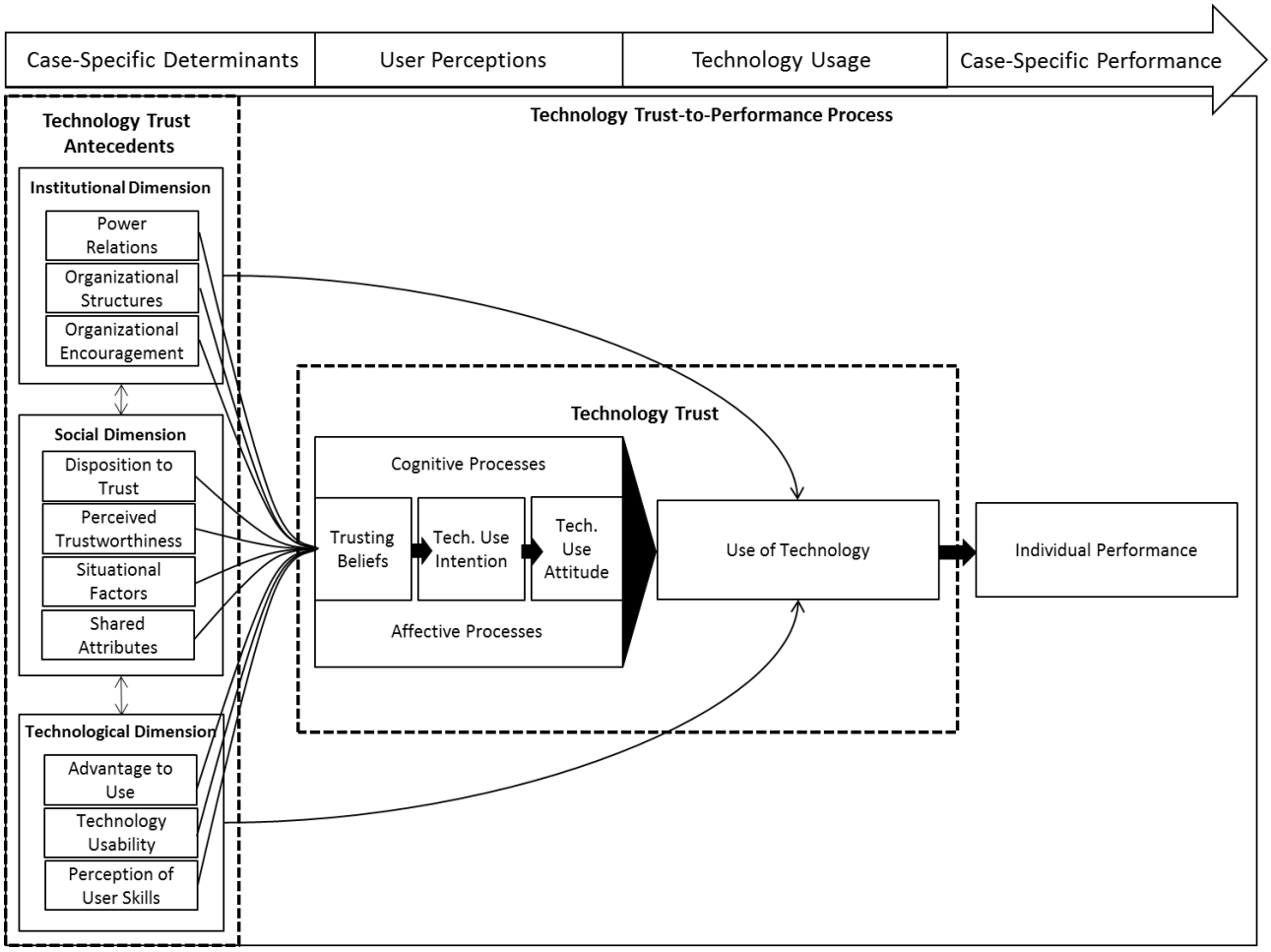
Based on the review it is possible to state with relatively high level of confidence that a framework containing the following four process elements would be a good depiction of how personal beliefs ultimately affect user performance: *Case-specific determinants* comprise of internal and external factors that directly affect *user perceptions* of the technology in question. Perceptions formulate into *technology usage*. Finally, *case-specific performance* arises from the usage of technology.

Two noteworthy remarks rise from this depiction: First, this process serves as a generalization of a very intricate individual activity, where each of the elements could also be described as independent processes, far more elaborately; thus this process should be observed as an initial platform for more detailed research. Second, it is notable that this process depiction is highly causal: for a successful trust-to-performance process to occur, all elements have to correspond to the requirements of the next element. As an example, an individual has to see the beneficial determinants to form a positive perception for using technology, and the technology usage experience has to correlate with those perceptions for discovering a performance improvement. This causality can also be observed from the various models presented in Appendix 1.

2.4.2 Technology Trust-to-Performance Model

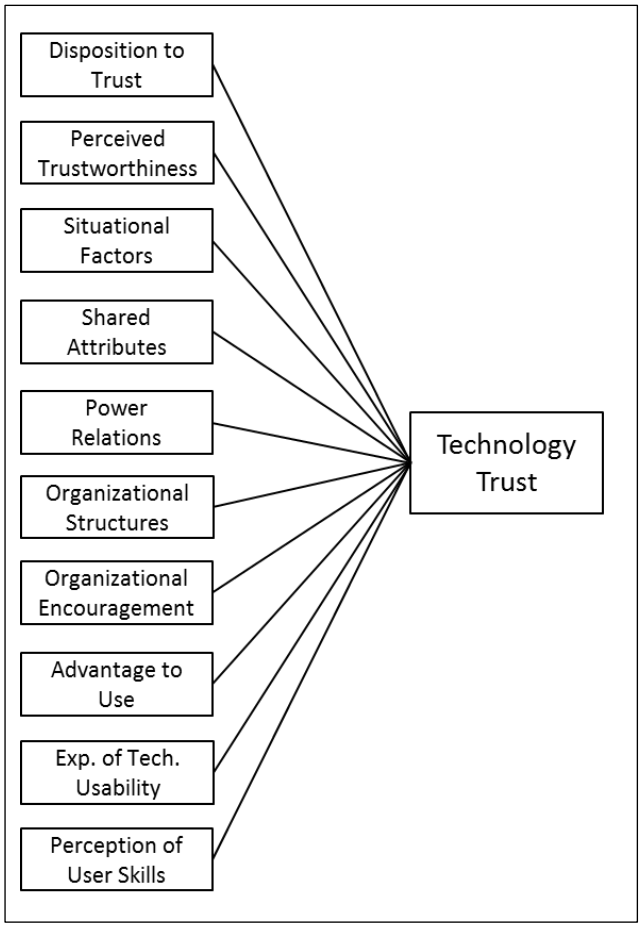
Using the perception-to-performance process as a foundation, the proposed theoretical framework is depicted as follows:

Figure 3: Technology trust-to-performance model



This framework, named as the *technology trust-to-performance model*, serves as a conceptualization for explaining the whole relationship between technology trust antecedents, technology trust, technology usage and individual performance. A technology trust antecedent is theorized to be an item within one of the three dimensions (institutional, social, technological) that affects the trusting beliefs towards technology. For the purpose of fulfilling the objectives set for this particular research, the discussion of this model will focus on the first two areas of the technology trust-to-performance process: case-specific determinants and user perceptions. The two key elements in scope are thus the technology trust antecedents and technology trust. To be clear of what the specific proposition pertaining to these two elements is, the following figure has been conjured:

Figure 4: Technology trust model



The technology trust antecedents are categorized by institutional, social and technological dimensions. Each of these dimensions contributes to the model by presenting distinct technology trust antecedents that affect the level of technology trust. As discussed in the beginning of part 2.3, this three-tier division has been proposed by both Misiolek et al. (2002) and Lippert & Swiercz (2005) and is thus deemed appropriate for categorizing the antecedents. To clarify the academic background of each technology trust antecedent, the following summarization is presented:

	Technology Trust Antecedent	Contributing Authors
Social	Disposition to Trust	McKnight et al. (1998), Sutcliffe (2006), Mayer et al. (1995), Rotter (1980)
	Perceived Trustworthiness	McKnight et al. (1998), Moorman et al. (1993), Benamati et al. (2006), Mayer et al. (2007), Sutcliffe (2006), Briggs et al. (2004)
	Situational Factors	McKnight et al. (1998), Boon & Holmes (1991), Moorman (1993), Purser (2001), Johns (1996)
	Shared Attributes	Boon & Holmes (1991), Sutcliffe (2006), Creed & Miles (1996), Hupcey (2001), Zucker et al. (1986), Powell (1996), Burt & Knez (1996)
Institutional	Power Relations	Zucker et al. (1986), Tajfel & Turner (1979), Lind & Tyler (1988), Tyler & Degoey (1996), Smith et al. (2002), Costa & Connell (2001)
	Organizational Structures	McKnight et al. (1998), Kramer (1996), Sheppard & Tuchinsky (1996), Dando & Swift (2003)
	Organizational Encouragement	Venkatesh & Davis (2000), Rogers (1983), Hartwick & Barki (1994), Creed & Miles (1996)
Technological	Advantage to Use	Goodhue (2006), Venkatesh & Davis (2000), Vessey (1991, 1994, 2006), Rogers (1983)
	Exp. of Technology Usability	Shneiderman & Plaisant (2005), Sutcliffe (2006), Briggs et al. (2002, 2004), Rogers (1983), Corritore et al. (2003), Nielsen et al. (2001)
	Perception of User Skills	Compeau (2006), Misiolek et al. (2002), Lippert & Swiercz (2005), Lippert & Davis (2005), Agarwal et al. (2000)

Table 1: Technology trust antecedents with contributing authors.

2.4.3 Technology Trust Formation Process

Like the reviewed literature suggests, trust as a social phenomenon relies on standard determinants of human behavior, therefore it can be best observed through elements in the theory of reasoned action with additional elements from both rationality-based and affectivity-based trust research. Technology trust is a concept that combines the aforementioned social sciences scope with research regarding technology acceptance and usage, both challenging and assimilating aspects from both areas of research.

Trust as a form of social interaction can be expressed as a behavioral outcome of a process containing beliefs, intention and attitude. According to the theory of reasoned action discussed more elaborately in part 2.2.1, an attitude is the outcome of a process that originates from a set of beliefs. Beliefs form into an intention, which then becomes an attitude. Thus when discussing the notion of trust, the behavior to trust results as the final element of this four-step process and all of the four elements are also part of the trust relationship formation.

In the framework, technology trust is depicted as a process that is initiated by individual trusting beliefs. Trusting beliefs are formed from the basis of technology trust antecedents. In case the trusting beliefs form a positive stance towards the technology in question, the

individual formulates an intention to use the technology. In case both cognitive and affective decision making processes positively support the beliefs and the intention, a positive technology usage attitude follows. Use of technology is a natural consequence of the trust formation process if the individual has an optimistic attitude towards using the technology. Consequently, should any of the aspects of trusting belief, intention or attitude result in a negative stance, technology trust is not formed and the actual use of technology is either not following at all or at least the usage will not be built on trust.

To stay clear of ambiguities it is beneficial to elaborate on the reasons, why this kind of relation between technology trust and technology usage can be seen both as possible and meaningful: According to the extensive review of literature conducted for this research, technology trust pertains to an individual belief of what it would be like to interact with a specific technological advancement. This case of trust undoubtedly has similarities to social life situations, where the question of whether to trust or not to trust arises most often when new entities enter that individual's immediate environment. Ergo, as trusting a person results in interaction, trusting technology results in interaction as well. Since the technological counterpart cannot as such present itself as a trustee, the interaction can be better described as using the technology. Thus in brief, the underlying argument for this research is that whenever an individual has positive trusting beliefs regarding technology, an intention to use that technology follows. The technology use intention then forms into a technology use attitude. Furthermore, a positive attitude is sufficient to initiate the positive behavior of using the technology.

This section concludes the discussion of the theoretical background of technology trust and its antecedents. Next the research methodology is presented and discussed for advancing with quantifying, measuring and validating the aforementioned theorized conceptualizations. After presenting the appropriate foundations for the quantitative research approach as well as discussing the limitations of the selected methods, an empirical assessment will be conducted.

3 METHODOLOGY

The academic literature signifies the importance of empirical research regarding the origins of technology trust. As the primary objective of this research is to propose a composition of antecedents that affect technology trust, it is suitable to advance into empirically research the overall validity of the model proposed in section 2.4, particularly focusing on how the proposed technology trust antecedents affect technology trust. Using Figure 4 as a guideline, the empirical research will firstly seek clarity to the question, which proposed antecedents can be empirically observed to affect technology trust. Secondly, the relative contribution of each antecedent to technology trust is measured and discussed. However, to reach these measurements, it is an imperative to present the methods on how the empirical research will be conducted. Thus the methodology part of this research will cover details of the empirical research approach, methods and tools. Moreover, the research hypotheses will be presented and to initially confirm that the empirics of the research lie on a solid foundation, the research validity will also discussed before moving on to making conclusive measurements. Next, an overview of partial least squares (PLS) research method is presented, after which PLS is utilized in accordance with the particular data gathered for this research.

3.1 Overview of Partial Least Squares Research Method

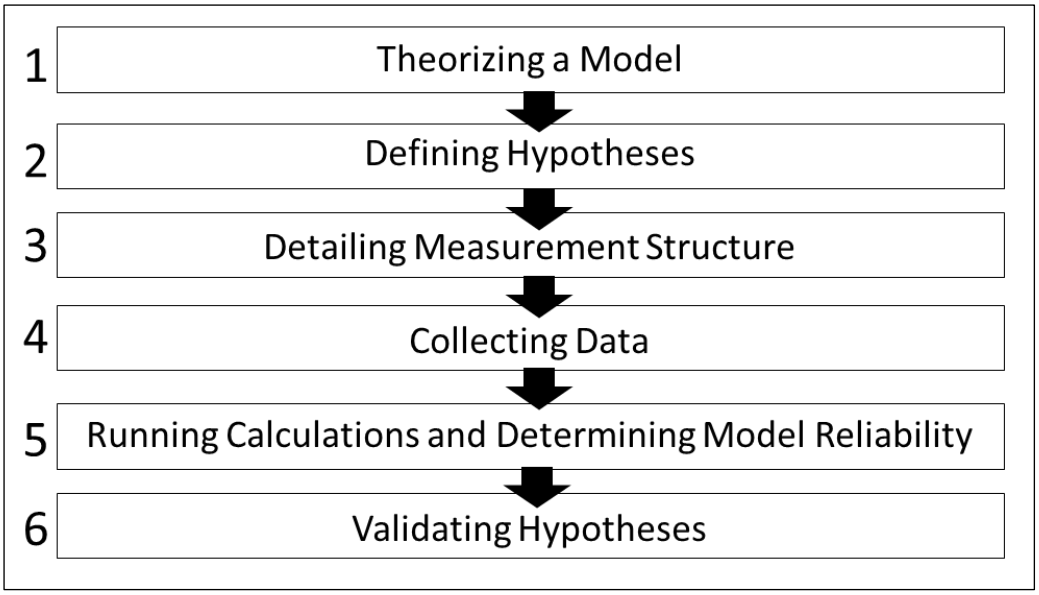
Contemporary research containing exact measurements of multi-dimensional technology trust antecedents is scarce; therefore this study's general empirical objective is to produce predictive results towards validating of the proposed technology trust model (see Figure 4), albeit through confirmatory research methods. This study aims to confirm the hypothesized relations between multiple factors that undoubtedly have interrelated dependencies. While exploratory factor analysis (EFA) has been often the approach for depicting similar relationships, Costello & Osborne (2005) state that quite often this approach does not fulfill generally acknowledged research best practices. They continue the statement by declaring that EFA has a high probability for errors and the results should always be considered as a set of non-hypothesized findings. Ergo, this study aims to depart from the exploratory approach to a more confirmatory direction by utilizing one form of confirmatory factor analysis (CFA), namely structural equations modeling (SEM). The reason for selecting CFA and SEM as the research approach is that it allows measuring how a theorized set of independent variables

impact a dependent variable when the independent variables are unobserved by themselves but measured through a set of observed indicators. Moreover, SEM research can be done with two distinct approaches: Covariance-based SEM (CBSEM) and variance-based SEM, more often referred to as partial least squares (PLS). As the empirical objective of this research is to offer predictive results with confirmatory research methods, the PLS approach will be used for determining the empirical validation for this study. (Reinartz et al. 2009)

The selection for PLS over the CBSEM was based on three arguments that limit the usage of CBSEM in certain circumstances: First, CBSEM aims to estimate a set of given parameters in a way that the theorized covariance matrix corresponds to the empirically discovered covariance matrix as closely as possible. This notion fundamentally limits the usability of CBSEM for predicting future as the objective is to achieve fit for the status quo rather than opening way for alternative solutions. Furthermore, due to its purely confirmatory nature, CBSEM might prove to be problematic specifically in situations where the theoretical fundaments for the proposition are still developing. Second, because CBSEM utilizes either maximum likelihood or generalized least squares regression methods in calculations, it requires that the empirically gathered dataset is normally distributed. Moreover, the sample size requirements arise significantly, requiring at least 200 observations in minimum for the research to be valid. (ibid)

The partial least squares (PLS) research method was originally presented by Wold (1975) as a modification of Jöreskog's (1973) structural equation modeling (SEM) approach and it is in fact sometimes being referred to as variance-based SEM. Although somewhat similar, the main differences between these two approaches are essential to understand and thus they have also been explained in this section when appropriate. However, as this research focuses on PLS as a research method for concluding empirical findings, it is of key importance to convey a clear description on what the purpose and general methodology behind PLS is. For initiating the discussion of this research model, Figure 5 suggests six steps according to which PLS research can be conducted. Next, each phase will be explained in more detail.

Figure 5: PLS Research Phases



3.1.1 Theorizing a Model

According to Haenlein & Kaplan (2004), SEM was originally developed to overcome the limitations that the regression-based approaches such as variance analysis, factor analysis and multiple regression analysis share: First, it is expected in regression-based analysis methods that all of the associated variables can be observed and thus measured. This poses a problem in real-life measurements, as most of the variables measuring *effects*, not mere categories are in fact only indirectly observable. Second, the regression-based methods take into account that every variable is to be measured without any error terms, which can be considered as a significant lack of information in certain measurement occurrences. Third, it is typical for the regression-based research methods to call for a very simple structure for models, which firstly deteriorates the measurements in case real-world situations are to be observed and secondly terminates the possibility for variables that are not single contributors but also *mediate* other variables. However, SEM approaches take into account all of these aspects firstly by considering the possibility for unobservable or latent variables and secondly by associating error terms with measured indicators and thirdly by allowing significantly more complex relational models to be built and measured.

Whereas the regression-based methods differentiate variables on whether they are *independent* or *dependent*, SEM approaches distinguish between *exogenous* and *endogenous* variables: An exogenous variable is a construct that is theoretically stated to impact another

construct, thus it can be considered as a similar item as an independent variable in a regression-based approach. An endogenous variable is a construct that is theorized to be defined by other constructs within a model. For this reason, the endogenous variables are similar to the dependent variables within the regression-based approaches. It is very typical for SEM models to have a visual depiction of these relationships and in the models the exogenous variables do not typically have any arrow paths pointing towards them, whereas the endogenous variables are theorized to be comprised of the latter. (Hair et al. 2010)

When quantifying the SEM approaches, the following notations are usually utilized to depict the aforementioned elements:

Item	Description (Exogenous)	Item	Description (Endogenous)
x_i	Indicator	y_i	Indicator
λ_{xij}	Indicator loading	λ_{yij}	Indicator loading
ξ_j	Variable	η_j	Variable
δ_i	Indicator measurement error	ε_i	Indicator measurement error
γ_{ij}	Path coefficient	γ_{ij}	Path coefficient

Table 2: Structural Equation Model Parameter Descriptions
Source: Modified from Haenlein & Kaplan (2004, 286-287)

Using the notation described above, the following equations form the overall *measurement model* that describes the relationship of the exogenous (*x*) and endogenous (*y*) indicators to their loadings (λ), measurement errors (δ and ε respectively) and their latent constructs (ξ and η respectively) (Haenlein & Kaplan 2004):

$$x_i = \lambda_{xij}\, \xi_j + \delta_i$$

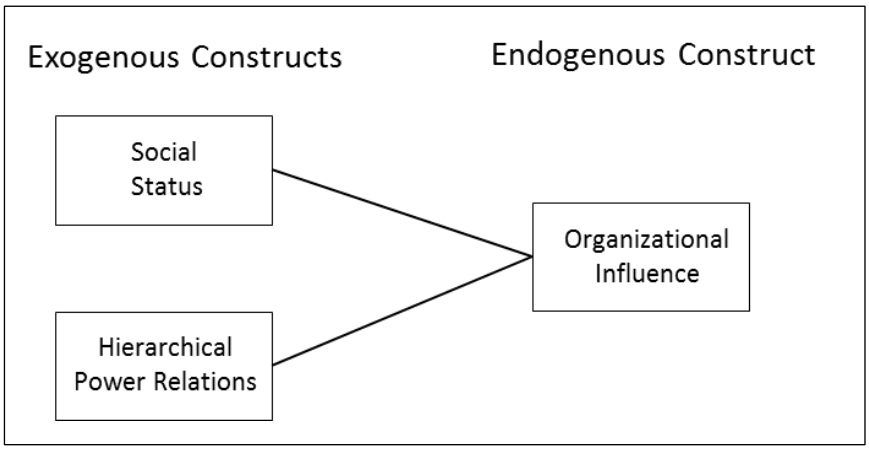
$$y_i = \lambda_{yij}\, \eta_j + \varepsilon_i$$

These equations thus explain how the individual indicators are formed with relation to their latent constructs. The next step is to construct the structural model equations which describe the relationships of each endogenous variable to exogenous variables with J endogenous variables η_1 ,…, η_J and K exogenous variables ξ_1 ,…, ξ_J. The following equation is constructed for each endogenous variable, where β_j^0 is a constant term and β_{ji} is a regression coefficient and ζ_j is the residual error (cf. Stan & Saporta 2005, 757):

$$\eta_j = \beta_j^0 + \sum_{i=1}^{K} \beta_{ji}\, \xi_i + \zeta_j \qquad \forall j = 1 \ldots J$$

The equation above is called the *structural model* and together with the *measurement model* they form the *structural equation model*. The depicted equations highlight the simplistic yet finely-tuned nature of PLS, as it treats the latent variables as direct linear compilations of their respective indicators (Fornell & Bookstein, 1982). Furthermore, although not necessary, it is useful to theorize the model visually for enabling a better comprehension of the relationships between the latent constructs. For the purposes of beginning to detail a visual example it is fictionally theorized that two separate constructs exist that affect the existence of *organizational influence*: *social status* and *hierarchical power relations*. The relationship is clear and very simple, the two latter constructs affecting the former and thus Figure 6 has been conjured for theorizing the initial model. Typically there is no need to distinct between exogenous and endogenous constructs in the model but for the purposes of this description of the PLS method highlighting this dependency was deemed useful.

Figure 6: Theoretical model example

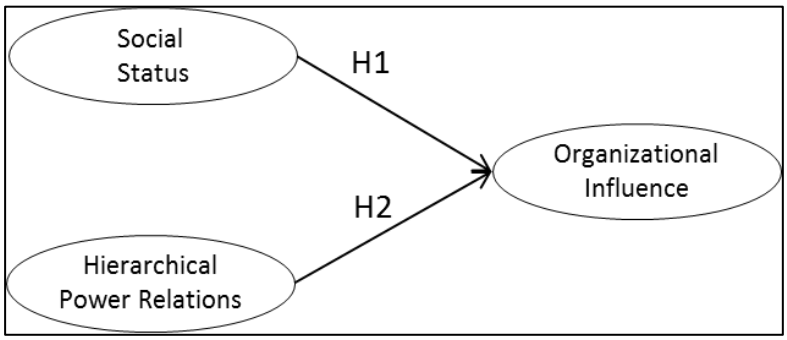


3.1.2 Defining Hypotheses

After proposing the initial stance of theorized relationships between the exogenous and endogenous variables, each causal relationship should be hypothesized to exist. The relationships are defined with hypotheses because the objective of the PLS measurements is to provide enough proof of model reliability. The latent construct relationships can be initially hypothesized to be either positively or negatively correlating, which simply point to whether high measures of an exogenous variable are expected to affect an increase or a decrease in the

endogenous variable. The correlation signs do not however act as validating remarks as such, since the correlations may in some circumstances attain controversial signs even though the research data would be in order. Figure 7 below gives an example of a simple model fictionally depicting the existence of the scenario discussed previously, the hypotheses being indicated with a letter H and numbers 1 and 2 respectively. It can be thus stated based on this figure that both social status and hierarchical power relations are expected to affect organizational influence.

Figure 7: Conceptual research model with hypotheses example



However, the Figure 7 does not yet inform whether the effect the two endogenous constructs have towards organizational influence is positive or negative. For clarifying the relationship expectations, these hypotheses should also be defined in writing, such as with a table of which an example is presented also below. When running the calculations, the negative influences would be indicated with a minus (-) sign in front of the weight coefficient and specifically the negative relationship shows that when the indicators of an endogenous construct get high ratings, the values of the exogenous construct are predicted to be lower. It is noteworthy that at this stage the constructed research model follows the generally used visual form of a *path diagram*, where the latent constructs are depicted as ellipses and each arrow depicts a *measurement relationship* that is hypothesized to exist. Moreover, the hypothesized relationships are restated in the table below. (Hair et al. 2010)

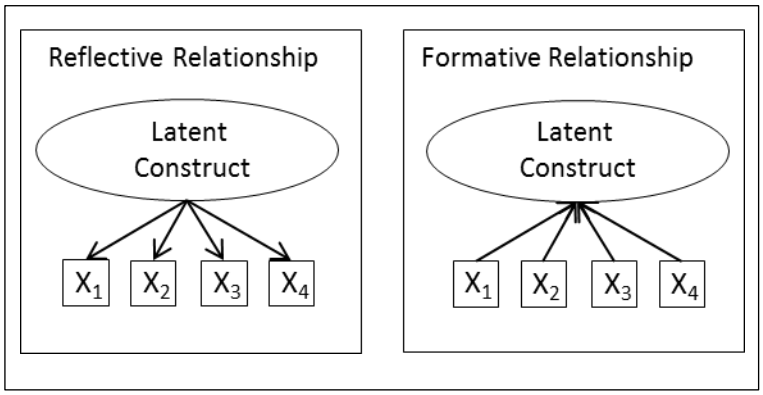
H	Description
H1	Social Status positively affects Organizational Influence.
H2	Hierarchical Power Relations positively affect Organizational Influence.

Table 3: Empirical research hypotheses example

3.1.3 Detailing Measurement Structure

Regarding measurement structure construction, it should be noted that two different kinds of indicators can be established to depict the relationship of the latent constructs: First, when a latent construct theoretically describes a superset of its indicators, the indicators are set to be *reflective*. Second, in case the indicators are theorized to have a causal relationship to the latent variable, they are *formative*. This differentiation brings about an important notion regarding correlation expectations of these indicators: Whereas the reflective indicators are expected to have a highly positive correlation towards their latent construct, the formative indicators can result in any kind of a correlation towards the construct as they are the ones influencing the latent construct, not vice versa. (Haenlein & Kaplan 2004)

Figure 8: Reflective and formative indicator relationships

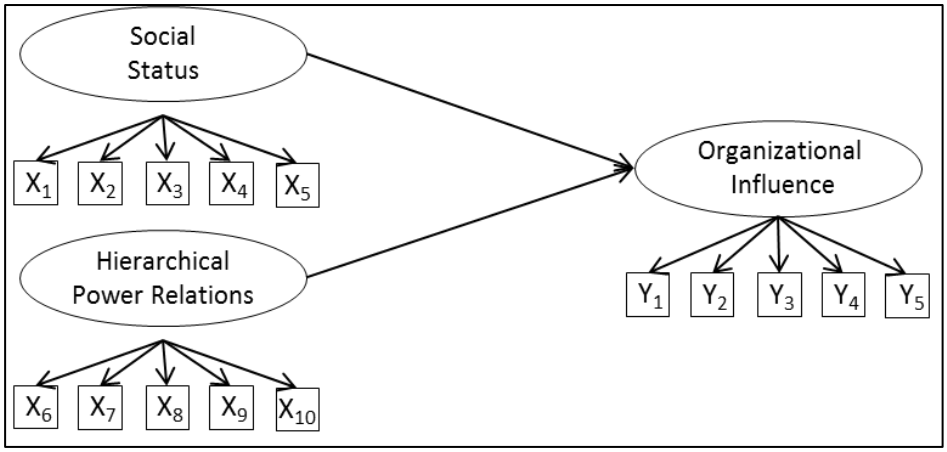


PLS utilizes three elements in final model construction: First, a *structural model* is a theoretical depiction of the dependence relationships that join the hypothesized model's constructs together and when graphically displayed, the structural model forms arrow paths from the theorized exogenous construct to the endogenous construct. Second, a *measurement model* determines the individual *indicators* for each theorized construct. Together, these two models can be stated to form a *structural equation model*. Thus whereas Figure 7 forms a structural model, the measurement model is a more detailed figure of the construct relationships including their respective indicators. Figure 9 serves as an example of how a structural equation model is depicted visually. In this example only reflective indicators are theorized to exist.

Third, there is an important element in addition to the elements of the previously discussed structural equation model: *weight relations*. Weight relations depict the relative importance of each indicator to its respective latent construct as well as the overall significance of the

hypothesized latent construct relationships. It is notable that although the weight relations can be observed immediately after running the calculations with PLS computer software, the correct approach is to first make sure that the model has a strong enough validity for the proposed weight relations can be trusted upon. (Haenlein & Kaplan 2004)

Figure 9: Structural equation model example



3.1.4 Collecting Data

PLS is both quantitative and multivariate in nature. Likewise to many other multivariate research methods, requires that emphasis should be put to determine, what kind of data should be collected for making it possible to draw conclusions from the research. Regarding the type of data, originally both PLS and CBSEM did not allow for other than metric data to be included in the set but nowadays many computer software packages make it possible to have also non-metric data to be used in all SEM-based research. Combined with its capabilities in calculating complex models, it can be stated that SEM approaches are among of the most versatile and sophisticated techniques of multivariate analysis. Furthermore, since the data is allowed to come in many forms, there are also a myriad of data collection methods existing for conducting research with these methods. (Hair et al. 2010)

To continue with the aforementioned fictional example of how social status and hierarchical power relations affect organizational influence, one possibility for gathering the data for the research could be constructing a survey questionnaire for individuals in a given organization. In the simplest form, gathering the data from individuals could be harnessed with metric values, utilizing perhaps a five or seven-point Likert scale for incorporating more individual

answering options for more truthful answers. Naturally other ways to gather data could be used, such as making explicit observations of individual behavior in an organizational context or by taking a more detailed look at how constructs of for example vocation, education and organizational structures contribute to an individual's ability to conduct organization-wide change management programs.

In case survey questionnaire is selected as the method for data collection, the relation between the questionnaire responses and the measurement model is quite straightforward as each question can be stated to be an individual indicator. While it is always important to include the survey questions within the research for informative exploration, this question-to-indicator relation is also very useful to depict. As survey was the data gathering tool also for this research, Appendix 2 details this kind of a relational explanation of survey questions and their respective corresponding indicators.

In addition to selecting an appropriate tool for data gathering, sampling is also a key element of the data collection phase. PLS is stated to be very flexible with low sample sizes as the calculative base of PLS is more of a heuristic type than a pure algorithm (Tenenhaus 2007). Henseler et al. (2009) give a general rule of thumb, where the suitable sample size would be ten times the number of arrow paths directed at a particular construct which is, compared to the CBSEM, a significantly looser requirement. Moreover, even very low sample sizes of 20 have been proved relatively reliable in simulation studies conducted by Chin et al. (1996) as well as Chin & Newsted (1999).

To complete the data collection, it is important to confirm the data quality before utilizing it for further assessments. Hair et al. (2010) elaborate on the notion of missing data, which may occur when there are possibilities for human errors. Regarding survey research, a significant amount of missing data may occur in case the questionnaire forms are returned only partially filled or when persons have a possibility to fill out more than a single questionnaire. While both of these erroneous situations may occur through simple mistakes, it is recommended to minimize the possibilities for these occurrences to happen. Next, it is discussed how to proceed after the data collection has been completed.

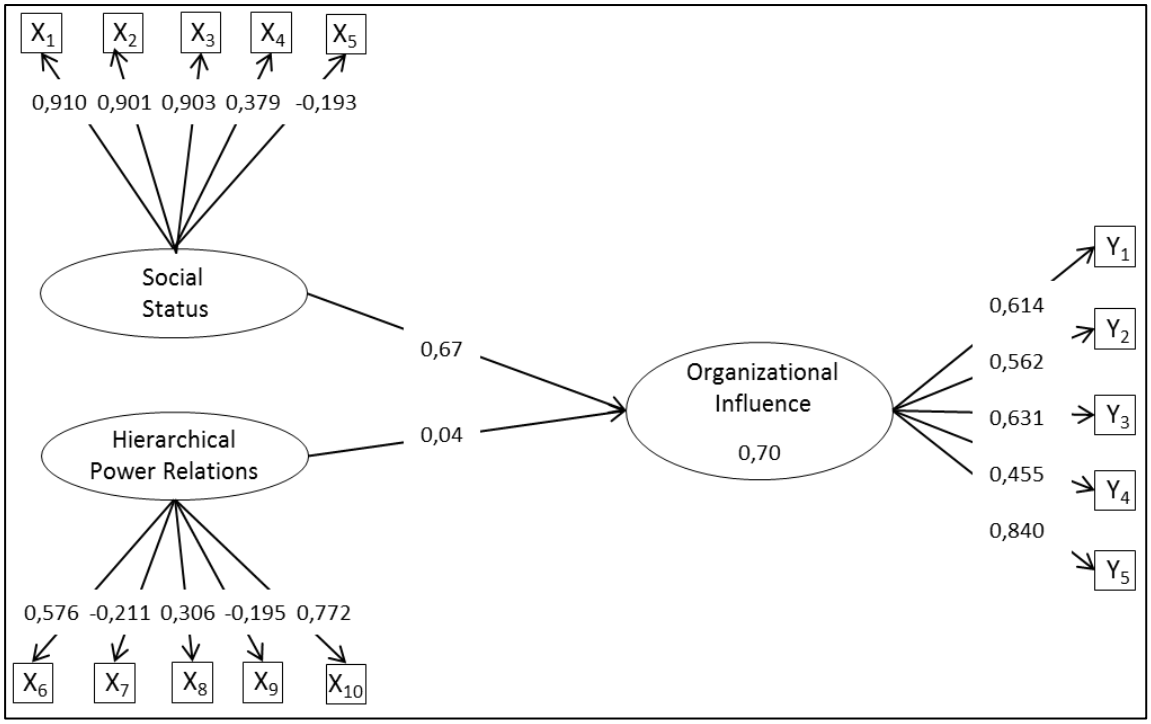
3.1.5 Running Calculations and Determining Model Reliability

PLS calculations can be easily conducted with PLS-capable computer software. First, the collected data is imported to the software on a spreadsheet and secondly the structural equation model presented by Figure 9 is plotted with the software's graphical tools. Third, each graphically plotted indicator is associated with its corresponding row on the spreadsheet data and then the model is subject to the PLS calculation procedure. During the calculation, the software will first reduce the indicators to their theorized latent constructs. This procedure is similar to principal components analysis, as the software determines weight relations for each indicator by observing the latent constructs as substitutes of their indicators. The principal components are theorized to be either exogenous or endogenous latent variables and they are thus defined with X and Y indicators respectively. The attained weight relation results are utilized by the software to calculate a weighted average for each indicator for their latent constructs by utilizing the previously calculated weight relations as inputs. The weight relations are then subject to calculation with a simple ordinary least squares (OLS) regression iterations to minimize the differences of the predicted values in contrast to the actual dependent variable values. Consequently, the objective of the PLS approach is to determine, which particular exogenous construct weights account for the most variance of the endogenous construct. The underlying assumption that this determination and thus the whole PLS approach requires is that all measured variance can be stated to be useful, attributing to the theorized dependent construct. After running calculations with PLS-capable computer software, the weight relations of indicators and latent constructs are displayed visually with numeric values next to their respective arrow paths in the structural equation model. Figure 10 serves as a fictive example of what PLS model results look like. (Haenlein & Kaplan 2004)

It should be noted that the exact iteration calculation depends on the number of dependent or endogenous variables: In case there is only one dependent variable, the exact approach is stated to be *univariate partial least squares* and if there's more than one dependent variable, the approach is *multivariate partial least squares*. With the OLS regression iterations of the univariate PLS, the linear combinations of the independent variables are formatted in sequences and related to the dependent variables with OLS. These linear combinations can thus be seen as weighted averages of the predictor values. Moreover, every predictor has residual information in an independent variable not contained in any earlier components. The quantity that is to be predicted can be considered as the vector of the residuals from regressing

the dependent variable against the earlier components. In the multivariate approach, the quantity that is to be predicted is in fact the weighted average of residuals that result from separately regressing every dependent variable against the earlier components. (Garthwaite 1994)

Figure 10: PLS model results example



While the figure above depicts essential information for finally accepting the hypotheses concerning the theorized latent construct relationships, it should be first observed and discussed how the individual indicators – or factors in this sense – correlate with each of the theorized construct. This procedure can be easily done by observing a factor cross-loadings table that is usually produced by the computer software at the same time with the weight relations calculation. The factor cross-loadings represent the individual indicators and their correlations towards each of the theorized latent constructs. An example of a factor cross-loadings table utilizing the same data set than the model above is depicted below. Here the indicators are labeled as Y1 through X10 and the three theorized latent constructs are listed on the top row.

Indicator	Organizational Influence	Social Status	Hierarchical Power Relations
Y1	0,614	0,211	0,086
Y2	0,562	0,106	0,151
Y3	0,631	0,287	0,115
Y4	0,455	0,146	0,068
Y5	0,840	0,764	0,306
X1	0,673	0,910	0,307
X2	0,613	0,901	0,281
X3	0,603	0,903	0,361
X4	0,069	0,379	0,342
X5	-0,072	-0,193	-0,218
X6	0,163	0,278	0,576
X7	-0,065	-0,137	-0,211
X8	0,026	-0,018	0,306
X9	-0,094	-0,159	-0,195
X10	0,215	0,187	0,772

Table 4: Factor cross-loadings example

Each factor loading value should be observed to understand, whether they support or cause problems for validating the proposed model: Henseler et al. (2009) state that for confirmatory research, factors should load with a weight of at least 0.7 on their theorized constructs and the loadings should be lower than that on the non-theorized constructs. The table indicates a greyed-out area for each theorized construct, where the indicator loadings should be most significant. The cross-loadings outside the greyed-out areas may in general prove to be an issue since they might convey that an indicator would in fact contribute to several constructs which should not be theorized in the proposed model. Several issues are present in the example table above: For instance, the indicator Y5 does load on the theorized construct with a good value of 0.840 but it also has a fairly high loading of 0.764 on another construct. As another example, the indicators from X6 to X9 express very low loadings for the hierarchical power relations construct, leaving the indicator X10 as the only one with a loading more than the 0.7 limit. Because of these issues, the table proposes that the presented model should be revised before further validation could be done.

In addition to the factor cross-loadings there are also other ways to further confirm the reliability of the proposed model. PLS-enabled computer software produces several tables of results, out of which the relevant figures can be consolidated on two tables. First, it is useful to observe the general reliability indicators with the software reporting capabilities. Secondly

it is possible to conduct an artificial inflation of sample size through a method called *bootstrapping* to produce a table of predictive measures, most importantly t-statistics. The first table is presented below and the second one is discussed later.

Construct	*Mean*	*S.D.*	R^2	*Weight*	ρ_v	ρ_c	α
Organizational Influence	5,62	0,31	0,47		0,40	0,76	0,75
Social Status	5,78	0,15		0,67	0,53	0,78	0,66
Hierarchical Power Relations	4,76	0,22		0,04	0,22	0,29	0,73

S.D. : Standard deviation, ρ_v: average variance extracted (>0.5 expected), ρ_c: composite reliability (>0.7 expected), α: Cronbach's alpha (> 0.7 expected)

Table 5: PLS model reliability measures example

Table 5 above indicates multiple useful measures of reliability. The determination coefficient R^2 is perhaps the most important measure of overall model fit to the real world as it expresses, what portion of variation in the observed dataset can be determined by the proposed model. Chin (1998) determines that the determination coefficient (R^2) values below 0.19 should be considered as weak, between 0.33 and 0.67 as average and above 0.67 as high; thus the value of 0.47 could be stated to be an average figure; the same value can also be found in Figure 10 from the middle of the organizational influence construct element. The table above also indicates the construct weights that are similar to those shown in Figure 10 alongside the pathways. Moreover, more elaborate descriptions on average variance extracted (ρ_v) and composite reliability (ρ_c) and can be found in section 4.2.

The average variance extracted (AVE) shows the average communality for the theorized latent constructs. AVE should exceed a value of 0.5 which in this case is fulfilled only by the social status construct with a value of 0.527. The composite reliability figure in the next column is the preferred way to observe general reliability and for confirmatory research, it should attain a value above 0.7. In this example the hierarchical power relations do not meet the requirement, indicating again that for this part the model does not provide sufficient reliability. Moreover, in PLS research the composite reliability is in fact a more supported reliability measure than Cronbach's alpha that is more widely used in non-PLS research. The reason for this is that Cronbach's alpha tends to either under- or overestimate the scale reliability. The acceptance limit for Cronbach's alpha is similar to composite reliability, 0.7. (Chin 1998)

Finally, the two generally used indicators of validity within statistical research are mean and standard deviation: Mean describes the weighted average of indicator responses that in this fictional case were measured with a 7-point Likert scale. Here these values show that for the questions pertaining to organizational influence and social status, the respondents indicated bit higher values than for the hierarchical power relations. Standard deviation depicts the average distance from the mean and in this example all constructs expressing fairly modest deviations.

In PLS, traditional fit indices cannot be produced for the data set and thus other measures will need to be set up for clarifying the validity of the model. Therefore, although measures of fit cannot be produced for PLS, confidence intervals are extracted with a method called bootstrapping through which an estimate of sampling distribution spread, shape and bias can be produced. Bootstrap considers the research sample as a population from which an approximation of the current sample distribution is made through creating a preset number of samples with the same amount of cases than what the original sample has. Thus in short, bootstrapping allows for an indication of model validity when sample size is small (Henseler et al. 2009). The bootstrapping results for the example data are presented in the next part to assist in validating the hypotheses.

As with the example case presented with various figures and tables in this section, measures can be taken for correcting the model structure: In case the proposed initial model does not correspond to the reliability tests correctly, Henseler et al. (2009) propose that an appropriate way to continue with the current data and model without a major reproduction of research would be considering to drop the problematic indicators out of the model and then continuing with the ones that do not cause significant cross-loadings. This kind of an iterative approach has been proposed in a general sense also by Hair et al. (2010) as they state that a *model development strategy* is very often a suitable way for model perfection in SEM-based research. The model development strategy thus pertains to first theorizing an initial model and then based on calculation results, revising the areas of the model that cause most disturbance in the result set. The revised model is then subject to the same calculations for verification and if deemed valid, hypotheses can be then validated based on the new consolidated model structure. Since this research takes a predictive confirmatory approach on attaining results, the model development strategy is a very good method to follow. In case the general model structure remains unaltered and at least two indicators are left for each latent construct, the

strategy allows making enhancements to the model validity and reliability to achieve solid conclusions regarding the weights of the hypothesized relationships.

After stating the possibilities and general limitations of the PLS research approach regarding model validity and reliability measurements, it should be noted that the limiting aspects of PLS should not be seen as a reason for abandoning it as a research method nor the research results it produces: The reason for this statement is that even with the more traditional models with low levels of communality and excellent measures of fit, very low factor loadings and low R^2 may still be observed. Ergo, instead of focusing on how well the sample data fits the proposed model, with PLS path analysis the objective should be to produce a model with a high level of predictability, that is, a model that most likely represents the real world. Good measures for estimating this kind of predictability are strong factor loadings, high weights and R^2 measures as well as strong structural paths above the 0.2 threshold. (Chin 1998). Thus it can be stated that while PLS employs a relatively simplistic approach to estimate model validity, it is a very good research method for conducting confirmatory factor analysis (CFA) for complex models in a predictive fashion, especially when the measuring model has a large amount of variables and when the sample size is small ($n<100$) (Chin et al. 1996; Tenenhaus 2007; Garthwaite 1993).

3.1.6 Validating Hypotheses

Pre-stated hypotheses can be convincingly accepted or rejected after conducting thorough investigations regarding the data and the structural equation model quality, reliability and validity. In the example, in case the data and model would have been proved to be of value, the hypotheses are validated by utilizing the resulted latent construct weights. Below is an example of the final hypotheses validation table. By observing the table it can be stated that the weight of social status towards organizational influence is 0.67, hierarchical power relations' weight being 0.04. While these weights present the weighted correlation of the latent constructs, thus making them comparable to each other, it should be mentioned that the PLS approach largely relies on a strong theoretical background in interpreting the attained result set. In this example it could be thus stated that social status seems to affect organizational influence more than hierarchical power relations.

H	Description	Weight	t-statistics*
H1	Social Status positively affects Organizational Influence.	0,67	6,27
H2	Hierarchical Power Relations positively affect Organizational Influence.	0,04	0,56

* t-statistics obtained with bootstrapping, 1,000 iterations

Table 6: Hypotheses validation example

As explained in the previous section the t-statistics values are obtained through bootstrapping. The t-statistics give a prediction on the confidence limits, as the general expectation is a value above 1.96 to produce a ca. 95 percent confidence level. By observing the table it can be stated that the social status construct has a very good value of 6.27, indicating that one can be relatively confident regarding the measured weight relation towards organizational influence. In contrast, the hierarchical power relations construct has a value of 0.56, marking a low level of confidence. Altogether the figures presented in the table above predict that when sample size is increased, it is likely that the social status construct will remain as the sole valid weight relation for this model. (Henseler et al. 2009)

Moreover, there is no one answer on what kind of weight should be considered as a large enough impact for drawing theoretical conclusions: As a general statement, latent construct weight values of over 0.1 can be considered to have an impact but one should always keep in mind the theoretical background with which the constructs are theorized to exist (Chin et al. 1996). Ergo, while it is clear that social status in the example provides a significant effect on organizational influence, the low weight of hierarchical power relations does not necessarily make the construct irrelevant in all cases. Especially in case the weight is close to the 0.1 threshold, external proof such as earlier valid theoretical and empirical research may give enough information for considering the weight to affect the theorized endogenous construct. In this case and based on the information discussed within the section, the hypothesis H1 can be accepted and no conclusive answers can be given for the hypothesis H2. The inconclusive nature of the hypothesis H2 arises from both the low t-statistics value as well as from the very low weight of 0.04.

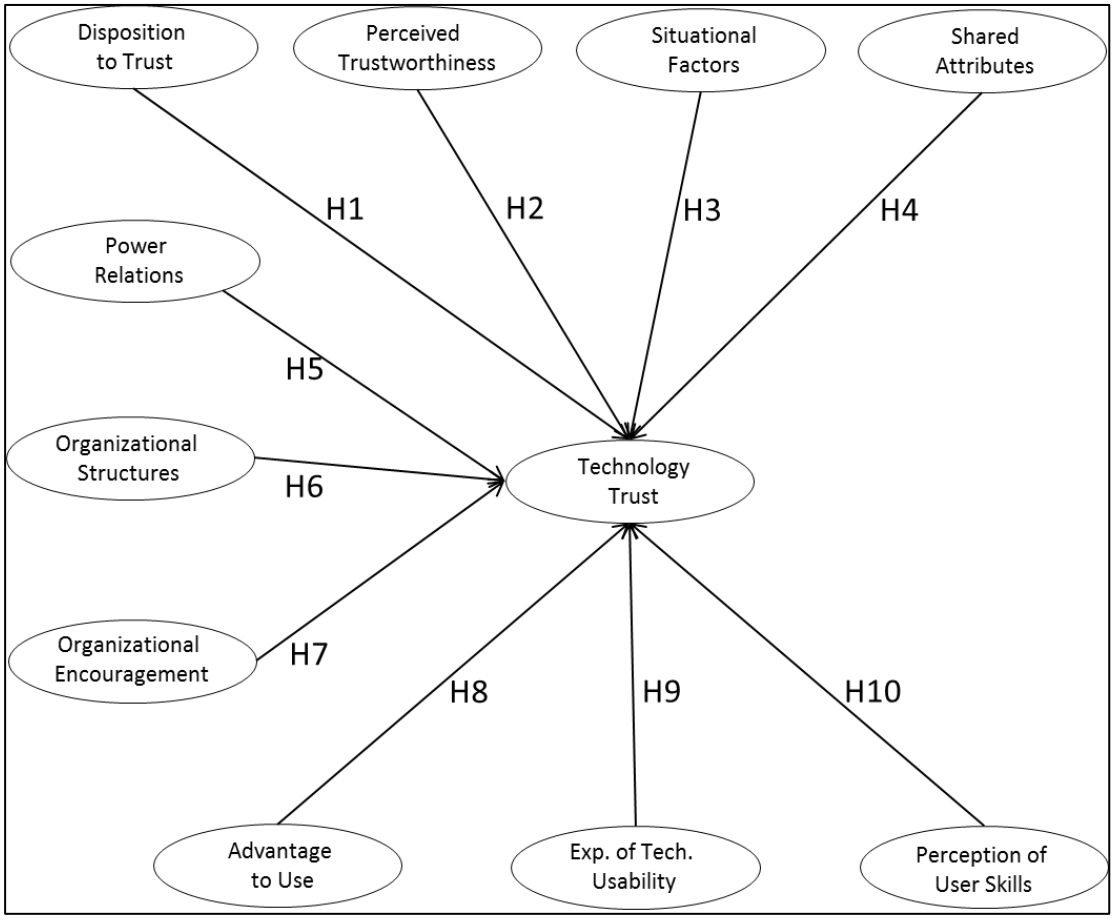
The validation is the final phase of PLS research and thus this section also concludes the discussion of how PLS research is conducted. After this clarification it is now possible to continue describing the specific methodological tenets of this research. Since the first phase of theorizing the model was already completed in section 2.4.2, the next steps are first to define

the empirical research hypotheses and secondly to outline the measurement structure for the PLS calculations.

3.2 Research Hypotheses and Full PLS Model

The technology trust antecedent constructs were selected based on the extensive review of academic literature concerning trust, organizational behavior and technology acceptance. The technology trust model presented in Figure 4 gave an overview of how the independent technology trust antecedent constructs are theorized to affect the independent construct which is technology trust. To observe the hypothesized relationships of constructs, the conceptual model for the empirical research is depicted in the following figure.

Figure 11: Conceptual research model with hypotheses.



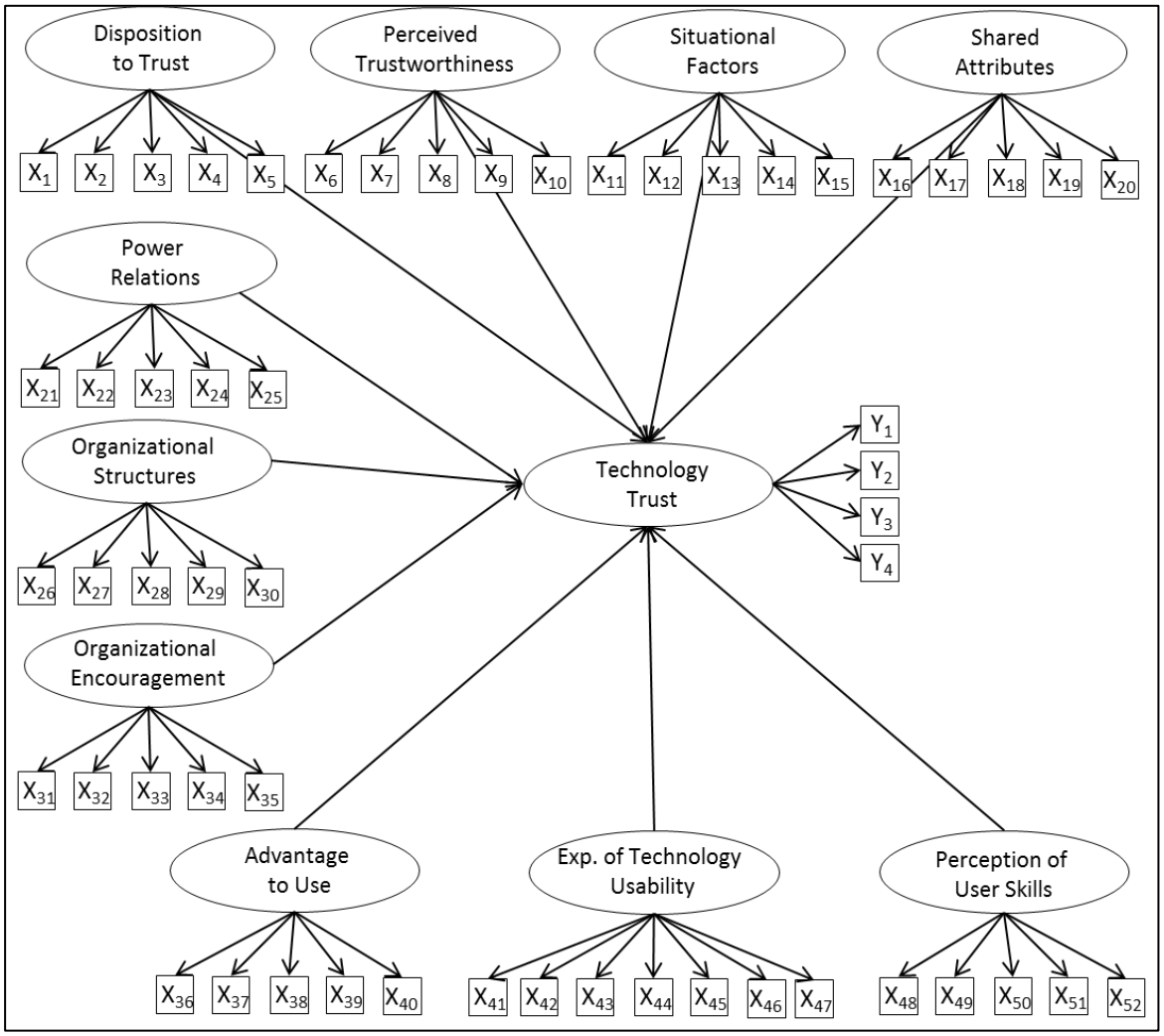
The hypotheses for this research are thus as follows:

H	Description
H1	Disposition to Trust affects an individual's level of Technology Trust.
H2	Perceived Trustworthiness affects an individual's level of Technology Trust.
H3	Situational Factors affect an individual's level of Technology Trust.
H4	Shared Attributes affect an individual's level of Technology Trust.
H5	Power Relations affect an individual's level of Technology Trust.
H6	Organizational Structures affect an individual's level of Technology Trust.
H7	Organizational Encouragement affects an individual's level of Technology Trust.
H8	Advantage to Use affects an individual's level of Technology Trust.
H9	Expectation of Technology Usability affects an individual's level of Technology Trust.
H10	Perception of User Skills affects an individual's level of Technology Trust.

Table 7: Empirical research hypotheses.

It is notable that out of these ten hypotheses, all except for one are expected to have positive effects on technology trust. This means that for hypotheses from H1 to H8 and H10, the measured indicators should express positive correlation with the four indicators measuring technology trust. Consequently, the hypotheses H9, the expectation of technology usability, is the one that is expected to affect negatively on technology trust. The reason for this is that the measured indicators of the expectation of technology usability antecedent inquired the requirements that new technology ought to have in order for that individual to start utilizing it, the indicators pertaining to areas of quality, security, ease of use as well as to the ability to test out the new technology before actual usage. Thus the more an individual has those personal requirements, it is theorized that the less likely it is for that person to have a high level of technology trust. Consequently, these hypotheses serve as the foundation for forming the full PLS model that is depicted in the following figure.

Figure 12: Structural relationships and measurement specification for latent constructs, full PLS model.



The proposed PLS model contains ten technology trust antecedents that are considered as exogenous constructs. Technology trust is proposed to be the endogenous construct that is dependent on the technology trust antecedents. The X and Y indicators each represent an observed indicator, measured through a single survey question (see Appendix 2 for the survey questions reflecting the indicators). According to the theoretical background discussed in part 2, the antecedents and technology trust are theorized to have a causal relationship, the antecedents attributing change to technology trust; therefore this model follows a reflective measurement theory. Moreover, the specific research approach follows a model development strategy, where the proposed measurement model serves as a foundation for a more detailed research (Hair et al. 2010); ergo, this approach strategy allows for some iterative work to be done between data analysis before detailing the final model for this research. Now, after the measurement structure has been detailed alongside with the appropriate empirical hypotheses,

the methods for data collection are discussed next before continuing to carrying out the PLS calculations.

3.3 Data Gathering Tool

Since this research approaches the empirical research from the social sciences scope, various ways of data collection could be utilized for this research, ranging from qualitative methods such as structured interviews or case studies for gathering quantitative numerical data. In order to shed light to the original research problems, this research adopts the survey research as the data collection method. The survey research method is chosen because when properly conducted and controlled, it delivers well-structured data that can be later quantitatively measured and analyzed in a relatively precise fashion. Furthermore, given the general nature of this research, the survey method is chosen because a prepared survey can be widely re-used, either fully or partially. Finally, the survey method also allows room for suggestions on how the data collection could be improved by for example designing new questions or reforming the old ones.

The specific tool for gathering the data was chosen to be a self-administered electronic survey and two academic publications regarding constructing surveys were utilized as guides for constructing and validating the survey type, format and the survey questions (Fowler 2002; Cramer 2003). The surveyed organization was chosen to be a multinational high-technology company with the initial point in mind that the employees of a highly technology-related business would express high initial levels of technology trust. As the company wished to remain anonymous, company-specific information is not depicted in the result set.

There were multiple reasons for selecting the survey method for gathering data: First, Hair et al. (2010) state that a survey is a suitable data gathering tool for approaching a confirmatory factor analysis through SEM. Second, because the surveyed organization can be considered as a high-technology company, it is likely that the respondents are both highly literate and very efficient in utilizing computers for recording responses. Third, an electronic self-administered survey allows for a vast population to be reached with a better probability despite of their geographical location, regional time or preferred responding time.

In addition to these general benefits, the surveyed organization's industry brought some additional incentives for conducting the survey electronically: First, the surveyed organization's intranet system was readily accessible by all employees, thus presenting the survey via this web service made it easy and secure to approach for the respondents. Second, as the platform and information technology tools for constructing the electronic survey were readily available at no additional investment, the cost was low and the required time short for producing the survey in electronic format when compared to printing and sending paper versions of a survey to respondents. Third, the used electronic survey tool ensured that correct information was provided by the respondents regarding the answering alternatives.

Because of the nature of the survey, closed questions are used in this research, that is, pre-determined answer alternatives. The closed question format is decided upon firstly to facilitate an ease of response for maximizing returns. Secondly, open-ended questions often make the quantification of results difficult due to the varying form of the answers. For enhancing the results of the research, the survey questions are prepared in a fashion to utilize both nominal and ordinal type of data. Nominal data questions were used to produce views of categories of respondent groups. Because one of the key research problems is to rate the relational validity of the technology antecedents, ordinal data questions are utilized for the major part of the survey as they allow the classification of the inquired element according to respondent's own preferences. (see Fowler 2002 for general guidelines of survey building)

In addition to the general survey structure described above the following guidelines are utilized in constructing the survey: First, if a suitable survey question relating to a specific antecedent component is discovered from an academic publication of a similar research area, its utilization is preferred to fabricating one. This approach was proposed by Cramer (2003) and many of the questions were based on the extensive review of different technology acceptance models conducted by Venkatesh & Davis (2000). In most cases, the term "technology" or "system" is rephrased as "new technology" to further target the questions for the purposes of this research. Second, the questions are modified to embed an individual person's perception from both affective ("I believe that…") and cognitive ("I think that…") elements for highlighting the requirement of having both in order to create individual trust. This approach is adopted from the Organizational Trust Inventory tool developed by Cummings & Bromiley (1996). Third, at least five survey questions are dedicated for each proposed technology trust antecedent for error reduction in the initial model. The questions are formed according to specific items that have previously been theorized to affect the

antecedent-in-question (please see Table 1 for a list of contributing authors). Fourth, the questions that contain individual, organizational and technology-related questions respectively are first categorized and then randomized within these categories. Fifth, being a generally accepted good practice, a 7-point Likert scale ranging from Strongly Agree (7) to Strongly Disagree (1) is utilized for continuous data, namely the technology trust antecedent and technology trust questions. Last, four categorical data questions are included: gender, nationality, interest in new technology and age. Out of these questions the first three included yes/no answer options and age is measured with a 5-point scale (less than 14 years, 15-29 years, 30-49 years, 50-69 years, 70 years and above).

For depicting the particular area of research and the survey's general purpose to the respondents, the following introduction was conjured above the electronic survey form:

"This questionnaire is a part of a Master's Thesis research regarding trust and technology and it is conducted for the Helsinki School of Economics. The questionnaire is anonymous, so your personal information or the name of your organization will not be published in the research results. Answering to this questionnaire will take approximately 5-10 minutes.

Please note that when the term 'new technology' is used in a question, you are asked to think about both IT systems (software) and electromechanical equipment (hardware) that you are not yet familiar with.

Most questions utilize an answering scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). You are asked to respond in a way that best reflects your current personal understanding of the topic. Thank you for your answers!"

As stated also above, because of the requirement from the surveyed organization to remain anonymous, the actual survey questionnaire is not produced to the Appendix section of this research. The survey depiction would indicate specific information of the organization in two ways: First, in the actual survey the questions having the words "my organization" were replaced with the name of the actual organization, although otherwise the survey questions remained unaltered. Second, the survey is produced into an electronic format by utilizing the organization's in-house developed internal survey tool that is available for all employees, that tool having a distinctly recognizable user interface.

Regarding sampling, for a typical regression-based quantitative analysis, sample size could be estimated to be based on Bartlett et al.'s (2001) discussion regarding appropriate sample sizes

in organization research. The population in the surveyed organization was 280, thus a multivariate regression analysis with a 95 percent confidence (t-value of 1.96) would have been deemed possible with a simple random sample of 85 respondents, given that continuous variables were utilized. However, this sample amount is not fully adequate according to both the most recent SEM guidance (Hair et al. 2010) as well as the research concerning PLS methods (Chin 1998) that point to conducting sample sizing based on the number of factors. Therefore the best possible sample should be of far greater size than 85 for complex models as the one in question. In fact, a suggested sample size would be to have at least five times of respondents than variables. Therefore with a total of 56 variables, an appropriate sample size for this research would be at least five times the number of variables, which amount to 280 and that is exactly the size of the population in question. It is thus natural that without the power to make responding to the survey mandatory, this limit is in a real world very difficult to achieve. Next, to confirm that the plans to carry out empirical research are solid, a discussion of empirical research reliability and validity is conducted.

3.4 Empirical Research Reliability and Validity

The initial point for clarifying the possible caveats of this research is to first discuss the validity of the survey: A key objective in constructing the survey questions is to create a consistent and clear survey responding experience. The survey is designed to be utilized for individuals from differing backgrounds, thus emphasis is put on making sure respondents both understand the questions as well as know what and how to answer them. On a more specific note, the survey questions listed in Appendix 2 have been designed to provide accurate and reliable points of measure, thus the questions have been checked for the following ambiguities: incomplete wording, unacceptable optional wording, poor wording, poorly defined terms and duplication (for a description of these categories, please see Fowler 2002, 79-84).

Regarding the language of the survey, because the ability to write and speak the English language is a general requirement for entering into a working relationship in the surveyed organization, the survey was held in English. This naturally may pose a challenge for specific respondents. However, before conducting the actual survey, a pilot was conducted with a small group of respondents after which the questions were modified in case the respondents

indicated miscomprehension. Moreover, information was gathered regarding the general ambiguity of specific questions for assisting further PLS model inspection in the data analysis. Within this small group, no one indicated the English language as a problem.

A vital aspect of the general research design is also the notion of missing data. For achieving responses with no missing data, the research employs a relatively sophisticated electronic survey tool that firstly does not allow for more than one response per respondent and secondly, it neither allows submitting a survey into the survey database unless it is completely filled out. Thus it is possible to state that missing data is not to exist in the survey results. Moreover, based on the discussion regarding sampling it can be stated that for the research, one should attain a 100% response rate to achieve the desired 5:1 ratio for respondents versus measured variables. Thus sample size clearly is one the most evident limitation for the overall generalizability of this research's results. Regardless of this limitation the target, as the result set of this research is expected to be utilized in a predictive way, the research is still to provide direction on the relation of technology trust antecedents to technology trust within a high-technology environment.

In addition to the more specific tenets of research reliability and validity described above, the two error elements, alpha error and beta error should also be discussed: The previously discussed sample size is the first limiter that may accrue either information that in real life does not exist (alpha error) or it may not produce a relevant aspect that should indeed exist (beta error). As this study contributes to academic research by combining information from a set of multidisciplinary studies and constructing a quantifiable model of social aspects relating to trust, there is a possibility for failing to find a crucial difference that would assist in explaining the relation of the constructs with better consistency. Likewise there is always a possibility that the specific combination of respondents and specific questions may relate to insignificance, an aberration of reality, twisting the findings into a less generalizable solution. However, the reader is assured that the contemporary literature has been observed with diligence to arrive to the theoretical framework and to further propose the model structure. Moreover, the construction of the survey questions for data gathering has relied mostly on already tried and tested structures and approaches to minimize the possibility for mistakes.

Ergo, while it is naturally an insurmountable claim to state that this study would be error-free, appropriate steps have been taken to reassure the relative validity of the empirical research. After stating this target for conducting empirical analysis with a solid methodological

background, this research will next begin to formulate the empirical findings first by making initial analyses regarding data quality and second by running the initial PLS calculations against the proposed measurement structure.

4 EMPIRICAL FINDINGS

The research data was gathered through an electronic survey tool with which a questionnaire containing 60 questions was made available. Although the surveyed organization remains anonymous in this research, it can be described as a multinational high-technology corporation that employs thousands of IT professionals worldwide. The high presence of technology was the main reason for selecting this organization for the survey, as it was expected to harness higher-than-average levels of technology trust and thus through this positive bias more useful data regarding the technology trust antecedents could be obtained. The specific population for this survey was comprised of the employees of the company's Finnish office, 280 persons in total.

The survey data was initially analyzed and tested for normality by using a computer application called SAS Enterprise Guide 4.1. After concluding that the data was of good quality, another computer application called SmartPLS 2.0 M3 was then utilized in constructing the theorized path model and in analyzing the survey results based on the structural equation model depicted in Figure 12. Since the strategy for approaching the analysis follows a model development strategy, the indicator sets are modified in order to arrive to concluding remarks regarding the study, resulting in analyzing first a full model with the proposed structure and second a consolidated model where the number of construct indicators is reduced based on distinct justifications. The reliability measures for both models can be seen in Tables 8 and 10 respectively, both model structures being depicted in Figures 13 and 15 respectively. Factor cross-loadings are also included in Tables 9 and 11 respectively. The results are discussed according to the general guidelines suggested by Chin (1998). Last, a notable issue is also that SmartPLS 2.0 M3 works by automatically standardizing the dataset, thus that procedure was applied also for this study. Data standardization pertains to a procedure conducted to each measured variable in the dataset where a variable's average is first reduced from the empirical observation, after that being divided by the variable's standard deviation. While required, standardization is also beneficial in PLS as it assists avoiding calculation errors through lowering the intercorrelation of model constructs and their respective indicators (Smith and Sasaki 1979).

4.1 Initial Data Analysis

Out of the population of 280, 93 people participated in the survey. Approximately 20 respondent candidates within the population declared to be absent during the survey period, resulting in a response rate of 35.8 percent. Regarding the 93 persons who responded to the survey, 64 (69% of sample) were male and 29 (31% of sample) female. A majority of the respondents, 74 persons (80% of sample) aged between 30 to 49 years. Second largest age group was formed by persons aged equal or less to 29 years (16% of sample) and four persons (4% of sample) equal or above 50 years participated in the survey. All respondents were Finnish citizens and 87 persons (94% of sample) indicated they would describe themselves as persons who would be interested in technology. Moreover, the respondent data was detected to be non-normally distributed that indicates it is still valid for PLS measurements but not for for example CBSEM measurements (Hair et al. 2010)[2]. Furthermore, as expected, the general level of interest towards technology within the sample demonstrates the initial objective of targeting the survey for a high-technology company: Technology trust antecedents are far more meaningful to observe and research initially with higher-than-average technology trust levels before generalizing the model for the general public, which presumably contains average or even lower-than-average technology trust levels. Next the analysis continues by discussing the results that were obtained after the data was analyzed with the full PLS model described in Figure 13.

4.2 Full PLS Model Results

The result set for the full PLS model depicted in Table 8 below indicates a substantial determination coefficient (R^2) of 0.70 which means that 70% of technology trust is explained by the proposed technology trust antecedents. This outcome can be considered to be substantially good (Chin 1998). The latent construct weights depicted in the column titled "Weight" present more mixed findings, as the general threshold for a weight to be considered substantial is 0.1 (Chin et al. 1996): Out of the ten theorized technology trust antecedents there are five constructs that predict an effect in technology trust, although the table below

[2] Shapiro-Wilk tests were conducted in the initial analysis for each variable for shedding light to the nature of data. Appendix 3 depicts these results, indicating that the data is non-normally distributed as the p-values at most 0.0002 for every variable.

does not reflect the confidence limits for these results. The most significant construct is the *disposition to trust* with a value of 0.81, indicating that the majority of technology trust arises from this particular construct. The second most affecting construct is the *advantage to use*, followed by the *perceived trustworthiness* and *expectation of technology usability* constructs. The negative signs in front of these weights indicate that the more individuals have expectations towards other people or the new technology, the less likely it is to have a high level of technology trust for them. The weights also predict that the *perception of user skills* would have some effect towards technology trust, although it should be again emphasized that the results at this point merely serve as an initial point of observation. To allow for arriving to more definite conclusions, the relevant reliability measures as discussed next.

Construct	*Mean*	*S.D.*	R^2	*Weight*	ρ_v	ρ_c	α
01. Technology Trust	5,77	0,20	0,70		0,62	0,87	0,80
02. Disp. to Trust	5,64	0,21		0,81	0,46	0,80	0,70
03. Perc. Trustworthiness	5,42	0,22		-0,14	0,44	0,78	0,76
04. Situational Factors	4,61	0,70		0,02	0,27	0,20	0,36
05. Shared Attributes	5,29	0,67		-0,02	0,34	0,72	0,53
06. Power Relations	5,83	0,51		-0,01	0,48	0,73	0,66
07. Org. Structures	4,98	0,51		-0,08	0,42	0,77	0,73
08. Org. Encouragement	5,71	0,20		0,06	0,34	0,71	0,61
09. Advantage to Use	5,36	0,40		0,20	0,41	0,74	0,63
10. Exp. of Tech Usability	5,59	2,38		-0,14	0,33	0,74	0,66
11. Perc. of User Skills	5,17	0,49		0,10	0,45	0,80	0,69

S.D.: standard deviation, ρ_v: average variance extracted (> 0.5 expected), ρ_c: composite reliability (> 0.7 expected), α: Cronbach's alpha (> 0.7 expected)

Table 8: Full PLS model reliability measures

Regarding scale reliability, the composite reliability[3] (titled as ρ_c in the reliability measures tables) figures show that apart from the situational factors antecedent's value of 0.20, the

[3] The composite reliability is a measurement of the variance expressed in a construct coefficient divided by the true variance with measurement error. It is derived with the following formula:

$$\rho_c = \frac{var(\sum_{i=1}^{p} \sum_{j=1}^{k} \lambda_{ij} \eta_j)}{var(\sum_{i=1}^{p} \sum_{j=1}^{k} \lambda_{ij} \eta_j + \sum_{i=1}^{p} \varepsilon_i)}$$

where λ_{ij} is the non-standardized coefficient of Y_i indicator loading on factor η_j and ε_i is the error term for the indicator. (Raykov & Shrout 2002)

model could be considered as being suitable for predictive confirmatory analysis with all the other constructs surpassing the generally accepted 0.70 limit. However, the poor reliability figure for the situational factors does not allow confirmation of the full model structure. Cronbach's alpha reinstates the condition of the model as only four of the 11 constructs surpass the generally accepted 0.70 limit for construct validity, two of the 11 constructs falling below 0.60. However, Cronbach's alpha is not the primary reliability measurement used in PLS research, as it assumes all indicators are of equal importance: Since PLS prioritizes the different indicators based on their reliability, the composite reliability measure better fits to the purpose of analyzing PLS data (Werts et al. 1974). All in all, even though values above 0.60 could be acceptable for exploratory purposes regardless of the reliability measurement and especially within a multidisciplinary research area such as the one in question, the low values of the situational factors antecedent and the shared attribute antecedent are not sufficient even for the predictive nature of this research.

Moreover, the Average Variance Extracted[4] (AVE, titled as ρ_v in the reliability measures tables) values for the full model are neither acceptable, as a minimum of 0.50 should be extracted for each construct (Höck & Ringle 2006). The reason for this strict limit is that in case AVE is over 0.50 for a given construct, the variance the construct causes in the dependent variable is greater than its error term; with a lower than 0.50 value, the error is considered larger which effectively nullifies the relevance of the factor in question. In fact, only the technology trust construct reaches the acceptable state in the full model. In addition to poor variable weights, the reason for this is likely to be affected by the number of indicators for each latent construct (5) except for technology trust (4) and expectation of technology usability (7).

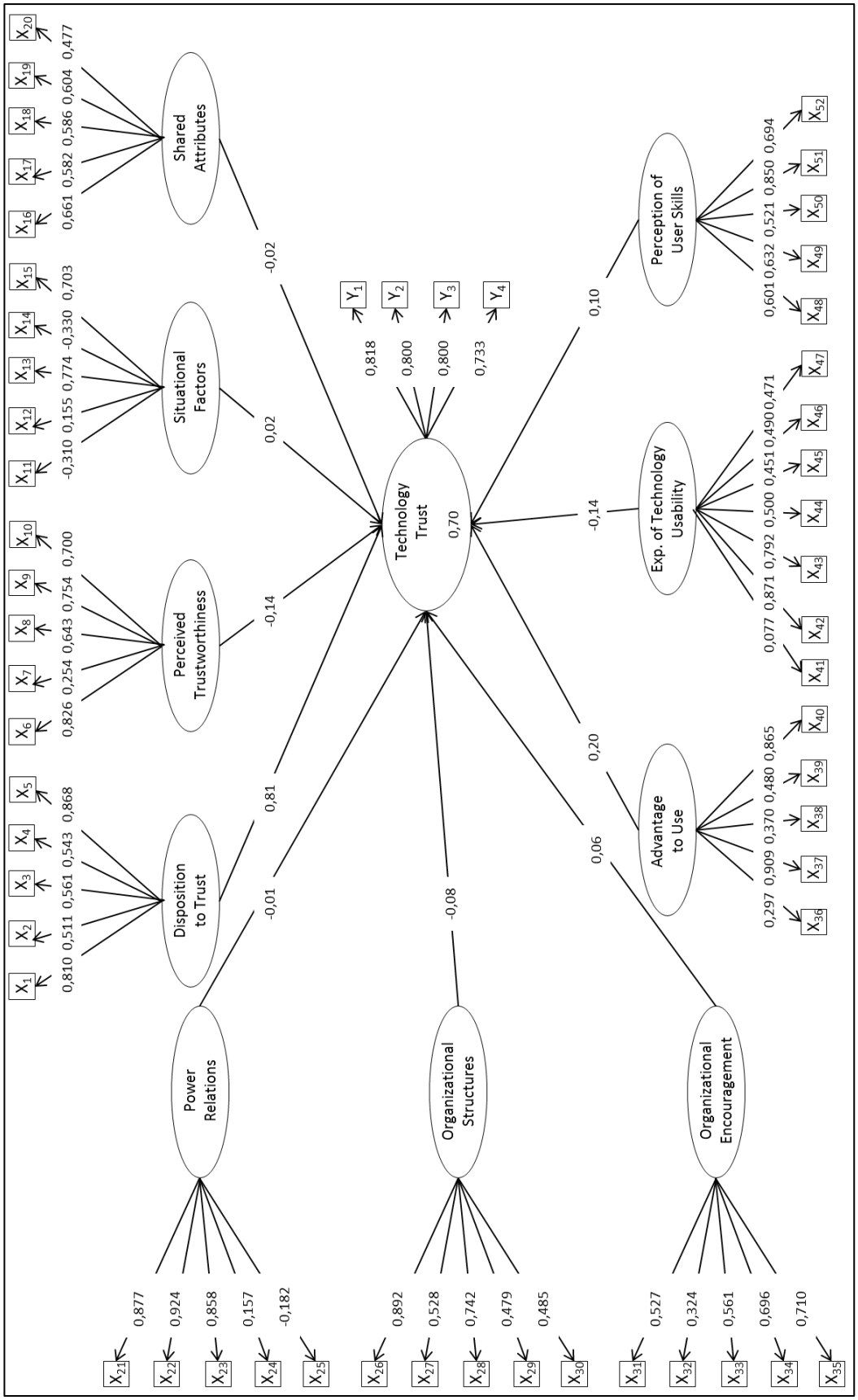
[4] Average Variance Extracted (AVE) is a general reliability value utilized widely in SEM-based research. AVE depicts the mean variance that is extracted for the indicators that are loading on a latent construct. The value is expressed by utilizing standardized indicator loadings and it is calculated by

$$\text{AVE} = \frac{\sum_{i=1}^{n} L_i^2}{n}$$

where L_i corresponds to the standardized indicator loading and n to the number of indicators. Thus for n indicators, AVE is the sum of all squared standardized indicator loadings divided by the indicator amount. Standardization in this scope pertains to a process where the indicator is transformed into a new one with a mean of zero (0) and a standard deviation of one (1). Standardization is done to allow direct comparisons between the effects of the exogenous constructs to the endogenous construct(s). (Hair et al. 2010)

As Henseler et al. (2009) state, indicator cross-loadings present a simple check for the model's discriminant validity. The factor loadings depicted both in the figure below as well as in Table 10 indicate that while all factors have at least two variables with strong loadings above 0.6, somewhat heavy cross-loadings can be observed. When this issue is discussed on a more general level, three main possibilities exist for the occurrence of a highly cross-loading indicator: First, in case the loading for the original construct is valued lower than for another construct, it is likely that the indicator is erroneously misplaced. This kind of result may have risen from suggestions of earlier academics' theorizations or due to a simple human error. Second, in case the original construct loading is higher but not significantly so, the case could be a weak measurement: As an example, since all indicators are measured with survey questions it might have occurred that the particular question is misunderstood by the majority of the respondents. Third, the reason might be the area of research. In fact, it is not unusual for observing high numbers of factor cross-loadings in studies of social topics because often the research topics concern elements that may experience only subtle differences, thus causing an intermittent interrelation of constructs. Consequently, cross-loading indicators do not necessarily pose a threat to research validity as to a certain point it may simply state that the differences are delicate, albeit observable. Nevertheless, while it is not the particular values causing instability, the plethora of indicators experiencing high loadings in multiple factors again point to the direction that model reiteration is to be completed before making any conclusive statements of the overall factor structure.

Figure 13: Full PLS model and weights



Regarding the construction and validation of the full PLS model, while the overall objective of proposing a technology trust model is achieved, both low construct reliability and high average variance underline the importance of the selected model development strategy; reiterating the model structure is highly valuable in case both the variance and the reliability can be improved, given it does not deteriorate the excellent R^2 already achieved. Moreover, due to a high possibility of error the full PLS model results cannot be used to accept or reject any of the hypotheses outlined in Table 7, thus continuing with a consolidated model analysis is crucial for achieving meaningful results.

4.3 PLS Model Iteration and Consolidated Model Results

After analyzing the initial result set from the full PLS model, modifications were done according to the model development strategy. As discussed in the previous part, according to Henseler et al. (2009), the observed values of AVE and composite reliability suggest a revision is deemed necessary for achieving a better reliability. The authors continue that the primary way for achieving this objective is to reduce the number of retained indicators. From a statistical perspective, observing the combination of construct loadings and cross-loadings of the full PLS model give an indication on the variable candidates to be removed for better construct reliability. Naturally removing the most erroneous indicators will contribute also to the overall variance, which further increases the AVE especially in case several similar indicators point to a single construct. From a theoretical perspective, this activity will not pose a problem to the model's theoretical validity as originally there were five indicators at minimum prepared for each constructs, each determined to measure essentially the same construct. The presumption is that the values of AVE and composite reliability will improve when the problematic indicators are removed, thus model development is conducted only on indicator level so that the original construct structure will stay the same. Thus every construct will have at least two indicators also in the consolidated PLS model.

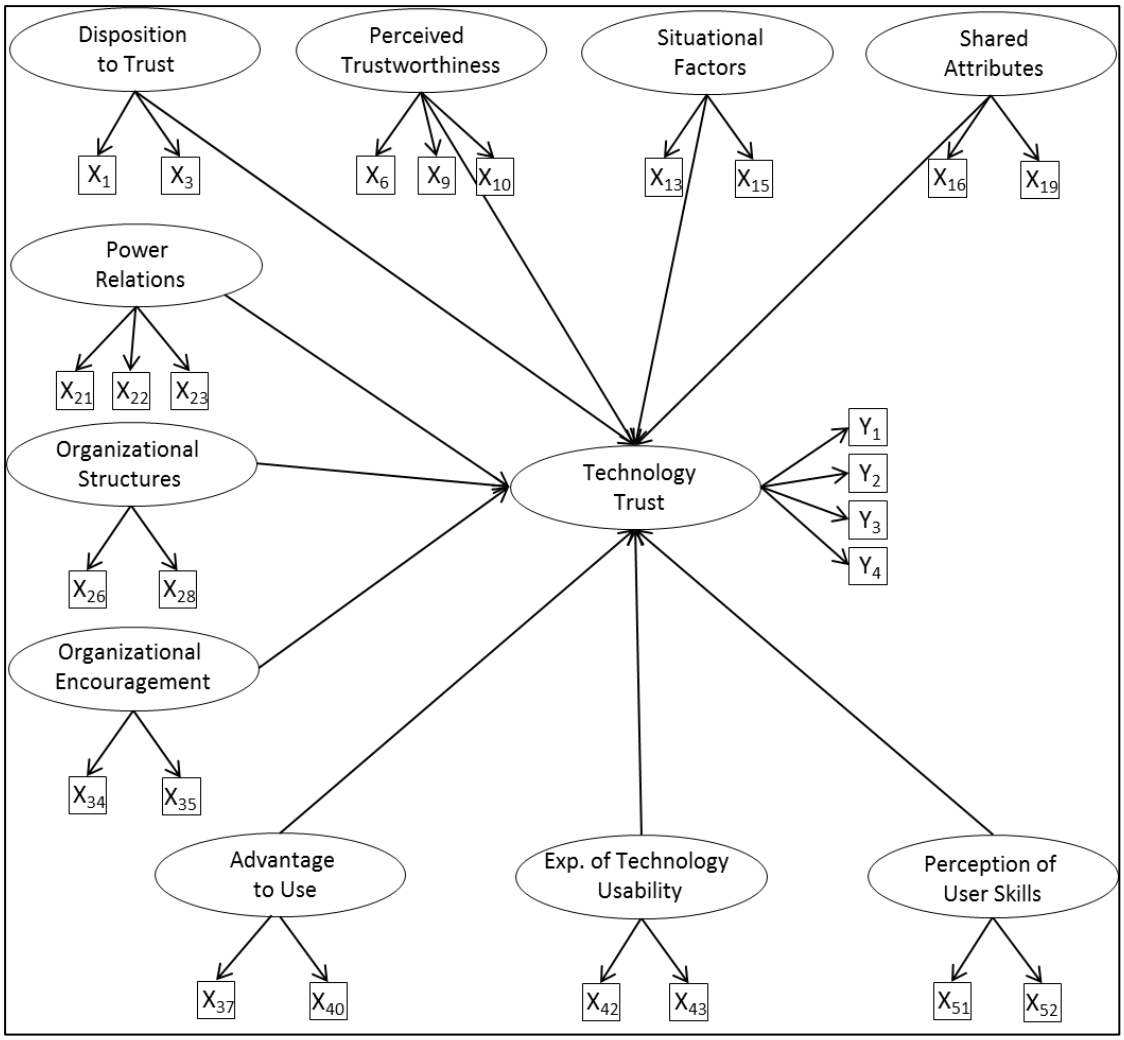
To assess the proper indicator candidates for exclusion it is suitable to observe the indicator cross-loadings for the full PLS model presented in the following table:

	01.	02.	03.	04.	05.	06.	07.	08.	09.	10.	11.
Y1	0,818	0,646	0,056	0,357	0,217	0,264	0,048	0,328	0,327	0,239	0,273
Y2	0,800	0,632	0,295	0,260	0,247	0,159	0,150	0,234	0,250	0,225	0,219
Y3	0,800	0,664	0,154	0,312	0,309	0,310	0,139	0,415	0,454	0,416	0,408
Y4	0,733	0,600	0,394	0,156	0,247	0,197	0,144	0,328	0,287	0,279	0,304
X1	0,706	0,810	0,310	0,419	0,244	0,219	0,106	0,304	0,318	0,339	0,271
X2	0,307	0,511	0,333	0,175	0,374	0,209	0,366	0,278	0,264	0,273	0,177
X3	0,362	0,561	0,503	0,174	0,219	0,056	0,315	0,371	0,277	0,188	0,185
X4	0,360	0,543	0,328	0,054	0,309	0,195	0,096	0,232	0,173	0,321	0,300
X5	0,774	0,868	0,318	0,330	0,352	0,358	0,131	0,361	0,396	0,369	0,364
X6	0,254	0,443	0,826	0,063	0,353	0,086	0,279	0,137	0,163	0,194	0,129
X7	-0,066	-0,067	0,254	-0,303	0,081	-0,013	0,156	0,304	0,076	0,116	0,075
X8	0,105	0,210	0,643	0,016	0,395	0,133	0,382	0,250	0,342	0,253	0,150
X9	0,193	0,333	0,754	-0,044	0,212	-0,009	0,313	0,314	0,224	0,134	0,121
X10	0,137	0,284	0,700	0,140	0,345	0,132	0,450	0,250	0,270	0,227	0,213
X11	-0,072	0,061	0,372	-0,310	0,207	-0,010	0,234	0,266	0,105	0,135	0,128
X12	0,050	0,145	0,527	0,155	0,369	0,101	0,456	0,126	0,317	0,192	0,103
X13	0,251	0,320	0,180	0,774	0,074	0,166	0,108	0,164	0,169	0,178	0,264
X14	-0,179	-0,084	0,133	-0,380	0,228	0,036	0,026	-0,053	-0,175	-0,209	0,031
X15	0,247	0,323	0,099	0,703	0,273	0,084	0,101	0,032	0,154	0,178	0,327
X16	0,152	0,217	0,280	0,189	0,661	0,151	0,167	0,005	0,191	0,260	0,464
X17	0,199	0,175	0,225	-0,115	0,582	0,034	0,235	0,032	0,110	0,014	0,101
X18	0,123	0,204	0,337	0,068	0,586	0,264	0,364	0,258	0,296	0,247	0,297
X19	0,170	0,325	0,437	0,149	0,604	0,058	0,339	0,367	0,441	0,350	0,223
X20	0,239	0,261	0,051	0,055	0,477	0,761	0,113	0,291	0,334	0,400	0,335
X21	0,199	0,313	0,138	0,116	0,497	0,877	0,174	0,423	0,398	0,386	0,356
X22	0,270	0,269	0,111	0,120	0,437	0,924	0,204	0,389	0,384	0,466	0,400
X23	0,227	0,303	0,108	0,133	0,479	0,858	0,196	0,443	0,396	0,454	0,362
X24	-0,126	0,068	0,153	0,045	0,196	0,157	0,479	0,248	0,393	0,309	0,112
X25	0,004	-0,058	0,097	-0,204	0,001	-0,182	0,389	0,248	0,113	0,008	0,094
X26	0,168	0,294	0,486	0,147	0,378	0,194	0,892	0,371	0,578	0,433	0,227
X27	0,031	-0,020	0,247	-0,228	0,100	-0,148	0,528	0,145	0,196	0,051	0,122
X28	0,052	0,088	0,226	-0,011	0,155	-0,099	0,742	0,160	0,337	0,194	0,129
X29	0,020	-0,079	0,147	-0,224	0,089	-0,150	0,479	0,249	0,119	0,009	0,096
X30	0,070	0,121	0,089	0,221	0,320	0,162	0,485	0,218	0,292	0,311	0,111
X31	0,188	0,189	-0,014	0,131	0,287	0,555	0,062	0,527	0,274	0,235	0,251
X32	-0,024	0,049	0,288	-0,254	0,201	0,191	0,275	0,324	0,170	0,093	-0,038
X33	0,130	0,167	0,070	0,180	0,315	0,563	0,139	0,561	0,410	0,270	0,215
X34	0,233	0,315	0,301	0,143	0,261	0,370	0,352	0,696	0,577	0,618	0,224
X35	0,375	0,355	0,242	-0,079	0,132	-0,006	0,327	0,710	0,344	0,212	0,069
X36	0,092	0,141	0,206	-0,151	0,290	0,105	0,386	0,202	0,297	0,164	0,204
X37	0,426	0,438	0,265	0,222	0,385	0,270	0,518	0,519	0,909	0,744	0,372
X38	0,075	0,032	0,241	0,041	0,172	-0,143	0,593	0,232	0,370	0,271	0,251
X39	0,152	0,172	0,096	0,106	0,365	0,548	0,144	0,493	0,480	0,344	0,271
X40	0,368	0,355	0,242	0,311	0,381	0,311	0,435	0,490	0,865	0,576	0,286
X41	-0,027	-0,078	0,118	-0,134	0,106	-0,165	0,469	0,164	0,212	0,077	0,183
X42	0,395	0,419	0,208	0,243	0,307	0,314	0,401	0,540	0,784	0,871	0,330
X43	0,230	0,299	0,148	0,215	0,372	0,380	0,334	0,439	0,718	0,792	0,327
X44	0,071	0,246	0,357	0,077	0,353	0,107	0,391	0,196	0,348	0,500	0,207
X45	0,153	0,201	0,193	0,077	0,370	0,315	0,210	0,155	0,155	0,451	0,492
X46	0,169	0,273	0,141	0,104	0,243	0,288	0,200	0,245	0,236	0,490	0,323
X47	0,158	0,099	0,028	0,181	0,173	0,192	0,134	0,061	0,152	0,471	0,462
X48	0,264	0,203	0,090	0,243	0,302	0,344	0,197	0,167	0,336	0,306	0,601
X49	0,197	0,210	0,253	0,196	0,264	0,130	0,018	0,064	0,138	0,284	0,632
X50	0,100	0,150	0,008	0,200	0,102	0,257	0,142	0,204	0,268	0,406	0,521
X51	0,367	0,368	0,127	0,254	0,397	0,260	0,133	0,223	0,303	0,358	0,850
X52	0,251	0,302	0,145	0,105	0,443	0,406	0,297	0,219	0,332	0,513	0,694

Table 9: Full PLS model factor cross-loadings

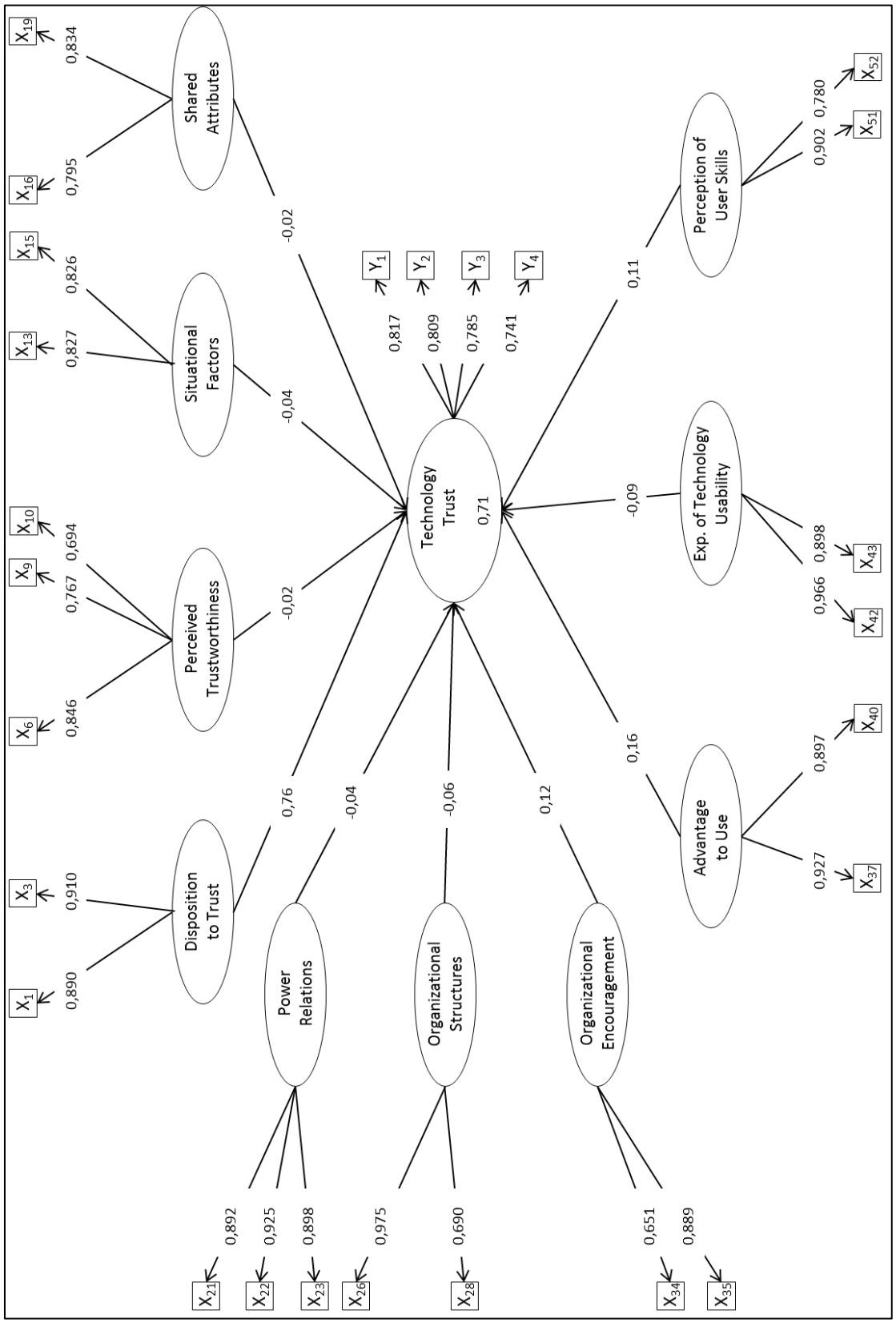
As Henseler et al. (2009) state, in case a particular indicator has a loading below 0.7 and that it can be presumed that composite reliability is improved upon excluding the indicator, then the indicator in question can be removed – naturally given that the underlying theoretical aspect remains intact. With this value as a guideline, 32 indicators are identified as both low-loading and as potential reducers of reliability. However, two indicators (X16 and X19) of the shared attributes antecedent are kept within the consolidated PLS model for three reasons even they do not surpass the 0.7 limit: First, their factor loadings are still relatively strong (0.661 and 0.604 respectively), second, the indicators do not experience significant cross-loadings and third, by including these two indicators the shared attributes construct can still be kept in the model as it was theorized to be a valid construct in part 2.3.1.3. Therefore, the consolidated PLS model will have 26 indicators measuring eleven (11) constructs, the iterated model being the following:

Figure 14: Structural relationships and measurement specification for latent constructs, consolidated PLS model.



After running the calculations with SmartPLS 2.0 M3, the consolidated PLS model weights results are as follows:

Figure 15: Consolidated PLS model and weights



The reliability measures for the consolidated PLS model are described in the following table:

Construct	*Mean*	*S.D.*	R^2	*Weight*	ρ_v	ρ_c	α
01. Technology Trust	5,77	0,20	0,71		0,62	0,87	0,80
02. Disp. to Trust	5,74	0,19		0,76	0,81	0,90	0,77
03. Perc. Trustworthiness	5,48	0,19		-0,02	0,59	0,81	0,67
04. Situational Factors	4,26	0,66		-0,04	0,68	0,81	0,54
05. Shared Attributes	4,97	0,11		-0,02	0,66	0,80	0,50
06. Power Relations	6,17	0,14		-0,04	0,82	0,93	0,89
07. Org. Structures	4,96	0,49		-0,06	0,71	0,83	0,68
08. Org. Encouragement	5,78	0,19		0,12	0,61	0,75	0,38
09. Advantage to Use	5,59	0,08		0,16	0,83	0,91	0,80
10. Exp. of Tech Usability	5,59	0,18		-0,09	0,87	0,93	0,86
11. Perc. of User Skills	5,00	0,36		0,11	0,71	0,83	0,60

S.D.: standard deviation, ρ_v: average variance extracted (> 0.5 expected), ρ_c: composite reliability (> 0.7 expected), α: Cronbach's alpha (> 0.7 expected)

Table 10: Consolidated PLS model reliability measures

By observing the table above, the results of the iteration are promising: The determination coefficient (R^2) of the consolidated model has improved slightly to 0.71 which can again be seen as substantial (Chin 1998). For all constructs the AVE values are now above 0.59 which states that the variance caused by error terms no longer questions the validity of the model. Moreover, the composite reliability figures have also improved, the lowest value being 0.75 which is 0.05 above the suggested limit for reliability. Cronbach's alpha has experienced a similar improvement, although six out of the eleven constructs remain below the 0.70 limit.

As the principal method for developing the full PLS model into a more reliable direction was the removal of problematic indicators, the indicator loadings depicted in Table 11 below for the consolidated model constructs are expectedly strong. Nonetheless, for indicator X28 the loading is just below the 0.70 limit in order to be considered as strong, but as the second indicator for the same construct is extremely high, 0.975, it does not pose a problem for the construct measurement. Similar situation occurs with indicators X34 and X35, the latter being the one that is supporting the former's loading of 0.651 with a stronger loading of 0.889. Apart from these two occurrences the indicators are loading on constructs at a value of 0.741 at minimum. (see Henseler et al. 2009 for a more elaborate discussion on this matter)

	01.	02.	03.	04.	05.	06.	07.	08.	09.	10.	11.
Y1	0,818	0,708	0,037	0,307	0,108	0,221	0,025	0,271	0,319	0,234	0,290
Y2	0,808	0,660	0,277	0,166	0,172	0,119	0,156	0,274	0,264	0,223	0,228
Y3	0,786	0,629	0,145	0,304	0,190	0,296	0,131	0,343	0,481	0,379	0,407
Y4	0,741	0,596	0,380	0,148	0,155	0,164	0,193	0,389	0,295	0,277	0,313
X1	0,706	0,890	0,286	0,368	0,213	0,208	0,141	0,326	0,326	0,310	0,286
X3	0,775	0,910	0,292	0,354	0,185	0,332	0,163	0,313	0,415	0,359	0,361
X6	0,258	0,300	0,804	0,112	0,401	0,095	0,299	0,190	0,182	0,107	0,140
X8	0,106	0,159	0,679	0,099	0,280	0,142	0,347	0,253	0,319	0,251	0,167
X9	0,198	0,238	0,781	0,063	0,274	0,020	0,317	0,370	0,166	0,138	0,124
X10	0,139	0,211	0,704	0,151	0,270	0,170	0,468	0,296	0,222	0,150	0,216
X13	0,246	0,326	0,154	0,827	0,090	0,180	0,118	0,037	0,179	0,119	0,254
X15	0,245	0,336	0,072	0,826	0,396	0,084	0,110	-0,010	0,160	0,174	0,340
X16	0,152	0,146	0,255	0,287	0,795	0,144	0,153	-0,022	0,156	0,188	0,477
X19	0,168	0,210	0,426	0,197	0,835	0,103	0,342	0,336	0,421	0,334	0,238
X21	0,196	0,291	0,149	0,158	0,115	0,892	0,187	0,174	0,336	0,303	0,350
X22	0,267	0,277	0,100	0,114	0,115	0,925	0,210	0,179	0,335	0,384	0,386
X23	0,222	0,257	0,101	0,169	0,182	0,898	0,222	0,189	0,334	0,393	0,359
X26	0,169	0,200	0,462	0,155	0,344	0,276	0,975	0,401	0,540	0,451	0,225
X28	0,051	0,004	0,251	0,031	0,075	-0,019	0,690	0,267	0,311	0,164	0,134
X34	0,228	0,272	0,317	0,146	0,233	0,390	0,357	0,652	0,588	0,640	0,216
X35	0,377	0,291	0,267	-0,067	0,120	0,020	0,306	0,889	0,305	0,228	0,067
X37	0,423	0,420	0,259	0,139	0,351	0,322	0,534	0,535	0,927	0,796	0,368
X40	0,361	0,329	0,235	0,244	0,305	0,356	0,436	0,394	0,897	0,657	0,273
X42	0,391	0,382	0,203	0,161	0,295	0,351	0,420	0,517	0,790	0,966	0,308
X43	0,228	0,297	0,143	0,176	0,321	0,424	0,360	0,338	0,693	0,898	0,330
X48	0,262	0,249	0,093	0,262	0,235	0,326	0,213	0,008	0,307	0,293	0,612
X49	0,196	0,157	0,240	0,240	0,356	0,115	0,078	0,084	0,128	0,151	0,641
X51	0,363	0,333	0,135	0,333	0,326	0,279	0,115	0,168	0,263	0,214	0,854
X52	0,250	0,243	0,144	0,160	0,326	0,407	0,239	0,155	0,286	0,297	0,689

Table 11: Consolidated PLS model factor cross-loadings

The consolidated PLS model results show a definite improvement regarding the model reliability when compared to the original full PLS model. Regarding the full PLS model, the poor reliability results did not allow for advancing to assess the hypotheses proposed in Table 7. However, since the consolidated PLS model is now more firmly backed by statements of reliability and validity, assessing the given hypotheses can be conducted with a usable purpose. Hence the hypotheses statements will be discussed next alongside with the key findings of the empirical research.

4.4 Main Findings

The empirical result set from the basis of the consolidated PLS model indicates the following results

H	Description	Weight	t-statistics*
H1	Disposition to Trust affects an individual's level of Technology Trust.	0,76	9,29
H2	Perceived Trustworthiness affects an individual's level of Technology Trust.	-0,02	0,22
H3	Situational Factors affect an individual's level of Technology Trust.	-0,04	0,57
H4	Shared Attributes affect an individual's level of Technology Trust.	-0,02	0,27
H5	Power Relations affect an individual's level of Technology Trust.	-0,04	0,58
H6	Organizational Structures affect an individual's level of Technology Trust.	-0,06	0,75
H7	Organizational Encouragement affects an individual's level of Technology Trust.	0,12	1,24
H8	Advantage to Use affects an individual's level of Technology Trust.	0,16	1,23
H9	Expectation of Technology Usability affects an individual's level of Technology Trust.	-0,09	0,65
H10	Perception of User Skills affects an individual's level of Technology Trust.	0,11	1,53

* t-statistics obtained with bootstrapping, 1,000 iterations

Table 12: Hypotheses validation.

As Henseler et al. (2009) state, the predetermined hypotheses' validation ought to be discussed with three dimensions: sign, magnitude and significance. While sign and magnitude can be observed with the results already obtained, a bootstrapping run with 93 cases and 1,000 iterations was applied to produce the t-statistics for evaluating confidence in the results. It is notable that the t-statistics in overall express relatively low confidence limits, except for the disposition to trust antecedent with a very high value of 9.29, in comparison to the general critical value of 1.96 for a 95 percent confidence level. However, as with previous statistical inferences, this result is most likely caused by the small sample size of 93 combined with the multitude of indicators. Namely, Goodhue et al. (2006) have stated that while bootstrapping is indeed a way to produce confidence limits for PLS, it still cannot yield additional reliability to the model itself if the original sample size is small. Therefore constructs with low t-statistics are still proposed to be taken into account for predictive purposes.

Out of the ten hypotheses depicted in Table 12, solely the hypothesis regarding the disposition to trust can be accepted based on the measurement data. Therefore, Based on this research, the only construct significantly affecting technology trust is the disposition to trust antecedent with a weight of 0.76. In addition to this significant impact there are four notable hypotheses from H7 to H10, yielding minor weights between 0.16 and 0.09. Moreover, it is notable that while the *expectation of technology usability* did not pass the minimum weight threshold of

0.1 outlined by Chin et al. (1996), usability has been deemed as a significant agent of technology acceptance and technology usage by many scholars (see for example Rogers 1995, Davis 1986, Sutcliffe 2006). Moreover, because of the predictive nature of this study, additional research is proposed to be conducted to truly verify the non-theorized insignificance of technology usability and therefore for this research's purpose the value of 0.09 leads to reconsidering the hypothesis that the expectation to technology usability affects technology trust in the future studies.

Although not a significant indicator of hypotheses' acceptance, the weight relation signs should be noted: The expectation of technology usability antecedent is negatively affecting technology trust, which was readily expected: In fact, it was theorized to be the sole antecedent that negatively affects technology trust. The reason for this expected negative direction is that while the overall usability of a technology naturally has a positive effect on technology trust and thus usage: The higher the expectations towards this usability, the lower the chances that a certain technology would include these aspects. Conversely, for the hypotheses from H2 to H6, a negative effect was not expected. In consequence, combining the finding of unexpected weight signs with insignificant weights between 0.06 and 0.02 allows reaching a conclusion with which to conclude that in light of these measurements, the hypotheses from H2 to H6 do not show significant effects towards technology trust. Furthermore, it is notable that the negative signs are connected with very low weights, therefore no indication of theoretical aberrations exist in this sense.

With respect to PLS-aided research in general, these empirical findings highlight the usefulness of conforming to a model development strategy instead of singlehandedly either accepting or rejecting a proposed construct structure: After a single reiteration of the full PLS model it can be predicted that one construct has a significant effect and four others might indicate a minor change on technology trust. While the five antecedents that are predicted to have an effect are undoubtedly more important for future research than those which do not, it is also beneficial to observe the reasons, why the other five failed to produce an effect towards technology trust. For formally estimating the validity of these empirical results from a theoretical perspective, the achieved result set for each antecedent are discussed next in contrast to the appropriate theoretical background covered in section 2. Furthermore, because of the predictive nature of this research, the theoretical framework is proposed to be kept as intact for allowing perhaps a wider study to take place in the future with similar initial stance.

5 DISCUSSION AND CONCLUSION

The key objectives of this research were to identify the gap between the current conceptual understanding of what antecedents affect technology trust as well as empirically validate both the importance and the relation of these constructs. The empirical findings discussed in section 4 highlighted interesting results regarding the contributions of the theorized technology trust antecedents. To conclude the research, it is first important to discuss the theoretical implications of these findings for linking them with the previously conducted research within the academic literature. Second, managerial implications are discussed to express, what aspects of the research could be applied within organizations that are currently experiencing difficulties in new technology implementations. Third, as the result set of this research is meant to be predictive, the suggestions for further research offer multiple points where the current knowledge of technology trust and its connection to increased technology usage could be widened.

5.1 Theoretical Implications

The underlying assumptions for this research were firstly that the relationship between technology trust and its antecedents can be approached by dividing the antecedents into social, institutional and technological dimensions. This relationship was proven to exist by detailing individual antecedents within each dimension: The antecedents were defined theoretically and their impact was measured empirically. The theoretical implications pull together these two aspects of theoretical and empirical knowledge by contrasting the findings to the origins of the antecedents. It is notable that the empirical findings indicate differing results in contrast to the theoretical background provided by the academic literature, as many of the theorized constructs were denied of being significant agents of technology trust. However, as the research strongly relies on a multidisciplinary research spanning through social sciences, organizational behavior and human-computer interaction, the measurements should always be observed with constructive criticism. Ergo, while the theoretical foundations of this research are strong, the empirical findings are an important addition as they give direction, offering points of emphasis for future research. Next, these findings are discussed within their respective dimensions in order to both clarify the key antecedents as well as to

discuss the relative importance of those antecedents that were not determined to be as significant with empirical analysis as the theory suggests.

5.1.1 Social Dimension

The empirical findings underline the importance of the *disposition to trust* antecedent with regard to the formation of technology trust. Results convey that when an individual has a strong commitment towards trusting in overall, it is very likely that he or she will be eager to engage in interacting with technology as well. However, when summarizing McKnight's (1998, see also Lippert & Swiercz 2005) original proposition for the model of initial formation of trust, the disposition to trust antecedent can be described as a summation of all individual experiences relating to trusting, including cultural and societal values. Ergo, it cannot be stated that the disposition to trust as such could be the only social trust tenet affecting technology trust even though the empirical findings indicate that. What can be stated is that no immediate direct relation is visible for any individual trust areas within the social dimension that could be purposefully increased for enhanced technology adoption experience. Thus, it should be noted that the social dimension of technology trust accounts for the individual's unaware conceptualization of trust and in case this trusting disposition accumulates on a high enough level, the likelihood of accepting new technology is high.

The empirical findings indicate that the *perceived trustworthiness*, *shared attributes* and *situational factors* antecedents do not directly contribute to technology trust. However, in addition to the notable finding of how an individual's overall perception of the trust concept significantly affects technology trust, a very interesting notion can be observed from the empirical validity of the social dimension antecedents: Since the disposition to trust was indicated as the sole antecedent within the social dimension that affects an individual's level of technology trust, the empirical findings somewhat question the validity of the media equation theory, discussed more elaborately in part 2.1.1. The results suggest that individuals do not knowingly concentrate on other social tenets of trust than their predetermined disposition to trust when forming an attitude towards technology usage. Although Clifford & Nass (1996) describe multiple tests, where people seemed to indicate similar social interaction elements towards machines than other people, the laboratory-based setting is, based on the results in this research, insufficient for making predictions of the real world. Although it was

not expected for many of the social antecedents to have a significant impact towards technology trust, some kind of suggestive relevance of the results would have been sufficient to provide a basis for the media equation's existence and immediate effect. As the perceived trustworthiness, shared attributes and situational factors antecedents were all expressing insignificant and negatively correlating relations to technology trust, a question arises whether the interaction of man and machine is not so straightforwardly socially justifiable after all.

5.1.2 Institutional Dimension

Out of the three technology trust antecedents within the institutional dimension, the *organizational encouragement* antecedent was the only one that was also deemed valid empirically in a predictive fashion. As organizational encouragement pertains to the notion on how individuals absorb influences within their immediate vicinity, this antecedent could also be utilized to the benefit of new technology introduction within organizations – As Rogers (1995) initially suggested, the effective utilization of opinion leaders, change agents and aides can lead to higher levels of positive perception towards new technology, and his proposition is also found applicable in the results of this research.

Moreover, organizational encouragement highlights the importance of managerial presence in enhancing technology trust. While having the power of making the technology adoption obligatory by enforcing the implementation through organizational policies (Venkatesh & Davis 2000), the encouragement can also be seen as a deeper mindset change in technology trust for the individuals in the organization without mandatory execution of new technology implementation. This approach, discussed in more detail by Creed & Miles (1996) is also backed up by this research, as the *power relations* antecedent was not included within those antecedents that affect technology trust. It is interesting to find that this accumulation of the different social influences that surround an individual's immediate vicinity do not significantly impact the individual views towards new technology. However, as this is an inherent implication of an individual, the reality for that same person may prove to be different: Both the social identity theory and the group value model propose that peers' and superiors' activities vastly affect individual behavior, even in case the individual would not testify correspondingly (Tajfel & Turner 1979, Lind & Tyler 1988).

Similarly to the inability of the power relations antecedent to affect technology trust, the *organizational structures* antecedent does not convey an impact. The reason for this could be a validation of Dodgson's (1993) proposition of hierarchical relationships being a somewhat artificial substitute to trusting in general. Kramer (1996) further elaborates the approach by stating that both trust and hierarchy are required to achieve fully functioning organizational relationships. However, while this statement has well-defined empirical evidence behind it, the empirical findings of this research point to the direction, or at least the individuals acting in the surveyed organization do not recognize that supervision, structure or hierarchy would give them additional reason to increase their level of technology trust. It is notable that this occurrence as such does not supersede Kramer's proposition, even though the findings point more to the direction of Dodgson's substitute theory of trust and hierarchy.

Although the power relations and organizational structures antecedents undoubtedly both have a significant effect on the overall perception of one's institutional surroundings, the organizational encouragement is clearly perceived as a way to increase the level of technology trust of individual employees. Consequently, the two other antecedents could perhaps be described as the indirectly affecting elements of the institutional dimension, the organizational encouragement having a more direct effect on technology trust.

5.1.3 Technological Dimension

All of the theorized three technology trust antecedents within the technological dimension were found to affect technology trust in a predictive sense; the combination of anticipated advantage, expectation of a positive usage experience as well as the individual understanding of having a sufficient skill set towards the technological advancement carry to increase technology trust. The *advantage to use* antecedent is formed from the internal motivators that allow the individual to expect that a more positive outcome will occur from using new technology that without it. Both Vessey (2006) and Goodhue et al. (2006) underline the importance of *fit* in its multiple forms as a personally important reason for using new technology: At best, utilizing technology has perceived benefits on both task level and cognitive level. It is noteworthy to mention that the external benefits from utilizing new technology are also part of the technology trust model and these benefits are included in the organizational encouragement antecedent that was also deemed as affecting technology trust.

In addition to the straightforward benefits resulting from using new technology it was found also that a required feature set of a given technology differs according to each individual's personal perspective: While an organization producing a certain technology might see their innovation's usability as being top-of-the-line, the actual users of that technology all form their own views using also other sources of information than those explicitly aimed to promote the usage of new technology. Moreover, the empirical findings indicate that the more individuals set expectations towards different aspects of usability of a technology, the more likely it is to have a low level of technology trust. Consequently, low set of expectations point to the direction that the particular individual is more open towards adopting the technology's usability tenets as a good practice, thus not deteriorating the individual's level of technology trust. It is notable to mention that as this *expectation of technology usability* was found to affect technology trust negatively, these expectations can therefore only diminish the technology trust accrued from other sources. Ergo, affecting to the set of expectations is the key to minimize that decrease from an organizational point of view.

The individual understanding of one's own capability to utilize new technology is likely to affect technology trust. The *perception of user skills* encompasses that specific skill set that can be accumulated from several different sources and experiences, thus this perception is a superset of all previous confrontations with what the user sees as technology. While the effect of receiving formal training is without a doubt an integral part of this superset, the value of training only partly corresponds to the totality of one's skills. Furthermore, as Lippert & Davis (2006) point out, the objective of all training should be targeted to produce long-term results instead of merely producing a set of guidelines for the current new technology in-hand.

5.2 Managerial Implications

The key objectives of this research were to identify what constructs technology trust is affected by and with what magnitude. The underlying reason for initiating this discussion arises however from a wider topic that continues to thrive within the contemporary academia, which is finding remedies for failing projects regarding technological implementations. As the institutional initiatives to deploy new technology are on the other hand conducted on a wide organizational scale, in the end they still require technology adoption from multiple individuals to attain the targeted performance increase. Ergo, while the theoretical findings of

this research already point out to some relevant findings from an organizational perspective, it is of paramount importance to propose steps for taking a more concrete approach for drawing more definite conclusions from the research results.

Disposition to trust was discovered to be the most important technology trust antecedent, having a significant effect to an individual's level of technology trust. One possible reason for the unacceptably high rate of failure in technological implementations could be due because organizations attempt to achieve benefits in a very short period of time – in fact, the implementations are most likely referred to as projects mainly because of the limitations in time, scope and budget. However, the findings indicate that individuals do not conduct assessments of benefits and costs with a similarly short timeframe: The individual disposition to trust was found out to be the most powerful technology trust antecedent of all constructs. This strongly indicates that organizations should take a more long-term view on their past projects regarding technological advancements and planned project roadmap to begin to harness an environment that encourages employees to trust technology and the organization behind it. All in all, quickly contributing to a direct change in a person's trusting disposition is out-of-reach for any entity, as it is a quest of long-term planning and realization to consistently increase the general reliability of the organization.

Predictively, organizational encouragement was also discovered to affect technology trust. It embeds the institutional support methods, processes and tools available for assisting in creating a positive environment and vision for individuals to begin to utilize new technology. In this sense, it is an antecedent that can be directly influenced by organizational authorities and thus the finding can be defined as important. However, the organizational encouragement also reflects to the individual perception of what the aforementioned assist activities are, therefore it is an imperative that the authoritative power understands and embraces the creation of a positive perception towards new technology. Active organizational involvement is required to heighten the individual perceptions regarding how the organization actually supports the usage and implementation of new technology.

It was very interesting to discover that while the previously discussed type of an organizational encouragement does impact technology trust, the direct utilization of organizational power does not incur an impact. This also brings about a very important notion on why technology trust is a key area of research in addition to technology acceptance: While a person with power can simply tell another to begin using a technology, the usage behavior is

not self-inflicted and cannot thus have long-term positive consequences: Encouragement arises from knowingly increasing the amount of positive expectations towards technology. Hence, this implication indicates that while managers do indeed have both direct and indirect impact on technology trust, it is not necessarily the authority that they possess that creates that impact but the strong commitment to continuously act as an example for their subordinates. Moreover, it is not only the immediate superior of a person who can make the decision to actively promote the usage of new technology; the perception that an organization's senior management encourages technology usage was also discovered to have a positively correlating relation to technology trust.

In addition to bringing the perception of future benefits from the long-term organizational perspective, the individuals also require reassurance of the more short-term benefits resulting from interacting with the new technology. However, these benefits ought not to be produced intentionally by the organization. This research implicates that the required short-term benefits arise from the individual needs of productivity increase. To quickly augment individual task performance, the technology has to firstly fit the purpose it is utilized for and secondly fit the individual interacting with the technology. When the individual either implicitly or explicitly perceives that the technology delivers on the need of finishing tasks more quickly and more easily, the advantage to use begins to affect technology trust. Organizational management staff should thus view new technology from three different angles when communicating a technology implementation decision to increase technology trust: First, the technology has to contribute to the organizational objective of increasing performance. Second, the technology also needs to deliver on an individual level, making it easier or faster to complete given tasks. Third, the usability of the technology should be claimed inviting enough to support the adoption decision even for the least technologically-savvy employee.

While the term usability mentioned above is undoubtedly a positive term to describe how easily approachable a particular technology is, the individual perceptions of what the level of usability for a given technology is are never standard. Especially for a technology that only a few people within an organization have actually observed in action, it might be very difficult for an individual to set straightforward expectations. Therefore the easiest solution is not necessarily to focus on selecting a technology with the most appealing user interface, as individuals see usability in its entirety, not merely as the visualization of data. Nevertheless, in addition to increasing the positive user perception of usability the other possibility is

naturally to conduct a thorough investigation of different technologies for accomplishing the current need. As Rogers (1995) has originally noted, in case a specific innovation is perceived to be advantageous, compatible, easy to adopt and the solution has both a possibility to test it out as well as see the gains in real life, the rate of adoption will be much higher than without these characteristics.

Regarding building an appropriate skill set for users to adopt technology more avidly, formal training is naturally the most obvious way for organizations to enrich the overall perception of user skills for increasing technology trust. More importantly, the findings of this research indicate that all training sessions targeted to teach technology-related skills also carry on to build the overall level of technology trust for individuals. This discovery calls for an understanding from organizational authorities that skill-building should be seen as an ongoing operation: While it is important to setup a training scheme whenever changes are introduced into the organizational tools and structures, purposefully setting an environment carries direct benefits. In case individuals can continuously attend to their technological training needs, it greatly increases the chances that the next time a strategically important, technology-enabled, performance-increase project is conducted, the higher level of technology trust allows for a much better outcome.

5.3 Suggestions for Further Research

Three main directions exist for extending the findings of this research: First, it is possible to validate the predictive analysis completed in this study with a confirmatory analysis to outline even a more robust model of technology trust and its antecedents. Secondly, the contemporary academia would benefit from research reaching to continue the research through empirical research on how the proposed managerial implications would impact technology trust creation for example in a case setting. Finally and most importantly, the technology trust-to-performance model outlined in part 2.4.2 sets a new basis for initiating the academic research from the perspective of how technology trust attributes to technology-enabled performance increase. Next, these three alternatives are discussed in greater detail, beginning with propositions regarding the appropriate research methodology for the future.

The methodological approach of this research was selected to be the partial least squares path analysis for three main reasons: First, since technology trust is a fairly new area of research,

the gathered theoretical background was not already readily established previously. Thus, more definite approaches such as covariance-based SEM (CBSEM) would have lacked the predictive capabilities PLS had in order to assist in establishing the theoretical foundations for conducting technology trust research. Second, PLS allowed analyzing data that was determined to be non-normal. Moreover, the selected research method also allowed a complex model to be constructed and measured even with a relatively small sample of 93 compared to the general CBSEM requirements of having at least a sample size of 200. However, even though the measurements conducted with PLS has indicated results of good validity for predictive purposes, in order to take into account the undoubtedly changing nature of technology trust research from the predictions into confirming stated theoretical fundaments, in the future it could be highly beneficial to switch from PLS to CBSEM. Given that the stricter set of assumptions of CBSEM could be met, the benefits of CBSEM over PLS would be first that CBSEM would allow for building indices of fit for more elaborate model validation (Hair et al. 2010). Moreover, SEM would allow for a more theoretically concise form of measurement for confirmatory purposes as each construct is assumed to correlate with one another that could better correspond to the nature of the constructs. This statement is made as all of the theorized constructs are part of an individual's social environment and thus they should not be researched as isolated entities. Last, there is some initial research already undertaken regarding technology trust with CBSEM: Both Li et al. (2008) as well as Lippert & Forman (2006) have indicated that CBSEM is soon to be the main research tool also for technology trust research.

In addition to consider a change of the research method, one useful area of advancing academic research of technology trust in the future would be to take a more detailed look at special kinds of applications, namely those that have been designed to communicate with the user in a more interactive way: In discussing the effect technology has made in social communications Rogers (1986, 4-5) states that "*interactivity* is the capability of new communications systems (usually containing a computer as one component) to 'talk back to' the user, almost like an individual participating in a conversation." He continues by reminding that all two-person information exchange cannot be considered as interactivity, nor can all two-way exchanges with technology be considered as interactive. Automated responses generated by a computer system cannot be interactive, as true interactivity always requires human attention in order to create the desired response. Therefore it is beneficial to note that even though interactivity as such is not a requirement for conducting successful technology

trust research, the studies relating to these kinds of relations with humans and advanced man-like applications would indeed pose an interesting continuance for expanding our current knowledge on human-computer interaction.

Being related to the previously discussed area of human-computer interaction, the final suggestion for further research proposes that the topic of people, trust and technology would also be studied from the viewpoint of increased performance: The theoretical framework of this research presents the trust-to-performance model as a foundation that could be utilized for ultimately discovering the relation between technology trust, technology acceptance and technology-enabled performance (see part 2.4.4). It is a generalization of several trust and technology acceptance frameworks, each having a somewhat limited approach in depicting the aforementioned totality. While this study concludes the initial section of the model, namely technology trust antecedents and technology trust, there is still a significant amount of research to be conducted for announcing, what is the quantifiable amount that technology trust contributes to technology-enabled performance? As this is naturally an academic objective of the model, the concrete managerial implication that the model calls for is to discover, what specific measures are most important within the realm of technology trust to increase the technology-enabled performance.

5.4 Limitations of Research

After suggesting areas of research where the research on technology trust and technology-enabled performance could be carried forward, it is beneficial to make a final assessment of the research limitations for confirming a solid foundation for future reference. It was noted in the introductory part of this study that a social sciences approach was taken to attain a holistic view on the contemporary trust research; therefore the general objective was to widen the scope of current technology trust research, not to focus on specific issues regarding technology trust with an information system sciences scope. This widened research area should be understood as being somewhat limiting in a sense, as discussion cannot thus be as thorough, nor can it be stated to produce such ground-breaking results as a more detail-oriented research might bring. Furthermore, the predetermined announcement of the social sciences approach has directed the fundamental justification of technology trust research towards social trust research, where the main interest lies in human behavior. Ergo, while the

scope should be seen both as valid and beneficial for technology trust research, it should be noteworthy that the more holistic view is taken upon trust, the more the results tend to be of general stature instead of pure concretism.

Regarding the methodological approach, the selection of partial least squares (PLS) as the research approach can either be seen as a limitation as such or as the only method that allowed for exactly this kind of study to be conducted. Although academically understood and utilized, PLS is not the most used approach for validating theoretical models. This is why the research was stated to act as a prediction for continuing the research in the future. For the purposes of this research, CBSEM was deemed infeasible to use because of the strict limits that it possesses relating to sample size and data normality. Furthermore, because of its purely confirmatory nature it is likely that CBSEM could have not produced such a easily conforming base of results for future research.

It is noteworthy to discuss a possible limitation of biased population as the surveyed population was specifically selected to be employees of a high-technology-related organization. One should keep in mind that a possible gender or age bias might have affected the results: As 69 percent of the research population was males, there is a slight chance of a gender bias, although it can be tentatively stated that a male-female ratio of 2:1 roughly corresponds to the employee gender distribution in the surveyed organization. This implies no high bias would exist regarding respondent gender. Similar kind of a ratio can also be stated to exist in the organization regarding age: 80% of the surveyed population was aged between 30 to 49 years that corresponds to the organization's employee age distribution. This again proposes that no significant bias for the younger- or older-than-average respondents existed.

Moreover, the justification for selecting an organization related to high-technology industry was to gather a dataset where the level of technology trust would be expectedly higher than on average. Moreover, beginning to conduct this kind of a fundamental analysis of a multi-disciplinary research area with fully non-technologically-biased population might have created possible problems in their understanding of how trust and technology could ever be discussed with a single term. User resistance of technology is the opposite technology acceptance and as this research was to conduct research regarding the latter, it was of high importance to initially select a population with stance towards acceptance more than resistance. After all it was very interesting to reveal that even within the highly technology-literate population, it was the individuals' initial tendency to trust other people that surpassed

even the technologically-oriented questions. This strongly suggests the purposeful selection of a high-technology organization as the expectedly biased survey population did not interfere but in fact even emphasized the results of the importance of the social dimension of trust in forming a positive trusting belief towards technological advancements.

Given that the research was done by a single person, there is a possibility that a personal bias has affected the research and the attained results. Regarding this topic it should be stated that this research has been conjured from a personal interest regarding trust formation and technology, thus the research objectives, the measurement methodology and the studied organization were all selected without external interference or study-related compensation. It is natural that due to this personal interest, a strong positive belief is reinforced in this study regarding the abilities that technological innovations assist individuals and organizations from simple tasks to extremely complex endeavors. For this reason, technology in this research is discussed on a positive note. Apart from this minor reflective stance towards technology, it can be stated that effort has been put to ensure that the research is both theoretically and empirically valid and that the research would bring real benefits to both the contemporary academia as well as for business practitioners.

5.5 Concluding Remarks

The primary research objective was to discover, what antecedents affect technology trust. It was found that the contemporary academia recognizes ten antecedents within three dimensions that are conceptualized to have an effect on technology trust. However, when conducting an empirical assessment of the theorized relationships it was found that out of the ten theorized antecedents only five were able to impose an effect on technology trust. These five technology trust antecedents were *disposition to trust*, *organizational encouragement*, *advantage to use*, *expectation of technology usability* and *perception of user skills*. Moreover, it was discovered that out of the five, the individual disposition to engage in a social trusting relationship affects the most, the four others accruing minor effects on technology trust. Based on the attained reliability measures as well as the relatively small sample size of 93, this finding can be considered to be predictive in nature. This means that while the results do present new theoretical and empirical information regarding the relational importance of technology trust antecedents, further study is proposed to be conducted for making the result

set definite and confirmed. The secondary research objective was to propose a conceptual model for outlining the relation of technology-enabled trust, technology acceptance and technology-enabled performance. Part 2.4 proposed a theoretical conceptualization of the model which can be utilized in future research touching upon these interrelating areas. All in all, it can be stated that both research objectives were reached with success.

In conclusion, organizations throughout the world have realized that technology can assist in many ways, thus both investments and expectations on implementing technological advancements has been on a continuous increase. Still it seems that technology-related projects are sometimes impervious to failure, even while the resources dedicated to the projects might well suffice. The findings of this study indicate that continuing the research on technology trust may yield significant results in suggesting concrete activities that could be done to make individuals commit to a long-term change of working methods, structures and tools. This research also suggests that to harness the power of technology trust, organizations should begin building a solid foundation of technology trust by actively encouraging the usage of new technology. Moreover, while technology trust is only one form of measure to assess an organization's trustworthiness, an overall organizational culture with impeccable integrity and reliability can only bring benefits for paving the way for success in the future.

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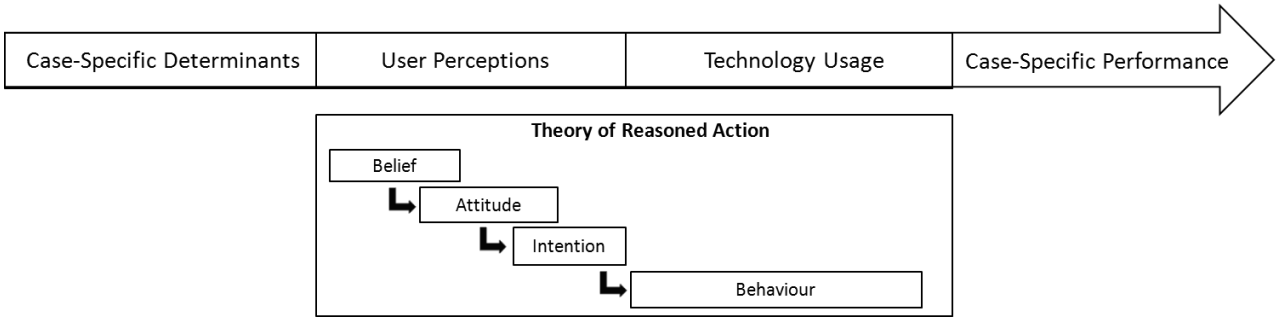
APPENDICES

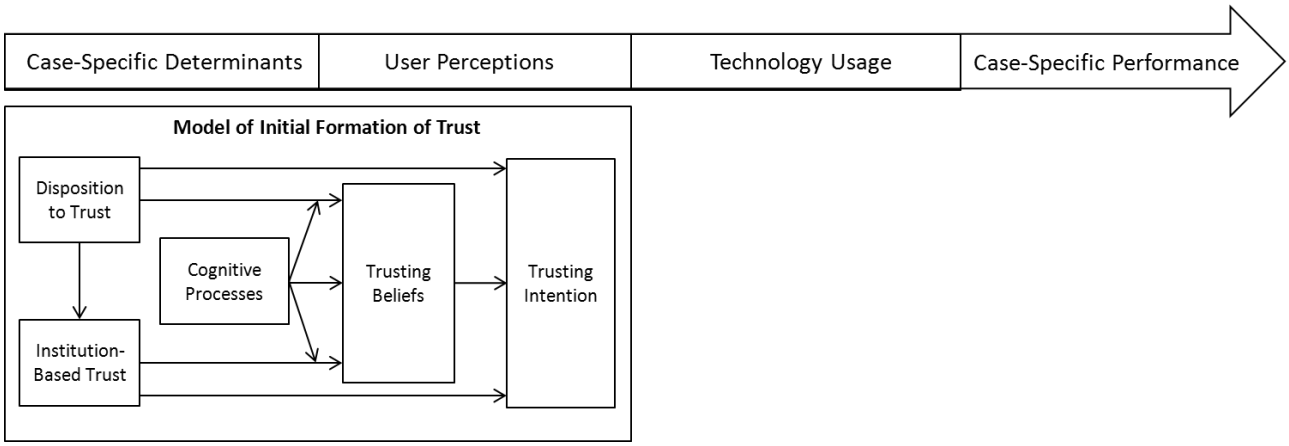
Appendix 1: Depiction of Relevant Theoretical Models with Perception-to-Performance Process (PPP).

a) Theory of Reasoned Action with PPP



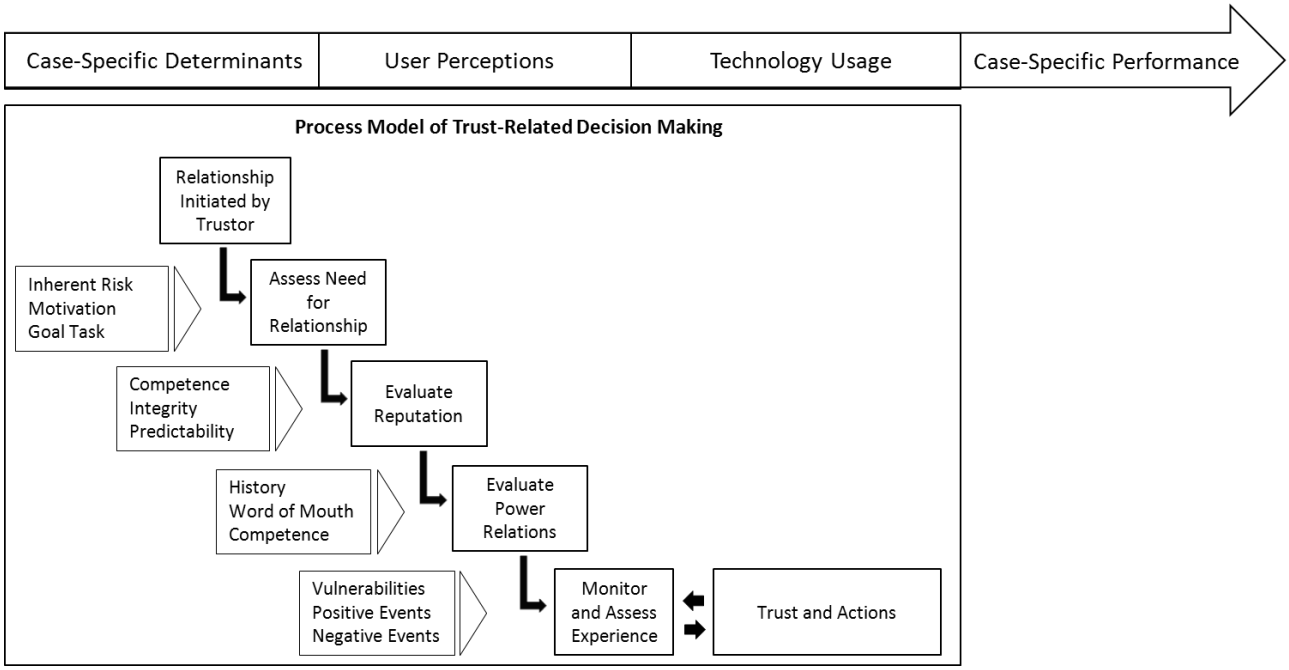
Source: Ajzen & Fishbein (1975), modified by author.

b) Model of Initial Formation of Trust with PPP



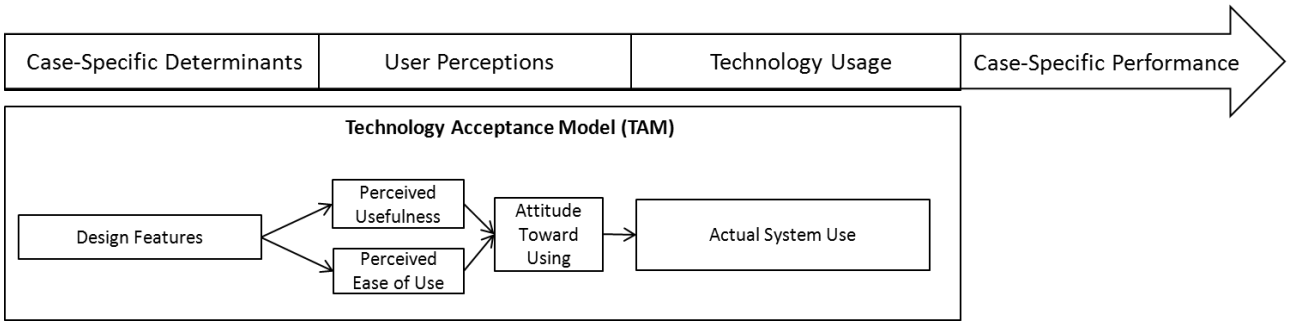
Source: McKnight (1998, 475), modified by author.

c) Process Model of Trust-Related Decision Making with PPP



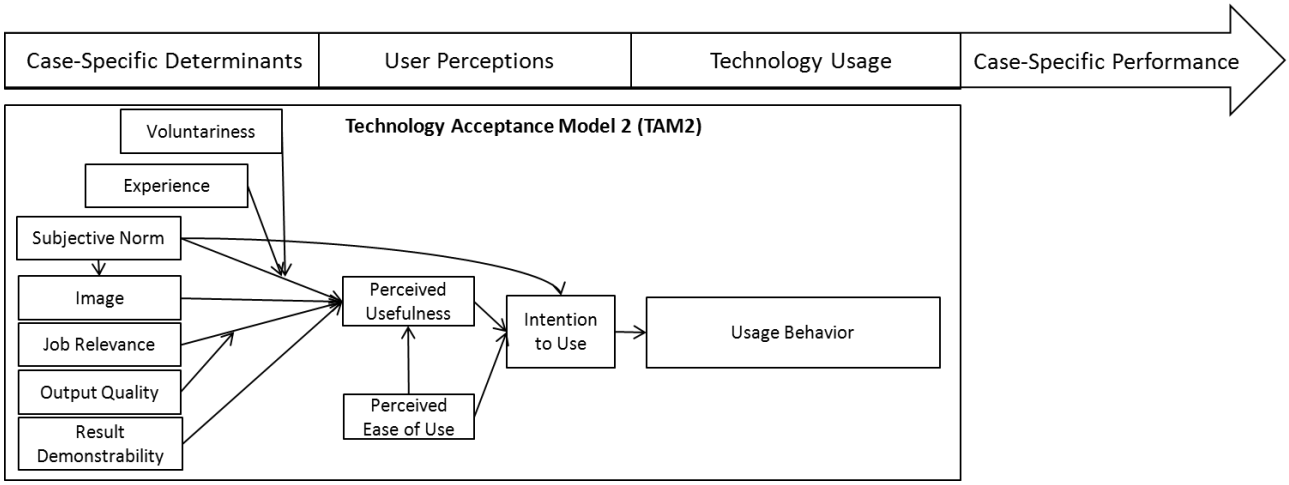
Source: Sutcliffe (2006, 7), modified by author.

d) Technology Acceptance Model with PPP



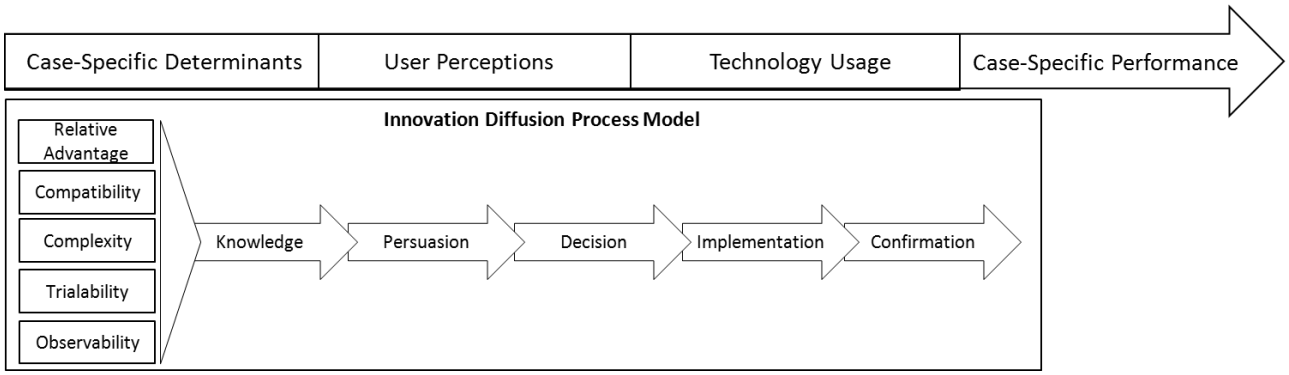
Source: Davis (1986), modified by author.

e) Technology Acceptance Model 2 with PPP



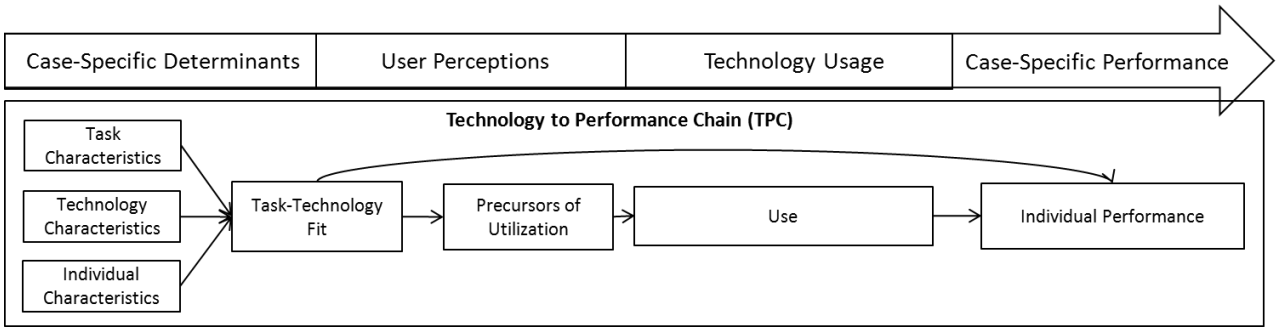
Source: Davis & Venkatesh (2000, 188) modified by author.

f) Innovation Diffusion Process Model with PPP



Source: Rogers (1995, 79), modified by author.

g) Technology to Performance Chain with PPP



Source: Goodhue & Thompson (1995, 214), modified by author.

Appendix 2: Technology Trust Survey Indicators and Questions

Latent Construct	Label	Question
Technology Trust	Y1	I like the idea of using new technology.
	Y2	I would have fun using new technology.
	Y3	New technology would make work more interesting.
	Y4	I look forward to those aspects of my job that would require me to use new technology.
Disposition to Trust	X1	I believe it is generally better to trust than not to trust.
	X2	I believe people in overall have a good will towards another.
	X3	I believe I have had more good than bad experiences resulting from trusting others.
	X4	I believe trusting others is part of my personality.
	X5	I believe it is common in my national culture to trust others.
Perceived Trustworthiness	X6	I think I trust those who seem to have a good will towards others.
	X7	I think I trust those who seem honest.
	X8	I think I trust those who seem to be skilled in their profession.
	X9	I think I trust those who seem to act in a predictable way.
	X10	I think I trust those who have a good reputation.
Situational Factors	X11	I believe specific situations exist that help me to trust others.
	X12	I believe in some situations trusting others is easier.
	X13	I believe situation has a strong effect on whether to trust others.
	X14	When I encounter difficult circumstances, trusting others does not worry or threaten me.
	X15	I believe I do not worry about risks when it comes to trusting.
Shared Attributes	X16	I think I trust those who have had similar experiences than myself.
	X17	I think I trust those who live by the same values than I do.
	X18	I think I trust those who have the same objectives than I do.
	X19	I think I would trust those who I assume I will work with in the future.
	X20	I think I trust some people only because I work with them.
Power Relations	X21	I believe people who influence my behavior think that I should use new technology.
	X22	I believe using new technology would make my coworkers perceive me as competent.
	X23	I believe I should use new technology because of the proportion of coworkers who use new technology.
	X24	I believe that there is a strong need for authority in our current civilization.
	X25	I believe that typically it is very easy for me to do what my superior asks me to.
Organizational Structures	X26	I think my organization acts in a very stable and predictable way.
	X27	I think my organization is a reliable company.
	X28	I think my organization is better off with its current hierarchical structure than without it.
	X29	I think having superiors really helps me to do my job better.
	X30	I think that because of the available documentation, I can trust my organization does what it is supposed to do.
Organizational Encouragement	X31	I believe using new technology would increase my chances of getting positively acknowledged at my organization.
	X32	I believe that in general, my organization would support the use of new technology.
	X33	I believe that at my organization, I could completely choose when to begin using new technology.
	X34	I believe that my organization's senior management would encourage workers to use new technology.
	X35	I believe that my supervisor would support of the use of new technology for my job.
Advantage to Use	X36	I believe using new technology would increase the quality of output on my job.
	X37	I believe using new technology would increase the effectiveness of performing job tasks.
	X38	I believe using new technology would increase the quantity of output for the same amount of effort.
	X39	I believe using new technology would increase my productivity.
	X40	I believe using new technology would improve the quality of the work I do.
Expectation of Technology Usability	X41	I think new technology should be very reliable for me to start using it.
	X42	I think new technology should be very secure for me to start using it.
	X43	I think new technology should be of very high quality for me to start using it.
	X44	I think there should be a possibility to try out new technology before using it for work.
	X45	I think new technology should be compatible with other technologies I use.
	X46	I think new technology should be very easy to use for me to start using it.
	X47	I think new technology should have a very low level of risk for me to start using it.
Perception of User Skills	X48	I believe learning to operate new technology would be easy for me.
	X49	I believe I would find it easy to get new technology to do what I want it to do.
	X50	I believe it would be easy for me to become skillful at using new technology.
	X51	I believe that given the resources and knowledge my organization offers to use new technology, it would be easy for me to use the system.
	X52	I believe guidance would be available to me start using new technology.

Appendix 3: Initial Data Analysis

	Basic Statistics			*Shapiro-Wilk*	
Label	**Mean**	**S. D.**	**Variance**	**W**	**p Value**
Y1	5,70	1,33	1,76	0,758	<0.0001
Y2	5,92	0,84	0,70	0,817	<0.0001
Y3	5,53	1,02	1,03	0,804	<0.0001
Y4	5,94	0,78	0,60	0,780	<0.0001
X1	5,87	0,85	0,72	0,779	<0.0001
X2	5,82	0,93	0,87	0,763	<0.0001
X3	5,60	1,20	1,44	0,790	<0.0001
X4	5,37	1,14	1,30	0,880	<0.0001
X5	5,55	1,20	1,45	0,840	<0.0001
X6	5,62	0,88	0,78	0,829	<0.0001
X7	5,16	1,48	2,20	0,879	<0.0001
X8	5,20	1,15	1,32	0,895	<0.0001
X9	5,56	1,12	1,25	0,802	<0.0001
X10	5,53	1,13	1,27	0,834	<0.0001
X11	5,32	1,22	1,48	0,903	<0.0001
X12	5,23	1,05	1,11	0,845	<0.0001
X13	4,73	1,39	1,94	0,887	<0.0001
X14	3,99	1,44	2,08	0,935	0,0002
X15	3,80	1,49	2,23	0,893	<0.0001
X16	4,89	1,42	2,01	0,878	<0.0001
X17	4,76	1,60	2,57	0,881	<0.0001
X18	5,32	1,09	1,18	0,843	<0.0001
X19	5,04	1,15	1,32	0,850	<0.0001
X20	6,42	0,84	0,70	0,698	<0.0001
X21	6,23	0,97	0,94	0,765	<0.0001
X22	6,28	0,86	0,75	0,767	<0.0001
X23	6,01	0,96	0,92	0,829	<0.0001
X24	5,55	1,06	1,12	0,870	<0.0001
X25	5,08	1,51	2,27	0,894	<0.0001
X26	5,31	1,11	1,24	0,895	<0.0001
X27	4,75	1,58	2,49	0,903	<0.0001
X28	4,61	1,49	2,22	0,926	<0.0001
X29	4,52	1,61	2,58	0,908	<0.0001
X30	5,72	1,11	1,23	0,848	<0.0001
X31	5,91	1,02	1,04	0,829	<0.0001
X32	5,63	1,10	1,21	0,867	<0.0001
X33	5,46	1,08	1,16	0,893	<0.0001
X34	5,65	0,93	0,86	0,875	<0.0001
X35	5,91	1,07	1,14	0,829	<0.0001
X36	5,12	1,44	2,06	0,891	<0.0001

	Basic Statistics			*Shapiro-Wilk*	
Label	**Mean**	**S. D.**	**Variance**	**W**	**p Value**
X37	5,65	0,93	0,86	0,881	<0.0001
X38	4,77	1,71	2,94	0,908	<0.0001
X39	5,73	1,01	1,02	0,824	<0.0001
X40	5,53	0,90	0,82	0,890	<0.0001
X41	4,59	1,58	2,51	0,871	<0.0001
X42	5,72	0,89	0,79	0,875	<0.0001
X43	5,46	1,12	1,25	0,894	<0.0001
X44	5,65	1,08	1,17	0,839	<0.0001
X45	5,17	1,36	1,84	0,811	<0.0001
X46	6,44	0,70	0,49	0,702	<0.0001
X47	6,06	0,92	0,84	0,747	<0.0001
X48	4,71	1,66	2,75	0,908	<0.0001
X49	4,77	1,34	1,79	0,922	<0.0001
X50	5,84	1,11	1,22	0,827	<0.0001
X51	5,02	1,34	1,80	0,858	<0.0001
X52	5,49	1,29	1,67	0,772	<0.0001