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Different ways to measure end-user information systems satisfaction in a large company

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TIIVISTELMÄ:
Tässä opinnäytetyössä tutkitaan erilaisia tapoja mitata loppukäyttäjien tyytyväisyyttä tietojärjestelmiin suuressa yrityksessä. Tarve tutkimukselle syntyi kohdeorganisaatiossa, jossa haluttiin selvittää, mitä kaikkia mahdollisuuksia on mitata loppukäyttäjien tyytyväisyyttä tietojärjestelmiin. Tutkimuksessa käytetään DeLonen ja McLeanin tietojärjestelmien menestysmallia ja teknologian hyväksymismallia teoreettisena perustana, jotta voidaan ymmärtää tekijöitä, jotka vaikuttavat käyttäjien tyytyväisyyteen.

Aikaisemmissa loppukäyttäjien tyytyväisyyttä koskevissa tutkimuksissa on suurelta osin keskitytty loppukäyttäjien tyytyväisyyteen vaikuttaviin ja sitä muokkaaviin eri tekijöihin. Näiden tutkimusten lisäksi ei ole tehty paljon tutkimusta siitä, miten tietojärjestelmätoimintojen tulisi mitata loppukäyttäjien tyytyväisyyttä ja miten eri menetelmät vaikuttavat mittaamiseen. Tämä johti tutkimuskysymykseen: "Mitä erilaisia menetelmiä yrityksillä on käytettävissään sisäisen loppukäyttäjätyytyväisyyden mittaamiseen tietojärjestelmiä kohtaan?". Tässä tutkimuksessa käytetään konstruktiivista menetelmää, jolla luodaan konstruktio erilaisille menetelmille, joilla mitataan loppukäyttäjien tyytyväisyyttä tietojärjestelmiin. Tutkija sai teoreettista ymmärrystä aiemmista tutkimuksista ja käytännön ymmärrystä ongelmista haastattelemalla kohdeyrityksen 19 tietotekniikan työntekijää.

Tutkimuksen tuloksena syntyi konstruktio, jossa luetellaan mahdolliset menetelmät loppukäyttäjien tietojärjestelmiin kohdistuvan tyytyväisyyden mittaamiseksi. Mukana ovat perinteisiksi koetut kyselylomakemuodot, tikettipohjainen kysely, ennakoiva automaattinen havainnointimenetelmä ja pienemmät kohdennetut kyselyt keskeisille käyttäjille. Konstruktion avulla yritykset voivat arvioida tietojärjestelmien loppukäyttäjien tyytyväisyyttä mittaavia menetelmiä omassa organisaatiossaan. Uudelleentutkimuskysymykseen vastataan konstruktiossa esitettyjen vaihtoehtojen ja niiden mittausongelmien avulla, joihin konstruktioon sisältyvillä menetelmillä vastataan. Lisäksi esitellään, mitä tietojärjestelmien menestys- ja teknologian hyväksymismallin tekijöitä voidaan mitata millä tahansa luetelluista menetelmistä.

Tutkimuksen rajoituksiin liittyy riski liikaa keskittymisestä kohdeorganisaatioon. Haastattelujen väliset ryhmät olivat melko pieniä. Aiheeseen liittyvää lisätutkimusta tarvitaan, jotta konstruktiota voidaan edelleen validoida ja, jotta voidaan tutkia loppukäyttäjien tyytyväisyyden mittausprosessin ja toteutuksen seuraavia vaiheita. Haastatteluissa havaittiin suuri kiinnostus loppukäyttäjien tyytyväisyyspalautteen käsittelyä kohtaan, minkä vuoksi lisätutkimusta olisi hyvä jatkaa.

AVAINSANAT: information systems, end-user satisfaction, survey, constructive research, measurement, large company

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ABSTRACT:
This thesis explores the different ways of measuring end-user satisfaction within an information system in a large company. The need for the study arose in the target organisation, where the aim was to find out what all the possibilities are to measure end-user satisfaction with information systems. The study uses the DeLone & McLean information systems success model and the Technology acceptance model as a theoretical basis to understand the factors that influence user satisfaction.

Previous research on end-user satisfaction has largely focused on the various factors that influence and shape end-user satisfaction. Beyond these studies, there has not been a huge amount of research on how information system functions should measure end-user satisfaction and how different methodologies influence the measurement. This led to the research question "What are the different methodologies available to companies to measure internal end-user satisfaction with information systems?" This study uses constructive methodology to create a construct for different methodologies for measuring end-user satisfaction with information systems. The researcher gained theoretical understanding from previous research and practical understanding of the problems by interviewing 19 IT employees of the target company. With these and innovation within a project group the research aimed to create the construct.

The resulting study produced a construction listing possible methodologies for measuring end-user satisfaction with information systems. Included are questionnaire formats perceived as traditional, a ticket-based survey, a proactive automatic observation method, and smaller focused surveys of key users. The construct allows platform companies to evaluate their methodologies for measuring information system end-user satisfaction within their own organizations. The research question is answered by the options presented by the construct and the measurement problems that the construct's methodologies address. It also presents what factors from the Information systems success- and Technology acceptance model can be measured using any of the listed methodologies.

Limitations of the study are the risk of being too focused on the target organization. The interview groups were quite small. Further research on the subject matter is required to further validate the construct and to research the next steps of end-user satisfaction measurement process and implementation. A high interest towards end-user satisfaction feedback processing was identified from the interviews that should warrant further research.

KEYWORDS: information systems, end-user satisfaction, survey, constructive research, measurement, large company

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Abbreviations

EUCS	End User computing satisfaction
IS	Information System
IT	Information Technology
ITSM	Information technology service management
TAM	Technology Acceptance Model
TAM2	Technology Acceptance Model 2
UIS	User information satisfaction
UMUX	Usability Metric for User Experience

1 Introduction

An IT organization is focused on improving the information systems available for the organization, support growth and make the organization function more efficiently. A key success factor for an effective Information System is the satisfaction of the users using it (Vaezi et al., 2016, p. 501). DeLone and McLean (1992, p. 62) also refer to user satisfaction as one of the key measurements of information systems success. Organizations face challenges in measuring the satisfaction of users within the Information System (IS). Without proper feedback from the users the organization cannot efficiently conduct improvements in areas viewed problematic by the users. Similarly, it has little visibility on other outcomes that user satisfaction has a positive effect. (Galletta & Lederer, 1989, p. 421).

This thesis will focus on a case study regarding a large industrial corporation and their IT end-user satisfaction measurement. The study will analyse the organizations ways of measuring their user's satisfaction and suggest solution options for the organization. The thesis research will be organized as a project team in the organization that consists of 2 employees on the organization side and the researcher. The research project will research and innovate on what different ways a company's information systems function can measure their end-user satisfaction towards information systems. The researcher will interview IT personnel within the company to gain deeper understanding from the practical point of view and what kind of feedback the IT area leads, and IT specialists need in their work.

The research methodology has been chosen to be a constructive research approach as the aim of this study is to innovate new solutions options. Constructive research approach suits this kind of innovative research goal well, due to combining both theoretical understanding with practical problems faced in organisations (Jones et al., 2023, p. 3065). The methodology does allow quite a bit of freedom for the innovations part and does combine very well the knowledge and expertise in the target organisation with the theoretical understanding of the researcher and previous theoretical research done.

Information systems satisfaction measurement doesn’t always solely focus on the technology at use in the organisation. The IS function is also considering their ways of working and processes that they employ and work with to be measurable factors affecting their users. Understanding of the area will be drawn from literature regarding IS success model (DeLone & McLean, 1992, p. 60) and Technology acceptance model (Davis et al., 1989; Venkatesh & Davis, 2000). There will also be a literature review towards ways to measure user Information Systems satisfaction. The gaps in research (Seddon et al., 1999; Vaezi et al., 2016; Mahmood et al., 2000) for IS end-user satisfactions are focused on the measurement options and the frequency of measurement events. What kind of tools does the IS function have to measure their end-user satisfaction and what should they consider when evaluating on different measurements? This creates the research question for this thesis, and it is “What kind of different measurement options do companies have to measure their internal end-user satisfaction towards information systems?”.

End-user satisfaction is formed out of multiple different factors and categories (Zviran & Erlich, 2003, p. 83—85). The difficulty of coming up with measurement methodologies and models is due to the ever-changing nature of information systems and the broadness of the subject matter. Some researchers like Doll and Torkzadeh (1988) focused their measurements on the actual systems used by end-users and its information output. Some viewpoints towards IS end-user satisfaction highlight the importance of organisational support internally and from the vendors used (Mahmood et al., 2000, p. 753). The different methodologies and models for measuring end-user satisfaction is discussed later in a more detailed level.

The research conducted through understanding the theoretical frameworks of user satisfaction, the interviews of IT personnel, and project discussions provide a solid foundation for practical understanding of the problems. The innovative construct of "Different ways to measure end-user satisfaction with information systems" is presented to and reviewed by a group of IT experts. The group validates the construct and gives their

feedback and thoughts on its components and the whole artefact. Conclusions for research are discussed based on the overall research project and the review discussions. Theoretical implications and discussions are touched upon at the end of the thesis. The findings of this research are compared and discussed based on previous research done in the field. Practical implications are given for practicioners of this field.

2 Theoretical framework

In order to understand the type of construct to create for the IT end-user satisfaction survey, one needs to understand the previous studies that have been conducted regarding information systems and User Acceptance Models. Especially in User Acceptance Model highlight underlining themes that guide organizations in their quest to improve the performance of the user via Information Systems (Davis et al., 1989, p. 986). How well are users perceiving and accepting new technologies to their use (Davis et al., 1989, p. 982)? The information systems success models by DeLone and McLean (1992) are also explored in this chapter.

2.1 Information systems success model

The Information Systems Success Model is a framework used to evaluate the effectiveness and performance of information systems within an organization. It was developed by DeLone and McLean in 1992 and later extended in 2003. The original idea was to study previous empirical studies conducted on different variables that make a successful Information System (IS). (DeLone & McLean, 1992, p. 62—63)

The original model of Information Systems Success Model included six categories that have been identified as major categories. These categories are system quality, information quality, use, user satisfaction, individual impact, and organizational impact (DeLone & McLean, 1992, p. 88). These six categories are not to be viewed as six independent success categories, rather a group of interdependent dimensions of a successful IS (DeLone & McLean, 1992, p. 87). The first iteration of IS Success model didn't necessarily create a comprehensive model that could be relied upon. Research suggested that it was a solid starting point on which to expand the research for variables to explain IS successes (DeLone & McLean, 1992, p. 88).

The need for a revised version was acknowledged by the researchers. Several references and new studies had been made in the ten years after the original IS Success model was

published. (DeLone & McLean, 2003, p. 10) The researchers made changes to the original model's categories. Organizational impact and individual impact were changed to a singular Net benefits DeLone & McLean, 2003, p. 19). Also Service Quality was added as a quality metric to measure the quality of *IT departments*, by comparing and evaluating user expectations and their view of the IT organization (Petter et al., 2008, p. 238). Depending on the system or systems that are analysed this quality metric can be higher or lower priority (DeLone & McLean, 2003, p. 18). Figure 1 illustrates the reformulated IS Success model with the new relationships between the categories. In this research we will focus on User satisfaction and the relationships it has with other categories alongside the entirety of information system success.

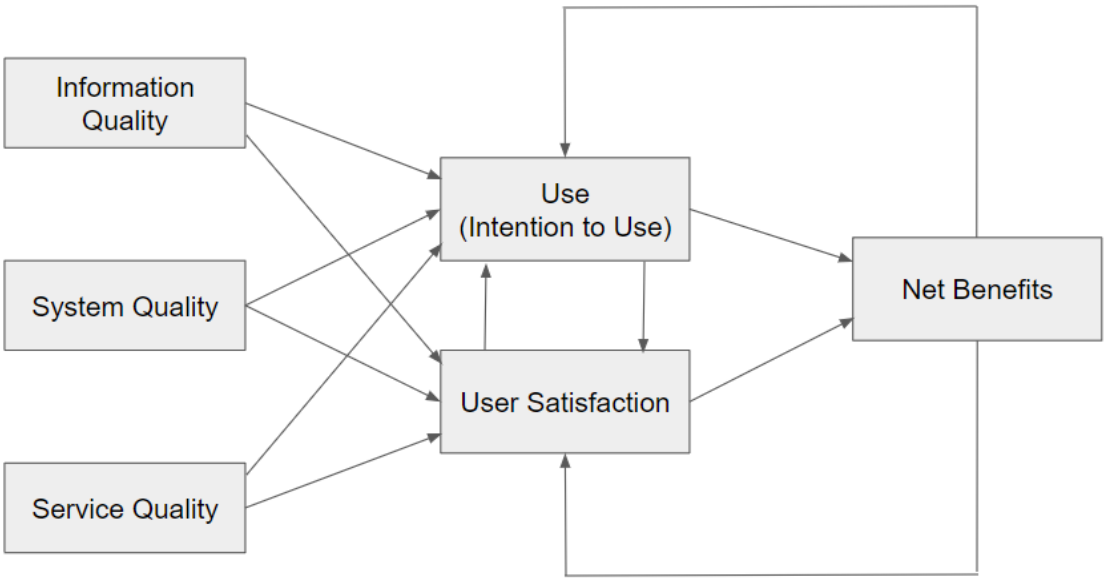


Figure 1. Updated D&M IS success model (DeLone & McLean, 2003, p. 24)

Petter along with DeLone and McLean made an updated literature review in 2008. In it they researched relationships between different categories in the IS Success model. User satisfaction effect on other categories and their effect on user satisfaction is a mixed bag as some relationships were proved to be fully positive and others mixed or not enough empirical test to confirm (Petter et al. 2008, p. 249 – 255). The strongest relationships that affected user satisfaction were system quality, information quality and net benefits

(Petter et al. 2008, p. 255). Surprisingly service quality had mixed support results from the literature review, but this is attributed largely to the broad nature of defining service quality (Petter et al. 2008, p. 246). *Intention to use* and *Use* effects on user satisfaction has not been easy to prove effective. The other way around is a moderate support from previous studies. User satisfaction has a positive impact on use. (Petter et al. 2008, p. 247) Bokhari and Rahat (2005) in their study tried to prove the relationship between Use and User satisfaction. The findings of the study are that there exists a moderate significant positive relationship between these two categories. Gelderman (1998, p. 16) proved in his research that user satisfaction has a significant relationship with organisational performance.

Seddon and Kiew (1996, p. 94) argue that DeLone and McLean's models Use should be replaced with Usefulness. They suggest that usefulness does impact user satisfaction, but not the other way around as much (1996, p. 95). Measuring IS success with Use is acceptable and doable when usage is entirely voluntary, but Usefulness does a better job of measuring IS Success when usage is made mandatory (Seddon & Kiew, 1996, p. 99).

There has been conflicts in research regarding measurement of information systems effectiveness and what are the theoretical backgrounds used to construct models for measuring it (Thong & Yap, 1996, p. 601). In Thong and Yap's (1996, p. 601) research it is discussed how information systems effectiveness research has been criticized the most for: questionable operationalizations of the user satisfaction construct, poor theoretical understanding of the user satisfaction construct, and misapplication of user satisfaction instruments. They also noted that researchers should revert to a more solid theoretical understanding of behavioural sciences and models when they are analysing user satisfaction and creating constructs for them (Thong & Yap, 1996, p. 607).

2.2 Technology acceptance model

User acceptance of information systems and technology is a very complex topic that has been extensively studied from the 80's all the way to nowadays (Venkatesh & Davis, 2000, p. 200). In the late 1980s Fred Davis developed the Technology Acceptance Model and it can be found in Figure 2. It's often used as a theory for understanding and predicting how people will receive and use a new technology. (Davis et al., 1989, p. 985) Davis et al. (1989, p. 985) describe the goal of the model is to provide reasons why for user behaviours across different information systems. It aims to be general enough to be used for broad range of end-user computing technologies and user populations (Davis et al., 1989, p. 985) The model argues that there are two particular factors that are of primary relevance for users accepting technologies (Davis et al., 1989, p. 985).

First part of the model is *System Design Features.* System Design Features refer to the attributes and characteristics of the technology itself. These are also referred to as external variables and the model seeks to mediate the relationship between these external variables and the Cognitive response of those. System Design Features affect the *Perceived Usefulness* and *Perceived Ease of Use.* (Legris, 2003, p. 191) Depending on the model system design features can also be described as external variables (Davis et al., 1989, p. 984).

External variables affect the user's perceived usefulness and ease of use of the system (Davis aet al., 1989, p. 985—986). Perceived ease of use is the user's judgement of how easy or convenient it is to use the technology. It includes factors such as the system's user interface, navigation, and the ease of performing tasks within the system. (Davis et al., 1989, p. 985) Perceived usefulness is the user's belief or perception of how the use of a particular technology will improve their job performance or make it easier for them to perform their tasks. It reflects the user's assessment of the tangible benefits they expect to gain from using the system. These variables are grouped into cognitive response. (Davis et al., 1989, p. 985)

The actual usage of the system is determined by the user's behavioural intention to Use it (Davis et al., 1989, p. 985). This is affected by the attitude toward using and directly from the perceived usefulness factor (Davis et al., 1989, p. 985—986). Perceived usefulness factor affecting behavioural intention to use is derived from the idea that within organisational settings, people form the intention towards usage of a system, by identifying that they are useful for their role and work tasks (Davis et al., 1989, p. 986).

The practical implications of the study of technology acceptance model naturally lean towards factors that predict and explain reasons why users wouldn't adopt a new system to use (Davis et al., 1989, p. 999). The result of the model suggests that ease of use is very important for end-users but doesn't tell the whole story. Users are tolerant of bad system design and bad usability if they can still access features that benefit their work and task completions very much. (Davis et al., 1989, p. 1000) It is important to note that peoples perceived usefulness and perceived ease of use are only their subjective appraisal of performance and effort (Davis et al., 1989, p. 985). Although objective ease of use measurement is still important and relevant to the user, but the subjective ease of use is more relevant when the user makes the decision to use the system (Davis, 1989, p. 323)

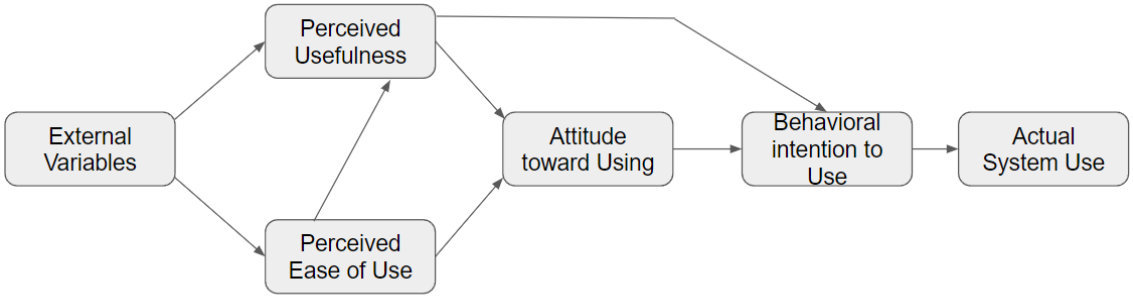


Figure 2. Technology Acceptance Model (TAM) (Davis et al., 1989, p. 985)

After a while in 2000's the Technology acceptance model (TAM) was revised into a new version by Venkatesh and Davis (2000, p. 186 —204). Further research showed the need for improvement in the old model. Extension of the Technology Acceptance Model

(TAM2) aimed to use TAM as a base and add additional elements to it (Venkatesh & Davis, 2000, p. 187). What categories affected Perceived usefulness was elaborated and expanded. Social influences (subjective norm, voluntariness, and image) were taken into consideration as well as cognitive instrumental processes (job relevance, output quality, result demonstrability and perceived ease of use) (Venkatesh & Davis, 2000, p. 198). In the study Venkatesh & Davis (2000, p. 198-199) discussed that subjective norm significantly influenced persons perceived usefulness in how they incorporate social influences into their own perception of usefulness as well as identification in which people use the system to gain status within peers. The more a person gained experience with the system the less they let relied on social influence in guiding their perceived usefulness (Venkatesh & Davis, 2000, p. 198—199). Experience has been found to impact a lot of variables more than the TAM2 model suggests (Venkatesh & Bala, 2008, p. 280). Experience also impacts the perceived usefulness and perceived ease of use factors (Venkatesh & Bala, p. 280).

The cognitive instrumental process was found to be consistent with TAM2. The quality of output had a significant impact on users' perception of job relevance (Venkatesh & Davis, 2000, p. 199). The quality of output had a significant impact on users' perception of job relevance (Venkatesh & Davis, 2000, p. 199). Users' perception of usefulness is influenced by how well their job goals match their cognitive abilities. Unlike social influence, which diminishes over time, cognitive instrumental process doesn't seem to diminish over time (Venkatesh & Davis, 2000, p. 199). TAM2 model is illustrated in Figure 3 below.

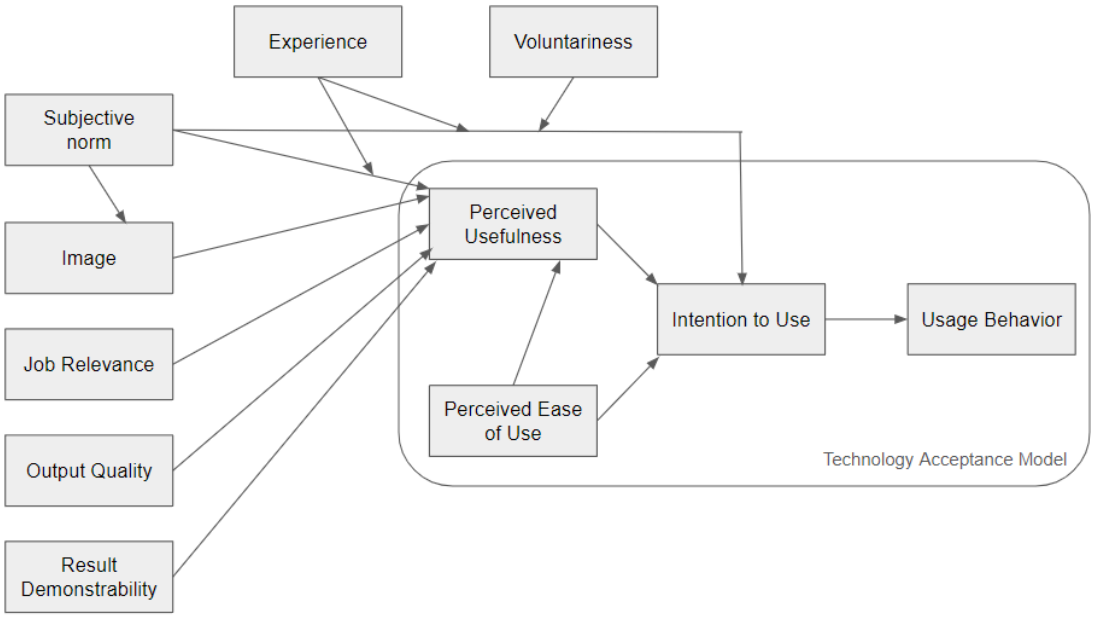


Figure 3. TAM2 extension of the technology acceptance model (Venkatesh & Davis, 2000, p. 186—204)

A big criticism of TAM models is that they often lack the explanatory power when used in mandated environments (Hwang, Al-Arabiat & Shin, 2016, p. 32). It's suggested that in mandated environments attitudes may not be in line with actual behaviour and use of the system, due to the mandatory nature (Hwang & et al, 2016. 32). Systems where use is voluntary the perception of usefulness affects the intention to use heavily and might leave the system completely out of use. In mandatory systems low perceived usefulness can have bigger effects overall. (Brown et al., 2017, p. 291)

Wixom and Todd (2005 p. 85) aimed to create a theoretical integration between user satisfaction research and Technology acceptance model in their research. User satisfaction has been primarily measured by different subsets of beliefs about specific components of a system, output information and other supporting features (Wixom & Todd, 2005, p. 87) It suggests that information and system quality which are objective-based beliefs and the satisfaction that is derived from them are object-based attitudes. These have been researched in the information systems satisfaction research extensively and other models such as Doll and Torkzadeh (1988) end-user computing satisfaction model

(Wixom & Todd, 2005, p. 87). Behavioural beliefs come from the Technology acceptance research (Davis et al., 1989) has focused on understanding behavioural beliefs and attitudes that are consisting of Attitude, ease of use, usefulness, and intention to use (Wixom & Todd, 2005, p 86—87). These influencing factors can be seen in Figure 4 below.

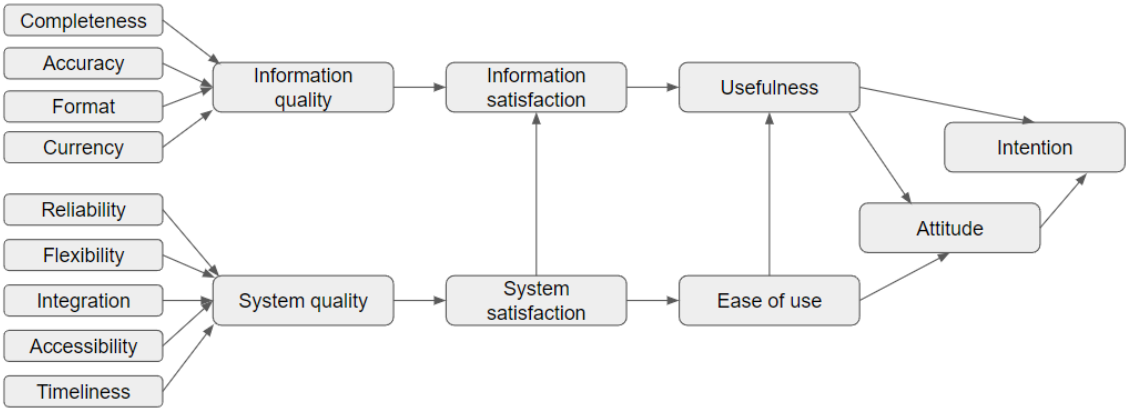


Figure 4. Proposed Technology acceptance and user satisfaction integrated model (Wixom & Todd, 2005, p. 90)

From the proposed integrated model by Wixom & Todd (2005) we can see what the impact of user satisfaction is towards the factors of technology acceptance model factors. The satisfaction does have an impact on ease of use and usefulness and in extension those two factors influence attitude and intention. IS success model by DeLone and McLean (2003, p.24) detail that Intention to use is influenced by the user satisfaction and actual use does impact the net benefits and user satisfaction of the information system. Researching TAM factors within the IS functions deployed applications could give more details into understanding different users' intentions to use and the attitude of these. Venkatesh and Davis (2000, p. 188) TAM2 model gives us a platform to evaluate the adoption of applications and what the factors are that affect them. These could be used in user satisfaction measurement to clearly understand Usage behaviour and intention to use. Even if a system is mandatory to use the usage is evaluated at some level of the organisation and a decision is made to keep the system in use or not (DeLone & McLean, 2003, p. 16—17)

3 Information systems user satisfaction

Knowledge of factors affecting user satisfaction for information systems helps in understanding the category at large. End user satisfaction can be described, as follows:

“End user satisfaction is a perceptual or subjective measure of system success, serving as a substitute for objective determinants of information systems effectiveness. (Shaw, Lee-Partidge & Ang, 2003, p. 2)”

Understanding user satisfaction and gaining knowledge on how to measure it is the aim of this chapter. It is split into two parts which aim to review theoretical implications and what practical implementations are to be found. There are some research gaps that are left out from the user satisfaction research that will be discussed.

3.1 Prior research

In the beginning User satisfaction was researched by looking into what marketing research has been researching about satisfaction (Vaezi, et al., 2016, p. 503). Early research was quite literal on the meaning of satisfaction and its attributes. Behavioral science has also played a key role in shaping the studies and understanding of satisfaction with consideration of favourable and unfavourable responses to satisfaction. (Vaezi, et al., 2016, p. 503)

Most studies on user satisfaction take an outcome-oriented approach, focusing on measures of satisfaction judgments and the factors that contribute to or are impacted by these judgments (Vaezi, et al., 2016, p. 505). Information systems are rarely simple products or services. This causes the user to be more or less satisfied with different objects within the Information systems. The overall satisfaction judgement would take shape from a sum of its IT product parts (i.e., support personnel, quality of hardware, ease of use of systems and information quality) (Vaezi, et al., 2016, p. 506).

User satisfaction was studied by Doll and Torkzadeh (1988) with the angle of end-user computing satisfaction. The end-user concept was in a breakthrough phase at that moment and more research on its success factors was needed (Doll & Torkzadeh, 1988, p. 259). They (1988, p. 259) described the ideal scenario for evaluating the end user computing would be on the basis of use in decision making and the resulting productivity and/or competitive advantage. Doll and Torkzadeh (1988) created a 12-item instrument that could be used to evaluate end-user applications. Their 12-items were derived from 5 categories: "Content, accuracy, format, ease of use, and timeliness" with detailed questions for each category. These items and categories can be found in the Figure 5 below. The model was found to apply for all kinds of applications due to the general nature of the survey (Doll & Torkzadeh, 1988, p. 270). It does not feature services or any factors outside the applications sphere of information systems or end-user computing that can be found in the modern workspace.

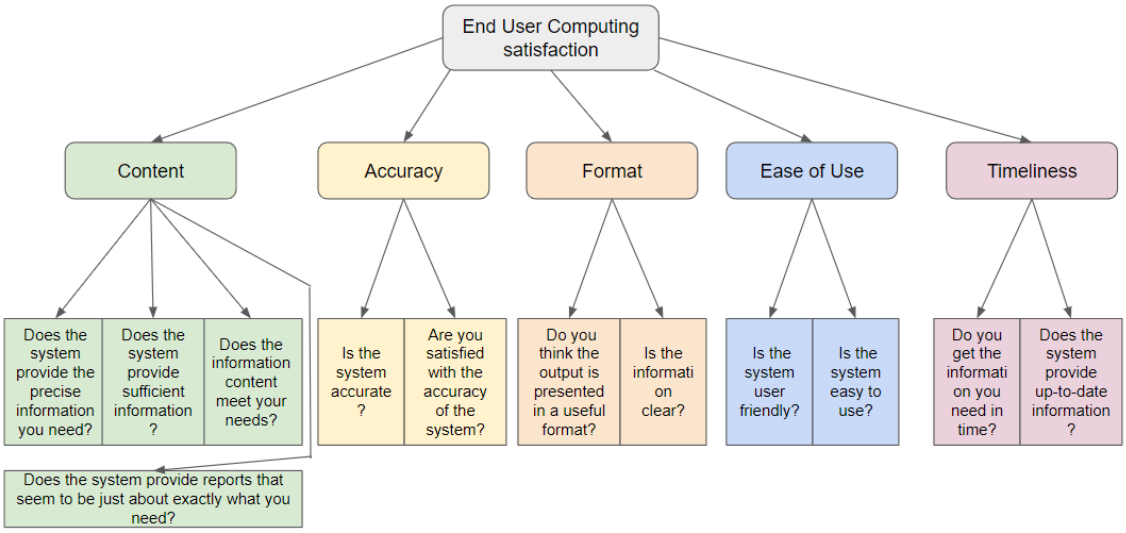


Figure 5. End User computing satisfaction measurement model (Doll & Torkzadeh, 1988, p. 268).

Etezadi-Amoli and Ferhoomand (1996) research took end-user computing satisfaction and wanted to create a structural model for measuring it using 2 larger categories modelled after attitudes from the user and performance related measures. In their research they identified six categories related to user attitudes: Documentation, ease of use, functionality of system, quality of output, support, and security (Etezadi-Amoli &

Ferhoomand, 1996, p. 69). It was considered important to measure user's viewpoint on the performance of the systems, as the systems performance is best analysed by the user based on the impact it has on their own work performance (Etezadi-Amoli & Ferhoomand, 1996, p. 66). The performance related questions presented to the users are only 4 opposed to the 27 in the user's attitude category. These four items are according to Etezadi-Amoli and Ferhoomand (1996, p. 67): improving the user's quality of work, making the end user's job easier, saving the end user time, and helping fulfil the needs and requirements of the end user's job.

Ives, Olson and Baroudi (1983) laid the groundwork for the User Information Satisfaction construct (UIS). He (1983, p. 785) defined UIS as "UIS is defined as the extent to which users believe the information system available to them meets their information requirements.". The study arguments that system usage of a system can be used to evaluate success but may not be recorded and kept track by the organization, thus reducing its value to research (Ives, et al., 1983, p. 786). It is also stated that low satisfaction towards information will reduce the usage of the system in a voluntary environment. The actual measurement model created by Ives et. al (1983, p. 792—793) is a 37-question questionnaire that aims to measure management information systems and go into details of the data and systems they use. The models (1983, p. 792) themes range from assessing user's skills and understanding of the systems, to technical functions output and stability of the systems, and the support given in the form of trainings and organisational support.

UIS measures have been criticized due to bad reliability and suggestions that global measurements for satisfaction taken from marketing would be more accurate (Vaezi, et al., 2016, p. 507). Galletta and Leder (1989, p. 422—424) study was cautious on the UIS instrument created namely the unknown factor of how the user approaches the survey and its's scale. Another is the unknown factor of user's inability to fully grasp the question asked or is in too much of a hurry to answer. To these problems Galletta and Leder (1989, p. 422—424) suggested that a mitigating format would be to increase the number of ways one question is asked from the user. Increasing the number of questions could

also theoretically increase the reliability of the measurement, but this is hard to prove, and the more questions you make the harder it becomes to interpret the results into anything meaningful.

To combat the previously mentioned problems Galletta and Leder (1989, p. 434) suggested that practitioners consider the surroundings of the users answering their survey questions. Not relevant information or events might have an impact on the user's view even though nothing has changed in the actual product or processes. Survey organisers might want to start their measurements by giving the users more general summary questions to find wider problem areas. Then delve deeper into those problems with case-by-case or sample basis using open-ended questions or interviews (Galletta & Leder, 1989, p. 434).

The need for creating a tool for measuring computer user satisfaction was acknowledged in Bailey's and Pearson's (1983) research. They wanted to create a construct to measure users based on adjectives. People are more likely to use adjectives to explain their thoughts and perceptions on the activities they face in daily life (Bailey & Pearson, 1983, p. 533). The users were also able to rate the importance of the question at hand to their work. The survey consisted of 38 question categories with four adjectives vs. adjectives questions in those categories (Bailey & Pearson, 1983, p. 532). The adjectives could be for the "Integration of systems: The ability of systems to communicate/transmit data between systems servicing different functional areas." question: "complete vs incomplete", "sufficient vs insufficient", "successful vs unsuccessful", "good vs bad" (Bailey & Pearson 1983, p. 543)

The model questionnaire also included a question asking the user to self-rank the importance of the factor relative to their own satisfaction (Bailey & Pearson, 1983, p. 532). The most important and least important factors are visualized in Table 1. According to the users the most important factors were: accuracy of the output information, reliability as in consistency and dependability, timeliness as in the availability of the information at

a time suitable for its use, relevancy which is described as the degree of match between users wants or needs and what is provided by information systems, and finally the users confidence and certainty of the system at hand (Bailey & Pearson, 1983, p. 540—542)

Table 1. Five most important and five least important factors (Bailey & Pearson, 1983, p. 533)

Most Important	Least important
1. Accuracy	1. Feeling of control
2. Reliability	2. Volume of output
3. Timeliness	3. Vendor support
4. Relevancy	4. Degree of training
5. Confidence in System	5. Organisational position of EDP

Some measurements of information systems effectiveness cover a larger number of factors. Miller and Doyle (1987, p. 108) developed an extensive instrument utilizing 38 items derived from another research and used it in the financial sector. The research construction was divided into 7 different factors: Characteristics of conventional systems, strategic measurement issues, user involvement, responsiveness to new system's needs, end user computing, IS staff quality, and reliability of service (Miller & Doyle, 1987, p. 110). What we can derive from the study is how they used user satisfaction and factors affecting it to evaluate the overall information systems effectiveness. Miller and Doyle (1987, p. 116) gave general guidance list to companies based on their research and measurement instrument and created a list of recommended approach:

1. Assess the level of information systems performance using the given instrument.
2. Derive performance and importance ratings for each of the underlying factors determined in this article.
3. Correlate performance with importance ratings.
4. If necessary, refocus information systems efforts in line with the findings, establishing specific priorities accordingly.

5. Review the effectiveness of the IS function on an on-going basis, informing both DP and users of shifts in perceptions.

One way to measure user satisfaction is to look at top management. Management Information Systems and the satisfaction top management has for their information systems department (Guimaraes & Gupta, 1988, p. 18 – 19). The questions focused on very top-down view of the departments ways of working and quality of output (Guimaraes & Gupta, 1988, p. 19) The 5 major categories in the 19 questions asked were: relations with other departments, relations with top management, technical image, service quality, Economics or cost/benefit to organization.

Information systems studies have researched IT end-user satisfaction in a very scattered way. The nature of research has been that researchers have focused on very specific attributes and focused on its effectiveness to end-user satisfaction. This increases the value of literature reviews of the subject as a whole (Mahmood, et. al., 2000, p. 752). The wealth of research done can be summarized into a well-defined model that includes three major categories affecting IT end-user satisfaction (Mahmood, et. al., 2000, p. 753). The research (2000) suggests that these main categories are perceived benefits, user background, and organizational support.

Mahmood, et. al. (2000, p. 753) highlighted that the three main categories are affected by three other types of variables. User expectations, ease of use, and perceived usefulness all affect Perceived benefits. User attitude towards IS, Organizational support, and perceived attitude of top management all have impact on the Organizational support variable. User background is affected by user experience, user skills, and User involvement in system development. These are highlighted in the Figure 6 (Mahmood, 2000).

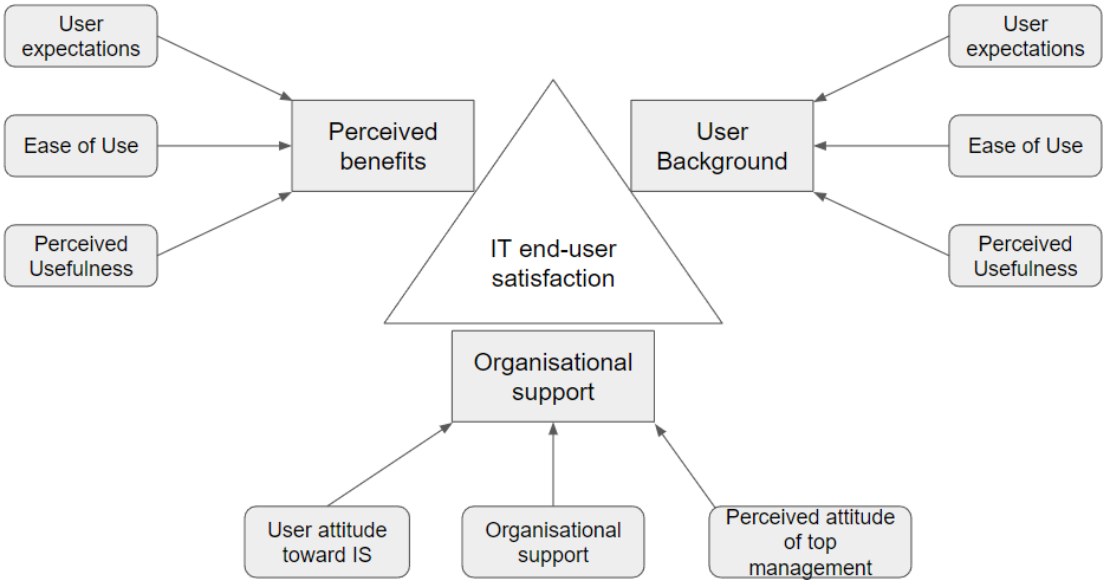


Figure 6. Mahmood proposed research model for IT end-user satisfaction (Mahmood, 2000, p. 76)

Out of all the categories researched in Mahmoods (2000, p. 766) research the most effective factor for user satisfaction was User involvement in system development. User involvement in system development also has an impact on system usage (Baroudi et al., 1986, p. 236) Ease of use and user's skills were surprisingly the least effective. Information systems that target first and foremost the users specific job tasks and are most efficient in gaining user satisfaction (Mahmood et. al, 2000, p. 767). The ranking of the attributes in impact they have on end-user satisfaction can be found in Table 2.

Table 2. Effectiveness of factors towards user satisfaction. (derived from Mahmood et al., 2000, p.766)

Rank	Factor
1	User Involvement in system development
2	Perceived usefulness
3	User experience
4	Organizational support
5	User attitude toward information systems
6	Perceived attitude of top management toward the project
7	User expectations
8	User skills
9	Ease of use

Measuring user information satisfaction is not always easy and poses many problems (Galletta & Lederer, 1989, p. 422—423). Problems rise when a respondent answers a subjective questionnaire item with a very unknown expectation. This becomes hard to compare results with another subjective respondent. Likert-type scales also face a challenge in interpreting meanings of adjective pairs consistently. (Galletta & Lederer, 1989, p. 422—423) Galletta's study (1989) provided some criticism of widely used User information satisfaction (UIS) measurements and the questionnaires included in the model. His (1989, p. 433) research highlighted the problems that detailed questionnaires were not in fact as consistent as previously thought. The study (1989, p. 433) suggested that broader questions were more consistent and suggested more research on larger scale UIS. For practical purposes Galletta and Lederer (1989, p. 434) want to emphasize that the measurer of UIS must identify their goal for the measurement of satisfaction first before any other considerations.

Evaluating the quality of an information system and the service provided is often a key factor in determining IS success. Taking into consideration both IS users and IS professionals evaluations help build a whole picture of IS service performance (Jiang, et. al., 2001, p. 499). The research done by Jiang (2001 p. 505) highlight the need of involving IS staff into evaluating the performance of their service. 360-degree feedback is

recommended, but the results suggested that different kind of evaluation criteria between the groups can lead to a disconnect between IS users and IS staff feedback (Jiang, et. al., 2001, p. 505).

In its literature review Vaezi, et al. (2016, p. 523) acknowledged that there is a lack of research and understanding how User satisfaction impacts outcomes for entire organization. The focus has been on individual level outcomes and net positives, but how well it translates beyond that is not that well known. They suggested that more research to be done on the factors that could bridge the gap between individual- and organization level for user satisfaction.

Au and Ngai (2008) in their research aims to expand the understanding of the formation of end user satisfaction (EUS). They used three previously identified theories of motivation expectation theory, needs theory, and equity theory. The employee has a set of expectations that they have about a current or new information system which creates the expectation theory and the user satisfaction that is influenced by it (Au & Ngai, 2008, p. 46). The needs theory expects the users to have needs that they are trying to fulfil with the use of products which in this case are the information systems (Au & Ngai, 2008, p. 45—46). The equity theory suggests that the user will view everything through the exchange of inputs to the system and the evaluate the output given from the information system (Au & Ngai, 2008, p. 46). Naturally the performance of the IS heavily influences this factor.

When the researchers tested their model (Au & Ngai, 2008, p. 53—54) with the target corporations they found that IS performance had the highest impact of them all towards end user satisfaction. It implies that the information system in use simply must work and perform sufficiently, and the users are given good support services. The equitable exchange between the employee and the task at hand has a significant impact on end user IS satisfaction. Meaning the user will take into consideration the required inputs into the system and what the perceived value outputted towards their work. Social factors also

seemed to have an impact on generating user satisfaction in similar ways Venkatesh and Davis (2000, p. 198—199) highlighted in their Technology acceptance model 2.

Support services have been suggested to affect end-user satisfaction in DeLone and McLean (2003) and it has been researched in multiple studies. Shaw, DeLone and Niederman (2002) conducted empirical research of sources of dissatisfaction in support services for end-users. Their research focused on support services and from the service quality model perspective (SERVQUAL). Measuring service quality gaps within information systems support would yield factors that negatively affect end-user satisfaction (Shaw et al., 2002, p. 53). Listed service quality gaps that would affect end-user satisfaction were: IS staff response time, staff technical competence, software upgrades, ease of access to computing, documentation to support training, cost effectiveness of systems, user understanding, and data security and privacy (Shaw et al., 2002, p. 53). The main findings of their study were listed as (Shaw et al., 2002, p. 53—54):

1. Software upgrades, staff response time, and documentation of training are support factors that likely influence user satisfaction.
2. Different support factors impact user satisfaction for different user groups. The aim of improving user satisfaction should focus on understanding the user group level and not treat the whole population the same.
3. The combination of service quality measures with user satisfaction measures provides a more comprehensive understanding of end-user support.

Information security is a hugely important area of information systems and organisations in general (Montesdioca & Maçada, 2015, p. 267). Tightening the restrictions based on information security policies can have a negative impact on user satisfaction, if the users don’t necessarily understand the benefits that come from safe practices and the risks that follow, if the safety policies are not followed (Montesdioca & Maçada, 2015, p. 270). User dissatisfaction towards information security practices can lead to heightened risks

of information security leaks and attacks from different threats (Montesdioca & Maçada, 2015, p. 270).

One example of surveying technology within a company can be found in Farzadmehr et al. (2023) research. In this research (2023) they surveyed the company stakeholders on their opinion on artificial intelligence projects. The main themes surveyed were preconditions of the respondents on the topic, perceived usefulness of the solutions, opinions on strategy, important stakeholders, and willingness to share data in AI projects (Farzadmehr et al., 2023, p. 16—19). The big lessons learned from the research was that a survey might not fully encompass detailed stakeholder opinions on technology and more detailed interviews and further research is needed (Farzadmehr et al., 2023, p. 21—22).

3.2 Gaps left out of research

User satisfaction in information systems has been extensively studied in the late 1900's and early 2000's (Zviran & Ehrlich, 2003). The need for measuring the user satisfaction is well noted in these periods and research have produced several models on how to measure the user satisfaction. What has been left out of previous studies and what factors haven't been explored yet?

Zviran and Ehrlich (2003) review of measuring IS user satisfaction gives a rundown of all the main studies done up until 2003. Questionnaires pointed towards users or managers in organizations dominate the research (Zviran & Ehrlich, 2003, p. 89—92). There seems to be a total lack of other ways of measuring satisfaction. Seddon et. al (1999, p. 19) suggested that an ever-changing environment such as information systems with multitude of stakeholders there is a need for multiple ways of measuring. Short form Pulse surveys are increasingly becoming more common in organisations to measure employee engagement and employee satisfaction (Garg, et. al., 2021, p. 2).

With the rise of easy-to-use mobile applications in people's daily lives (Wang, et. al., 2016, p. 53) one must question the 2024's users preferences compared to the models created

in the 1980's and 1990's. Doll (1988) did include ease of use in his EUCS (end user computing satisfaction) measurement construction however, Davis (1987) technology acceptance model did not put much weight on ease of use being a significant part of perceived usefulness and intention to use.

Current research towards IS user satisfaction appears to lack completely a short Pulse format used in employee engagement measurements. A short format survey conducted multiple times per year to get a feel of the "pulse of the organisation" (Kwon et al., 2024, p. 180), is lacking in research. Can this kind of format be used for measuring IS user satisfaction and what kind of benefits there can be drawn from it?

One factor that has been brought up in the discussion with the target company regarding measurement of IS satisfaction, is the frequency of surveys during the year. How much measurement and how often should the employees be surveyed? Often the research papers validate existing models or try and create new models or constructions to better measure the factors affecting the IS satisfaction for example the Doll and Torkzadeh measurement of end user computing (1988). What is missing from research done are the factors and categories affecting the frequency of surveys and what should be the targeted amount. The dangers of mass surveying on the web overwhelming even a quality crafted survey was acknowledged by Couper (2000, p. 465) in his research regarding web surveys approaches and issues. These topics have however not been expanded in the realm of IS satisfaction research.

Looking at the research done for information systems user satisfaction there seems to be lacking practical research done in creating valuable implications for organizations on different ways on how to measure user satisfaction. Research work has been successful in creating models for creating satisfaction measurement surveys for organisations, but the focus has been on actual survey questions and factors affecting the user satisfaction. There is a lack of managerial implications on what else to consider for the measurement processes and frequencies.

There is also a lack of understanding of what measurement processes are involved in producing and running a survey format. Is it enough to create a model and run it every year? What intervals should the survey be updated and what does it imply for the trends gathered from the previous surveys? Should there be understanding of what is the capacity of the organization to perform based on the feedback given?

The research question for this thesis is what kind of different measurement options do companies have to measure their internal end-user satisfaction towards information systems? The measurements are evaluated and weighted in comparison to each other.

3.3 Practical existing measurement applications

When an organisation is looking for implementing measurements for user satisfaction in their information systems, they need concrete tools and processes for the measurement construction. As this research aims to evaluate development opportunities for IS user satisfaction measurements it is important to look at what the current market is offering as tools and services for measurement of IS user satisfaction.

At no point in history have organisations had so many ways to measure and evaluate their employees and tools (Burnet & Lisk, 2019, p. 108). One thing that has become a very hot topic in the employee engagement measurement is the Pulse format (Welbourne, 2016, p. 33). A short and focused survey that aims to measure employee engagement at that current moment is found to be a very effective way to measure and allow the organisation to be kept in the loop on the current “pulse” of employees (Welbourne, 2016, p. 33). Burnet and Lisk research (2019) on the future of digital tools for employee engagement looks at practical questions and problems. As highlighted in the previous chapter this kind of research is lacking from the information systems field of study. Can we draw some parallels between employee engagement- and IS user satisfaction measurements? At the end of the day in both cases the measurement target is the employee of the organisation.

The pulse surveys according to Garg, Kiwelekar and Netak's research (2021, p. 4) are frequent and short survey's that are created with one or two questions at a time. They are then sent and asked from the employees much more frequently than a large annual survey. The accuracy of interpreting engagement results can be affected by various workplace and individual factors that fluctuate over time. Their research suggest that organisations are adopting this method in increasingly faster rate.

The downside from a jungle of frequent short-term surveys sent and collected is the amount of data gathered and processed (Garg, Kiwelekar & Netak, 2021, p. 4). The volume of information gathered blurs the possibility of creating actionable items from it (Garg, et. al., 2021, p. 4). There is a danger of gathering a lot of data and not being able to do anything with it (Burnett & Lisk, 2019, p. 117). Making the whole process questionable in the first place.

As mentioned previously the research for Pulse survey use in IS satisfaction measurement is not comprehensive, but the market has slowly started to provide them for organisations. HappySignals (2024) provides services for measuring and managing IT experience for organisations. They provide tools for short form Pulse surveys to be conducted with analytics to analyse the answers and results. Naturally features are included based on services a buying organisation wants from the partnership. These can include consultation on constructing surveys and feedback on what to ask users and how to interpret the answers. One important function of buying survey services is to have a benchmark of the wider industry.

Similar to IT Pulse measurement of satisfaction an organisation can employ a Micro survey on their information systems to gain feedback. Some solution vendors refer this as micro survey's (Userpilot, 2023). This sort of instance could be also described pop-up's and is often seen on websites used as an attention grabber for the user trying to trigger an action on the website (Willermark, et. al., 2020, p. 4204). What makes Microsurveys

different from other survey ways is that they are most often baked into the application in use by the user. (Userpilot, 2023, chapter. 2) This makes reaching the target audience easy, because you aren't limited to people opening their email and clicking through the answer buttons, but you are gaining visibility with 100% of your user base that use the system that is being measured (Userpilot, 2023).

Microsurvey's are mainly targeted for software as a service system to measure and gain knowledge on churn and why customer's leave the system (Userpilot, 2023, chapter. 7). Internal information systems are operating in a monopoly market within an organisation however, the usefulness of low barrier of contact point for the end user satisfaction feedback, could be very a valuable process for the information systems department.

Large IT consultation enterprises such as IBM, CapGemini, and Infosys offer their partners to outsource the running of an IS user satisfaction measurement. They provide consultation and service of running the measurement operations. In some situation the service provider is the same organisation running the operations side of the measurement target. In this service the company that procure the survey services will benefit from expertise on the provider side.

Mahmood (2000, p. 766) research highlighted that user involvement in system development is the most important user satisfaction factor. Can the user's involvement in IS development be combined with user satisfaction measurements? Apart from survey's asking users how they feel about certain elements of information systems, would it be possible to arrange a forum or workshop for this kind of feedback to be given? Asking users via surveys about their satisfaction towards an information system is not the only way to gain insight and feedback towards the products in use. Certain attributes such as Mahmood (2000) highlighted usability, user skills, and user involvement in system development could be measured through observation rather than asking their viewpoints towards these attributes. Observing how users interact with different information systems can help develop pain points and understand the problem areas the users experience

(Danilov, et al., 2016, p. 218). These kinds of tools are available for example “Hotjar Heatmaps” is a tool that can be used to observe user’s behaviour on a web-based software (Hotjar, 2024). The solutions within this chapter are summarised in the Table 3 below.

Table 3. Practical existing measurement applications

Practical existing measurment applications		
Method	**Description**	**Vendor**
Pulse	Short and focused survey that aims to measure the exact moment feeling of end-user. Uses one or two questions and is sent frequently.	HappySignals
Micro Survey	Short form survey that is implemented within the system the user uses.	Userpilot
Pop-up Survey	Survey that is forced upon the user using the application by a pop-up banner / window	Userpilot
Outsourcing	Outsourcing the measurement to third party vendors to gain expertise and ease the workload of IS functions.	IBM, CapGemini, Infosys
Automated Observing	Automated systems that observe rather than survey the users usage and interaction with information systems	Hotjar

4 Methodology

Information systems (IS) draws heavily from other research disciplines, such as economics, social sciences, and computer sciences, to evaluate and solve problems at the border of organizations and information technology (Peffers, et al., p. 1). This research will be done as a case study with close collaboration with the target company. As the research will evaluate and suggest improvements for a business organization it is best to use interventionist research, which aim is to: “engage in purposive action to stimulate and evaluate change (Jones, et al., 2023, p. 3052)”. This helps the research’s relevance to working in business organizations (Jones, et al., 2023, p. 3052).

The research conducted for this thesis will use a subset of interventionist research called constructive research approach (CRA). It was first designed to answer some challenges regarding management accounting research (Kasanen, et al., 1993, p. 1). The research team found that most researchers and methodology focused on only looking at what has been done and focusing on studying it (Kasanen, et al., 1993, p. 2—4). The researcher will develop a new construction, tests its validity for the organization and takes the theoretical contributions that this solution or process has produced (Jones, et al., 2023, p. 3054). Constructive research is built from seven different phases. The arrangement of these phases might differ depending on the case. The steps include are listed below.

1. Find a practical relevant problem which also has research potential.
2. Obtain general and comprehensive understanding of the topic.
3. Innovate, i.e., construct a solution idea.
4. Demonstrate that the solution works.
5. Show the theoretical connections and the research contribution of the solution concept.
6. Examine the scope of applicability of the solution.

(Kasanen et. al., 1993, p. 3).

Finding practical problems in the world is not a challenge in of itself. Finding the theoretical contribution can be difficult for the researchers (Lukka, 2014, para. 5). The demand is to obtain a theoretical knowledge of the subject while also the subject should be under analysed by itself. Often in the science branches that lean on more practical business world the research done inside the case organisation are the most lucrative theoretical contributions (Lukka, 2014, para. 5—6). Sometimes in constructivist research a secondary phase is added after the first. The phase is to find out partnership opportunity with the target organisation (Lukka, 2014, para. 6).

In this study the relevancy was identified using principles presented by Hevner (2007) from design science Figure 7. Relevancy is found in analysing the environment which the organisation consists of and gaining requirements from it. People, organisations, technical systems, and problems & opportunities all contribute to a goal. (Hevner, 2007, p. 2—3) In this study the target organisation identified a need for re-examining their current IT satisfaction measurement structures and looking for improvements on the current and potential options for future development. Iivari (2007, p. 14) points out that design science is also in many ways about the potential. He argues that new ideas or artefacts could provide new opportunities long before any real problem is recognized.

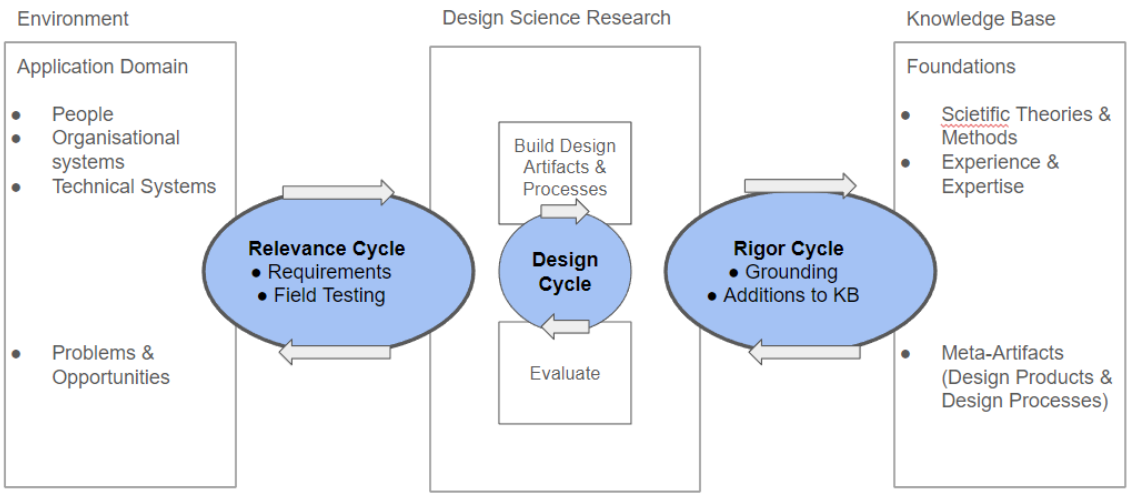


Figure 7. Design Science Research Cycles (Hevner, 2007, p. 2)

Lukka (2014) Suggests that a deep theoretical understanding is part of the constructivism model. The researcher needs to acquire the knowledge from the theoretical world in order to understand the subject and in the end analyse theoretical contributions. It is also required to gain an understanding of the practical side of the organisation and their structures and ways of working.

In this research the theoretical understanding is gained through scientific journals and theories. As detailed in the previous chapter the theories are built upon previous models and studies. Technology acceptance model and IS success model give a platform for understanding what factors influence what and how IS organisations should focus their efforts on. End-use satisfaction measurements detail different factors that influence users' satisfaction towards IS. It gives the tools to analyse the current processes and identify gaps in them and solution opportunities. Practical understanding of the organisation is done through discussions within the project team and researching the target company current ways of working within the end-user satisfaction measurements. The current situation regarding IT satisfaction measurement is mapped through an "AS IS" analysis. Giving a good understanding of the starting point for the innovation phase.

Development and innovation needs are mapped through interviews of the IS functions management. Interviews are held via Video conferencing platform with the researcher giving the questions and leading the discussion. Structure for the interview is chosen to be a semi-structured way of conducting interviews. Semi-structured interview style was chosen, because it can facilitate best an open discussion among the participants (Galletta & Cross, 2013, p. 24). The structure facilitates theoretical connections to the questions while also leaving room for open ended and more detailed questions based on the participants answers and background (Galletta & Cross, 2013, p. 24). The questions and structure for the interview is decided in advance and used as the skeleton for the interview. Some questions are parts based on connections between theoretical understanding of user satisfaction towards information systems and parts drawn from the organisations own ways of working, structures, and goals of the IS function. Meetings are recorded and used for cross-checking notes and points made during the interview. Results are gathered in a centralized location to be analysed however, there is not an inherent aim to compare and make a flat interview scheme, due to the nature of the current survey and organisation. Different professionals and managers have a different focus and role in the satisfaction measurement process.

Other IS function employees are also surveyed for their innovation and development ideas. Survey will be made by a survey tool and sent online to the target personnel. The survey aims to mimic the interview structure closely to gain comparable results, but by the nature of online survey the questions must be presented in a slightly different way to facilitate better understanding of the questions. The interview personnel consist of 17 company employees. Eleven of them were interviewed in a one-on-one interview and six of them were organised in a group interview discussion. The breakdown of roles is eight IT area leads in managerial positions. One communications specialist, one HR manager, and six IT product managers. The personnel were chosen, because they are directly involved with IT end-user satisfaction measurements within the company. The topics of interview discussions were the current ways in which the company conducts IT end-user satisfaction measurements. What are the most important feedback factors that the

interviewed person needs for their area? What different measurements could we deploy for end-user satisfaction? How often should the IT satisfaction surveys be conducted?

Constructing the solution idea or innovation is the main outcome of the research and what it aims at. The main expected outcomes of the innovation will be concrete proposals on how to measure IS satisfaction among the organisation's end-users. The construction would be a list of suggestions of improvements to the current organisation's measurement processes and tools in addition, there will be proposal options for other type of measurement ways. The argument for these proposals would consists of theoretical background and previous studies as well as expert and management interview.

The fourth step in constructive research is the demonstration and testing of the artefact. Due to the nature of the construction artefact and the project at hand there will not be a live test phase of a new type of survey or measurement option. The validation of the innovation will be conducted using Sonnenberg and vom Brocke (2012, p. 393—394) evaluation methodology where the artefact is demonstrated expert interviews and focus groups. To evaluate if it fits the organization's structure, processes, and ways of working. The expert panel reviewing the innovated construct will consist of 20 IT professionals from the target company consisting of IT specialists, Product managers, and IT area leads. The entire project and its creations will be presented to them in a hybrid meeting. Discussion of the options available and the construct itself will be held and the reviewers express their opinion and ideas about the subject.

The two final parts are to evaluate the scope of applicability of the innovation and to identify theoretical contributions that it made. This would remain to be seen, if the artefact created based on the organisations needs and criteria can be applied directly to another organisation. Theoretical contribution will be discussed based on the previous research done on the subject and the possibility of future research based on the finding of this thesis.

5 Construction of different measurement options

In this chapter the development of the construction is detailed. Different phases of the development are introduced as well as the arguments behind choosing the decisions that were made during development. The goal of the construction is to create multiple different options for measurement of IT satisfaction within an information systems function. The different options have been formulated through discussions, interviews, surveys, and previous research on the measurement subject.

Interviews with managers of the IS function at the target company have given the target and focus of the measurement of IS satisfaction towards company's employees and end-users as a whole. Satisfaction between organisations as institutions and the relationships between them should not be counted or taken into account when creating end-user measurement options.

The different sections represent different methods of conducting an IS end-user satisfaction measurement. It can range from classic surveys to technical integrations of shorter survey formats, as well as automated measurements that bypass the direct questioning of the end-users and focus on measuring their actions within an application. The measurement options presented can vary from each other the way they focus the feedback surveying, but they can still be harmonized internally, by creating questions within the survey formats to be as similar to each other as possible. This way information systems function has comparable results that they can mirror the different measurement options with each other. Understanding that the situations in which different functions of the information systems for example IT support end-user feedback differs depending on if the question is asked in an annual survey or in a ticket-based format.

The chapters below detail all the different methods the construct keeps within itself. The theoretical frameworks IS Success Model revised (DeLone & McLean, 2003) and Technology Acceptance Model 2 (Venkatesh & Davis, 2000) are used to elaborate on what factors of satisfaction formation the particular measurement option can measure. It is

also discussed what kind of measurement problems the particular measurement solves and the pro and con of each measurement option is discussed based on interviews and project team discussions. After these chapters the whole construct will be reviewed and discussed as a singular item used to aid companies in developing or creating their own IS end-user satisfaction measurements.

5.1 Yearly long form satisfaction survey

One of the ways of conducting a measurement of satisfaction is to arrange a survey sent to employees of the organisation. It's frequency of how many times the survey is organised during the year can vary based on certain variables and the organisation around the survey. During IT area leads interviews, it was discussed that the frequency of the surveys should be chosen based on the speed of development within the IT department. The faster the development is the faster the organisation needs to gain feedback from its users and measure the satisfaction towards new information systems. When the changes are slowed down then the measurements should follow in line with it. During the literature review there seemed to be a gap in information systems research along the lines of survey frequency research.

When debating on how often a survey should be conducted one has to balance the wanted feedback frequency and detail with the target end-user's willingness to answer the wanted number of surveys. In the interviews a communications specialist concluded that a lot of departments and teams want to survey the employees constantly as often as possible. An organisation is filled with measurement ways that want to grab the employee's attention and gain feedback towards their own area. One innovation towards avoiding too frequent surveying, but still maintaining a steady flow of feedback towards information systems, is splitting the target group of the survey. By splitting the entire target population into for example four groups, the survey can be held during each quarter without causing survey fatigue to the end-users by overburdening them with

constant survey invitations. Possible challenges would be to make sure the groups are spread evenly enough for cross-organisation reach.

In-house produced large satisfaction survey is a way of fully control the handling of satisfaction measurement in the organisation. During the interviews there was a recognition that overall, the larger surveys do create value for the organisation. A large survey allows the organisation to measure different parts of their information systems and make sure no relevant part is left out. From the literature a similar nature measurement model is the Miller and Doyle (1987) that included multitude of questions on different levels of management information systems. Their (1987) model was generally geared towards upper or lower levels of management as opposed to the end-user focus rather than a companywide end-user focused one.

The contents of the survey as in the questions asked from the end-users should try and be built around the factors that affect the end-users IT satisfaction. The challenge is how to align theoretical categories with the practical everyday IT tools and applications the end-user is using. Mahmood et. al. (2000) meta-analysis research suggests that the three high-level categories that IT end-user satisfaction is formed from are: Perceived benefit and convenience, organizational support and encouragement, and user background & involvement. The logical conclusion is that these categories and the factors that have an impact on them should be the base for the measurement tools questionnaire.

During the interviews with IT area leads it was identified that the most important tools and services that an end-user needs in their daily work are the basic IT infrastructure that keeps the work environment up and running. Network, enterprise-wide workplace information systems, and IT hardware such as workstations and mobile phones are the most important technologies that the end-user is interacting with every single day and cannot be productive without. After these technologies the most impactful tools are the applications that end-users are using to support their work. Support services such as service desk and local support were identified as having a big impact, if the experience

is bad for the user. Other tools and services that the end-users interact might have larger or smaller impact on their satisfaction, but these technologies are the ones that without them an end-user is not capable of conducting their work. There came up a conflicting viewpoint from an IT area lead suggesting that the very basic everyday tools of the end-user shouldn't be measured too detailed and widely. Those tools do not experience a lot of change between the survey intervals and thus might not validate that much focus from the measurement. In their opinion in the application area, there is greater use for end-user feedback on the applications performances and development areas.

None of the categories of Mahmood's (2000, p. 753) research model and the research as a whole go into detail what kind of systems are the most important for the users. Perceived usefulness consists of multiple different variables that include: "Output quality and result demonstrability" according to Venkatesh and Davis (2000, p. 188) Technology acceptance model 2. Both factors include the measurement of quality of the information systems in use, which is somewhat simple to measure and ask the user. Different technologies for example hardware and software have a different weight on what the user is expecting from them in terms of the attributes affecting user satisfaction. Ease of use is no longer as relevant for workstations, because of decades of standardization of keyboard layouts and operating systems. In the application environment there can be huge differences between different systems and the usability, output quality, and other variables. Delving deeper into those attributes in the application environment can yield better quality and actionable feedback.

User expectations affect the end-user satisfaction according to Szajna and Scamell (1993, p. 510), but that can be hard to measure in a frequent user satisfaction survey. Overall understanding of the particular information system does change over time and managing the expectations can be key to successful Information system implementation (Szajna & Scamell, 1993, p.510—511) however, these kinds of questions could lead to clutter and overall strain on the surveyed end-user.

One way to create an IS satisfaction survey is to categorize the structure and questions. This method of constructing the survey format based on the most important areas that a company's end-user is interacting with. In the interviews and discussions, it was identified that categories help structure the survey for the user and focus the feedback that the user gives. It also helps focus the future actions taken based on the feedback gained.

Categorized survey does provide challenges for the organisation by creating hard lines between the different measurement categories and who is responsible for taking care of any given category and its questions. This was highlighted in the group discussion with IT specialists, and they pointed out that there is difficulty in managing workload and responsibilities on where to drive the feedback traffic in each category. What should for example support services include? Is it only service desk services or a broader support from the entire information systems functions or top management?

Examples of categories for end-user satisfaction survey could include support services, IT hardware, applications, information security, and IT processes. The structure that end-user would follow in the survey is shown in Figure 8 below. These categories do portray the different factors and technologies that end user satisfaction is derived from quite well. What questions and technologies to include in the categories chosen is another balancing factor from the perspective of feedback gathered, strain on user responding to the survey, and the amount of effort it takes to process all the feedback. It also depends heavily on what the IS function wants to focus their feedback surveying onto. End-user satisfaction surveys should focus on the most important technologies for productivity for end-users according to one IT area lead.

The applications category does provide a big challenge in how the applications are presented to the end-users. As mentioned previously large companies might have multitude of different applications used by different teams and individuals, but not everyone is relevant to every employee. This creates the challenge of balancing on how many applications are surveyed and which of them are chosen for the feedback. Categorizing the

applications based on the usage or role that they occupy in the organisation eases the user into giving scores to each application category. However, this creates question marks, on which specific applications for example “invoice management application” does the user likes or doesn’t like. An option to comment low scoring applications does pinpoint the satisfaction or dissatisfaction onto the correct application, but depending on the number of applications used can be difficult for the user to explain in enough detail.

During the discussion with IT specialists there came an idea of giving the user themselves an option on choosing the applications they wanted to give feedback on. Rather than attempting to catch every application through lumping them into categories, the survey allows users to choose their most important or impactful applications and express their satisfaction towards them.

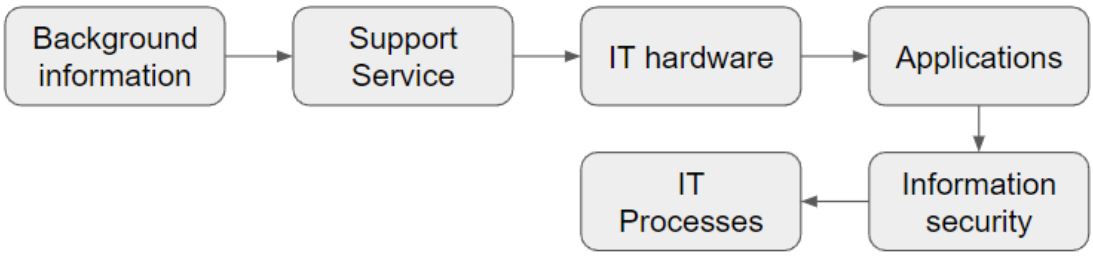


Figure 8. Example of categorized survey and user pathway through the survey categories based on interviews and discussions.

The goal of the end-user satisfaction survey is to measure their satisfaction towards information systems, but not every system and process within the organisation is visible or relevant to the end-user. In the interviews it this was brought up and for example infrastructure changes and development isn’t visible to the end-user and thus not relevant measurement target, unless problems in the availability of basic services hinder the productivity of the users.

Information security or cyber security has risen in importance in the information systems space. It does occupy a unique role in IS end-user satisfaction in the sense that it does impact end-users heavily, but it's development and decision-making isn't necessarily tied to the end-users. During the research it was discussed that the most important user satisfaction feedback on information security is the user's skills and knowledge of secure practices and technologies. End users are often referred to as the weakest link in information security and have the ability to create risks for the organisation through not following security policies (Guo et al., 2011, p. 205—206).

Information systems adoption is a key problem when corporations launch and introduce new systems to their users (Venkatesh & Davis, 2000, p. 186). Using technology acceptance model factors, we can predict and have visibility on what factors affect the end-user's adoption of the systems they are introduced. It has been detailed before that this survey format allows the IS function to measure wide trends and do a long form survey with multiple questions in it. Due to this it lends itself to measure the TAM2 model factors also from the users given that the overall length of the survey does not reach too far.

From the base form of TAM (Venkatesh & Davis, 2000, p. 188) factors such as perceived usefulness and perceived ease of use are easy to measure using this measurement as they can be outright asked from the user if they do perceive their systems as useful or easy to use. Intention to use is influenced by these factors especially Perceived Usefulness in addition by subjective norm, experience, and voluntariness (Venkatesh & Davis, 2000, p. 197). It doesn't necessarily need to be asked from the user directly rather by analysing the affected factors it can be interpreted. Yearly long form satisfaction survey can also analyse the extended TAM2 factors such as output quality, result demonstrability, and users experience. These are factors that can be made into questions that are then presented to the user. Naturally not every question and factor can be included in the questionnaire not to make it overly long for the user to answer. The IS function needs

to identify what are the most important factors that they want to focus their measurements towards.

Comparing this method to what attributes from the DeLone and McLean (2003, p. 24) revised IS success model it can measure effectively. Due to the generalised nature of the survey methodology, it can be used to observe information quality, system quality, support quality, and the use of an information system. An organisation can use the measurement solution to tailor their questionnaire to fit whatever attributes of quality they need to measure. The yearly cycle and continuity provide a clear trend for the IS function to follow and base decisions on. The results can be compared to previous ones, thus reducing the risk of subjectivity and unrelated events having an impact on the answer. Using the categorized structure, the IS function can make sure they focus the questionnaire on the most important information systems for the end-user's productivity. The problem of having a large pool of applications in use within the company would be solved by giving the end-user an option to choose their most relevant applications that they want to give feedback on. The broad nature of a yearly survey lends itself to measure the entire information systems functions and the relevant part of it that is visible to the end-users.

Pros using this measurement solution have been touched upon by the problems it solves, but there are also others. Standardization and repeatability allows the IS function to follow and measure the trends accumulated throughout the years of using this measurement. One IT area lead mentioned how comparisons to previous years and the trend it sets is useful for reviewing the next steps for IT strategy. This kind of survey can also reflect better changes to information systems due to the general nature of it. With the entire user base surveyed the measurement doesn't run into any selection biases or run the risk of not considering certain user groups. Everyone is surveyed and the broad nature lends itself to measuring as much as possible. If categorization is implemented to the measurement, it eases the sharing of responsibility of the satisfaction to the stakeholders responsible for different areas of the IS function.

Cons can be identified from the measurement's general nature. It can be hard to identify actionable feedback directly from the user feedback given. This con can be alleviated by allowing open comments from the user, but this does not guarantee specific feedback and relies on the user knowing exactly what to say. With the goal of measuring as wide and much as possible the measurement can run into straining the user too much and hurting the response rate of the survey. This along with the generalized nature of the questions can lead to a balancing act of surveying too much or too little from the users. It can be a tedious process to go through all the responses with a large user base. This can lead to reduced quality in the review phase of the measurement and reduce the gains from feedback given.

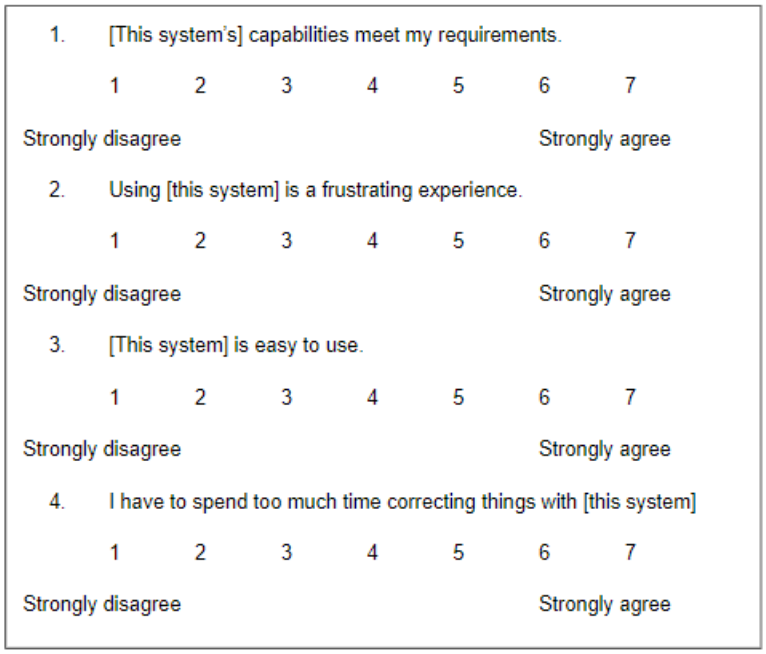
5.2 Small, focused surveys to target groups

Large surveys by nature lean towards generalization and broader questions. While trying to survey as much as possible, it can lead to a situation where the questionnaires become too long and too detailed. The user cannot be overloaded by every detail, hardware, and application they have ever used within their daily work. Everything can't be surveyed with detail in one singular survey. During the interviews it came up by IT area leads that a single product owner or application team might not always benefit from the large survey and its generalized trends that measure categories and their performance numbers. A large organisation can use many different applications and systems and a large amount of those are not used by every employee in the company. This creates challenges when designing surveys that attempts to survey as broadly as possible and for every employee equally.

During the interviews with IT area leads it was brought up that all feedback gathered from a large population or user base wasn't that useful for the application development and operations. Pinpointing accurate location and definition on where the problem areas lie that cause users to be unsatisfied with their application use is the real challenge. A

Likert scale 1-5 with an average number of satisfaction as itself doesn't offer application development the actionable development areas that they need. Further elaboration on specific applications and the problems users faces with using them is needed.

An example of a focused survey would be the Usability Metric for User Experience (UMUX) (Finstad, 2010, p. 326). In this measurement a specific application is chosen, and its usability is then measured through the model. The questions can be seen in Figure 9 below. There are 4 different areas focusing on surveying about the capabilities meeting the users' requirements, the usage of the system as a frustrating experience, ease of use of the system, and the users need to correct things in the system (Finstad, 2010, p. 326). The questionnaire highlighted by Finstad (2010) does lack the open comment's part that interviewed IT area leads and IT specialist said that they would require. The UMUX model does however offer reliable feedback on where the usability and user experience are with the targeted system (Finstad, 2010, p. 327).



1. [This system's] capabilities meet my requirements.

1 2 3 4 5 6 7

Strongly disagree Strongly agree

2. Using [this system] is a frustrating experience.

1 2 3 4 5 6 7

Strongly disagree Strongly agree

3. [This system] is easy to use.

1 2 3 4 5 6 7

Strongly disagree Strongly agree

4. I have to spend too much time correcting things with [this system]

1 2 3 4 5 6 7

Strongly disagree Strongly agree

Figure 9. UMUX model questionnaire (Finstad, 2010, p. 326)

Targeted key-user surveys drive the user involvement in system development that has been shown to increase user satisfaction and information system success in the past

according to Bano et al (2017, p. 2342—2343). A well-defined process where the information systems department identifies key users and communicates the targets and expectations of the focused survey could entice the users and have an involvement with the system development. A larger and more expansive survey hasn't always produced the same amount feeling of involvement from end users' perspective according to previous year's survey results according to one IT specialist.

Since a target group-based satisfaction measurement often focuses on narrow areas of the information system, it would be appropriate to measure the following attributes of the IS Success Model (DeLone & McLean, 2003, p. 24): information quality and system quality. As the Figure 8 showed the short form survey can be used to measure user experience elements that belong under system quality attribute (DeLone & McLean, 2003, p. 15). The project team discussed that this measurement could be tailored to be used as system support attribute measurement, for example a focused geographical survey measuring local supports service quality, but there are other better measurement models for measuring it.

From the TAM2 model (Venkatesh & Davis, 2000, p. 197) the same perceptions that a larger survey can measure are also visible within this measurement method. It just appears in a more focused and smaller scale. Result demonstrability, output quality, and experience are also capable of being measured with a small survey. How many of these factors should be used and surveyed depends very much on the resources and commitment an IS function has towards surveying them. They do give great visibility to how users adopt or use the applications and systems IS function has deployed (Venkatesh & Davis, 2000, p. 199—200).

Focused surveys answer the problem of having too generalized survey topics to get actionable feedback for the information systems functions. Product owners want to know from the end-users what exactly lowers their user-satisfaction and what should be fixed from the system to make it better. Rather than sending the survey to every user in the

company the product owners can identify their most valuable key-users and facilitate the survey with relatively low labour needed. The survey is also easy and more straightforward to answer for the user and does solve the problem of having a too long and tiring survey to fill.

Pros this measurement method has is that it is useful in pushing new development ideas forward. Focused surveys towards specific problem areas within an application can be used effectively when arguments towards new developments are made one IT area lead told in the interview. They are easy to answer from the user's perspective and thus doesn't put too much strain on them. Cons can be considered that users are bombarded with constant surveys. Due to the focused nature of this measurement you need to deploy a large quantity of them to measure more applications and more functionalities. There is also a risk of selection biases when identifying key-users. Within the project group there was discussion of how to select the best candidates for key-user survey. Selecting the ones that use the systems the most can leave out users that have stopped using them due to a problem they faced.

5.3 Continuous feedback forum

Leaving the user waiting for the right end-user satisfaction survey to roll around to them can affect the quality of the feedback gathered from the users. It would be beneficial for the information systems function to gain user satisfaction feedback directly from the users voluntarily. The IS function would create a feedback space within internal communication systems that gives the end-users a place where they can submit their user satisfaction feedback to.

In the interview with an IT specialist, it was discussed that user feedback could be better guided in their feedback by constructing the open feedback space with categories and further questions on exact location or functions of a system that the user is satisfied or dissatisfied with. The key to feedback according to interviewed IT area leads and product managers is to gain actionable feedback and to have detailed feedback on where and

what is wrong with the information systems. The user should be thus guided through the feedback process to make sure they are providing the system owners with as much valuable information as possible.

An example of an open-ended feedback category would be network connectivity within an office building. The user would choose the category to give feedback on network connectivity only. Then they would be asked to input exact location on where the disruption of connectivity happened for example: site, building, floor, meeting room level. This would ease workload taken when conducting investigations by relevant stakeholders. Generalized feedback is gained through other means of user satisfaction measurement and adding another open feedback forum to gather that same could be not that useful according to an IT specialist. It would depend on the required workload needed to implement the solution and what the expected response rate is. What kind of communication campaign is needed to create enough interest and traffic towards an open feedback survey.

Success of this kind of measurement depends on the end-user's seeing usefulness in going their way to find the feedback forum and filling in a guided questionnaire according to an IT specialist. They also mentioned that communication towards this solution would need to be quite high in order to provide the users with evidence that feedback is taken seriously. The survey itself can be built fairly similarly as Figure 8 categories and separate the applications into their own. Parsing the feedback from a very large open-ended measurement can require extensive work. The strength of this voluntary continuous feedback methodology is that the user is never forced or feel overwhelmed to answer and give the feedback towards information systems.

Users are able to voluntarily express some parts of the TAM2 model (Venkatesh & Davis, 2000, p. 188). Experience in the form of training required from the company in order to fully use and understand the system. Output quality, perceived usefulness and ease of use are factors that a user is able to give feedback on an open feedback forum.

Depending on how it is constructed and how much the user is guided in their answers as opposed to a fully open feedback form, it can bend to other factors such as result demonstrability and more detailed answers on the other factors. Pros for this measurement solutions are that the feedback is proactive from the user and is immediate when the user feels the need to provide it. The measurement doesn't burden the user by requiring them to answer as many surveys as possible. The cons are that feedback can be hard to point towards the right stakeholders within the IS function without hand holding the user to answer as detailed as possible. This methodology doesn't either provide any real difference from content and question point of view from the other measurements listed. It only changes how the feedback is gathered.

Taking a look at the DeLone and Mclean model (2003, p. 24) on what factors influence the end-user satisfaction within information systems we can analyse that the continuous feedback survey can measure all three quality factors. The measurement type does not constrict the survey maker to any particular quality factor. The continuous user satisfaction measurement does solve a problem of wanting feedback throughout the year, but not constricting the IS function to specific survey period. The users can give their feedback whenever they experience a problem or event that warrants a feedback action from them. Due to the user being proactive with the feedback there is a good chance of guiding them via survey structure and options to give precise feedback on the location of their satisfaction or dissatisfaction. The effort of kickstarting and making the users aware of the continuous measurement can be high but maintaining it shouldn't require a lot of communication effort.

5.4 Ticket based IT satisfaction survey

Information technology service management (ITSM) has been an important part of companies around the world and successes in it is seen as important strategic tool for surviving in an increasing competitive environment (Jäntti & Hotti, 2016, p. 141). In the interviews with an IT specialist and an IT area lead it was discussed how ticket-based

service model is also a great tool for user satisfaction measurement. According to DeLone and Mclean (2003, p. 18—19) service quality has increased its relevance to user satisfaction and by extension the success of information systems. Ticket-based services are key part of the services that the end-user is receiving in order to support their working, according to product manager interviewed.

Measuring IT departments and their service providers provided information systems services towards the end users would give a realistic picture of the impacted user satisfaction according to interviews with IT product managers. One innovation that came up from the interviews is to tie a user satisfaction survey to the IT service management ticket-based process. Practically it would work so when a user's ticket is resolved in the ITSM tool it will immediately send the user a link to feedback form. User is instructed to answer a short questionnaire based on their experience with the service provided and the IT personnels skills, speed of service, and communication throughout the ticket lifecycle.

From the interviews with product managers and IT area leads this kind of feedback methodology of integration with the ticket lifecycle system is a welcomed one. The most useful thing is that the feedback is always tied to an actionable item i.e. the service ticket or incident. This allows the relevant stakeholders to always analyse the end-to-end user journey from creating the ticket until the resolved phase of it. For example, a user gives a dissatisfied score for the speed of service of the ticket, when reviewing the feedback, the relevant stakeholders can analyse the path and different phases of the given request or incident, and possibly find out at which points the ticket process was bogged down or stuck in pending mode.

Integrating the IT service survey to the ITSM tool used by the organisation can yield additional data and synergies to the analysis phase of the satisfaction measurement. Taking the stress of filling every detail into a form out from the user's hands thus possibly aiding the response rate. The feedback gained from the measurement solution is also a great

tool for leading the service provider partner and building the partnership towards more quality service for the end-users according to a product manager. The end-user's also might not always have the full understanding of the entire process of their ticket or incident and might give a feedback based on guessing where the problem is. Having the link with actionable items such as tickets or incidents, gives the analysis phase clearer picture of what the user possibly might have been satisfied or dissatisfied with, even though the user might not know it themselves. A possible negative side of ticket-based IT survey was discussed in the project team. It can be that the measurement solution silos the responsibility of the end-to-end user journey and experience into strict responsibility areas.

The TAM2 model (Venkatesh & Davis, 2000) is hard to include into this measurement solutions, because the focus is very much on the support services of the IS function and not on any applications. It can be attributed to being part of the information systems and thus there are elements that are measured such as tracking intention to use via ticketing data and feedback gained from it. Perceived ease of use of the support services and channels provided. Output quality can be measured by the quality of provided services.

Ticket-based end-user satisfaction survey can measure Service Quality and Use from the DeLone and McLean (2003) model the best. With it's tie to ITSM tool and service provider it does lend itself to Service Quality measurement and gaining Use and Intention to Use statistics from the ITSM tool helps IS function understand what requests or incidents happen to what parts of the information systems environment and what systems are the users trying to use or access. The problem a ticket-based end-user satisfaction survey solves is the ability to have a detailed user pathway and service provider actions that affect the users feedback given. With this survey method, there is no need for the IS function to guess or judge what the user's problem that had an impact on their response. Due to integration possibilities the methodology can be also clearly tied into third-party vendor key performance indicators.

5.5 Integrated quick feedback

Waiting for the yearly satisfaction survey can be a long time for the end-user to express their feedback on information systems. A lot of the applications in use by the employees are daily tools and the problems they face with them might occur on a regular basis. The problem of pinpointing problem areas that causes user dissatisfaction when using information systems. Embedding the end-user satisfaction feedback directly into the application and webpages the users use, could more accurately pinpoint the feedback into the areas that need improvement. During the project two different types of integrated end-user satisfaction measurements were identified pop-up surveys and voluntary feedback button.

Problem of implementing pop-up surveys is that they might seem intrusive to the end-user using the application for completing tasks. End-users have probably experienced pop-up ads on commercial websites previously and can consider those kinds of advertisements as confusing, deceptive, annoying, and considered as the unwelcomed interruption (Le & Vo, 2017, p. 216). Hsieh et al. (2021, p. 1802—1803) suggested that intrusiveness and general negative feeling towards a pop-up element on a website can be lowered, by controlling the timing of the pop-up object. While pop-up surveys do not share like for like the same idea and goal as advertisements on webpages, we can still take some elements from the lessons learned in the marketing spaces. A pop-up survey would need to be controlled in a way that it doesn't interrupt the users' goals and working.

Another way of integrating small pop-up surveys into the applications directly would be to make them voluntary buttons for users. A small add-on into the side or corner of the website where a user can access the "feedback" button at will. Internal communications would promote the feedback function to users and encourage the usage of it. A draft of what a quick integrated feedback question could look like can be found in Figure 10 below. The contents of the feedback question can vary depending on what area the application owners would like to gain feedback for. System- and information quality attributes

(DeLone & McLean, 2003) are among the areas that could be surveyed by application pop-up surveys. One of the goals of integrated feedback buttons would be to make it as convenient as possible for the end-user to give their immediate feedback. Thus, lowering the bar for answering, and giving their feedback.

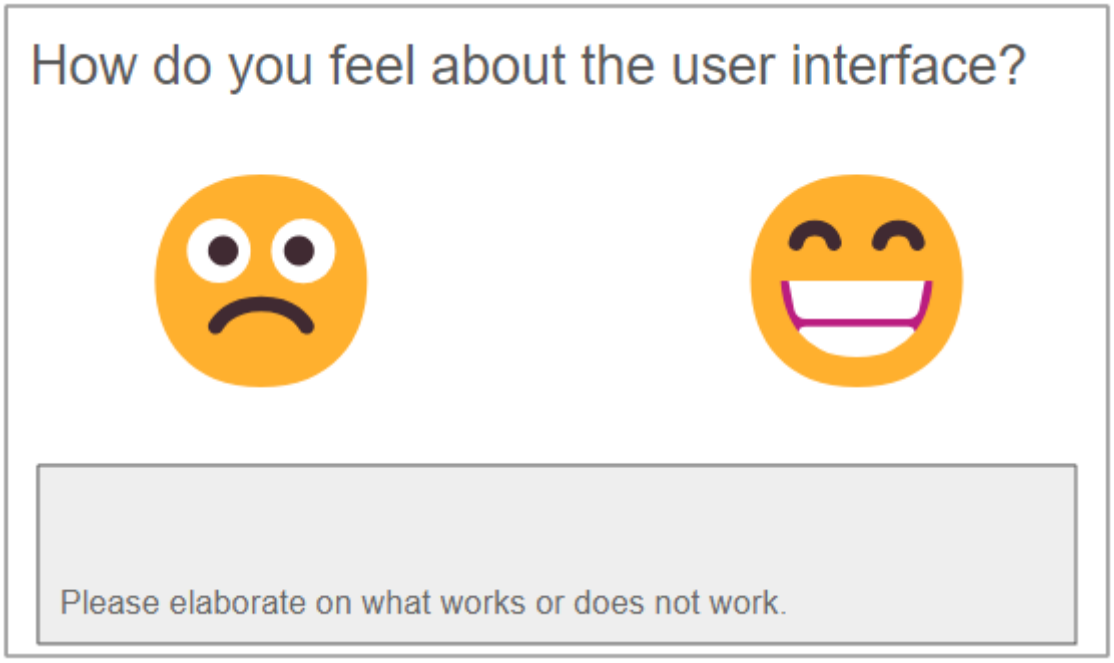


Figure 10. A draft of what a quick feedback question could look like.

During the interview with an IT area lead it was mentioned that integrated pop-up feedback has been under considerations. The question has been that is it worth the investment of implementation of this kind of solution. A large company might have hundreds of applications in use, so it is difficult to optimally and cost efficiently implement this solution to all of them. Key applications might possibly warrant the commitment of implementing in order to gain maximum use out of the solution.

From the TAM2 model (Venkatesh & Davis, 2000) factors the integrated quick feedback measurement can take a hold of the output quality in the sense that the user gives feedback on the quality of the system output and the overall system quality. Job relevance can be effectively measured through questions in the menus and features asking the

user if they feel these benefit their work. Ease of use factor is the one this measurement has the strongest case for. Asking directly about the UI changes allows the application developers to see the change in user satisfaction towards them.

Integrated quick feedback helps solve the problem of waiting for survey season to come and answering based on what the user might have felt when facing a problem with an application. Gaining access to a feedback form when using the application directly reduces risks of other factors impacting the feedback negatively or positively. The experience of using the application is fresh in the user's mind and thus the feedback represents an accurate feeling and analysis from the user. It doesn't even require the user to seek a communication channel to give the feedback.

Problems with integrated quick feedback is that the pop-up nature of questions and ever-present feedback button, might feel intrusive and annoying features for the users according to an IT specialist. The short nature of the emoji-based surveys or simple questions does not lend itself to high-quality feedback, unless the user feels like writing a lot into the open comments.

5.6 Observation measurement

Measuring end-user satisfaction doesn't have to be a game of waiting around for the user to find their way onto the multiple different surveys the IT department have created for the user. When the user finds themselves satisfied or dissatisfied their feedback can sometimes be difficult to interpret and pinpoint the exact root cause of the problem. This was a problem identified by IT specialist and IT area leads during the interviews. "Observe, don't ask" was said by an IT area lead describing how it would be better to observe the user's path through information systems and what are the possible problems they face during usage. Making a measurement not dependent on the end-user and their interpretation can eliminate the middleman in the search for improvement areas in an information system.

Traditional surveys require a lot of manual work from the information system department in parsing and curating answers then delegating them to the right personnel and departments depending on the platform used for surveys. From the survey towards IT specialist and Product managers, it was brought up that automating measurements as opposed to a manual would cut down on a lot of working hours and bring the user to the centre of attention in problem solving and application design. Moving the measurement directly to usage of the information system removes a big process from the feedback measurement process.

Two different types of automated observation methods were found by the project team. Both vary in the scope and scale of the solutions. First one is a heatmap and user recording measurements for web-based applications. The aim of recording the users' actions on an information system is to gain clues on how the user interacts with the system and what are the possible problems they face. Frustration clicks and under-utilised features can be revealed by the recording and heatmap statistics. Usability or ease of use attributes are important in formulating End-user satisfaction (Doll & Torkzadeh, 1988, p. 267). Tools for measuring user recordings within web-applications were considered by the project team. Among them were services from Hotjar (Hotjar, 2024), Mouseflow (Mouseflow, 2024), and Microsoft Clarity (Microsoft, 2024) providing similar features and services.

Second option for automated measurements would be to focus on users' skills and integrating user onboarding into the information systems directly. In the IT product manager and specialist survey it has come up that there would be use for actually embedded user guidance system that would reach further than a regular user training session with videos and Q&A sessions. A proactive system that would measure where users have problems within an information system and guide the user depending on their tasks and responsibilities within the system. In the project it was discussed that this measure could likely impact several variables from Mahmood's et al. (2000, p. 753) model of IT end-user

satisfaction namely user experience, user skills, and organisational support. These attributes wouldn't be measured by surveying users on their feeling of these, but a more proactive approach would be adopted to measure and analyse these attributes from the information system directly. Observation methods would also give insight into the Use attribute and intention to use from DeLone and McLean (2003, p.24) reformulated IS success model. If users experience problems gaining access to functions they want to use, then it can affect their user satisfaction.

The observation methods are great at measuring factors from the TAM2 model (Venkatesh & Davis, 2000, p. 188). Experience is described to affect users' dependency of other social influences to adopt and form their own opinion on the systems. By adopting a digital adoption platform or measuring through a heatmap recording system, the IS function are better equipped to measure users experience with the systems. Making it easier to adopt it increases the experience factor, thus reducing the reliance on social influences (Venkatesh & Davis, 2000, p. 189—190). Intention to use is also well measured through the use recordings and heatmaps of actions. The application owners are able to see what and where the users are intending to use the system and its functionalities. By analysing user experience and the usage of the UI, the application developers can measure perceived ease of use by the users and measure the output quality of the system.

Automated measurement methodology would solve the problem of relying on end-users' interpretation for user satisfaction and problems they face using information systems. With a tool that tracks the user's usage of the system the application owners can clearly see where the pain points of the usage lie. Actionable feedback would be more easily available and not dependent only on the user's feedback. The implementation of these measurements can be very laborious and the costs high, if deployed onto several applications. Different user adoption automations also help ease the users into the information system and helps proactively the users' skill development, thus reducing future need to measure their satisfaction towards training and skill development.

5.7 Third party end-user satisfaction measurement

A company can choose to not create their measurement tools and processes internally and decide to opt for a third-party option. This option doesn't necessarily differ from the other measurement solutions in this research, rather it changes the execution and responsibilities of running the end-user satisfaction measurements. Third-party vendors offer solutions and benefits to a company and require some challenges in overseeing them.

In the interview with IT area leads and product managers third-party vendors were considered an option for handling and running the satisfaction measurements. In general, the two options for partners are the corporate IT service provider or a smaller specialist vendor for these specific tasks. Both have their advantages, and one highlight came up in the interviews that what both providers offer is the benchmark to other companies and industries. Companies aren't always sure on what they are doing is the best way forward and there were some concerns that satisfaction measurements are maintained the way they are, just because they have always been that way. Gaining access to benchmarking data compared to other organisations benefits the information systems function in assessing if their chosen methods and ways are the best practices.

Large IT service providers positives are that them handling the end-user satisfaction measurements gives a good opportunity to assess and discuss the findings directly with the service provider themselves. This helps the partnership between the stakeholders and give a good platform for it. It was also discussed in the interviews that there are some synergies that can be achieved when the service provider runs and measures the user satisfaction, given that the user satisfaction is directly affected by the service providers actions and solutions. Large service providers have access usually access to technical solutions such as automated results parsing. One product manager was cautious in dealing with large IT service providers in this topic as the collaboration is not always the smoothest and when the ownership of the user satisfaction measurement is moved away from the company it can lead to some quality losses. Smaller local IT service

providers are in contrast much more nimble and easier to collaborate with according to interview with a product manager. The solutions can be more tailored to the company's goals and ways of working.

Expert help and consultation were also a highlighted advantage of third-party services for measurements. Alongside the benchmarking a third-party expert consult can help bring much needed clarity and targets to a user satisfaction measurement. Things such as optimizing the questions to measure as much as possible to minimize multiple measurement questions on the same topic, thus exerting strain on the end-user answering the survey. One IT area lead gave some doubt over the need of possible expensive investment into third party services regarding IS end-user satisfaction measurements and the perceived benefits it would concretely bring to a company.

As detailed in this chapter the third-party survey methodology doesn't rule out the other survey methods presented within this research. It only moves the responsibility of creating and running the survey to another stakeholder from the IS function. When analysing it with the DeLone and McLean (2003) IS success model, the third-party methodology can analyse all the three quality measurements, Use, and Intention to Use. It merely depends on what the chosen third-party methodology is and measures. From the TAM2 model (Venkatesh & Davis, 2000, p. 188) it can measure the same as the yearly long form satisfaction survey and other measurements. The third-party measurements don't restrict the IS function to any measurement, but it only transfers the responsibility of running the survey onto a third party. The major problem this methodology solves is the benchmarking and expert support that a vendor can provide the IS function. Not knowing exactly what and how to measure the end-user satisfaction can be a big risk for the company and help towards that problem is identified as helpful from the interviews. The workload is ideally lowered for the IS function when tasking a vendor to provide the measurements, but that depends on the partnership and how well it is led by the IS function.

6 Presenting and validating the construct

In this chapter the construct of this research will be presented as a whole and analysed as well as reviewed. The construct of "Different end-user information systems satisfaction measurement solutions" is presented in the Table 4 below. It consists of five parts: measurement solutions, IS success model (DeLone & McLean, 2003) attributes measured, TAM2 (Venkatesh & Davis, 2000) factors measured, Problems solved, and Pro & Con of the measurement solution. The goal of the project was to create and innovate options for IS functions on how they can measure end-user satisfaction within their company and how would those measurement options look like. As detailed previously the results for this construct have been created with understanding the theoretical background of IS Success model (DeLone & McLean, 2003), Technology Acceptance Model 2 (Venkatesh & Davis, 2000), and information systems end-user satisfaction measurements as well as interviews and surveying the target corporation's information systems functions employees for their views on the matter. The project team the researcher was a part of innovated the options from existing solutions and some of the options had not been put into use before. The innovated measurements from the previous chapter are presented in the Table 4 as a whole construction.

Measurement columns in Table 4 represent all the innovated measurements that a company can choose to evaluate their end-user satisfaction. During the interviews there came up problems that the respondents have faced when dealing with end-user satisfaction measurement. The column problems solved aims to describe solutions that these measurements bring out. The Pro and Con columns in the construct are there to guide the company in their decision making on what measurement options to implement. Each solution does bring positives and negatives from implementation or results point of view. The contents of these columns were developed during the project team discussions and based on the interview discussions with the respondents.

The construct of this research was presented to the target company for review. The research went ahead with an expert focus group presentation to gauge feedback and test

the validity of the created construct (Sonnenberg & Vom Brocke, 2012, p. 394). The focus group event was participated by 20 IT professionals from within the company. “Different end-user information systems satisfaction measurement solutions” construct was presented during the review and then the researcher made proposal to the target company on what measurements they should adopt and what could be the best future development areas from the construct.

The different measurement solutions were listed as: Yearly long form satisfaction survey, small, focused survey to target groups, continuous feedback forum, ticket-based IT satisfaction survey, integrated quick feedback, observation measurement, third-party measurement. These different method options aim to give the IS function the tools to gather end-user satisfaction feedback and measure it. The review discussion highlighted that the IS function can choose which options it wants or needs to implement based on the different services and technologies offered by the IS function, as well as the current structure and capabilities of the organisation. Top management involvement is required for those measures that require a higher level of investment, such as observation- and third-party measurement.

Table 4. Different ways to measure end-user information systems satisfaction construct.

Different ways to measure end-user information systems satisfaction					
Measurement solution	**IS Success model attributes measured** (DeLone & McLean, 2003)	**TAM2** (Venkatesh & Davies, 2000)	**Problems solved**	**Pro**	**Con**
Yearly long form satisfaction survey	Information Quality System Quality Support Quality Use	Experience Output Quality Result Demonstrability Perceived Usefulness Perceived Ease of Use	- Can measure the general trend of the IS function. - Comparable to previous trends. - Generalized questionnaire fits to all solutions.	- Standardization & repeatability allows trend measures - Easy to updated based on IS changes - Measures entire user base - Categories ease responsibility	- Can be too general for actionable feedback - Long survey answers might reduce response rates - Laborious process
Small, focused surveys to target groups	System Quality Information Quality	Experience Output Quality Job Relevance Perceived Usefulness Perceived Ease of Use	- Focused actionable feedback for IS function. - Easy to answer for the user. - Timing is easy to control. - Customizable for the system surveyed.	- Useful in pushing new development ideas forward - Easy and quick to answer - Effective actionable feedback	- Survey fatigue for users from constant surveying - Difficult to identify key-users
Continuous feedback forum	Information Quality System Quality Support Quality	Experience Output Quality Perceived Usefulness Perceived Ease of Use	- No need for user to wait for a survey period. - Guide the user to accurately describe feedback area and location.	- Feedback is proactive from user - Doesn't burden the user - Feedback doesn't need to wait for a survey	- Feedback can be hard to drive to right responsibilties - Content doesn't differ from others
Ticket based IT satisfaction survey	Support Quality Intention to Use Use	Intention to Use Perceived ease of Use Output Quality	- Tied to evidence of user pathway through the support system. - Easy to assign responsibility of the feedback action.	- Feedback is immediate after ticket - Linked to a ticket thus user pathway clear - Responsibility of user satisfaction is clear to define	- Siloed and narrow view of responsibility of the entire end-user experience
Integrated quick feedback	System Quality Information Quality	Output Quality Perceived ease of Use Result Demonstrability Job Relevance	- Easy access for feedback by the user. - Not having to wait for a survey period. - Immediately available when user encounters a event that affects their satisfaction.	- Easy access to give feedback on satisfaction - Feedback is immediate after the user has experienced the system	- Intrusive - Deployment separate for each system - Short nature of feedback
Observation measurement	System Quality Information Quality Intention to Use Use	Output Quality Experience Intention to Use Perceived Ease of Use	- Proactive feedback measurements on application functionalities. - Not dependent on user interpretation of problems within an application. - Eases digital adoption and helps proactively user skills and training.	- Actual real time data on user experience - Visibility on users challenges when using applications - Proactive attitude and solutions to user satisfaction	- Possibly costly to implement - Implementation require a lot of commitment from the IS function
Third-Party measurement	Information Quality System Quality Support Quality Intention to Use Use	Experience Output Quality Result Demonstrability Perceived Usefulness Perceived Ease of Use Intention to Use	- Benchmarking to other companies and industries. - Eases the workload of satisfaction measurement. - Expert consultation provided	- Benchmarking with other organisations - Consultation as a service for optimizing survey's - Technology solutions provided to ease processing of feedback	- Possibly a large additional investement - Risk of not gaining enough from the vendor as opposed to internal solution

The IS function should be guided in the early stages of the user satisfaction measurement renewal process by the construct presented in Table 4. The IS Success Model (DeLone & McLean, 2003) and TAM2 (Venkatesh & Davis, 2000) factors provide decision makers with guidance on which user satisfaction influencing factors to focus their measurement on. Both models identify factors that have a greater or lesser impact on end-user satisfaction. The problems solved category describes what kind of measurement or user satisfaction solutions the measurement can provide. These are based on the interviews with IT staff and the project team discussions. The pros and cons columns give an idea of the advantages and disadvantages of the specific solutions. These are useful when considering what kind of solutions, the IS function needs to effectively measure end-user satisfaction. Some of the cons are due to the nature of the measurement and some are risks that could become realised if implemented unsuccessfully.

The review of this construct resulted in support of the created construct. It was identified to give a good platform for understanding the different options for an IS function has when decided on how to start or modify their end-user satisfaction measurement process. The ability to pick and choose the solutions is a good option to have when making these decisions. When using the construct, the IS function has to take into consideration four different factors that come with implementing the options: quality of the feedback measured, quantity of the feedback measured, how laborious internally the option is to implement and operate, and the cost of the solution. Each methodology requires its own communication and presentation of results in order to get the end users to continue to respond to the measurements in the future. This means that the implementation of measurements cannot be taken too lightly, as users will feel it if their feedback falls on deaf ears.

As noted above, these solutions are modular and can be combined with each other or kept separate in implementation. Harmonization was also discussed in the review as being an important part of using multiple options from the construct. For better

comparability between the measurement options, the IS function should try and harmonize the questions asked within these options as close as possible. This way the options from the construct can better provide a deeper understanding of how users answer the same questions in a different measurement environment. It was also discussed that there are benefits to keeping the measurements as separated as possible with their question structure and not harmonizing them. Having clear definition for the targets and roles of each measurement option benefits them individually to be more clear and easily followable. An IT area lead also commented on this that the IS function should not only rely on one solution to measure the satisfaction of the end-users. It is better to have multiple angles of measurement to engage and determine the user satisfaction, which this construct helps with.

7 Discussion

This research was initiated as a means of creating options for corporate information systems functions to improve the way they measure end-user satisfaction with information systems. It was identified that the previous theory researched lacked guidance on what the different options for an IS function is to measure end-user satisfaction towards their systems. The research was done with collaboration from a large corporation and their IS function. The primary aim was to answer the research questions: “What kind of different measurement options do companies have to measure their internal end-user satisfaction towards information systems?”. To achieve this a constructive research approach was adopted to create a concrete proposal for different options. Understanding of the problem was gained by analysing the target company's current measurement practices and conducting interviews with IT professionals within the IS function. Theoretical understanding was gained through research papers on end-user satisfaction with information systems. The construct was created within a project group and each measurement options was analysed individually, then the construct artefact was validated by an expert focus group review consisting of IT professionals.

From the interviews it was clear that IT professionals want actionable feedback for their responsibility areas when it comes to end-user satisfaction. User satisfaction can be a key driver of net benefits and IS success (DeLone & McLean, 2003), but the practitioners value most the feedback that guides them to develop the systems and ways of working to support the end-users. There was also a caution on implementing too many different measurements to overload the users and requiring too much labour from the IS function to operate and maintain. Every methodology does require their own communications and results presentation, in order to engage the end-users to keep responding to the measurements in the future.

The resulting construction consists of seven end-user satisfaction measurement options. It is considered to be successful in breaking from the traditional survey mentality of only sending a survey questionnaire to end users and waiting for the feedback to come. The

construct provides options for proactive feedback gathering for user satisfaction in the form of observations methods and pop-up surveys. Actionable feedback from the end-users can be derived from most of the measurement options, but for example the ticket-based, small focused, and observation does lend itself best to giving clear visibility for IS function on where the problems within their information systems are. Others are geared towards measuring general user satisfaction trends of different information systems categories within the company.

The scientific value of this research is significant in the way that it opens up the possibility of further exploring the different measurement ways of end-user satisfaction. The factors affecting satisfaction are already extensively researched and discussed, but the way information systems functions can derive those factors from the end-users should be more closely researched. Contemporary IS functions within large corporations can have hundreds of applications in use, so a one system-based survey such as Doll and Torkzadeh (1988) End-user computing satisfaction model isn't nearly enough for gaining an understanding of the user satisfaction of applications. In the previous gaps in research chapter, it was identified that there is a lack of research towards the frequency of surveys and measurement methods deployed for end-users. This thesis introduces the idea of evaluating the frequency of surveys and possibly avoiding the overburdening the end-user as Couper (2000, p. 465) acknowledged. Frequently deployed Pulse surveys measurement idea is also introduced within the measurement options construct and could be used for bridging the research done in employee engagement measurement field.

This research also touches upon the previous research in the way that it does utilize the research done towards attributes affecting end-user satisfaction. The different methods listed in the construct measure and use the attributes researched and does focus on for example usability and user skills (Mahmood et al., 2000, p. 766). The need for creating tools for measurement does date back very far and identified by Bailey and Pearson (1983) research. This thesis extends this idea of creating tools to broadening the horizon of thinking what kind of tools an IS function needs to have. The theoretical framework

for research on user satisfaction measurement lacks research on different ways to measure user satisfaction. Galletta and Leder, (1989, p. 434) alluded to the need to consider the different ways and environments in which the end user responds to the measurement survey. They (1989) suggested that a general survey should be conducted and based on the responses further research should be conducted with more detailed interviews. This lends itself to supporting the construct created as the measurement shouldn't only be left depending on one measurement method.

For the practitioners, this research does provide a valuable starting point when considering the IS user satisfaction measurements of their function. What kind of methodologies should be adopted into use can be consulted based on the construct created in this survey. The first part of the measurement implementation process is completed by evaluating the options and selecting the modules that fit the overall picture provided by the construct in Table 4. What remains are the steps to begin implementing the selected measurement options and to modify the current measurements to fit these new ones. Several different vendors and measurement solutions provided in the market was researched in the chapter 3.3. These can be used to supplement the created construct when choosing the right measurement solutions to deploy for the IS function. Measurement providers (Hotjar, 2024; Userpilot, 2024) offer solutions for a lot of the options listed in the Table 4 construct. This research aims to provide valuable implications on what the impact and benefits a measurement solution deployment would have towards the IS function end-user satisfaction processes.

The research was made for one specific company, and it did accomplish in its task to create suggestion construct to guide that company on its user satisfaction measurement processes. When broadening the research for wider use of different companies and organisations the focused nature of this research might prove as a limitation. The research can be too tailored to one company and not general enough for significant wider adoption by other companies' IS functions. The research conducted is only for the initial phase of the end-user satisfaction measurement process. There is however a lot of general

elements in this research. The construct in Table 4 can be used as a tool for evaluating the measurement options for IS function and the elements within the columns are applicable for other IS functions as well. Further research should be conducted for the next steps in the process. The IT staff interviewed mentioned that it would also be beneficial to research the process of analysing and implementing user feedback gained from end-user satisfaction measurements.

Future research should be focused to validate and continue the development of the construct created in this study. There should be also more research on the next steps of the user satisfaction measurement and what kind of technology solutions would make it easier. Artificial intelligence solutions could ease this process where a lot of open comments are gathered and processed. From the gaps identified in the theoretical framework chapter, future research should try and answer the impact of ease of use towards end-user satisfaction. Older research (Mahmood et al., 2000) ranked it the least impactful, but practitioners interviewed put a lot of emphasis on it. Other area of future research would be the frequency of the measurements and measurement processes as a whole. How often should we measure the end-user satisfaction and what kind of processes for measuring, analysing, and actions taken based on the feedback should the IS function consider? This research only touched upon the first part of the evaluation of measurement solutions. Future research should also focus on the later parts of the entire process.

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