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Mobile Technology Update to Delone and Mclean Model of Information Success

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MOBILE TECHNOLOGY UPDATE TO DELONE AND MCLEAN MODEL OF INFORMATION SUCCESS

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Abstract

Senior managers are challenged to measure the success of their IT systems when justifying technology investments needed to meet the organization's mission. Due to increasing implementation of mobile technology, enterprise adoption of smartphones is no exception. Traditionally, the DeLone and McLean Information Systems (IS) Success Model has been proven as a valid framework for measuring IS success. However, it has not been updated to address the success variables related to mobile technology. Many studies on mobile technology have reviewed mobile success, but none have attempted theoretical assimilation. This thesis attempts to correct this situation by examining the DeLone and McLean IS Success Model in measuring the efficacy of mobile technology integration within information systems. The result of the literature review is a list of variables related to mobile success in information systems. The findings hope to show that the new variables discovered to be related to mobile technology success are applicable as an update to the DeLone and McLean IS Success Model.

Keywords: DeLone, McLean, IS success model, mobile technology, smartphones

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Chapter 1 – Introduction

For decades, telephones have been used for simple communications. At first, phones were stationary, but the advent of the mobile phone allowed communication anywhere outside the traditional office. Today, mobile phones are no longer limited to simple communication. Smartphones allow enterprise workers to make intelligent business decisions on the go. This chapter examines the growth of mobile technology such as smartphones, along with the new challenges they produce. It also describes the goals of this thesis and the research questions it answers.

1.1 Mobile Phones, Challenges, and IS Success Models

During the past decade, the worldwide mobile phone market has grown rapidly. According to market researcher IDC, the global population of mobile workers is projected to reach 1.3 billion users by 2015, up from 1 billion in 2010; a 37.2% increase (IDC, 2011). In a similar study, Gartner researchers noted that worldwide mobile phone sales to end users totalled 314.7 million units in the first quarter of 2010, a 17% increase from the same period in 2009 (Gartner, 2010). According to the International Telecommunication Union (ITU), the number of worldwide mobile subscriptions increased 14.2% in 2010 and 11.3% in 2011 (ITU, 2011a). The slow growth is partly due to weak global macroeconomic conditions. It may also be indicative of market saturation, as 86.7 out of 100 inhabitants now have a mobile cellular subscription (ITU, 2010).

Although feature phones still dominate the mobile phone market, smartphones have seen the strongest growth. Worldwide smartphone sales in 2011 reached 472 million units and accounted for 31 percent of all mobile devices sales, up 58 percent from 2010 (Gartner, 2012). Additionally, market researcher comScore found that nearly 42% of U.S. mobile phone

subscribers are smartphones users, and 44% of mobile phone subscribers use smartphones in France, Germany, Italy, Spain, and the UK (comScore, 2012). Similarly, researchers at Market Analytics projected that global business smartphones users will reach 752 million users by 2016 with a 5-year 34.6% CAGR growth (Luk, 2012).

The growth in smartphones is also impacting other technology industries. Industry experts, for example, predict that in the near future the majority of mobile applications will be stored and processed in the cloud, not on mobile devices themselves (Purdy, 2012). In addition to cloud computing, services such as mobile video conferencing are high on the list of mobile user expectations (Taylor, Young, Kumar, & Macaulay, 2011).

Although personal use is important, enterprises are a major driving force behind the high growth of mobile technology. "The growing number of individual-liable devices that organizations are allowing to access business data is a significant driver of business mobile email as this is often the first and most critical business application for this user base" (Drake, 2010). Executives are also discovering the value of mobile technology through personal use (Dickie, 2011; Hawser, 2011).

The growth of mobile phones is truly global. The International Telecommunication Union, a specialized agency of the United Nations, noted that in 2011, almost three million mobile cellular subscriptions were activated in Asia and the Pacific, the strongest of any region (ITU, 2011b). Mobile technology use is increasing rapidly in emerging markets such as China and India due to their large populations and expanding economies, which allow more individuals the opportunity to own mobile technology (Eddy, 2012). Mobile technology will allow more variance in worker locale and also an increase in freelancing work capabilities (Elance, 2011).

In the past decade, mobile technology has seen a paradigm shift. Whereas previously referring to any technology not bound to a desk, such as laptops or tablets, mobile technology in the recent literature seems to refer to handheld platforms. The adoption of smartphones by the enterprise has effected this shift in part. Laptop computers began the mobile trend, allowing concepts such as telecommuting to revolutionize the way professionals worked. Changes in laptop computer size and form factors further blurred the boundaries between mobile and traditional – or stationary – computing.

Mobile use of technology originally applied to devices that enabled use "on the move" or portable (Church & Oliver, 2011). Laptop computers allowed enterprise users to work from home or on the road. But manufacturers began marketing smaller mobile devices while maintaining system performance. Laptops began to shrink in size, and several new form factors were created, such as netbooks and ultrabooks. Mobile phones were then developed with the ability to connect to the Internet, further obscuring the differences in mobile platforms. With the development and release of the 3G and 4G mobile telecommunications standards, mobile phones and laptop computers were able to connect to the Internet in the same manner, and the differences in mobile technology became even more difficult to delineate. Manufacturers began to look for ways to increase mobility even further, which resulted in devices with smaller screens, lack of physical keyboards, speech to text software, and many other design changes. Tablet computers evolved from this new wave of mobile devices, along with "netvertibles" – laptops with screens that rotated to provide a form factor similar to a tablet.

While laptops continued to reduce in size, mobile phone manufacturers began releasing devices with increasing form factors. Mobile phone screen sizes began increasing and physical keyboards were included. Mobile technology had seemingly been merged from laptop

computers and mobile phones into a single platform. To further obfuscate the technology landscape, technology was developed that allowed these mobile devices to connect to their stationary counterparts.

For the purposes of this study, mobile technology will only include devices developed and marketed as mobile phones with the ability to run high level operating systems. These devices are commonly referred to as smartphones, due to their increased sophistication as compared to feature phones with lesser capabilities, such as the ability to run high level operating systems. Smartphones are specifically designed with more computing power than traditional mobile phones and are capable of running full-featured applications. Smartphones are further distinguishable from their netbook, tablet, or laptop counterparts in that they are designed to be kept on a user's person at all times (Jarvenpaa, S., Lang, K., 2005).

Properly leveraging smartphones to accomplish an organization's mission, however, presents challenges for enterprise managers. Smartphones extend the capabilities of communication and productivity beyond the constraints of the traditional office. This characteristic has a dualistic effect on mobile workers. Increased productivity is a positive effect due to constant availability for work, regardless of physical location, proximity to the traditional office, or time of day. However, a higher surface of responsibility increases the potential for worker burnout and stress (British Psychological Society, 2012).

Enterprises must also determine how to deal with mobile technology support. While solutions exist that manage traditional technology, mobile technology management solutions are still in their infancy (Messmer, 2010). The vast number of devices available as well as differences among carrier standards has become a major roadblock to universal, granular control

of mobile devices. As such, supporting mobile devices presents a unique challenge to enterprise technology management.

Additionally, the increasing sophistication and growth of hacking has prompted enterprises to adopt security policies for mobile phones. In the wake of Research In Motion's decline, some enterprises are allowing employees to use their personal devices for enterprise work (Messmer, 2010). Personal smartphones likely have the same capabilities as a company-issued smartphone, so to reduce costs, technology managers are simply allowing personal devices to be used on the network. This practice introduces possible threats to enterprise security. Personal devices cannot be locked down like enterprise devices without user permission. If an employee loses their personal device that has not been properly password protected or encrypted, the likelihood of data loss or theft increases dramatically. Further, the type of data that is authorized for access on a smartphone should be defined (Ashford, 2012).

Other challenges have been identified which can inhibit successful use of mobile phones in the enterprise. Training users to interface with a much smaller device requires expending company resources, including the employees' time, costs for the training sessions, and loss of productivity during training (Chu & Huang, 2008; Mas & Ng'weno, 2010). The type of device, the service required, and the software to be included are more questions that face potential mobile technology decision makers in the enterprise (von Niman et al., 2006). Many studies focus on the importance of proper interface design for mobile applications, pointing out the smaller screen size poses a unique challenge for designers (Chiem et al., 2010; Donker & Blumberg, 2011; Holtzblatt, 2005). These challenges of mobile technology create – in part – the need to determine the existence of new variables related to information systems (IS) success. For enterprises to confidently implement mobile technology within information systems, a solid

framework of mobile success needs to be followed. Many researchers have noted that by adopting a success framework more IS projects are successfully implemented (DeLone & McLean, 2003; Ustasüleyman, & PerçİN, 2010). This is partly due to the direction such frameworks give to senior management in areas such as technology adoption, implementation, and use (Chung, Skibniewski, & Kwak, 2009).

A leading model to determine successful use of technology has been the DeLone and McLean IS Success Model. DeLone and McLean tackled the issue of discovering what causes IS success in the early 1990s. Hundreds of studies had posited several different variables that determined the success of an IS project. DeLone and McLean compiled a list of these variables and transformed them into a cohesive framework that described IS success. Ten years later, they updated their model to include the variables created by e-commerce, a concept that characterized the technological advances made since the inception of their first model. The Internet had revolutionized the manner in which business took place, and e-commerce became a dominant business model.

As the field of mobile technology has expanded, researchers have shown increasing interest in mobile implementation issues and the larger impact of mobile phones on society and business (Lehmann et al. 2008; Lu, Yao, & Yu, 2005; Chiem et al., 2010; Chung & Kwon, 2009; Vatanparast & Butt, 2010). However, the literature is fragmented. Several researchers have indicated that the measurement and use of mobile technology within IS is under-studied (Chatterjee, Chakraborty, Sarker, Sarker, Lau, 2008; Lehmann, Prasad, Scornavacca, 2008). Chatterjee et al. (2008) stated that most studies in the area of mobile technology are organized around case studies and do not "attempt…theoretical assimilation."

1.2 Research Questions

This thesis attempts to correct this situation by examining the DeLone and McLean Information Systems Success Model (aka D&M IS Success Model) in measuring the efficacy of mobile technology integration within information systems. It examines the literature, develops a methodology, and presents the results. The result of the literature review is a list of variables related to mobile success in information systems. The findings hope to show that the new variables discovered to be related to mobile technology success are applicable to the DeLone and McLean IS Success Model. The resulting framework is a quality resource for researchers to construct solutions to practical issues. It also provides IS managers a practical model for integration of mobile technology within their organizations' information systems.

An examination of these new variables is necessary to ensure the D&M IS Success Model remains applicable to modern information systems utilizing mobile technology. One of DeLone and McLean's highest priorities for their model was to maintain a parsimonious framework to be simple enough to apply to any IS situation. To that end, the relative significance of the new variables must be established to determine their potential inclusion within the proposed model. This study examined the following three questions:

- What new dependent variables applying to mobile technology have been introduced since the D&M IS Success model was last updated for e-commerce?
- What is the relative significance of these variables to each other and the D&M IS Success Model?
- How can these variables be used to update the D&M IS Success Model to mobile technology?

1.3 Research Method

To answer these three questions, this researcher reviewed the existing academic literature to identify success variables applicable to mobile technology. These variables were then tabulated similarly to DeLone and McLean's original study. The list of variables was examined for applicability to mobile technology and normalized to reduce redundancy. The resultant table was then scrutinized to identify variables that expanded upon the latest revision of DeLone and McLean's IS Success Model to include mobile technology. The adapted model is presented in Chapter 4 of this study.

1.4 Summary

Developments in mobile technology have provided many benefits to enterprise workers, such as mobility and flexibility. But mobile technology also presents unique challenges to enterprises, such as device support and security. Enterprises need a model that provides a framework for successful mobile implementation to overcome those challenges and obtain the full benefits of mobile technology. Although the current literature has examined many facets of mobile technology, none apply a general theory of success. By updating the DeLone and McLean IS Success Model for mobile technology, this study presents a model for successfully implementing mobile technology. The next chapter examines the current academic literature in depth.

Chapter 2 – Review of Literature and Research

Chapter 1 explained that smartphone proliferation is playing a key role in the enterprise, not just in allowing communication, but also facilitating productivity among mobile workers, allowing them to work efficiently and effectively from remote locations. However, the acceptance and advanced support required by smartphones and other mobile devices is critical to the successful implementation of smartphones. Thus, the factors that affect IT management's goals, plans and risks to deploy smartphones need to be researched. Many models have been developed that provide guidance towards IS success. In this chapter, the widely used DeLone and McLean IS Success Model is reviewed. The history and purpose of the model are important aspects in determining its significance to smartphones. Studies that adapt the model for mobile technology are identified, along with other practical uses of the model.

2.1 Measuring IS Success

Researchers and practitioners have long been interested in identifying determinants in IS success, asserting that IT projects face high failure rates. Gartner, for example, published a report that found 43% of IT projects failed in 2010 (Tan, 2011 in Gulla, 2011). A similar study in 2010 by PM Solutions – a project management consulting firm – examined projects from 163 organizations from several industries and found 37% of IT projects failed (PM Solutions, 2010). In addition, the United States Government Accountability Office found that 49% of federally funded IT projects in 2008 were failing (Powner, 2008). IBM, analyzing success rates of its projects between 2006 and 2008, found that success rates only increased 4% - from 57% to 61% despite management involvement (IBM, 2008). The Standish Group, in its study of success rates, defined project success as "delivered on time, on budget, with required features and

functions" (The Standish Group, 2009). The high rate of project failure emphasizes the importance of identifying the factors of a successful IS project. This decades-old challenge motivated DeLone and McLean to create their IS Success Model.

2.2 History

The D&M IS Success Model, though published in 1992, was based on theoretical and empirical IS research conducted by a number of researchers in the 1970s and 1980s (Ortigueira, 1987; Finkelstein & Carson, 1985). It introduced a way of measuring the success of information systems. Before DeLone and McLean published their work, IS researchers used a vast array of qualifying categories to determine information system success. But DeLone and McLean felt that some determinants where surely more important than others. Thus, DeLone and McLean tabulated nearly 100 separate variables used to determine IS success, shown in Appendix A. From that plethora, they created a categorical model to determine IS success. Their model consisted of six interrelated dimensions that comprehensively defined IS success:

- System Quality – which measures the information processing system itself
- Information Quality – which measures information system output
- Use – which measures the intention to use the output of an information system
- User Satisfaction – which measures recipient response to the use of the output of an information system
- Individual Impact – which measures the effect of information on the behavior of the recipient
- Organizational Impact – which measures the effect of information on organizational performance

Figure 2.1 shows how the six dimensions interact and respond to each other. As DeLone and McLean (1992) wrote:

> System Quality and Information Quality singularly and jointly affect both Use and User Satisfaction. Additionally, the amount of Use can affect the degree of User Satisfaction – positively or negatively – as well as the reverse being true. Use and User Satisfaction are direct antecedents of Individual Impact; and, lastly, this Impact on individual performance should eventually have some Organizational Impact.

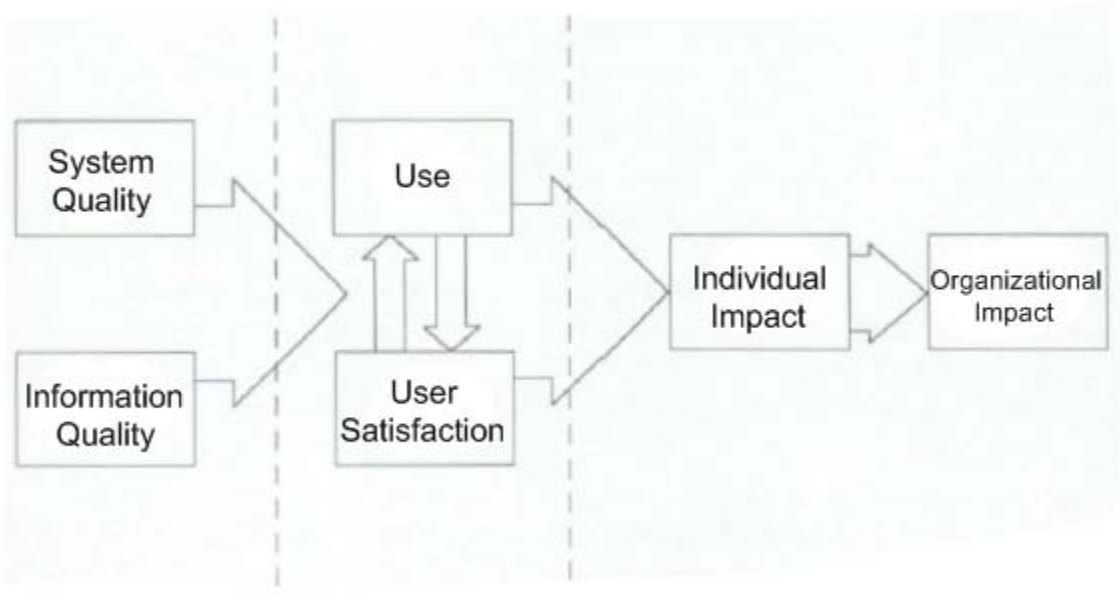

Figure 2.1. Graph depicting the original graphical representation of dimensional relationships of the D&M IS Success Model.

2.3 E-Commerce Upgrade

Motivated by DeLone and McLean's call for further validation of their model, many researchers attempted to extend the original model (Ballantine et al., 1996; Seddon, 1997; Fraser & Salter, 1995; Pitt, Watson, & Kavan, 1995; Wilkin & Hewett, 1999). Ten years after the publication of their first model and based on the evaluation of the many contributions to it,

DeLone and McLean proposed an updated IS success model to accommodate changing industry practices and methods, especially with regard to e-commerce. As enterprises began investing in costly and sophisticated e-commerce applications, the need to adapt the D&M IS Success model became apparent. The primary users of e-commerce applications replaced internal users that DeLone and McLean envisioned with their original model. Success factors were no longer contained within the organization. The success of an IS was expanded to include stakeholders across the entire value chain, including customer and suppliers. As a result, the D&M IS Success model required modification to incorporate changes brought on by ecommerce. Additionally, new variables had to be examined to determine their inclusion within the adapted model, shown in Appendix B.

When DeLone & McLean updated their model for ecommerce, new success elements were identified. Service Quality was added to reflect the "overall support delivered by the service provider" (DeLone & McLean, 2003). They were referring to variables such as "usability, availability, reliability, adaptability, and response time (e.g., download time)" unique to e-commerce (DeLone & McLean, 2003).

In addition, Net Benefits became the new conclusion dimension of success, calculated by the difference of positive and negative impacts of the system. The dimension of Use was subcategorized with Intention to Use to differentiate actual system use and the attitude toward the system before use.

Figure 2.2 shows a graphical representation of the updated D&M IS Success Model. The success of a system begins with the quality of the system itself, the information provided, and the level of service maintained. These dimensions affected the user's intention to use the system, the

actual use, and the user's level of satisfaction. The difference between the positive and negative aspects of the user's experience will determine the success – or Net Benefit – of the system.

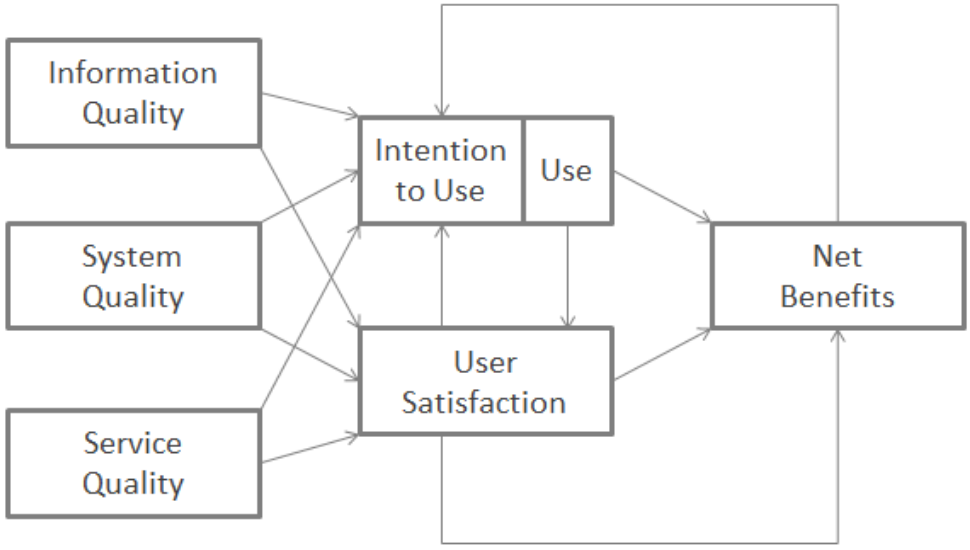

Figure 2.2. The updated D&M IS Success Model includes Service Quality as a new dimension, subcategorizes Use with Intention to Use, and combines the Impacts of the system into Net Benefits.

2.4 Studies Applying Mobile Technology

A number of researchers have since continued to adapt the D&M IS Success model to their specifications by introducing new variables applicable to mobile technology (Lee & Chung, 2009). Chatterjee et al. (2008) introduced several variables, such as device selection, immediacy, and coverage. In another study, Lee and Chung (2009) presented variables that affect the level of trust in mobile use, including system quality, information quality and interface design quality. Other studies introduced success variables within their own frameworks similar to the D&M model (Lee & Park, 2008; Gebauer & Shaw, 2004). These adapted models tended to support specific IS applications, such as banking systems or in marketing (Byramjee, Bhagat, Krishnan, & Pankaj, 2010; Kim, Chan, & Gupta, 2007; Lee & Chung, 2009; Lehmann, Prasad,

Scornavacca, 2008). Byramjee et al. (2010) performed a study to "establish the convergent and discriminant validity" of variables they found to be related to the success of m-commerce (aka mobile commerce). Their study focused specifically on the use and adoption of mobile technology specifically to mobile applications in a commercial setting. They introduced "consumer innovativeness for mobile technology usage, consumers' quality perceptions of mobile technology, trustworthiness of the mobile technology system, and perceived value from mobile technology" as dependent variables to the success of mobile commerce. However, their study focused on the aspect of Use or Intention to Use within the D&M IS success model without discussing the relationships of those variables to the rest of the model.

2.5 Further Uses

In addition to mobile, researchers have adopted the D&M IS Success Model to other technologies. Chung (2007) adapted the model to identify success factors specific to ERP implementations. Urbach, Smolnik, and Riempp (2010) adapted the model to determine the success of an employee web portal. Twine and Brown (2011) used the model to evaluate the efficacy of a web conferencing system. Several hundred other peer-reviewed studies cite DeLone and McLean's two studies based on this researcher's search results from academic search engines, illustrating the vast impact of their work.

2.6 Summary

The topic of IS success has been researched for decades. But the work of DeLone and McLean laid much of the foundation for understanding determinants of IT success. Their model focused on universality and parsimony, two concepts that have produced a substantial number of dependent studies of varying subject matter. DeLone and McLean recognized that changes in IT required a constant update to accommodate changing technologies and business environments.

Chapter 3 details the methodology used in this study to update the D&M model for mobile technology.

Chapter 3 – Methodology

Chapter 2 reviewed models that have been developed to identify determinants for IT success. The widely used DeLone and McLean model provided a parsimonious look at what variables constitute IS success. Their model has been validated by several studies. DeLone and McLean last updated their IS success model in 2003 to adjust for the manifestation of e-commerce as an element of IS. Since then, mobile computing has become a dominant element in IS and thus necessary to measure. To facilitate the inclusion of variables relevant to mobile technology, a comprehensive review of relevant literature was undertaken, similar to the method DeLone and McLean employed to substantiate their original study.

3.1 Review of Current Literature

To perform the literature review, four academic search engines were used to identify peer-reviewed studies that would contain variables relevant to the success of mobile technology in IS. The search engines used are listed in Table 3.1. The table also includes the syntax used to perform the queries, along with the number of results, and the results reviewed. Some queries included additional filters to reduce the number of irrelevant results. The queries performed on both the ACM Digital Library provided more relevant results when using a broader query, thus the number of results were significantly higher than Business Source Complete and the Computer Database. The results from ScienceDirect were even higher, although a more restrictive filter was used. This was likely due to the inclusion of journals from all fields of science, whereas the other search engines focused on computer science and information technology fields. Results were typically filtered to include only studies or articles that were peer reviewed or academic in nature. Only studies published after 2001 were considered. This

researcher assumed that articles published before this limit would not have contained variables relevant to mobile technology because mobile technology was not widely used. Additionally, articles related to IS success prior to 2001 would likely have already been considered by DeLone and McLean for inclusion in their updated model.

Table 3.1

Syntax and Search Engines Used to Search for New Variables

Search Engine Title	Syntax	Additional Filters	Number of Results	Results Reviewed
Business Source Complete	(mobile) AND (success OR effectiveness)	Full text; Scholarly/Peer Reviewed; Later than 2001	440	440
Computer Database	(mobile) AND (success OR effectiveness)	Full text; Scholarly/Peer Reviewed; Later than 2001	230	230
ACM Digital Library	Mobile work		>38,000	420
ScienceDirect (Elsevier)	mobile AND (success OR effectiveness)	Later than 2001	>55,000	400

3.2 Data Qualification

A total of 1,490 publications were qualified between November and December 2011. Each publication was determined relevant based on the information contained in the short preview or abstract displayed by the search engine. A total of 114 publications were determined to contain enough relevant material for further review. Each of these publications was

scrutinized for variables related to mobile success or effectiveness in IS. A subset of 42 publications contained relevant variables. The other publications were:

1) Irrelevant to mobile technology
2) Provided variables that were not directly related to mobile success
3) Not peer-reviewed
4) Did not actually contain variables, even though they were relevant to mobile success
5) Based on the Technology Acceptance Model

The Technology Acceptance Model (TAM) was designed to predict a user's perception of technology usefulness (Biljon, 2007; Lu, Yao, & Yu, 2005). The final measured variable in TAM is "Actual System Use." System Use is one of the existing dimensions of the D&M IS Success Model, thus, TAM would be considered as a single supporting variable contained in that dimension. Including the individual variables that support TAM would dilute the significance of the variables that autonomously support the dimensions of the D&M IS Success Model.

3.3 Review Results

Of the 42 relevant publications, 196 variables were identified and determined to be relevant to the application of mobile technology to the D&M IS Success Model. These variables were tabulated in the same manner as DeLone and McLean's original study. Each variable was listed in a row with the authors of the study it was taken from, a description of the study, the type of study (field or lab), an existing dimension in which to be subcategorized, and notes about the variable. The description included the industry the study was performed within and the type of study performed (e.g., questionnaire, literature review). In applicable cases, the scope of the study was documented, including the number of interviewees, respondents, or users that participated in the study to ensure that each study was given the proper amount of consideration,

based on scope. The variables were each assigned to an existing dimension to adhere to the original model's level of parsimony. Some variables were already included in DeLone and McLean's models and were grouped according to their existing dimension. Variables that were not included in the existing models were grouped into relevant dimensions based on their context. For example, "interface design" was not found in either existing model, but was categorized as part of the System Quality dimension due to the context of the study. "Interface design" in Bertini, Gabrielli, & Kimani (2006) referred to design heuristics of a mobile system, thus it was included in the System Quality dimension. Variables that could not be assigned were considered as possible new dimensions in the adapted model.

3.4 Summary

This chapter contains a comprehensive review of current literature related to mobile technology success in IS. The variables collected were tabulated in the same manner as DeLone and McLean's original studies and assigned to existing dimensions if possible. The variables that did not correlate with an existing dimension were possible candidates for a new IS success dimension created through the implementation of mobile technology. Chapter 4 details the data analysis and provides the findings of this study.

Chapter 4 – Data Analysis and Findings

The literature review in Chapter 3 provided a table of 196 variables related to mobile technology success. To determine whether mobile technology in IS necessitates consideration for supplementary dimensions within the D&M IS Success Model, the table of variables required an in depth analysis. Several significant discoveries were made from this data analysis.

4.1 Data Normalization

To determine the inclusion of a new dimension in the D&M IS Success Model, the new variables were tabulated and ranked ordinally based on frequency of use. Variables occurring in more studies would be more highly considered for inclusion within the adapted model. Proper analysis of the table of 196 variables required data normalization.

Different authors sometimes used different linguistic syntax to convey the same meaning. Certain variables were given different grammatical classes; for example, some authors chose to use “effective” or “usable” while others used “effectiveness” or “usability.” These variables were normalized into a single grammatical class to consolidate the number of similar variables.

Some variables were conceptually related. DeLone and McLean (1992) referred to these kinds of variables as “interdependent.” To maintain the framework’s parsimony, these interdependent variables were categorized within the concept they supported. Several variables supported the concept of interface design as a success variable, including Hedonics; Output Interaction; Flexibility, Efficiency of Use and Personalization; Interface Design Quality, and Interface Design itself. These variables all support the concept of Interface Design and were normalized under the single variable of Interface Design. The normalized table of variables is shown in Appendix C.

4.2 Review of the Variables

4.2.1 Context

The concept of Context surfaced in many of the reviewed studies. The following lists the variables combined into the single variable of Context:

- Consistency and Mapping
- Contextual
- Dangerous
- Factors related to mobile work context
- Information Access
- Infrastructural Context
- Localization
- Locatability
- Location Dependency
- Location Independence
- Location-centric
- Match between system and the real world
- Mobility
- Network Externalities
- Portability
- Safety
- Social Context

- Spatial Context
- Task Context
- Task Mobility
- Temporal Context
- Time Independence
- Ubiquity
- Use Situation
- Work Variability
- Worker Environment

Cherubini, de Oliveira, Hiltunen, and Oliver (2011) surveyed 395 users of contextually-aware mobile services. They adopted Dey's definition of context as "any information that can be used to characterize the situation of an entity (a person, place, or object that is considered relevant to the interaction)." They identified nine barriers for the adoption of mobile contextually-aware services, which can also be viewed as success factors to mobile success. Each barrier was considered from a contextual perspective, but only one – "Dangerous" – was specific to contextual use. The example given was "it is better not to use Google Maps while biking (Cherubini, de Oliveira, Hiltunen, and Oliver (2011). Thus, it is necessary to consider the situation or activity of mobile use.

Chu and Huang (2008) identified "information access" as a qualifying characteristic of a successful mobile application. Information access implies constant network connectivity regardless of user location, thus this variable was normalized as Context. Mallat (2007) identified "Location Independence" and "Network Externalities" as contextually relevant variables. In a survey of 179 professionals using mobile technology, Yuan, Archer, Connelly,

and Zheng (2010) identified "mobility" and "location dependency" as contextually relevant variables to mobile workers.

Bertini, Gabrielli, and Kimani (2006) analyzed a number of papers that examined human-computer interaction research methods in mobile communications. They determined the two primary factors in mobile usability heuristics were "consistency and mapping" and "match between system and the real world." They defined Consistency and Mapping as the correspondence of the user interface to real world tasks. The example given was GPS navigation in the real world. The match between System and the Real World was defined as the capability of the system to "sense its environment and adapt the presentation of information accordingly." Both factors are related to the concept of context and were normalized as the variable Context.

Table 4.1

The Five Dimensions of Context

Task Context	Social Context	Infrastructural Context	Temporal Context	Spatial Context
Interaction when using the system	Work community	Technologies	Schedules, deadlines	Place, location
Entity and goal of the task and work	Persons present at usage situations	Network connections	Pace of work	Temperature
	Culture	Device, system, and service ecosystems	(Ir)regularity	Noise
			Planned/Unplanned	Lighting
			Time of day or week	Furniture

Wigelius and Väätäjä (2009) examined three context related studies and identified five

contextual dimensions related to mobile technology use based on their findings. Each dimension contained several factors affecting mobile user experience as seen in Table 4.1. These factors relate to mobile workers specifically and present an entirely new set of variables that lead to – or block – mobile IS success. Each of these context dimensions was normalized as Context to maintain the requirement of parsimony for this framework.

The concept of Context, especially in terms of mobility, did not apply to IS while DeLone and McLean were performing their studies. Use of IS was within the context of the office space, thus context did not apply and does not occur in either of their studies. It occurred 33 times in 18 studies reviewed in this research. Based on the high occurrence of use in mobile technology studies of IS success, it is this researcher's recommendation to include Context as an additional dimension in the DeLone & McLean IS Success Model.

4.2.2 Trust

The concept of Trust occurred eight times in eight studies. Trust was not included in either of DeLone and McLean's studies. Lee and Chung (2009) performed a study measuring the effect of Trust on user satisfaction of a mobile banking system. They developed a research framework augmenting DeLone and McLean's model. Lee and Chung's model replaced Intention to Use and use with Trust. Their study showed that the users' trust of the system correlated with their satisfaction. Mas and Ng'weno's (2010) study showed that trust was built with the branding or marketing of the system as well as actual use of the system. Shen, Huang, Chu, and Hsu (2010) showed that trust increases Intention to Use. Because the variable of Trust was shown to be dependent on Intention to Use and Use and in order to keep with DeLone and McLean's requirement of parsimony, it is this researcher's recommendation to include Trust as a variable within the dimension of intention to use and use.

As shown in Table 4.2, several other variables occurred frequently in the studies reviewed. These variables were all easily placed within existing dimensions. Thus, regardless of the frequency of their occurrence in other studies, they do not prove substantive as individual dimensions within this framework.

Table 4.2

Variables with Significant Occurrences

Variable	**Occurrences**
Ease of Use Count	7
Interface Design Count	5
Security Count	5
Accessibility Count	4
Flexibility Count	4
Personalization Count	4
Support Count	4

4.3 Interdimensional Relationships

A second purpose of documenting the existing dimensions of the variables reviewed was to discover whether the new variables uncovered any new inter-dimensional relationships. With the exception of Context and Trust, the new variables collected could be categorized within existing dimensions. These new variables significantly expanded upon the list of variables collected by DeLone and McLean, and several applied specifically to mobile technology. Interface Design and Device Selection are important factors to mobile technology considering the smaller screen sizes and various methods of input (Coursaris & Kim, 2011; Gebauer & Shaw, 2004; Tarasewich, Gong, Nah, & Dewester, 2008). Immediacy and Coverage apply to mobile technology in the dimensions of System Quality and Information Quality (Lehmann, Prasad, &

Scornavacca, 2008). Portability and Flexibility are also specific to mobile technology (Bertini et al., 2006; Chatterjee, Chakraborty, Sarker, & Lau, 2009; Chen & Nath, 2008; Correa, Ishikawa, Ziviani, & Faria, 2008; Perry, O'hara, Sellen, Brown, & Harper, 2001). Many of the new variables collected apply to mobile or stationary technology, and are able to be grouped into existing dimensions. Thus, no new inter-dimensional relationships were discovered.

4.4 Summary

By analyzing the normalized table of variables, several key discoveries were made. The concept of Context was determined to be substantive enough to warrant its inclusion in the D&M IS Success Model as a new dimension of success due to its high frequency of occurrence in the studies reviewed as well as its singularity, which does not allow for categorization within an existing dimension. Although Trust was mentioned many times throughout the current literature, it was determined that its applicability within the existing dimensions of Use and Intention to Use did not warrant the creation of a new dimension of success. Instead, it was added to the prior dimensions as a new variable. Other variables such as Trust, Ease of Use, or Interface Design did not have the literary substantiation to warrant consideration as new dimensions. Finally, no new interdimensional relationships or changes to existing relationships were substantiated from the data analysis. Chapter 5 discusses the contributions of this work to the literature and recommendations for further research.

Chapter 5 – Conclusions

This chapter revisits topics covered in this study. It begins by recapping what has been learned about D&L model and then discusses the implications of extending the model to mobile technology. It ends with recommendations to validate and strengthen the findings of this study.

5.1 The DeLone and McLean Model Revisited

Thus, this researcher believes that this study had made a contribution to the literature on measuring IS success, and in particular extending the DeLone and McLean model to mobile technology. As Chapter One noted, the increased use of mobile technology cannot be ignored as simply a feature or enhancement. Mobile technology is replacing traditional computing as the core of IS infrastructure. The evolutionary nature of this phenomenon required an in depth look at the variables that cause mobile technology success. The resulting variables have been applied to the DeLone & McLean IS Success Model to enable enterprise leadership with the necessary tools to successfully complete modern IS projects. The findings from this study have aggregated the results of separate, similar studies to show that the concept of Context is a major factor in modern IS success.

The DeLone & McLean IS Success Model provided technology leaders with traditional IS success dimensions as a way to identify IS success. Their updated model accounted for the emergence of e-commerce and its resultant set of enterprise success variables. The continued innovation of technology manufacturers has given rise to a new phenomenon that has reshaped information systems. Mobile technology is no longer a feature of IS; it is a requirement. Mobile technology has emerged as the new direction for enterprise IS. Concepts such as telecommuting

and the global office have gained more traction as mobile technology becomes more integrated in the enterprise. Such practices have been shown to increase productivity and reduce costs.

In order to maximize the potential of mobile technology, enterprises must be able to correctly identify the successful implementation of mobile technology. The adapted model in Figure 5.1 visualizes the new dimension and its relationships with the existing model discovered by this study. Many of the variables found in the literature on mobile technology were applicable to traditional IS devices. Only the variables related to Context were singularly applicable to the concept of mobility. Traditional IS devices were controlled in a context dictated by company leaders. As workers became more mobile, the context of their workplace became more ambiguous. Company leaders were not able to control the context of their mobile workers. As such, it was apparent that context has become germane to the success of mobile workers.

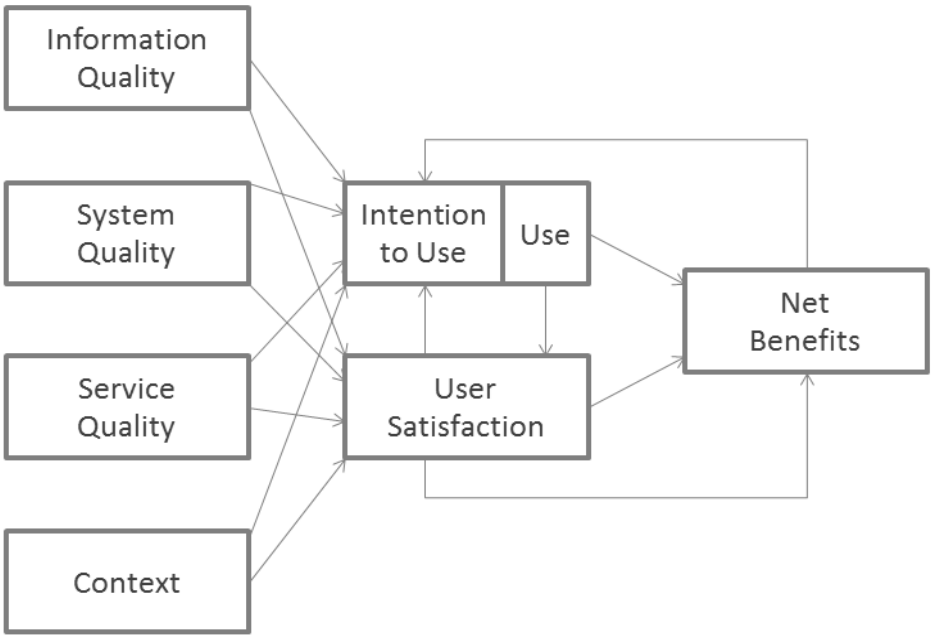

Figure 5.1. Update DeLone and McLean IS Success Model to include mobile technology

Many other variables were discovered in the current literature applicable to mobile technology. These variables – such as Trust – provide additional depth to the existing dimensions perhaps not as readily apparent prior to the emergence of mobile technology. Trust did not occur as a variable in DeLone and McLean's studies. However, it is clear in the studies of mobile technology that Trust is imperative when using technology. Users must trust their devices, service, and the information they use. In order to maintain the same level of parsimony as the existing model, Trust was added as a variable to the dimensions of Information Quality, System Quality, and Service Quality.

5.2 Further Research

The model displayed in Figure 5.1 was created from a comprehensive review of the current literature applying to mobile technology. To verify the findings of this study, this researcher encourages other researchers to develop other methodologies. One area for future research could include developing questionnaires for technology leaders to rank the mobile variables in order of relevance to IS success. The questionnaire should focus on:

1) Identifying dependent variables they consider relevant to mobile success in IS
2) Ranking a list of dependent variables of mobile technology relevant to IS success
3) The relation of the dependent variables to each other

This study can be regarded as an early attempt to document variables for measuring mobile technology success. A broader range of perspectives would result in a more complete and useful picture of the effect context has on IS success. Additionally, the findings from this study should be validated to identify the exact effects of context on IS project success. Further examination of Trust is required to determine its effect on use and intention to use. Finally, the relationships between Context and Intention to Use and User Satisfaction should be verified

through further research.

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Appendix A – Table of Variable from DeLone and McLean's Original Study

System Quality	Information Quality	Information Use	User Satisfaction	Individual Impact	Organization Impact
Data accuracy	Importance	Amount of use/duration of use:	Satisfaction with specifics	Information understand-ing	Application portfolio
Data currency	Relevance	Number of inquiries	Overall satisfaction	Learning	Range and scope of application
Database contents	Usefulness	Amount of connect time	Single-item measure	Accurate interpreta-tion	Number of critical applications
Ease of user	Informative-ness	Number of functions used	Multi-item measure	Information awareness	Operating cost reductions
Ease of learning	Usableness	Number of records accessed	Information satisfaction	Information recall	Stall reduction
Convenience of access	Understand-ability	Frequency of access	Difference between information needed and received	Problem identifica-tion	Overall productivity gains
Human factors	Readability	Frequency of report requests	Enjoyment	Decision effective-ness	Increased revenues
Realization of user requirements	Clarity	Number of reports generated	Software satisfaction	Decision quality	Increased sales
Usefulness of system features and functions	Format	Changes for system use	Decision-making satisfaction	Improved decision analysis	Increased market share
System accuracy	Appearance	Regularity of use		Correctness of decision	Increased profits
System	Content	Use by whom?		Time to	Return on

flexibility			make decision	investment
System reliability	Accuracy	Direct vs. chauffeured use	Confidence in decision	Return on assets
System sophistica-tion	Precision	Binary use	Decision-making participation	Ratio of net income to operating expenses
Integration of systems	Conciseness	Use vs. nonuse	Improved individual productivity	Cost/benefit ration
System efficiency	Sufficiency	Actual vs. reported use	Change in decision	Stock price
Resource utilization	Completeness	Nature of use	Causes manage-ment action	Increased work volume
Response time	Reliability	Use for intended purpose	Task performance	Product quality
Turnaround time	Currency	Appropriate use	Quality of plans	Contribution to achieving goals
	Timeliness	Type of information used	Individual power or influence	Increased work volume
	Uniqueness	Purpose of use	Personal valuation of I/S	Service effectiveness
	Comparability	Levels of use	Willingness to pay for information	
	Quantitative-ness	General vs. specific		
	Freedom from bias	Recurring use		
		Institutionaliza-tion/routinization		

	of use
	Report acceptance
	Percentage used vs. opportunity for use
	Voluntariness of use
	Motivation to use

Appendix B – Table of E-Commerce Variables

Systems Quality	Information Quality	Service Quality	Use	User Satisfaction	Net Benefits
Adaptability	Completeness	Assurance	Nature of use	Repeat purchases	Cost savings
Availability	Ease of understanding	Empathy	Navigation patterns	Repeat visits	Expanded markets
Reliability	Personalization	Responsiveness	Number of site visits	User surveys	Incremental additional sales
Response time	Relevance		Number of transactions executed		Reduced search costs
Usability	Security				Time savings

Appendix C – Normalized Table of New Variables Applying to Mobile Technology

Authors	Description of Study	Type	Variables	Existing Dimension
Bao, P., Pierce, J., Whittaker, S., Zhai, S., 2011	Survey, 214 smart phone users	Lab	Task Frequency	Use
Bao, P., Pierce, J., Whittaker, S., Zhai, S., 2011	Interview, 30 smart phone users	Lab	Task Type	Use
Bertini, E., Gabrielli, S., Kimani, S., 2006	Expert Evaluation	Lab	Context	N/A
Bertini, E., Gabrielli, S., Kimani, S., 2006	Expert Evaluation	Lab	Context	N/A
Bertini, E., Gabrielli, S., Kimani, S., 2006	Expert Evaluation	Lab	Ease of Use	System Quality
Bertini, E., Gabrielli, S., Kimani, S., 2006	Expert Evaluation	Lab	Interface Design	System Quality
Bertini, E., Gabrielli, S., Kimani, S., 2006	Expert Evaluation	Lab	Flexibility	System Quality
Bertini, E., Gabrielli, S., Kimani, S., 2006	Expert Evaluation	Lab	Aesthetic, privacy and social convention	Intention to Use
Bertini, E., Gabrielli, S., Kimani, S., 2006	Expert Evaluation	Lab	Realistic error management	System Quality
Bertini, E., Gabrielli, S., Kimani, S., 2006	Expert Evaluation	Lab	Visibility of system status and losability/findability	System Quality
Büyüközkan, G., 2009	Survey, 3 experts, 5 m-commerce users	Field	Context	N/A
Büyüközkan, G., 2009	Survey, 3 experts, 5 m-commerce users	Field	Reliability	System & Information Quality
Büyüközkan, G., 2009	Survey, 3 experts, 5 m-	Field	Price	Net Benefits

	commerce users			
Büyüközkan, G., 2009	Survey, 3 experts, 5 m-commerce users	Field	Added Value	Net Benefits
Büyüközkan, G., 2009	Survey, 3 experts, 5 m-commerce users	Field	Simplicity	System Quality
Byramjee, F., Bhagat, P., Krishnan, K., Pankaj, 2010	Survey, 225 respondents	Lab	Trust	–>Use
Byramjee, F., Bhagat, P., Krishnan, K., Pankaj, 2010	Survey, 225 respondents	Lab	Consumers' Innovativeness	Intention to Use
Byramjee, F., Bhagat, P., Krishnan, K., Pankaj, 2010	Survey, 225 respondents	Lab	Perceived Value	Net Benefits
Byramjee, F., Bhagat, P., Krishnan, K., Pankaj, 2010	Survey, 225 respondents	Lab	Quality Perceptions	Intention to Use
Chatterjee, S., Chakraborty, S., Sarker, S., Lau, F., 2009	Medical, Literature Review	Lab	Support	Service Quality
Chatterjee, S., Chakraborty, S., Sarker, S., Lau, F., 2009	Medical, Literature Review	Lab	Reliability	Service Quality
Chatterjee, S., Chakraborty, S., Sarker, S., Lau, F., 2009	Medical, Literature Review	Lab	Task Structure	Use
Chatterjee, S., Chakraborty, S., Sarker, S., Lau, F., 2009	Medical, Literature Review	Lab	Portability	System Quality
Chen, L., Nath, R., 2008	Interview, 10 CIOs	Field	Security	Information Quality
Chen, L., Nath, R., 2008	Interview, 10 CIOs	Field	Flexibility	System Quality
Chen, L., Nath, R., 2008	Interview, 10	Field	Support	Service Quality

	CIOs			
Chen, L., Nath, R., 2008	Interview, 10 CIOs	Field	Connectivity	Service Quality
Chen, L., Nath, R., 2008	Interview, 10 CIOs	Field	Attractiveness	N/A
Chen, L., Nath, R., 2008	Interview, 10 CIOs	Field	Employee Management	Net Benefits
Cherubini, M., de Oliveira, R., Hiltunen, A., Oliver, N., 2011	Survey, 395 Respondents	Lab	Context	N/A
Cherubini, M., de Oliveira, R., Hiltunen, A., Oliver, N., 2011	Survey, 395 Respondents	Lab	Trust	–>Use
Cherubini, M., de Oliveira, R., Hiltunen, A., Oliver, N., 2011	Survey, 395 Respondents	Lab	Ease of Use	System Quality
Cherubini, M., de Oliveira, R., Hiltunen, A., Oliver, N., 2011	Survey, 395 Respondents	Lab	Personalization	Service Quality
Cherubini, M., de Oliveira, R., Hiltunen, A., Oliver, N., 2011	Survey, 395 Respondents	Lab	Privacy	Information Quality
Cherubini, M., de Oliveira, R., Hiltunen, A., Oliver, N., 2011	Survey, 395 Respondents	Lab	Usefulness	Net Benefits
Cherubini, M., de Oliveira, R., Hiltunen, A., Oliver, N., 2011	Survey, 395 Respondents	Lab	Embarrassment	Use
Cherubini, M., de Oliveira, R., Hiltunen, A., Oliver, N., 2011	Survey, 395 Respondents	Lab	Overload	Information Quality
Cherubini, M., de Oliveira, R., Hiltunen, A., Oliver, N., 2011	Survey, 395 Respondents	Lab	Popularity	Intention to Use
Chu, Y. Huang, L., 2008	Case Study, Distributor	Field	Context	N/A

Chu, Y. Huang, L., 2008	Case Study, Distributor	Field	Connectivity	Service Quality
Chu, Y. Huang, L., 2008	Case Study, Distributor	Field	System Performance	System Quality
Chu, Y. Huang, L., 2008	Case Study, Distributor	Field	Communication	Service Quality
Chu, Y. Huang, L., 2008	Case Study, Distributor	Field	Data Processing	Information Quality
Chu, Y. Huang, L., 2008	Case Study, Distributor	Field	Notification	Service Quality
Chu, Y. Huang, L., 2008	Case Study, Distributor	Field	Scope of the system	Net Benefits
Chung, N., Kwon, S. J., 2009	Financial, Questionnaire, 397 respondents	Lab	Trust	–>Use
Correa, B., Ishikawa, E., Ziviani, A., Faria, M., 2008	Medical, Proof-of-Concept	Lab	Flexibility	System Quality
Coursaris, C. K., Kim, D. J., 2007	Literature Review	Lab	Context	N/A
Coursaris, C. K., Kim, D. J., 2007	Literature Review	Lab	Interface Design	System Quality
Coursaris, C. K., Kim, D. J., 2007	Literature Review	Lab	Accessibility	Service Quality
Coursaris, C. K., Kim, D. J., 2007	Literature Review	Lab	Usability	System & Information Quality
Coursaris, C. K., Kim, D. J., 2007	Literature Review	Lab	Task	Use
Coursaris, C. K., Kim, D. J., 2007	Literature Review	Lab	Technology	System Quality
Coursaris, C. K., Kim, D. J., 2007	Literature Review	Lab	User	User Satisfaction
Coursaris, C.K., Kim, D.J., 2011	Literature Review	Lab	Interface Design	System Quality

Coursaris, C.K., Kim, D.J., 2011	Literature Review	Lab	Accessibility	Service Quality
Coursaris, C.K., Kim, D.J., 2011	Literature Review	Lab	Efficiency	Net Benefits
Coursaris, C.K., Kim, D.J., 2011	Literature Review	Lab	Effectiveness	Net Benefits
Coursaris, C.K., Kim, D.J., 2011	Literature Review	Lab	Satisfaction	User Satisfaction
Fidel, R., Scholl, H.J.J., Liu, S.M., Unsworth, K., 2007	Government, Case Study	Field	Context	N/A
Fidel, R., Scholl, H.J.J., Liu, S.M., Unsworth, K., 2007	Government, Case Study	Field	Corporate Structure	Intention to Use
Fidel, R., Scholl, H.J.J., Liu, S.M., Unsworth, K., 2007	Government, Case Study	Field	Detail Complexity	Use
Fidel, R., Scholl, H.J.J., Liu, S.M., Unsworth, K., 2007	Government, Case Study	Field	Task Specificity	Use
Fidel, R., Scholl, H.J.J., Liu, S.M., Unsworth, K., 2007	Government, Case Study	Field	Turnover Rate	Net Benefits
Fidel, R., Scholl, H.J.J., Liu, S.M., Unsworth, K., 2007	Government, Case Study	Field	User Commitment	User Satisfaction
Gebauer, J., 2008	Survey, 216 Respondents	Field	Context	N/A
Gebauer, J., 2008	Survey, 216 Respondents	Field	Functionality	System Quality
Gebauer, J., 2008	Survey, 216 Respondents	Field	Usability	System & Information Quality
Gebauer, J., 2008	Survey, 216 Respondents	Field	Operation	Use
Gebauer, J., 2008	Survey, 216	Field	Technology Maturity	System Quality

	Respondents			
Gebauer, J., Shaw, M.J., 2004	Case Study & Survey, 17 respondents	Field	Context	N/A
Gebauer, J., Shaw, M.J., 2004	Case Study & Survey, 17 respondents	Field	Context	N/A
Gebauer, J., Shaw, M.J., 2004	Case Study & Survey, 17 respondents	Field	Efficiency	Net Benefits
Gebauer, J., Shaw, M.J., 2004	Case Study & Survey, 17 respondents	Field	Functionality	Intention to Use
Gebauer, J., Shaw, M.J., 2004	Case Study & Survey, 17 respondents	Field	System Performance	System Quality
Gebauer, J., Shaw, M.J., 2004	Case Study & Survey, 17 respondents	Field	Task Frequency	Use
Gebauer, J., Shaw, M.J., 2004	Case Study & Survey, 17 respondents	Field	Task Structure	Use
Gebauer, J., Shaw, M.J., 2004	Case Study & Survey, 17 respondents	Field	Need to handle "Emergency Situations"	Net Benefits
Gebauer, J., Shaw, M.J., 2004	Case Study & Survey, 17 respondents	Field	User Support	Service Quality
Junglas, I., Abraham, C., Watson, R., 2008	Case Study, 112 Students	Lab	Context	N/A
Junglas, I., Abraham, C., Watson, R., 2008	Case Study, 112 Students	Lab	Context	N/A
Kim, H., Chan, H., Gupta, S., 2007	Literature Review, Survey, 161 respondents	Lab	Ease of Use	System Quality
Kim, H., Chan, H.,	Literature Review, Survey,	Lab	Usefulness	System Quality

Gupta, S., 2007	161 respondents			
Kim, H., Chan, H., Gupta, S., 2007	Literature Review, Survey, 161 respondents	Lab	Enjoyment	System Quality
Kim, H., Chan, H., Gupta, S., 2007	Literature Review, Survey, 161 respondents	Lab	Perceived Fee	Net Benefits
Lee, C., Cheng, H., Cheng, H., 2007	Survey, 238 Respondents	Field	Ease of Use	System Quality
Lee, C., Cheng, H., Cheng, H., 2007	Survey, 238 Respondents	Field	Reliability	System Quality
Lee, C., Cheng, H., Cheng, H., 2007	Survey, 238 Respondents	Field	Compatibility	Information Quality
Lee, C., Cheng, H., Cheng, H., 2007	Survey, 238 Respondents	Field	Data Quality	Information Quality
Lee, C., Cheng, H., Cheng, H., 2007	Survey, 238 Respondents	Field	Timeliness	Information Quality
Lee, C., Cheng, H., Cheng, H., 2007	Survey, 238 Respondents	Field	Authorization	System Quality
Lee, C., Cheng, H., Cheng, H., 2007	Survey, 238 Respondents	Field	Data Locatability	Information Quality
Lee, C., Cheng, H., Cheng, H., 2007	Survey, 238 Respondents	Field	Relationship with Users	Net Benefits
Lee, K. C., Chung, N., 2009	Banking, Survey, 276 respondents	Lab	Trust	–>Use
Lee, K. C., Chung, N., 2009	Banking, Survey, 276 respondents	Lab	Interface Design	System Quality
Lee, M. J. W., Chan, A., 2007	Education, Case Study, Survey, 18 respondents	Lab	Context	N/A
Lee, M. J. W., Chan, A., 2007	Education, Case Study, Survey, 18 respondents	Lab	Context	N/A

Lee, M. J. W., Chan, A., 2007	Education, Case Study, Survey, 18 respondents	Lab	Context	N/A
Lee, M. J. W., Chan, A., 2007	Education, Case Study, Survey, 18 respondents	Lab	Personalization	Information Quality
Lee, M. J. W., Chan, A., 2007	Education, Case Study, Survey, 18 respondents	Lab	Pervasive	Information Quality
Lee, M. J. W., Chan, A., 2007	Education, Case Study, Survey, 18 respondents	Lab	Spontaneous	Service Quality
Lehmann, H., Prasad, M., Scornavacca, E., 2008	Medical, Case Study	Field	Device Selection	System Quality
Lehmann, H., Prasad, M., Scornavacca, E., 2008	Medical, Case Study	Field	Device Selection	Information Quality
Lehmann, H., Prasad, M., Scornavacca, E., 2008	Medical, Case Study	Field	Immediacy	System Quality
Lehmann, H., Prasad, M., Scornavacca, E., 2008	Medical, Case Study	Field	Immediacy	Information Quality
Lehmann, H., Prasad, M., Scornavacca, E., 2008	Medical, Case Study	Field	Coverage	Service Quality
Lehmann, H., Prasad, M., Scornavacca, E., 2008	Medical, Case Study	Field	IT Governance	Service Quality
Liang, T., Huang, C., Yeh, Y., Lin, B., 2007	Multi-Case Study	Field	Fit	System Quality
Liang, T., Huang, C., Yeh, Y., Lin, B., 2007	Multi-Case Study	Field	Viability	System Quality
Mahatanankoon, P., Wen, H., Lim, B., 2005	Survey, 251 Respondents	Lab	Context	N/A

Mahatanankoon, P., Wen, H., Lim, B., 2005	Survey, 251 Respondents	Lab	Convenience	System Quality
Mahatanankoon, P., Wen, H., Lim, B., 2005	Survey, 251 Respondents	Lab	Always on	Service Quality
Mahatanankoon, P., Wen, H., Lim, B., 2005	Survey, 251 Respondents	Lab	Customization	Information Quality
Mahatanankoon, P., Wen, H., Lim, B., 2005	Survey, 251 Respondents	Lab	Identifiability	Information Quality
Maiju, V., Anne, A., Minna, K., Teija, V., Wigelius, H., 2008	Review of Two Case Studies	Lab	Context	N/A
Maiju, V., Anne, A., Minna, K., Teija, V., Wigelius, H., 2008	Review of Two Case Studies	Lab	Context	N/A
Maiju, V., Anne, A., Minna, K., Teija, V., Wigelius, H., 2008	Review of Two Case Studies	Lab	Ease of Use	System Quality
Maiju, V., Anne, A., Minna, K., Teija, V., Wigelius, H., 2008	Review of Two Case Studies	Lab	Ease of Use	System Quality
Maiju, V., Anne, A., Minna, K., Teija, V., Wigelius, H., 2008	Review of Two Case Studies	Lab	Support	Service Quality
Maiju, V., Anne, A., Minna, K., Teija, V., Wigelius, H., 2008	Review of Two Case Studies	Lab	Efficiency	Net Benefits
Maiju, V., Anne, A., Minna, K., Teija, V., Wigelius, H., 2008	Review of Two Case Studies	Lab	Effectiveness	Net Benefits
Maiju, V., Anne, A., Minna, K., Teija, V., Wigelius, H., 2008	Review of Two Case Studies	Lab	Impacts on mobile work productivity	Net Benefits
Maiju, V., Anne, A., Minna, K., Teija, V., Wigelius, H., 2008	Review of Two Case Studies	Lab	Installation	System Quality
Maiju, V., Anne, A., Minna, K., Teija, V.,	Review of Two	Lab	User Satisfaction	User

Wigelius, H., 2008	Case Studies			Satisfaction
Mallat, N., 2007	Interview, 46 Mobile users	Lab	Context	N/A
Mallat, N., 2007	Interview, 46 Mobile users	Lab	Context	N/A
Mallat, N., 2007	Interview, 46 Mobile users	Lab	Context	N/A
Mallat, N., 2007	Interview, 46 Mobile users	Lab	Context	N/A
Mallat, N., 2007	Interview, 46 Mobile users	Lab	Trust	–>Use
Mallat, N., 2007	Interview, 46 Mobile users	Lab	Security	Information Quality
Mallat, N., 2007	Interview, 46 Mobile users	Lab	Compatibility	Information Quality
Mallat, N., 2007	Interview, 46 Mobile users	Lab	Complexity	System Quality
Mallat, N., 2007	Interview, 46 Mobile users	Lab	Costs	Net Benefits
Mallat, N., 2007	Interview, 46 Mobile users	Lab	Critical Mass	Use
Mas, I., Ng'weno, A., 2010	Case Study & Literature Review	Field	Trust	–>Use
Mas, I., Ng'weno, A., 2010	Case Study & Literature Review	Field	Price	Net Benefits
Perry, M., O'hara, K., Sellen, A., Brown, B., Harper, R., 2001	Interview, 17 Professionals	Lab	Accessibility	Service Quality
Perry, M., O'hara, K., Sellen, A., Brown, B., Harper, R., 2001	Interview, 17 Professionals	Lab	Flexibility	System Quality
Perry, M., O'hara, K., Sellen, A., Brown, B.,	Interview, 17 Professionals	Lab	Response Time	System Quality

Harper, R., 2001				
Perry, M., O'hara, K., Sellen, A., Brown, B., Harper, R., 2001	Interview, 17 Professionals	Lab	Collaboration	Service Quality
Perry, M., O'hara, K., Sellen, A., Brown, B., Harper, R., 2001	Interview, 17 Professionals	Lab	Monitoring	Service Quality
Shen, Y., Huang, C., Chu, C., Hsu, C.,2010	Financial, Questionnaire, 400 respondents	Lab	Trust	–>Use
Shen, Y., Huang, C., Chu, C., Hsu, C.,2010	Financial, Questionnaire, 400 respondents	Lab	Security	Information Quality
Shen, Y., Huang, C., Chu, C., Hsu, C.,2010	Financial, Questionnaire, 400 respondents	Lab	Convenience	System Quality
Shen, Y., Huang, C., Chu, C., Hsu, C.,2010	Financial, Questionnaire, 400 respondents	Lab	Expertise	Use
Shen, Y., Huang, C., Chu, C., Hsu, C.,2010	Financial, Questionnaire, 400 respondents	Lab	Self-efficacy	Use
Shen, Y., Huang, C., Chu, C., Hsu, C.,2010	Financial, Questionnaire, 400 respondents	Lab	Technology Anxiety	Use
Siau, K., Shen, Z., 2003	Literature Review	Lab	Trust	–>Use
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Personalization	System Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Content	Information Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Content	Information Quality

Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Privacy	Information Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Data Quality	Information Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Response Time	Service Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Capture	Service Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Data Format	Information Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Data Volume	Information Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Interoperability	System Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Maintenance	Service Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Metadata	Information Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Request Handling	Information Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Scalability	System & Information Quality
Smith, J., Mackaness, W., Kealy, A., Williamson, I., 2004	Government, Case Study	Field	Standards/format	Service Quality
Spivack, A. J., Rubin,	Proposition for	Lab	Context	N/A

B. A., 2011	further study			
Stoica, M., Miller, D W., Stotlar, D., 2005	Literature Review	Lab	Context	N/A
Stoica, M., Miller, D W., Stotlar, D., 2005	Literature Review	Lab	Context	N/A
Stoica, M., Miller, D W., Stotlar, D., 2005	Literature Review	Lab	Security	Information Quality
Stoica, M., Miller, D W., Stotlar, D., 2005	Literature Review	Lab	Accessibility	Service Quality
Stoica, M., Miller, D W., Stotlar, D., 2005	Literature Review	Lab	Personalization	Information Quality
Stoica, M., Miller, D W., Stotlar, D., 2005	Literature Review	Lab	Convenience	System Quality
Stoica, M., Miller, D W., Stotlar, D., 2005	Literature Review	Lab	Capacity (Bandwidth)	Service Quality
Stoica, M., Miller, D W., Stotlar, D., 2005	Literature Review	Lab	Size and Form Factors	System Quality
Tarasewich, P., Gong, J., Nah, F.F.H., Dewester, D., 2008	Literature Review & Framework	Lab	Interface Design	System Quality
Tarasewich, P., Gong, J., Nah, F.F.H., Dewester, D., 2008	Literature Review & Framework	Lab	Security	Information Quality
Tarasewich, P., Gong, J., Nah, F.F.H., Dewester, D., 2008	Literature Review & Framework	Lab	Device Selection	System Quality
Tarasewich, P., Gong, J., Nah, F.F.H., Dewester, D., 2008	Literature Review & Framework	Lab	Privacy	Information Quality
Väätäjä, H., 2010	Interview, 19 Journalism Professionals	Field	Support	User Satisfaction
Väätäjä, H., 2010	Interview, 19 Journalism Professionals	Field	Enabling Ambition	User Satisfaction

Väätäjä, H., 2010	Interview, 19 Journalism Professionals	Field	Professional Image	Intention to Use
Vuolle, M., Tiainen, M., Kallio, T., Vainio, T., Kulju, M., Wigelius, H., 2008	Questionnaire Development	Lab	Context	N/A
Vuolle, M., Tiainen, M., Kallio, T., Vainio, T., Kulju, M., Wigelius, H., 2008	Questionnaire Development	Lab	Perceived impacts on mobile work productivity	Net Benefits
Vuolle, M., Tiainen, M., Kallio, T., Vainio, T., Kulju, M., Wigelius, H., 2008	Questionnaire Development	Lab	Perceived usability of mobile business services	Intention to Use
Wang, Y., Liao, Y., 2007	Survey, 116 Respondents	Field	Ease of use	System Quality
Wang, Y., Liao, Y., 2007	Survey, 116 Respondents	Field	Content	Information Quality
Wang, Y., Liao, Y., 2007	Survey, 116 Respondents	Field	Service Quality	Service Quality
Wang, Y., Liao, Y., 2007	Survey, 116 Respondents	Field	Appearance	Information Quality
Wigelius, H. & Väätäjä, H., 2009	Review of Three Case Studies	Lab	Context	N/A
Wigelius, H. & Väätäjä, H., 2009	Review of Three Case Studies	Lab	Context	N/A
Wigelius, H. & Väätäjä, H., 2009	Review of Three Case Studies	Lab	Context	N/A
Wigelius, H. & Väätäjä, H., 2009	Review of Three Case Studies	Lab	Context	N/A
Wigelius, H. & Väätäjä, H., 2009	Review of Three Case Studies	Lab	Context	N/A
Yuan, Y., Archer, N., Connelly, C. E., Zheng, W., 2010	Survey, 179 Mobile workers	Field	Context	N/A

Yuan, Y., Archer, N., Connelly, C. E., Zheng, W., 2010	Survey, 179 Mobile workers	Field	Context	N/A
Yuan, Y., Archer, N., Connelly, C. E., Zheng, W., 2010	Survey, 179 Mobile workers	Field	Timeliness	Information Quality
Zhao, L., Lu, Y., Zhang, L., Chau, P. Y. K., 2011	Survey, 1075 Respondents	Lab	Service Quality	Service Quality
Zhao, L., Lu, Y., Zhang, L., Chau, P. Y. K., 2011	Survey, 1075 Respondents	Lab	Justice	User Satisfaction