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Chapter 1

The Updated DeLone and McLean Model of Information Systems Success

Nils Urbach and Benjamin Müller

Abstract In order to provide a general and comprehensive definition of information systems (IS) success that covers different evaluation perspectives, DeLone and McLean reviewed the existing definitions of IS success and their corresponding measures, and classified them into six major categories. Thus, they created a multidimensional measuring model with interdependencies between the different success categories (DeLone and McLean 1992). Motivated by DeLone and McLean’s call for further development and validation of their model, many researchers have attempted to extend or respecify the original model. 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 (DeLone and McLean 2003). This chapter gives an overview of the current state of research on the IS Success Model. Thereby, it offers a concise entry point to the theory’s background and its application, which might be specifically beneficial for novice readers.

Keywords DeLone & McLean Model • Information Systems Success • IS Success Model

Abbreviations

D&M	DeLone & McLean
ICIS	International Conference on Information Systems
Ind.	Individual
IS	Information systems

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Org.	Organizational
ROI	Return on investment
TAM	Technology acceptance model

1.1 Introduction

During the first International Conference on Information Systems (ICIS), Keen (1980) introduced his perspective on the key challenges of the information systems (IS) discipline. While today, 3 decades later, these questions remain core issues for many IS scholars, the last years have brought about tremendous progress in methodologies and theories. Especially with respect to Keen's second question, the search for the dependent variable in IS research, a lot of progress has been made. Since Keen's paper, work on technology acceptance (e.g. Davis 1989; Davis et al. 1989), IS benefit frameworks (e.g. Kohli and Grover 2008; Müller et al. 2010; Peppard et al. 2007; Shang and Seddon 2002), and the business value of IT (e.g. Sambamurthy and Zmud 1994; Soh and Markus 1995) has been published. One of the most prominent streams of research on the dependent variable of IS research, however, is work connected to the DeLone and McLean IS Success Model (D&M IS Success Model) (1992, 2003).

Since its introduction in 1992, the D&M IS Success Model has created a broad response in the literature. In fact, the 1992 article of DeLone and McLean (1992) was found to be the single-most heavily cited article in the IS literature (Lowry et al. 2007). Through all this work, the model's principal constituents and their relations have been investigated in a broad spectrum of settings (Petter et al. 2008; Urbach et al. 2009b). While the original version of the model, presented in an earlier chapter in this book, was a logical aggregation of research published on IS success, the model has been updated by its original authors to reflect and integrate some of the empirical work investigating the model's propositions as well as to consider the measurement challenges of the growing e-commerce world (DeLone and McLean 2003). A recent meta-study has shown that this updated version of the model has not only received great appreciation in the IS community, too, but that most of its propositions explaining the success of an IS are actually supported (Petter et al. 2008).

Through its popularity, DeLone and McLean's work also managed to address another of Keen's key challenges to the IS discipline: the lack of a cumulative tradition in IS research. Given its high citation counts and the intense investigation of the model's propositions in a broad spectrum of contexts, we believe that the D&M IS Success Model should be part of a comprehensive compendium of IS theories.

To present the updated D&M IS Success Model, we structure this chapter as follows. The next section briefly introduces the updated model (DeLone and McLean 2003), especially highlighting its development after its first introduction (DeLone and McLean 1992). We then present the model's different constructs in more detail and provide an exemplary selection of validated measures that can be reused in future applications. Afterward, we present an analysis of the construct interrelations. Furthermore, we give an overview on existing research that uses the D&M IS Success Model as theoretical basis and/or adapts the model to a specific domain. To conclude,

we discuss the significance of the D&M IS Success Model for the IS discipline and link the model to related theories. Finally, we discuss future research opportunities in the field of IS success.

1.2 Development of the D&M IS Success Model

In 1980, Peter Keen referred to the lack of a scientific basis in IS research and raised the question of what the dependent variable in IS research should be. Keen argued that surrogate variables like user satisfaction or hours of usage would continue to mislead researchers and evade the information theory issue (Keen 1980). Motivated by his request for clarification of the dependent variable, many researchers have tried to identify the factors contributing to IS success. Largely, however, different researchers addressed different aspects of IS success, making comparisons difficult. In order to organize the large body of existing literature as well as to integrate the different concepts and findings and to present a comprehensive taxonomy, DeLone and McLean (1992) introduced their (first) IS Success Model.¹

Building on the three levels of information by Shannon and Weaver (1949), together with Mason's expansion of the effectiveness or influence level (Mason 1978), DeLone and McLean defined six distinct dimensions of IS success: *system quality*, *information quality*, *use*, *user satisfaction*, *individual impact*, and *organizational impact*. Based on this framework, they classified the empirical studies published in seven highly ranked IS journals between January 1981 and January 1988. Their examination supports the presumption that the many success measures fall into the six major interrelated and interdependent categories they present. These authors' IS Success Model was their attempt to integrate these dimensions into a comprehensive framework. Judged by its frequent citations in articles published in leading journals, the D&M IS Success Model has, despite some revealed weaknesses (Hu 2003), quickly become one of the dominant evaluation frameworks in IS research, in part due to its understandability and simplicity (Urbach et al. 2009b).

Motivated by DeLone and McLean's call for further development and validation of their model, many researchers have attempted to extend or re-specify the original model. A number of researchers claim that the D&M IS Success Model is incomplete; they suggest that more dimensions should be included in the model, or present alternative success models (e.g. Ballantine et al. 1996; Seddon 1997; Seddon and Kiew 1994). Other researchers focus on the application and validation of the model (e.g. Rai et al. 2002).

Ten years after the publication of their first model, and based on the evaluation of the many contributions to it, DeLone and McLean (2002, 2003) proposed an updated IS success model.²

The primary differences between the original and the updated model are: (1) the addition of *service quality* to reflect the importance of service and support in successful

¹ A graphical representation of this model can be found in DeLone and McLean (1992, p. 87).

² A graphical representation of this model can be found in DeLone and McLean (2003, p. 24).

e-commerce systems; (2) the addition of *intention to use* to measure user attitude as an alternative measure of use; and (3) the collapsing of *individual impact* and *organizational impact* into a more parsimonious *net benefits* construct. The updated model consists of six interrelated dimensions of IS success: *information*, *system*, and *service quality*; *(intention to) use*; *user satisfaction*; and *net benefits*. The arrows demonstrate proposed associations between the success dimensions.

Looking at its constructs and their interrelations, the model can be interpreted as follows: a system can be evaluated in terms of information, system, and service quality; these characteristics affect subsequent use or intention to use and user satisfaction. Certain benefits will be achieved by using the system. The net benefits will (positively or negatively) influence user satisfaction and the further use of the IS.

Although DeLone and McLean have refined their first model and presented an updated version, they encourage other researchers to develop the model further and help to continue its evolution. In order to provide a basis for IS scholars to answer this call for future research, the following sections of this chapter will briefly introduce the constructs, measures, and propositions used in research on the IS success model so far.

1.3 Constructs and Measures

Although the D&M IS Success Model is a result of the attempt to provide an integrated view on IS success that enables comparisons between different studies, the operationalization of the model's different success dimensions varies greatly between the several studies which have been published in the past. Especially, the diversity of different types of information systems the model has been adapted to leads to several construct operationalizations. However, with a large amount of publications using the D&M IS Success Model as theoretical basis (Lowry et al. 2007; Urbach et al. 2009b), typical item sets for each of the constructs have emerged which have often been used in several IS success studies.

In the following paragraphs we present the different success dimensions of the D&M IS Success Model in more detail and provide an exemplary selection of validated measures that can be reused for future application of the model. While such a list can certainly not be a comprehensive account of measures, the studies cited should provide a first overview and a good starting point for a more (context-) specific search of the literature.

1.3.1 System Quality

The success dimension *system quality* constitutes the desirable characteristics of an IS and, thus, subsumes measures of the IS itself. These measures typically focus on usability aspects and performance characteristics of the system under examination. A very common measure is *perceived ease of use* caused by the large amount of research related to the Technology Acceptance Model (TAM) (Davis 1989).

Table 1.1 Exemplary measures of system quality

Items	References
Access	Gable et al. (2008), McKinney et al. (2002)
Convenience	Bailey and Pearson (1983), Iivari (2005)
Customization	Gable et al. (2008), Sedera and Gable (2004b)
Data accuracy	Gable et al. (2008)
Data currency	Hamilton and Chervany (1981), Gable et al. (2008)
Ease of learning	Gable et al. (2008), Sedera and Gable (2004b)
Ease of use	Doll and Torkzadeh (1988), Gable et al. (2008), Hamilton and Chervany (1981), McKinney et al. (2002), Sedera and Gable (2004b)
Efficiency	Gable et al. (2008)
Flexibility	Bailey and Pearson (1983), Gable et al. (2008), Hamilton and Chervany (1981), Iivari (2005), Sedera and Gable (2004b)
Integration	Bailey and Pearson (1983), Gable et al. (2008), Iivari (2005), Sedera and Gable (2004b)
Interactivity	McKinney et al. (2002)
Navigation	McKinney et al. (2002)
Reliability	Gable et al. (2008), Hamilton and Chervany (1981)
Response time	Hamilton and Chervany (1981), Iivari (2005)
Sophistication	Gable et al. (2008), Sedera and Gable (2004b)
System accuracy	Doll and Torkzadeh (1988), Hamilton and Chervany (1981), Gable et al. (2008), Sedera and Gable (2004b)
System features	Gable et al. (2008), Sedera and Gable (2004b)
Turnaround time	Hamilton and Chervany (1981)

However, many additional measures have been proposed and used to capture the system quality construct as a whole. Table 1.1 shows a sample of typical items for measuring system quality.

1.3.2 Information Quality

The success dimension *information quality* constitutes the desirable characteristics of an IS's output. An example would be the information an employee can generate using a company's IS, such as up-to-date sales statistics or current prices for quotes. Thus, it subsumes measures focusing on the quality of the information that the system produces and its usefulness for the user. *Information quality* is often seen as a key antecedent of *user satisfaction*. Typical measurement items are presented in Table 1.2.

1.3.3 Service Quality

The success dimension *service quality* represents the quality of the support that the users receive from the IS department and IT support personnel, such as, for example, training, hotline, or helpdesk. This construct is an enhancement of the updated

Table 1.2 Exemplary measures of information quality

Items	References
Accuracy	Bailey and Pearson (1983), Gable et al. (2008), Iivari (2005), Rainer and Watson (1995)
Adequacy	McKinney et al. (2002)
Availability	Gable et al. (2008), Sedera and Gable (2004b)
Completeness	Bailey and Pearson (1983), Iivari (2005)
Conciseness	Gable et al. (2008), Rainer and Watson (1995), Sedera and Gable (2004b)
Consistency	Iivari (2005)
Format	Gable et al. (2008), Iivari (2005), Sedera and Gable (2004b)
Precision	Bailey and Pearson (1983), Iivari (2005)
Relevance	Gable et al. (2008), McKinney et al. (2002), Rainer and Watson (1995), Sedera and Gable (2004b)
Reliability	Bailey and Pearson (1983), McKinney et al. (2002)
Scope	McKinney et al. (2002)
Timeliness	Bailey and Pearson (1983), Gable et al. (2008), Iivari (2005), Doll and Torkzadeh (1988), McKinney et al. (2002), Rainer and Watson (1995)
Understandability	Gable et al. (2008), McKinney et al. (2002), Sedera and Gable (2004b)
Uniqueness	Gable et al. (2008)
Usability	Gable et al. (2008), Sedera and Gable (2004b)
Usefulness	McKinney et al. (2002)

Table 1.3 Exemplary measures of service quality

Items	References
Assurance	Pitt et al. (1995)
Empathy	Pitt et al. (1995)
Flexibility	Chang and King (2005)
Interpersonal quality	Chang and King (2005)
Intrinsic quality	Chang and King (2005)
IS training	Chang and King (2005)
Reliability	Pitt et al. (1995)
Responsiveness	Chang and King (2005), Pitt et al. (1995)
Tangibles	Pitt et al. (1995)

D&M IS Success Model that was not part of the original model. The inclusion of this success dimension is not indisputable, since *system quality* is not seen as an important quality measure of a single system by some authors (e.g. Seddon 1997). A very popular measure for *service quality* in IS is SERVQUAL (Pitt et al. 1995). However, several other measurement items have been proposed. Table 1.3 presents a sample of those.

1.3.4 *Intention to Use/Use*

The success dimension (*intention to use*) represents the degree and manner in which an IS is utilized by its users. Measuring the usage of an IS is a broad concept that can

Table 1.4 Exemplary measures of (intention to) use

Items	References
Actual use	Davis (1989)
Daily use	Almutairi and Subramanian (2005), Iivari (2005)
Frequency of use	Almutairi and Subramanian (2005), Iivari (2005)
Intention to (re)use	Davis (1989), Wang (2008)
Nature of use	DeLone and McLean (2003)
Navigation patterns	DeLone and McLean (2003)
Number of site visits	DeLone and McLean (2003)
Number of transactions	DeLone and McLean (2003)

be considered from several perspectives. In case of voluntary use, the actual use of an IS may be an appropriate success measure. Previous studies measured use objectively by capturing the connect time, the functions utilized, or the frequency of use. As the amount of time a system is used is apparently not a sufficient success measure, other studies applied subjective measures by questioning users about their perceived use of a system (e.g. DeLone 1988). A more comprehensive approach for explaining the usage of an IS is TAM (Davis 1989). TAM uses the independent variables *perceived ease of use* and *perceived usefulness* contributing to *attitude toward use*, *intention to use*, and *actual use*. Due to difficulties in interpreting the dimension *use*, DeLone and McLean suggest *intention to use* as an alternative measure to *use* for some contexts. Table 1.4 presents some typical measurement items for this success dimension.

1.3.5 User Satisfaction

The success dimension *user satisfaction* constitutes the user's level of satisfaction when utilizing an IS. It is considered as one of the most important measures of IS success. Measuring user satisfaction becomes especially useful, when the use of an IS is mandatory and the amount of use is not an appropriate indicator of systems success. Widely used user satisfaction instruments are the ones by Ives et al. (1983) and Doll et al. (2004). However, these instruments also contain items of system, information, and service quality, rather than only measuring user satisfaction. Accordingly, other items have been developed to exclusively measure user satisfaction with an IS. Table 1.5 presents some examples.

1.3.6 Net Benefits

The success dimension *net benefits*, constitutes the extent to which IS are contributing to the success of the different stakeholders. The construct subsumes the former separate dimensions *individual impact* and *organizational impact* of the original D&M IS Success Model as well as additional IS impact measures from other researchers like work group impacts and societal impacts into one single success dimension. The choice of what impact should be measured depends on the system being

Table 1.5 Exemplary measures of user satisfaction

Items	References
Adequacy	Almutairi and Subramanian (2005), Seddon and Yip (1992), Seddon and Kiew (1994)
Effectiveness	Almutairi and Subramanian (2005), Seddon and Yip (1992), Seddon and Kiew (1994)
Efficiency	Almutairi and Subramanian (2005), Seddon and Yip (1992), Seddon and Kiew (1994)
Enjoyment	Gable et al. (2008)
Information satisfaction	Gable et al. (2008)
Overall satisfaction	Almutairi and Subramanian (2005), Gable et al. (2008), Rai et al. (2002), Seddon and Yip (1992), Seddon and Kiew (1994)
System satisfaction	Gable et al. (2008)

Table 1.6 Exemplary measures of individual impact

Items	References
Awareness/Recall	Gable et al. (2008), Sedera and Gable (2004b)
Decision effectiveness	Gable et al. (2008), Sedera and Gable (2004b)
Individual productivity	Gable et al. (2008), Sedera and Gable (2004b)
Job effectiveness	Davis (1989), Iivari (2005)
Job performance	Davis (1989), Iivari (2005)
Job simplification	Davis (1989), Iivari (2005)
Learning	Sedera and Gable (2004b), Gable et al. (2008)
Productivity	Davis (1989), Iivari (2005), Torkzadeh and Doll (1999)
Task performance	Davis (1989)
Usefulness	Davis (1989), Iivari (2005)
Task innovation	Torkzadeh and Doll (1999)

evaluated, the purpose of the study, and the level of analysis. Although use and user satisfaction are correlated with net benefits, there is still the necessity to measure net benefits directly. Some studies look at the value of technology investments through quantifiable financial measures such as return on investment (ROI), market share, cost, productivity analysis, and profitability. Some researchers argue that benefits in terms of numeric costs are not possible because of intangible system impacts and intervening environmental variables (McGill et al. 2003). Most of the studies applying the D&M IS Success Model measure the benefits of utilizing an IS on the individual and organizational levels. Accordingly, we present exemplary measurement items of individual impact in Table 1.6 and organizational impact in Table 1.7.

1.4 Construct Interrelations

After the introduction of the original D&M IS Success Model (DeLone and McLean 1992), many authors have investigated the model both empirically and theoretically. Beyond the constructs discussed above, also the construct interrelations received

Table 1.7 Exemplary measures of organizational impact

Items	References
Business process change	Gable et al. (2008), Sedera and Gable (2004b)
Competitive advantage	Almutairi and Subramanian (2005), Sabherwal (1999)
Cost reduction	Almutairi and Subramanian (2005), Gable et al. (2008), Sedera and Gable (2004b)
Enhancement of communication and collaboration	Almutairi and Subramanian (2005), Sabherwal (1999)
Enhancement of coordination	Almutairi and Subramanian (2005)
Enhancement of internal operations	Almutairi and Subramanian (2005), Sabherwal (1999)
Enhancement of reputation	Almutairi and Subramanian (2005)
Improved outcomes/outputs	Gable et al. (2008), Sedera and Gable (2004b)
Improved decision making	Almutairi and Subramanian (2005)
Increased capacity	Gable et al. (2008), Sedera and Gable (2004b)
Overall productivity	Gable et al. (2008), Sedera and Gable (2004b)
Overall success	Almutairi and Subramanian (2005), Sabherwal (1999)
Quality improvement	Sabherwal (1999)
Customer satisfaction	Torkzadeh and Doll (1999)
Management control	Torkzadeh and Doll (1999)

manifold attention. In their revised model, DeLone and McLean (2003) have already accounted for and integrated some of these findings. Similarly, Petter et al. (2008) look at the literature on IS success published between 1992 and 2007 and aggregate their findings into an overall assessment of the theoretical and empirical support of the current model. Drawing on their work, we would like to highlight the most important findings for the 15 pair-wise construct interrelations by looking at the dependent variables respectively. Table 1.8 summarizes these relationships at the individual (Ind.) and organizational (Org.) levels. Please note that Table 1.8 does not show the strength or direction of the relations, but highlights how strongly any relation is supported by current studies. For a detailed review of the directions (i.e., positive or negative relations), please see Tables 3 and 4 in Petter et al. (2008).

1.4.1 System Use

At the individual level, the meta-analysis by Petter et al. (2008) shows mixed to moderate support for the explanation of system use. Of the three quality indicators, system quality has received the broadest attention in the literature. However, only mixed support can be found to support the hypothesis that system use can be explained by system quality overall. While a total of nine studies reported a positive association with system use, seven studies reported nonsignificant results for this model path. The same is true for information quality, especially as only a total of six studies reviewed by Petter et al. (2008) did look at this relation to start with. Even fewer data is available for the investigation of service quality, which is why no

Table 1.8 Construct interrelations (as discussed by Petter et al. (2008))

Antecedents	→	Explained constructs	Ind.	Org.
System use				
System quality	→	System use	~	~
Information quality	→	System use	~	o
Service quality	→	System use	o	o
User satisfaction	→	System use	+	o
Net benefits	→	System use	+	o
User satisfaction				
System quality	→	User satisfaction	++	o
Information quality	→	User satisfaction	++	o
Service quality	→	User satisfaction	+	o
System use	→	User satisfaction	+	o
Net benefits	→	User satisfaction	+	o
Net benefits				
System quality	→	Net benefits	+	+
Information quality	→	Net benefits	+	o
Service quality	→	Net benefits	+	o
System use	→	Net benefits	+	+
User satisfaction	→	Net benefits	++	o

++, strong support
 +, moderate support
 ~, mixed support
 o, insufficient data

conclusive argument can be drawn for this relation to date. User satisfaction, on the other hand, has been investigated by a high number of studies and was found to be positively linked in most of them. The same is true for the feedback link from net benefits to system use. The literature has shown that both links receive moderate support overall.

The effects on system use at the organizational level are, as of yet, largely uninvestigated. The impact of user satisfaction on system use in an organizational context, for example, has not been covered by a single study. Only the impact of system quality has been covered in a sufficiently high number of studies. The results, however, are somewhat inconclusive as positive, negative, mixed, and nonsignificant relations were found. Especially at the organizational level, a lot of work remains to be done to investigate the IS success model’s propositions.

1.4.2 User Satisfaction

In comparison to actual system use, propositions related to user satisfaction received broad and often strong support for positive associations in the literature on the individual level of the D&M IS Success Model. Both system and information quality were found to have strong positive relations with user satisfaction in most studies

conducted to date. The results on service quality, on the other hand, only provide mixed support for its ability to explain user satisfaction. While investigated less often, the interrelation between use and user satisfaction shows only moderate support in the literature. However, studies available to date mainly show positive associations (e.g., Chiu et al. 2007; Halawi et al. 2007). Additionally, the feedback effect from net benefits to user satisfaction has shown to be very strong (e.g., Hsieh and Wang 2007; Kulkarni et al. 2007; Rai et al. 2002).

At the organizational level, Petter et al. (2008) highlight the lack of conclusive data on the antecedents of user satisfaction. None of the five constructs interrelations leading to user satisfaction were investigated more than four times. Looking at the quality constructs, the studies conducted so far do, however, indicate a positive relationship. The effects of system use and net benefits, on the other hand, show mixed results. Similarly to the research on system use, the investigation of user satisfaction in an organizational context remains an interesting area for future research into IS success.

1.4.3 Net Benefits

As the D&M IS Success Model's overall dependent variable, net benefits play a significant role in IS success research. Looking at the individual level, current studies have found at least moderate support for all interrelations. System quality has mostly been found to have a positive association with net benefits, even though most of the effect is moderated through system use and user satisfaction. While investigated less often, the same is also true for information and service quality. System use, in turn, also has a moderate positive association with net benefits, even though six studies reviewed by Petter et al. (2008) reported nonsignificant findings. The construct covering user satisfaction was unanimously reported to be positively associated with a system's net benefits by all the studies reviewed. Accordingly, this interrelation was found to be supported strongly by current studies.

On the organizational level, insufficient overall data is a major hurdle for the assessment of the D&M IS Success Model. Three of the five possible antecedents are not covered sufficiently to determine their associations with net benefits in a reliable way. Only the constructs system quality and system use are covered in a sufficient manner to determine a moderate support for their positive association with net benefits. Despite the lack of widespread investigation of net benefits at an organizational level, most of the studies conducted on the other constructs so far do indicate a positive association with net benefits.

1.5 Existing Research on IS Success

During the last years, the D&M IS Success Model in its original and updated version has become a widely used evaluation framework in IS research. Several articles have been published that use the model as the theoretical basis. In a recent literature

Table 1.9 Exemplary collection of IS success studies

Type of information system	Publications
Data warehouse	Nelson et al. (2005), Shin (2003), Wixom and Watson (2001), Wixom and Todd (2005)
Decision support system	Bharati and Chaudhury (2004)
e-Commerce system	DeLone and McLean (2004), Molla and Licker (2001), Wang (2008)
e-Mail system	Mao and Ambroso (2004)
Enterprise system	Gable et al. (2003), Lin et al. (2006), Qian and Bock (2005), Sedera (2006), Sedera and Gable (2004b), Sedera and Gable (2004a), Sedera et al. (2004a, b)
Finance and accounting system	Iivari (2005)
Health information system	Yusof et al. (2006)
Intranet	Hussein et al. (2008), Masrek et al. (2007), Trkman and Trkman (2009)
Knowledge management system	Clay et al. (2005), Halawi et al. (2007), Jennex and Olfman (2003), Kulkarni et al. (2007), Velasquez et al. (2009), Wu and Wang (2006)
Learning system	Lin (2007)
Online communities	Lin and Lee (2006)
Picture archiving and communications system	Pare et al. (2005)
Portal	Urbach et al. (2009a), Urbach et al. (2010), Yang et al. (2005)
Telemedicine system	Hu (2003)
Web-based system	Garrity et al. (2005)
Web sites	Schaupp et al. (2006)

review, Urbach et al. (2009b) explore the current state of IS success research by analyzing and classifying recent empirical articles with regard to their theoretical foundation, research approach, and research design. The results show that the dominant research analyzes the impact that a specific type of IS has by means of users' evaluations obtained from surveys and structural equation modeling. The D&M IS Success Model is the main theoretical basis of the reviewed studies. Several success models for evaluating specific types of IS – like knowledge management systems (Kulkarni et al. 2007) or enterprise systems (Gable et al. 2003) – have been developed from this theory.

In order to give an overview on existing literature on IS success, we present an exemplary collection of research articles in Table 1.9. These are classified in terms of the type of IS being evaluated and should provide a point of departure for context-specific research in these or additional areas.

Taking a closer look at these publications, we see a broad variety of IS types that have been analyzed using the D&M IS Success Model. Thereby, the D&M IS Success Model is used in different ways.

Several authors use the model in its predefined form as a theoretical basis. In these publications, only the operationalizations of the model's success dimensions were adapted to the specific research context. Iivari (2005), for example, evaluates

the finance and accounting system of a municipal organization. The empirical data collected is used to validate the D&M IS Success Model in its original form. However, the success dimensions are operationalized with regard to the specific research problem.

Other authors use the model in its predefined form for constructing their research model, but add additional success dimensions that are necessary to fully capture the specifics of the type of IS under investigation. As an example, Urbach et al. (2010) use the D&M IS Success Model as the theoretical basis for investigating the success of employee portals. However, in contrast to other types of IS, employee portals are not only utilized to exchange information, but also to electronically support work processes as well as collaboration between users. Accordingly, the two additional success dimensions, process quality and collaboration quality, were added to the research model.

Finally, in some of the presented publications, the D&M IS Success Model is fully adapted to a specific research problem using newly developed constructs that are similar to those of the original model. Wixom and Watson (2001), for example, develop and validate a model for empirically investigating data warehousing success on the basis of the D&M IS Success Model. Instead of referring to the proposed success dimensions, however, context-specific constructs such as organizational, project, and technical implementation success are utilized.

An additional observation is that many of the published studies only partially analyze the D&M IS Success Model (e.g., Garrity et al. 2005; Kulkarni et al. 2007; Velasquez et al. 2009). Only few studies validate the model in its complete form (e.g., Iivari 2005; Urbach et al. 2010; Wang 2008).

1.6 Conclusion

Despite the high number of studies already conducted in the context of the D&M IS Success Model, there are quite a few further research opportunities. For example, DeLone and McLean (2003) themselves make recommendations for future research. They highlight that the model, especially the interdependent relationships between its constructs, should be continuously tested and challenged. In order to provide a basis for the much needed cumulative tradition of IS research, the authors urge future users of their model to consider using proven measures where possible. Only a significant reduction in the number of measures used can make results comparable beyond the various contexts of IS success studies. Moreover, they emphasize that more field-study research is needed in order to investigate and incorporate net benefit measures into the model.

As especially the summary of the meta-review of Petter et al. (2008) has shown, additional research covering the IS success model from an organizational perspective is required to be able to determine the degree of associations between the constructs.

Looking at current work on the D&M IS Success Model, many studies conducted to date have focused on the measurement and assessment of selected parts of

the model. Only few studies use the entire model and, thus, present a holistic approach to measuring IS success. More research using the complete model will help to extend our understanding of the model's overall validity.

Once such additional work has been created, the model could also be used in fieldwork to help IT management teams in the selection, implementation, and assessment of new IS. It would be interesting to see whether the model's propositions can actually help practitioners to better handle their IS in practice. A first step into this direction is the "applicability check" by Rosemann and Vessey (2005, 2008).

As one of the few truly IS-specific pieces of theoretical knowledge created by IS scholars in the last decades, work using the D&M IS Success Model will remain popular in the years to come. Its update provides a powerful argument for the model's accuracy and parsimony and the many studies using the model provide us with a broad basis of empirical support and proven measures. Given the rise of more and more service-oriented IS as well as the increasing use of IS in an interorganizational setting, the D&M IS Success Model is likely to witness a new round of extensions and probably even another update. We hope that this brief introduction will help IS scholars, especially those still new to the profession, to tap into this vibrant and fascinating stream of research and build their own contributions.

References

- Almutairi, H., & Subramanian, G. H. (2005). An empirical application of the Delone and Mclean model in the Kuwaiti private sector. *Journal of Computer Information Systems*, 45(3), 113–122.
- Bailey, J. E., & Pearson, S. W. (1983). Development of a tool for measuring and analyzing computer user satisfaction. *Management Science*, 29(5), 530–545.
- Ballantine, J., Bonner, M., Levy, M., Martin, A., Munro, I., & Powell, P. (1996). The 3-D model of information systems success: The search for the dependent variable continues. *Information Resource Management Journal*, 9(4), 5–14.
- Bharati, P., & Chaudhury, A. (2004). An empirical investigation of decision-making satisfaction in web-based decision support systems. *Decision Support Systems*, 37(2), 187–197.
- Chang, J. C. J., & King, W. R. (2005). Measuring the performance of information systems: A functional scorecard. *Journal of Management Information Systems*, 22(1), 85–115.
- Chiu, C. M., Chiu, C. S., & Chang, H. C. (2007). Examining the integrated influence of fairness and quality on learner's satisfaction and web-based learning continuance intention. *Information Systems Journal*, 17(3), 271–287.
- Clay, P. F., Dennis, A. R., & Ko, D. G. (2005). Factors affecting the loyal use of knowledge management systems. In *Proceedings of the 38th Hawaii international conference on system sciences (HICSS 05)*, January 3–6, Big Island, Hawaii.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 318–340.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982–1003.
- DeLone, W. H. (1988). Determinants of success for computer usage in small business. *MIS Quarterly*, 12(1), 50–61.
- DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, 3(1), 60–95.

- DeLone, W. H., & McLean, E. R. (2002). Information systems success revisited. In *Proceedings of the 35th Hawaii international conference on system sciences (HICSS 02)*, January 7–10, Big Island, Hawaii.
- DeLone, W. H., & McLean, E. R. (2003). The Delone and Mclean model of information systems success: A ten-year update. *Journal of Management Information Systems*, 19(4), 9–30.
- DeLone, W. H., & McLean, E. R. (2004). Measuring e-Commerce success: Applying the Delone & Mclean information systems success model. *International Journal of Electronic Commerce*, 9(1), 31–47.
- Doll, W. J., & Torkzadeh, G. (1988). The measurement of end-user computing satisfaction. *MIS Quarterly*, 12(2), 258–274.
- Doll, W. J., Ziaodong, D., Raghunathan, T. S., Torkzadeh, G., & Weidong, X. (2004). The meaning and measurement of user satisfaction: A multigroup invariance analysis of the end-user computing satisfaction instrument. *Journal of Management Information Systems*, 21(1), 227–262.
- Gable, G., Sedera, D., & Chan, T. (2003). Enterprise systems success: A measurement model. In *Proceedings of the 24th international conference on information systems (ICIS 03)*, December 14–17, Seattle, Washington.
- Gable, G. G., Sedera, D., & Chan, T. (2008). Re-conceptualizing information system success: The IS-impact measurement model. *Journal of the Association for Information Systems*, 9(7), 377–408.
- Garrity, E. J., Glassberg, B., Kim, Y. J., Sanders, G. L., & Shin, S. K. (2005). An experimental investigation of web-based information systems success in the context of electronic commerce. *Decision Support Systems*, 39(3), 485–503.
- Halawi, L. A., McCarthy, R. V., & Aronson, J. E. (2007). An empirical investigation of knowledge management systems' success. *Journal of Computer Information Systems*, 48(2), 121–135.
- Hamilton, S., & Chervany, N. L. (1981). Evaluating information system effectiveness – part I: Comparing evaluation approaches. *MIS Quarterly*, 5(3), 55–69.
- Hsieh, J. J. P. A., & Wang, W. (2007). Explaining employees' extended use of complex information systems. *European Journal of Information Systems*, 16(3), 216–227.
- Hu, P. J. H. (2003). Evaluating telemedicine systems success: A revised model. In *Proceedings of the 36th Hawaii international conference on system sciences (HICSS 03)*, January 6–9, Big Island, Hawaii.
- Hussein, R., Masrek, M. N., & Karim, N. S. A. (2008). The utilization and effectiveness of intranet: A case study at selected Malaysian organizations. *Communications of the IBIMA*, 4, 200–206.
- Iivari, J. (2005). An empirical test of the Delone–Mclean model of information system success. *The DATA BASE for Advances in Information Systems*, 26(2), 8–27.
- Ives, B., Olson, M. H., & Baroudi, J. J. (1983). The measurement of user information satisfaction. *Communications of the ACM*, 26(10), 785–793.
- Jennex, M. E., & Olfman, L. (2003). A knowledge management success model: An extension of Delone and Mclean's IS success model. In *Proceedings of the 9th Americas conference on information systems (AMCIS 03)*, August 4–6, Tampa, FL.
- Keen, P. G. W. (1980). Reference disciplines and a cumulative tradition. In *Proceedings of the 1st international conference on information systems (ICIS 80)*, Philadelphia, PA.
- Kohli, R., & Grover, V. (2008). Business value of it: An essay on expanding research directions to keep up with the times. *Journal of the AIS*, 9(1), 23–39.
- Kulkarni, U. R., Ravindran, S., & Freeze, R. (2007). A knowledge management success model: Theoretical development and empirical validation. *Journal of Management Information Systems*, 23(3), 309–347.
- Lin, H. F. (2007). Measuring online learning systems success: Applying the updated Delone and Mclean model. *Cyber Psychology & Behavior*, 10(6), 817–820.
- Lin, H. F., & Lee, G. G. (2006). Determinants of success for online communities: An empirical study. *Behaviour & Information Technology*, 25(6), 479–488.
- Lin, H. Y., Hsu, P. Y., & Ting, P. H. (2006). Erp systems success: An integration of IS success model and balanced scorecard. *Journal of Research and Practice in Information Technology*, 38(3), 215–228.

- Lowry, P. B., Karuga, G. G., & Richardson, V. J. (2007). Assessing leading institutions, faculty, and articles in premier information systems research journals. *Communications of the Association for Information Systems*, 20(16), 142.
- Mao, E., & Ambrose, P. (2004). A theoretical and empirical validation of IS success models in a temporal and quasi volitional technology usage context. In *Proceedings of the 10th Americas conference on information systems (AMCIS 04)*, August 5–8, New York City, New York.
- Mason, R. O. (1978). Measuring information output: A communication systems approach. *Information Management*, 1(5), 219–234.
- Masrek, M. N., Karim, N. S. A., & Hussein, R. (2007). Investigating corporate intranet effectiveness: A conceptual framework. *Information Management & Computer Security*, 15(3), 168–183.
- McGill, T., Hobbs, V., & Klobas, J. (2003). User-Developed applications and information systems success: A test of Delone and Mclean's model. *Information Resources Management Journal*, 16(1), 24.
- McKinney, V., Kanghyun, Y., & Zahedi, F. M. (2002). The measurement of web-customer satisfaction: An expectation and disconfirmation approach. *Information Systems Research*, 13(3), 296–315.
- Molla, A., & Licker, P. S. (2001). E-commerce systems success: An attempt to extend and respecify the Delone and Maclean model of IS success. *Journal of Electronic Commerce Research*, 2(4), 131–141.
- Müller, B., Viering, G., Legner, C., & Riempp, G. (2010). Understanding the economic potential of service-oriented architecture. *Journal of Management Information Systems*, 26(4), 147–182.
- Nelson, R. R., Todd, P. A., & Wixom, B. H. (2005). Antecedents of information and system quality: An empirical examination within the context of data warehousing. *Journal of Management Information Systems*, 21(4), 199–235.
- Pare, G., Aubry, D., Lepanto, L., & Sicotte, C. (2005). Evaluating pacs success: A multidimensional model. In *Proceedings of the 38th Hawaii international conference on system sciences (HICSS 05)*, January 3–6, Big Island, Hawaii.
- Peppard, J., Ward, J., & Daniel, E. (2007). Managing the realization of business benefits from IT investments. *MIS Quarterly Executive*, 6(1), 1–11.
- Petter, S., DeLone, W., & McLean, E. (2008). Measuring information systems success: Models, dimensions, measures, and interrelationships. *European Journal of Information Systems*, 17, 236–263.
- Pitt, L. F., Watson, R. T., & Kavan, C. B. (1995). Service quality: A measure of information systems effectiveness. *MIS Quarterly*, 19(2), 173–187.
- Qian, Z., & Bock, G.-W. (2005). An empirical study on measuring the success of knowledge repository systems. In *Proceedings of the 38th Hawaii international conference on system sciences (HICSS 05)*, January 3–6, Big Island, Hawaii.
- Rai, A., Lang, S. S., & Welker, R. B. (2002). Assessing the validity of IS success models: An empirical test and theoretical analysis. *Information Systems Research*, 13(1), 50–69.
- Rainer, R. K., Jr., & Watson, H. J. (1995). The keys to executive information system success. *Journal of Management Information Systems*, 12(2), 83–98.
- Rosemann, M., & Vessey, I. (2005). Linking theory and practice: Performing a reality check on a model of IS success. In *Proceedings of the 13th European conference on information systems (ECIS 05)*, Regensburg.
- Rosemann, M., & Vessey, I. (2008). Toward improving the relevance of information systems research to practice: The role of applicability checks. *Management Information Systems Quarterly*, 32(1), 1–22.
- Sabherwal, R. (1999). The relationship between information system planning sophistication and information system success: An empirical assessment. *Decision Sciences*, 30(1), 137–167.
- Sambamurthy, V., & Zmud, R. W. (1994). *It management competency assessment: A tool for creating business value through it*. Morristown: Financial Executives Research Foundation.

- Schaupp, L. C., Fan, W., & Belanger, F. (2006). Determining success for different website goals. In *Proceedings of the 39th Hawaii international conference on system sciences (HICSS 06)*, Hawaii.
- Seddon, P., & Yip, S. K. (1992). An empirical evaluation of User Information Satisfaction (Uis) measures for use with general ledger accounting software. *Journal of Information Systems*, 6(1), 75–92.
- Seddon, P. B. (1997). A respecification and extension of the Delone and Mclean model of Is success. *Information Systems Research*, 8(3), 240–253.
- Seddon, P. B., & Kiew, M. Y. (1994). A partial test and development of the Delone and Mclean model of Is success. In *Proceedings of the 15th international conference on information systems (ICIS 94)*, Vancouver.
- Sedera, D. (2006). An empirical investigation of the salient characteristics of Is-success models. In *Proceedings of the 12th Americas conference on information systems (AMCIS 06)*, Acapulco.
- Sedera, D., & Gable, G. (2004). A factor and structural equation analysis of the enterprise systems success measurement model. In *Proceedings of the 37th Hawaii international conference on system sciences (HICSS 04)*, Hawaii.
- Sedera, D., & Gable, G. (2004). A factor and structural equation analysis of the enterprise systems success measurement model. In *Proceedings of the 25th international conference on information systems (ICIS 04)*, Washington.
- Sedera, D., Gable, G., & Chan, T. (2004). Knowledge management as an antecedent of enterprise system success. In *Proceedings of the 10th Americas conference on information systems (AMCIS 04)*, New York.
- Sedera, D., Gable, G., & Chan, T. (2004). Measuring enterprise systems success: The importance of a multiple stakeholder perspective. In *Proceedings of the 12th European conference on information systems (ECIS 04)*, Turku.
- Shang, S., & Seddon, P. B. (2002). Assessing and managing the benefits of enterprise systems: The business manager's perspective. *Information Systems Journal*, 12(4), 271–299.
- Shannon, C. E., & Weaver, W. (1949). *The mathematical theory of communication*. Urbana: University of Illinois Press.
- Shin, B. (2003). An exploratory investigation of system success factors in data warehousing. *Journal of the AIS*, 4, 141–170.
- Soh, C., & Markus, M. L. (1995). How it creates business value: A process theory synthesis. In *Proceedings of the 16th international conference on information systems (ICIS 1995)*, Amsterdam.
- Torkzadeh, G., & Doll, W. J. (1999). The development of a tool for measuring the perceived impact of information technology on work. *Omega*, 27(3), 327–339.
- Trkman, M., & Trkman, P. (2009). A wiki as intranet – a critical analysis using the Delone & Mclean model. *Online Information Review*, 33(6), 1087–1102.
- Urbach, N., Smolnik, S., & Riempp, G. (2009). A conceptual model for measuring the effectiveness of employee portals. In *Proceedings of the 15th Americas conference on information systems (AMCIS 2009)*, San Francisco.
- Urbach, N., Smolnik, S., & Riempp, G. (2009b). The state of research on information systems success. *Business & Information Systems Engineering*, 1(4), 315–325.
- Urbach, N., Smolnik, S., & Riempp, G. (2010). Improving the success of employee portals: A causal and performance-based analysis. In *Proceedings of the 18th European conference on information systems (ECIS 2010)*, Pretoria.
- Velasquez, N. F., Durcikova, A., & Sabherwal, R. (2009). Studying knowledge management system success in system administration. In *Proceedings of the 42nd Hawaii international conference on system sciences (HICSS 09)*, Hawaii.
- Wang, Y. S. (2008). Assessing e-commerce systems success: A respecification and validation of the Delone and Mclean model of IS success. *Information Systems Journal*, 18, 529–557.
- Wixom, B. H., & Watson, H. J. (2001). An empirical investigation of the factors affecting data warehousing success. *Management Information Systems Quarterly*, 25(1), 17–41.

- Wixom, B. H., & Todd, P. A. (2005). A theoretical integration of user satisfaction and technology acceptance. *Information Systems Research*, 16(1), 85–102.
- Wu, J. H., & Wang, Y. M. (2006). Measuring KMS success: A respecification of the Delone and Mclean's model. *Information Management*, 43(6), 728–739.
- Yang, Z., Cai, S., Zhou, Z., & Zhou, N. (2005). Development and validation of an instrument to measure user perceived service quality of information presenting web portals. *Information Management*, 42(4), 575–589.
- Yusof, M. M., Paul, R. J., & Stergioulas, L. K. (2006). Towards a framework for health information systems evaluation. In *Proceedings of the 39th Hawaii international conference on system sciences (HICSS 06)*, Hawaii.