Information Systems Success: The Quest for the Independent Variables

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ABSTRACT: In 1992, DeLone and McLean suggested that the dependent variable for information systems (IS) research is IS Success. Their research resulted in the widely cited DeLone and McLean (D&M) IS Success Model, in which System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact are distinct, but related dimensions of IS success. Since the original IS Success Model was published, research has developed a better understanding of IS success. Meanwhile, comprehensive and integrative research on the variables that *influence* IS success has been lacking. Therefore, we examine the literature on the independent variables that affect IS success. After examining over 600 articles, we focused our attention on integrating the findings of over 140 studies. In this research, we identify 43 specific variables posited to influence the different dimensions of IS success, and we organize these success factors into five categories based on the Leavitt Diamond of Organizational Change: task characteristics, user characteristics, social characteristics, project characteristics, and organizational characteristics. Next, we identify 15 success factors that have consistently been found to influence IS success: Enjoyment, Trust, User Expectations, Extrinsic Motivation, IT Infrastructure, Task Compatibility, Task Difficulty, Attitudes Toward Technology, Organizational Role, User Involvement, Relationship with Developers, Domain Expert Knowledge, Management Support, Management Processes, and Organizational Competence. Finally, we highlight gaps in our knowledge of success factors and propose a road map for future research.

KEY WORDS AND PHRASES: independent variables, IS success, research integration, success determinants, success factors.

IN AN EFFORT TO ANSWER ONE OF THE QUESTIONS posed by Peter Keen at the first International Conference on Information Systems (ICIS) in 1980, DeLone and McLean (D&M) suggested that the dependent variable for the field of management information systems should be Information Systems (IS) Success [36]. In a review of the literature, they developed a taxonomy of IS success that identified six interrelated variables for IS success: System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact. Since the original publication of this IS success model in 1992, researchers have proposed and examined one or more of the variables of IS success in conjunction with independent variables. Although much research has been conducted on IS success, there is a lack of comprehensive and integrative research on variables that influence success. If IS success is the dependent variable for IS, then these success factors are the independent variables. Therefore, the objective of this paper is to explore the question: What "causes" IS success, or, at the very least, what influences IS success?

To answer the question of what factors or variables influence IS success, this study examines research published during the 15-year period between 1992 and 2007. The studies examined in this research cover multiple levels of analysis, different types of IS, and different contexts. As a result, this study provides an overview of the determinants of IS success with a focus on breadth. We identified 43 determinants or variables that have been posited to affect one or more of the IS success variables. These 43 success

factors are organized into five success determinant categories, namely, *task, individual, social, project,* and *organizational* characteristics, which in turn are grouped based on three of Leavitt's dimensions of organizational change (i.e., task, people, and structure). We then highlight the success factors found to affect success most consistently.

As we describe what we have learned from our integrative research, we also identify gaps in our knowledge thereby identifying the independent variables that merit further study. This research not only identifies important independent variables related to IS success (i.e., success factors) that are relevant across multiple contexts, but also challenges researchers to investigate why many determinants yield conflicting results in terms of the relationships between various independent variables and IS success.

This research makes three contributions. First, it integrates research studies over a recent 15-year period to identify those variables that have been shown to have an impact on specific dimensions of IS success directly. Among the 43 independent variables that we identified, many have a direct effect on IS success across different types of IS and with different measures, suggesting a level of consistency among many of these relationships, regardless of the context. The determinants of success identified in this study are the result of a qualitative research review, which allows for a broader identification of predictors of IS success. Therefore, this study identifies consistent, well-studied determinants of IS success.

Second, this research examines the relationships between each of the success factors and specific dimensions of IS success. Not only does this research identify a listing of these factors, but it also examines which determinants influence each of the dimensions of IS success—System Quality, Information Quality, Service Quality, Intention to Use, System Use, User Satisfaction, and Net Benefits. This provides additional insights to researchers and practitioners as to which independent variables (i.e., success factors) can influence specific measures of IS success.

Third, this integration of the research identifies other important independent variables that have been neglected or that warrant further study. Some presumed success factors have been inadequately studied or yielded inconsistent results. This study highlights significant gaps in the empirical research on success factors and provides a comprehensive road map for improving our understanding of the variables, both those presented here and others that are understudied, that are associated with successful IS.

In summary, this research (1) identifies the determinants of IS success, (2) explores the relationship between these determinants and specific dimensions of IS success, and (3) reveals the gaps in our knowledge of success determinants in order to guide future research.

The organization of this paper is as follows. First, we present a background of our current understanding of success and its determinants. Next, we explain the methodology used to conduct our integration of previous research concerning these determinants. Then we describe the results of research in terms of the determinants that most consistently correlate with IS success. Next, we apply the D&M IS success dimensions [36] as an analytical framework to identify gaps in our understanding of IS success determinants. Finally, we provide the implications and conclusions of this research.

The Dependent Variable: IS Success

Identifying IS Success

> "Success" is achieving the goals that have been established for an undertaking.—Anonymous

Defining "success" has been a challenge for the IS field. To research "what *is* IS success?" DeLone and McLean [36] undertook a review of the research published during the period 1981–87. They identified six variables or dimensions of IS success: System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact. These six variables serve not as *independent* success measures, but as *interdependent* variables used to measure IS success.

After the publication of the original D&M IS Success Model, some researchers suggested that the variable, Service Quality, be added to the D&M model. An instrument from the marketing literature, SERVQUAL, measures the service quality of information technology (IT) departments or organizations by measuring and comparing users' expectations against their perceptions of the service. Pitt et al. [122] evaluated the instrument from an IS perspective and suggested that the construct of Service Quality be added to the D&M model. Recognizing this and other proposed modifications to their model, DeLone and McLean, in a follow-up work [37], reviewed the empirical studies that had been performed during the years since 1992 and revised the original model accordingly, as indicated in Figure 1. Table 1 defines and provides examples for each of the IS success variables in the updated IS Success Model.

The D&M model has proven to be a useful framework to understand IS success. One study found that the 1992 paper that first introduced the D&M model was the most cited article among the top three IS journals during the 15-year period of 1992–2007 [102]. The D&M IS Success Model has stood up well to time and scrutiny. Many studies have empirically examined a portion or all of the IS success model and have found reasonable support for it [66, 124, 131, 132]. Literature reviews have also found support for much of the IS success model [8, 37, 53, 120, 121]. Therefore, this study takes the next step by identifying the relevant factors that affect the dimensions of IS success as described in the D&M IS Success Model.

Identifying IS Success Determinants

For decades, IS researchers have searched for factors that affect IS success. Reviewing antecedents to IS success is a task complicated by both the sheer number of hypothesized antecedents and the variety of definitions for each antecedent. Past research has examined determinants of IS success either in depth or in breadth, rarely both.

Research with a strong focus on depth provides insight on a single determinant (e.g., [63, 67]). While research regarding how a specific determinant influences success is useful, researchers and practitioners are left wondering about other variables that might influence IS success. Other research has focused on breadth to identify causes or influences on IS success [64, 86], yet these studies do not provide details about the

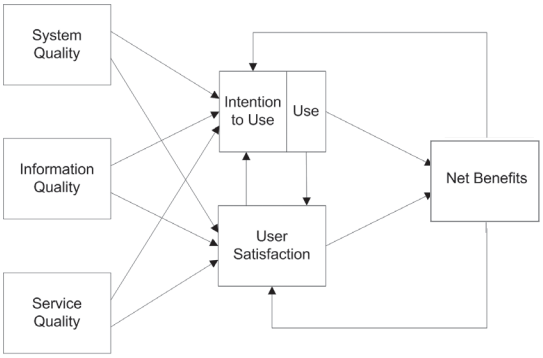

Figure 1. Updated DeLone and McLean IS Success Model [37]

Table 1. IS Success Variables

IS success variable	Definition	Examples of measures
System quality	Desirable characteristics of an IS.	Ease of use, system flexibility, system reliability, and ease of learning, as well as intuitiveness, sophistication, flexibility, response time.
Information quality	Desirable characteristics of the system outputs (content, reports, dashboards).	Relevance, understandability, accuracy, conciseness, completeness, understandability, currency, timeliness, usability.
Service quality	Quality of the service or support that system users receive from the IS organization and IT support personnel in general or for a specific IS.	Responsiveness, accuracy, reliability, technical competence, empathy of the personnel staff.
System use	Degree and manner in which staff and customers utilize the capabilities of an IS.	Amount of use, frequency of use, nature of use, appropriateness of use, extent of use, purpose of use.
User satisfaction	Users' level of satisfaction with the IS.	Single item to measure user satisfaction, semantic differential scales to assess attitudes and satisfaction with the system, multiattribute scales to measure user information satisfaction.
Net benefits	Extent to which IS are contributing to the success of individuals, groups, organizations, industries, and nations.	Improved decision making, improved productivity, increased sales, cost reductions, improved profits, market efficiency, consumer welfare, creation of jobs, economic development.

relationships between specific antecedents and measures of IS success. Furthermore, some studies integrate depth with some breadth by examining multiple antecedents of IS success in some depth (e.g., [126]). While this type of research synthesizes prior research related to the determinants of IS success, there are likely to be other important IS success determinants that are omitted, either due to the lack of research on the topic or the lack of a theory base to support the research model.

The fact that a large number of antecedents of IS success have been proposed is not surprising. The introduction of a new IS or the modification of an existing system subjects the organization to both technological and social changes [14, 90]. Leavitt [90] posits that organizations encounter four interdependent variables: tasks, people, technology, and structure. His model has been used to explain sociotechnical IS and the interrelationship between an IS and other aspects of the working environment [14]. In this study, the technology variable in Leavitt's model represents the IS, measured by its success characteristics, consistent with the DeLone and McLean's [36] view that the dependent variable in IS research is IS Success. The other three variables in Leavitt's model—task, people, and structure—in this study are considered the predictors, or success factors, of technology success.

Research Method

ONE OF THE MOST WELL-ESTABLISHED METHODS to integrate research findings and assess the cumulative knowledge within a domain is a qualitative literature review [118]. This method allows a researcher to analyze and evaluate both quantitative and qualitative research within a domain to draw conclusions about the state of the field. In this integration of the IS success literature, determinants of IS success are identified from both quantitative and qualitative research perspectives. In addition to identifying the factors that have been shown to determine IS success, we also considered the relationship between each success factor and the specific variables of IS success as identified in the D&M IS Success Model. This research method allowed us to perform a comprehensive and integrative review of previous research to identify determinants of IS success and enabled us to develop insights into the causes of different dimensions of IS success.

Scope of the Search

To identify the determinants of IS success, we performed full-text searches in a number of online databases (EBSCOhost, ABI/Inform, and Web of Knowledge) using the key words "IS success," "IS effectiveness," and "DeLone and McLean." Furthermore, we performed a citation search using the Web of Science database on the original DeLone and McLean paper [36], the updated DeLone and McLean paper [37], and the Seddon response paper [130] to identify potential articles related to IS success. To ensure that the bibliography of relevant studies was as complete as possible, the list of studies was triangulated with reference lists of other literature reviews and Web sites related to IS success (e.g., [37, 53]). We identified over 600 empirical and conceptual papers in the

initial search related to IS success. These papers were published in the 15-year period between 1992, the year the D&M IS Success Model was first published, and 2007.

The primary searches were for papers in journals within the IS discipline. To be inclusive, we did not restrict our search to a specific type of IS or a specific use context (i.e., individual versus organizational or voluntary versus mandatory). We eliminated papers from our review that were purely conceptual in nature, ones that focused solely on instrument development, or those that did not examine predictors of IS success. From this collection of papers, only papers reporting empirical results (both quantitative and qualitative research) of determinants of one or more of the dimensions within the IS success model were included in our analysis. Overall, we collected data from over 450 studies.

After collecting these data, we then chose to exclude certain studies. Studies that were literature reviews or meta-analyses related to IS success were examined but were not included because these papers already represented a composite of multiple studies. Furthermore, given the large number of relationships under consideration, we chose to focus only on direct effects between the determinants of IS success and the dimensions of IS success. Our concern is with variables that predict IS success, not those variables that act as control variables or moderators of IS success. In conducting our analysis, we found a number of studies that considered moderating factors or interaction terms. For example, a study by Rodgers et al. [125] considered the moderating role of experience in an online environment on various variables of IS success. We did not include findings such as this in our analysis since a moderating effect is different than a direct effect. However, if a study did examine the direct effect as part of the research, we included the direct relationship in our formal data analysis. This elimination process yielded over 140 studies for analysis.

Classifying Antecedents

Specifying Antecedent Categories

To classify the antecedents of IS success, two researchers worked independently. One researcher recorded the relevant relationship findings in a document.[1] At this point, 303 relationships were identified. This researcher then organized the independent variables, with no preconceived idea of how many categories would emerge and how to structure the categories.

The categories that emerged from the data are consistent with Leavitt's Diamond of Organizational Change [90]. *Task characteristics,* which are the independent variables associated with the tasks that are supported by an information systems, is consistent with Task in Leavitt's model. *User characteristics* is consistent with People in the Leavitt Diamond. These user characteristics are attitudes, perceptions, and demographics that are specific to the individual users of the IS. Another category of independent variables that focuses on People is *social characteristics* or relationship among users. There are two dimensions of Leavitt's Structure variable that were identified as categories of independent variables of IS success: project characteristics

and organizational characteristics. *Project characteristics* relate to the structures used to manage the development and updating of an IS. *Organizational characteristics* are aspects of the organization that can have an impact on success, such as organizational size (e.g., [28]) or an organization's support of technology (e.g., [24]). Leavitt's Diamond also included Technology, which we consider as the dependent variable in this study (i.e., the IS evaluated in terms of its success).

Once these five categories were identified and compared with those in Leavitt's Diamond, another researcher independently used a bottom-up approach to confirm the classifications. This second researcher was given the 303 relationships identified, along with definitions of the five categories. The researcher then grouped the relationships into the five categories: Task, User, Social, Project, and Organizational. The second researcher also created an "other" category for any relationships that did not fit within the five categories specified by the first researcher. When differences emerged, both researchers revisited the original paper (rather than the coded data) and the definitions of each category. The researchers then worked together to classify the independent variable into one of the five categories. Using Cohen's kappa to assess interrater reliability, the two researchers achieved $\kappa = 0.81$ in their grouping of the relationships into the five categories, which demonstrates a high level of interrater reliability.

Traditionally, the Leavitt Diamond of Organizational Change is used to explain how various factors will change when technology is introduced or modified within a firm [14, 79]. However, in this study, we take a different approach. We consider the effect of tasks, structures, and people on the *success* of technology. Table 2 summarizes the relationship between the constructs within Leavitt's Diamond of Organizational Change and the antecedent categories identified in this paper.

Identifying Antecedent Variables

Once the high-level categories were determined, the next step was to identify or name the antecedent variables and to classify these variables within each of the five categories based on the definitions of the variables and the measures used for each of the variables. One challenge was that a variable was sometimes identified by different names. For example, *task compatibility* may be called "compatibility" in one study (e.g., [25]), but called "task–technology fit" in another study (e.g., [39]). In some cases, the same measures were used for each study, but with different identifying names; therefore, we could easily codify these studies as representing the same antecedent variable. If different measures were used, the actual measures were examined to evaluate the similarity across the studies. If there were still questions about whether or not an antecedent could be identified by a specific variable name, the first researcher examined the theoretical basis from the original article to determine if there was enough similarity to include the antecedent under a synonymous variable name. If there was sufficient difference between the constructs across studies, a new antecedent variable was named. After the first researcher performed this classification, the results were discussed with the second researcher to finalize the naming. This process identified 43 unique success factor variables, which are listed in Table 3 within the five resulting success factor categories.

Table 2. Mapping Between Leavitt's Diamond and Antecedent Categories

Leavitt's constructs	Antecedent category
Task	Task characteristics
People	User characteristics
	Social characteristics
Structure	Project characteristics
	Organizational characteristics
Technology	Dependent variables of IS Success (System Quality, Information Quality, Service Quality, Intention to Use, Use, User Satisfaction, Individual Impact, Organizational Impact)

To further evaluate our classification procedure for variables and categories, we used a holdout sample. Studies from 2006 and 2007 were not analyzed in the first review of the literature. This holdout sample had two purposes: (1) to confirm that the approach to assign determinants to categories was appropriate and consistent across researchers and (2) to ensure the stability of the results. When we analyzed the holdout sample, we found that our five categories covered all of the determinants, so no new categories were needed and there was no need to define or create new antecedent variables beyond what was identified in our earlier classification (see Table 2).

As a final test of our classification, we compared our antecedent variables to antecedents of IS success from prior studies [64, 86, 126]. For instance, in comparing our antecedents with those identified by Sabherwal et al. [126], all of the antecedents of IS success in that study were found in our study.[2] We also compared our results to a comprehensive taxonomy of antecedents of IS success developed by Larsen [86]. In his review, Larsen examined a large number of studies and used quantitative methods (i.e., cluster analysis and multidimensional scaling) to develop a taxonomy of antecedents, consisting of 83 concepts in 12 categories. The majority of Larsen's categories were the same as the variables we found; however, some of his antecedents we classify as *dependent* variables (rather than antecedents) in our study (e.g., his Ease of Use in IT and Support Concepts is a measure of System Quality and thus a dependent variable in our study). Also, our research goes beyond Larsen's classification scheme of identifying and classifying antecedents of IS success since we analyze the results and explore the relationships between the antecedents and the measures of IS success.

Analyzing Relationships

Each hypothesis or direct relationship between an independent variable of IS success and a dependent variable of IS success is recorded in the Appendix and is represented in the various tables and figures within this paper. This means that a study may be listed multiple times based on the number of hypotheses or relationships reported in the study. Furthermore, some studies examined the same relationship using different data within the study. For example, a study might have examined the same relationship at different points in time in a longitudinal study [145]; thus, some relationships may

Table 3. Determinants of IS Success by Category

Characteristic	Description	Related variables	Variable description
Task	Determinants related to the work activities that support an organization, often supported by IS.	Task compatibility	The fit or consistency between the task and the IS that supports that task.
		Task difficulty	The degree to which the task supported by the IS is challenging for the user.
		Task interdependence	The amount that the task supported by the IS is reliant on other tasks or IS for completion.
		Task significance	The importance of the task within the business process or organization.
		Task variability	The degree of consistency (or lack of consistency) between tasks that an individual completes as part of their interaction with a work process and/or IS.
		Task specificity	The level of clarity of the task supported by the IS.
User	Determinants related to the individuals that use IS, such as those related to attitudes, personal demographics.	Attitudes toward technology	The degree to which the user possesses a favorable view about technology.
		Attitudes toward change	The degree to which the user possesses a favorable view about change, such as technology change or change in general.
		Enjoyment	The level of pleasure or enthusiasm a person has regarding the use of technology.
		Trust	The degree to which the individual has a positive view about the technology in terms of the technology being used in the individual's best interest.
		Computer anxiety	The degree of fear or concern a user has regarding the use of technology.
		Self-efficacy	The user's self-confidence about their ability to use the IS or technology in general.
		User expectations	The degree to which the user's perceptions about the IS are consistent with the actual IS.
		Technology experience	The amount of past experience a user has had with technology, even if it is a different type of technology than the IS under study.
		Organizational role	The position of the user within the organization (i.e., worker, manager, secretary, senior executive).

		Education	The degree of education completed by the user of the IS (i.e., some high school, high school, college, graduate degree).
		Age	The age of the user of the IS.
		Gender	The gender of the user (i.e., male or female).
		Organizational tenure	The length of time the user has been an employee of the firm.
Social	Determinants related to the impact that others within a person's peer group or social network influence an individual.	Subjective norms	The level of perceived social pressure related to the use of the IS.
		Image	The user's perception of how others view him or her due to his or her use of the IS.
		Visibility	The degree to which others in the organization are aware that the user is using the IS.
		Peer support	The level of support provided to users from their peers for a specific IS.
Project	Determinants related to the processes established during a project to identify, develop, and implement an IS.	User involvement	The degree to which users participate and are involved in the IS development and implementation process.
		Relationship with developers	The nature of the interaction, or closeness, between the developers and users of the IS.
		Third party interaction	The role of third parties, such as vendors or consultants, in the development of an IS.
		Developer skill	The capabilities and knowledge of the developers creating the IS.
		Development approach	The software development method used within the project, such as prototyping or the systems development life cycle.
		IT planning	The degree of planning performed by the IS department for IT projects and systems within the organization.
		Project management skills	The skill level of the project manager who is overseeing the development and implementation of the IS.
		Domain expert knowledge	The knowledge level of those that provide the expertise regarding the requirements for the IS.

(continues)

Table 3. Continued

Characteristic	Description	Related variables	Variable description
		Type of IS	The nature or purpose of the IS, such as strategic IS versus transactional IS or customer relationship management systems as opposed to knowledge management systems.
		Time since implementation	The length of time since the IS has been operational within the organization.
		Voluntariness	The degree to which users are not required to use the IS as part of their job.
Organizational	Determinants related to the overarching organizational procedures and environment, such as management influences, organizational characteristics, and the organization's environment.	Management support	The degree to which management supports an IS as a champion, sponsor, or promoter of the system.
		Extrinsic motivation	Incentives or rewards (financial, recognition, or reputation) offered by management within the organization to encourage users to use an IS.
		Management processes	Policies and procedures used by management within the organization to achieve IT alignment or to oversee the use and implementation of IS within the organization.
		Organizational competence	The knowledge possessed by the firm about the use, application, and operationalization of IT.
		IT infrastructure	The degree of sophistication of the IT infrastructure within the firm.
		IT investment	The amount of money spent by the organization on IS and technology.
		External environment	Factors beyond the organization itself, such as the industry, the competitive nature of the industry, or the influence of customers or suppliers.
		IS governance	The degree to which the IS department is centralized or decentralized.
		Organizational size	The size of the entire organization in terms of the number of people or amount of revenue.

be supported at certain time periods but not at others. Some studies examined the same relationship but may group the data (such as the gender of the respondents) [147], so the same study would be listed as both supportive and not supportive of the relationship. Finally, a study might have used multiple measures for an independent or dependent variable [97]; thus, if the findings are mixed, the study would be listed multiple times for the same relationship.

The current study includes both quantitative and qualitative research findings, allowing us to include studies that have not been considered in past reviews of IS success antecedents [64, 86, 126]. However, because this study includes both quantitative and qualitative studies, we could not perform statistical meta-analysis. Therefore, to determine the level of support for various antecedents of IS success, we used the same procedures specified by Petter et al. [121], who also included both quantitative and qualitative studies in their paper. For a study that fully supports the relationship between the antecedent and measure of IS success, a score of 1.0 point is assigned; any study with mixed results receives a score of 0.5 points; and studies that do not support the relationship, 0.0 points. The sum of the points is divided by the number of unique studies that examined the relationship in question. Relationships are considered "strong" if the percentage of papers supporting the relationship is 90 percent to 100 percent or "moderate" support if the percentage of papers supporting the relationship is 67 percent to 89 percent. Relationships for which there are four or fewer studies were not evaluated using this criteria since there would be insufficient data to make a determination about the nature of the relationship [121].

Consistent with Petter et al. [121], the purpose of this analysis is not to determine the absolute magnitude of the relationship between constructs (i.e., an effect size), but rather to provide guidelines regarding areas for future research and to identify where there seems to be some consistency for an antecedent of IS success.

We first performed this analysis to assess the support for the antecedent with overall IS success (i.e., *Task Compatibility* with any measure of IS success). Through this analysis, we found five antecedents with a strong relationship to overall IS success: Enjoyment, Trust, User Expectations, Extrinsic Motivation, and IT Infrastructure. We also identified 10 antecedents that have moderate support for the relationship between the antecedent and overall IS success: Task Compatibility, Task Difficulty, Attitudes Toward Technology, Organizational Role, User Involvement, Relationship with Developers, Domain Expert Knowledge, Management Support, Management Processes, and Organizational Competence.

We then analyzed each of the antecedents using the same criteria for the relationships between the antecedent and the specific measure of IS success (e.g., Task Compatibility and System Quality, Task Compatibility and Intention to Use). This allowed us to identify strong and moderate relationships. In this analysis, only 12 constructs had a strong or moderate level of support with a specific measure of IS success: Task Compatibility, Task Difficulty, Attitudes Toward Technology, Self-Efficacy, User Expectations, Technology Experience, User Involvement, Management Support, Management Processes, Extrinsic Motivation, Organizational Competence, and IT Infrastructure.

The Independent Variables of IS Success

THE 43 ANTECEDENT VARIABLES DESCRIBED ABOVE have been grouped into five success factor categories based on our data analysis and the theories of organizational change and sociotechnical system design [14, 90]. The following five sections are organized by success factor category and describe the antecedent variables as they relate to IS success.

Task Characteristics

Tasks are the activities that support an organization, and IS are introduced to augment the completion of tasks [90]. IS are created to automate or infomate tasks [158]. Given the relationship between tasks and IS, there are several antecedents of IS success related to tasks [86]. Table 4 summarizes the success relationships for the task characteristic variables found across the 140 empirical studies by showing the number of relationships that found support, "S," or no support "N," for the relationship between the antecedent and each success dimension.[3] Our data analysis revealed that task compatibility and task difficulty had a moderate level of support as antecedents of overall IS success.

Among task characteristics, the most frequently studied and validated determinant of IS success is task compatibility. *Task compatibility* examines the consistency of the technology with the work processes or work styles [123, 138]. It appears that the lack of studies on task compatibility as an antecedent to System Quality, Information Quality, and Service Quality is because the construct "task–technology fit" [51, 52] is a composite construct with these three success dimensions embedded within the construct. The relationship between task compatibility and System Quality is not supported by the three of the four studies examined. The preponderance of research to date examining task compatibility has considered Individual Impact, Use, and User Satisfaction as the dependent variables.

Task difficulty was also found to have a moderate level of support as an antecedent of IS success. Task difficulty has an inverse relationship with IS success in that the easier the task, the more successful the IS. The relationship between the complexity, or the challenging nature of the task, and IS success has focused on User Satisfaction and Individual Impact as the dependent variables.

Task significance is the relevance or importance of a task and would be expected to have an influence on IS success, especially Use and Impact [99, 145]; however, the few studies that have studied this relationship have mixed results.

User Characteristics

While IS are critical resources for an organization, it is the people using these systems and the information derived from them that can influence the resulting success of the system. Leavitt [90] realized that people are a critical component in the organization. Sociotechnical theory accepts this notion and encourages the study of the role of individuals as well as of the IS [14]. Differences among users of an IS have been found

Table 4. Number of Relationships Supporting Task Characteristics and IS Success Dimensions

Characteristic	System quality	Information quality	Service quality	Intention to use	Use	User satisfaction	Individual impact	Organizational impact	Summary N|S
Task compatibility	NNN|S	-	-	NN|SS	N|SSSSSSS	-|SSSSSSSS	N|SSSSSSSSSS	N|-	8|28
Task difficulty	-	-	-	-	-	N|SSS	-|SSS	-	1|6
Task interdependence	N|-	-	-	-	-	-|S	-|SS	N|-	2|3
Task significance	-	-	-	N|S	-|S	N|S	N|SS	-	3|5
Task variability	-	-|S	-	-	-	N|-	-	-	1|1
Task specificity	N|S	-	-		-	-	N|S	-|S	2|3

Notes: N = not supported; S = supported; - = no studies.

to have an impact on the dimensions of IS success, including usage, user satisfaction, and decision making [79].

Table 5 summarizes the success relationships for the user characteristic variables found across the empirical studies. In our review, we found that the most frequently studied user characteristics were attitudes toward technology, self-efficacy, and technology experience. Enjoyment, trust, and user expectations were identified as having strong support as antecedents of IS success; attitudes toward technology and organizational role were identified as having moderate support as antecedents of IS success. It is noteworthy that no studies were found that investigated the relationship between user characteristics and Organizational Impact.

Enjoyment, or the degree to which users have a positive affect toward the use of technology or an IS, was examined across several dependent variables (i.e., System Quality, Intention to Use, Use, User Satisfaction, and Individual Impact) with support found in each of the studies. *Trust* has also been examined as a determinant of multiple IS success variables, including System Quality, Information Quality, Intention to Use, and User Satisfaction. The third antecedent with strong support, *user expectations,* suggests that reasonable expectations toward an IS by users are a precursor to IS success for both the project [110, 128] and the resultant IS [133].

Attitudes toward technology has been extensively studied as a predictor to Intention to Use, Use, and to lesser extents, User Satisfaction and Individual Impact. These findings are consistent with well-known past reviews of the literature that found that attitudes had a strong impact on usage of an IS [79]. Our analysis found moderate support for the relationship between attitudes toward technology and overall IS success, with most studies supporting this relationship. An additional group of independent variables related to user characteristics are the demographics of the users themselves. Unlike beliefs, these variables encompass objective characteristics of users, such as age, technology experience, and organizational tenure. *Organizational role* is a demographic user characteristic that has a moderate influence on IS success. Early studies in the IS field have noted that one's role in the organization does affect a user's resistance to a new IS [38]. Our study found that the position of a person within an organization has an impact on multiple dimensions of IS success.

Other demographic variables are often studied, not as predictors of IS success, but rather as control variables. Yet several of these variables may influence the success of an IS. The most widely studied demographic user characteristic is *technology experience.* Technology experience has been shown to have a greater impact on System Quality and Use than other variables, such as Individual Impact. The lack of association between technology experience and Individual Impact is worthy of further exploration.

Another noteworthy user characteristic is *self-efficacy,* or one's belief that he or she is capable of performing tasks with an IS. We found that self-efficacy is strongly related to System Quality and moderately related to Intention to Use and Use; however, most studies did not find a relationship between self-efficacy and Individual Impact. This result demonstrates the importance of drilling down to determine which dependent variables are influenced by each antecedent, rather than only considering the relationship between the antecedent and overall IS success.

Table 5. Number of Relationships Supporting User Characteristics and IS Success Dimensions

Characteristic	System quality	Information quality	Service quality	Intention to use	Use	User satisfaction	Individual impact	Organizational impact	Summary N|S
Attitudes toward technology	N|-	-	-	NNNN|SSSSSSSS	N|SSSS	-|SSSS	-|SS	-	6|18
Attitudes toward change	N|-	-	-	-|S	-|SS	N|-	-|SS	-	2|5
Enjoyment	-|SS	-	-	-|SS	-|SS	-|S	-|SS	-	0|9
Trust	-|S	-|S	-	-|SSS	-	-|S	-	-	0|6
Computer anxiety	-	-	-	-	N|S	-	-	-	1|1
Self-efficacy	-|SSSSS	-	-	NN|SSSS	NN|SSSSSS	N|-	NNNN|SS	-	9|17
User expectations	-	-	-	-|S	-|SS	N|SSSS	-|S	-	1|8
Technology experience	N|SSSSSS	-|S	-	-|SS	-|SSS	NN|-	NNNNNNN|SS	-	10|14
Organizational role	N|S	-	-	N|S	N|S	N|SSS	N|S	-	5|7
Education	N|S	N|-	-	-	N|S	-|S	NNN|SS	-	6|5
Age	-|S	N|-	-	-	NN|S	N|-	NN|-	-	6|2
Gender	-	N|-	-	-	N|-	-	N|-	-	3|0
Organizational tenure	N|-	-	-	-	-|SS	-	N|-	-	2|2

Notes: N = not supported; S = supported; - = no studies.

Social Characteristics

Sociotechnical system design acknowledges the role that people can have on the resulting IS [14]. While the specific characteristics of a user performing a task can certainly affect the implementation of an IS, there are social factors within the user's peer group that can also affect various dimensions of IS success. Many studies have examined the effect of group behavior on an individual's behavior and perceptions. Over time, these researchers have introduced representations of social characteristics as an antecedent to IS success. Table 6 summarizes the success relationships for the social characteristic variables found across the 140 empirical studies that we analyzed.

The only independent variable that has been widely studied is *subjective norms,* which has mixed results. Given the variation in the results within and across studies, our analysis suggests that the subjective norms variable is not related to IS success. While subjective norms and other social characteristics are often examined in terms of technology acceptance, little research has examined the relationship between social characteristics and IS success, suggesting a need for additional research.

Project Characteristics

All organizations have structural elements [90]. The first structural element category that emerged from our research review is the structure associated with a project to identify, develop, and implement the IS under study. Software project management and implementation has received a great deal of attention within the IS literature, but to a lesser extent as a predictor of IS success. Table 7 summarizes the success relationships for the project characteristic variables found in the studies we analyzed. *User involvement, relationship with developers,* and *domain expert knowledge* were the moderate predictors of IS success and most often associated with User Satisfaction.

User involvement has long been associated with IS success [10, 68], and our review confirms that it is a predictor of IS success. We found that it had a downstream effect on the variables Use, User Satisfaction, Individual Impact, and Organizational Impact, but not on System Quality, Information Quality, and Service Quality. The *relationship with developers,* that is, the relationship between the IS group and the users, has been shown to have a positive effect on several dimensions of IS success. This relationship between the users and developers is maintained through a partnership, shared knowledge, trust, and effective communication during the development process. *Domain expert knowledge* has not been studied much, but when it has been included as an independent variable predicting IS success, there is often support for this relationship. While there is moderate support for this relationship, there is a need for further studies to better understand the impact of the expertise of those providing the domain knowledge within the project on how it affects the IS. Some other interesting project variables such as *IT planning, development approach,* and *project management skills* have been inadequately researched as determinants of IS success.

Table 6. Number of Relationships Supporting Social Characteristics and IS Success Dimensions

Characteristic	System quality	Information quality	Service quality	Intention to use	Use	User satisfaction	Individual impact	Organizational impact	Summary N|S
Subjective norms	NN|-	-	-	NNNNN|SSSSSSS	-|SS	N|S	N|SS	-	9|12
Image	N|-	-	-	NN|-	N|-	N|-	N|S	-	6|1
Visibility	-	-	-	N|-	-|S	-	-	-	1|1
Peer support	-	-	-	-	-	-	N|-	-	1|0

Notes: N = not supported; S = supported; - = no studies.

Table 7. Number of Relationships Supporting Project Characteristics and IS Success Dimensions

Characteristic	System quality	Information quality	Service quality	Intention to use	Use	User satisfaction	Individual impact	Organizational impact	Summary N|S
User involvement	-	-	-	-	NN|SS	NN|SSSSSSSSSSSS	-|SSS	-|SS	4|19
Relationship with developers	-	-	-	-|S	-|S	N|SSSS	-	-	1|6
Third-party interaction	-|SSS	-	-	-	-|S	NN|SSS	N|SS	N|SS	4|11
Developer skill	-|S	-	-	-	-|SS	NNN|SSSS	N|S	-	4|8
Development approach	-|SS	-	-	-	-	N|SS	N|S	-	2|5
IT planning	-|S	-|S	-	-	-|S	-	-	N|-	1|3
Project management skills	-|S	N|-	-	-	N|-	NN|S	-	-	4|2
Domain expert knowledge	N|-	-	-	-	-	-|SS	-|SS	-	1|4
Type of is	-	-	-	-	-	-|S	-	N|SSS	1|4
Time since implementation	-	-	-	-	-	-|S	-|S	-|SS	0|4
Voluntariness	-	-	-	N|-	-|S	-|S	-	-	1|2

Notes: N = not supported; S = supported; - = no studies.

Organizational Characteristics

Like project characteristics, organizational characteristics are part of the structural element of the organization [90], which directly and indirectly affects the technology used by the organization [14]. The structure of the organization affects the project, the task, the people, and the IS. Organizational structures, including *IT investment, management support,* and *organizational size,* have been studied to varying degrees in terms of their impact on dimensions of IS success. Table 8 summarizes the success relationships for the organizational characteristic variables found in the studies we analyzed.

The use of *extrinsic motivation,* such as incentives or pressure by the organization to use the IS, has strong support as a predictor of IS success. To date, most studies have focused on Use as the dependent variable, so it is unknown the role of incentives on other measures of IS success. A second determinant with strong support as a predictor of IS success is *IT infrastructure.* Studies that examine the sophistication or level of IT infrastructure have consistently found positive relationships between IT infrastructure with Information Quality, Use, and Organizational Impact.

The concept of *management support* has moderate support as an antecedent of IS success. Management support refers to the willingness to allocate time, resources, and encouragement for the use of an IS. Management support is probably the most widely studied and best supported organizational characteristic that predicts IS success. Studies have found consistent relationships between management support and success measures such as Use, Individual Impact, and Organizational Impact; however, the results are mixed when User Satisfaction is the dependent variable. While a previous meta-analysis found a significant relationship between management support and User Satisfaction [126], our literature review found that less than half of the studies that examine this relationship supported this finding, suggesting that there is still more to learn about this relationship.

Managers with higher levels of IT knowledge and competencies affect the adoption of IS [21] and the extent of use of IS within the firm [7, 15]. Knowledge possessed by the management of a firm about IS, also known as *organizational competence,* is moderately supported as an antecedent of IS success.

Certain *management processes,* such as the culture, bureaucracy, or change control processes, also affect IS success. When management invokes processes that encourage open communication or strongly inform users about the benefits of the new IS, more Use of the IS seems to follow (e.g., [74, 136]). However, mere knowledge of management processes is not enough to cause Use or Net Benefits [15, 40]. Formal management processes must be adopted to influence the resulting benefits received from the IS (e.g., [24, 78]). In these cases, management processes strongly affects both Use and Net Benefits (i.e., Individual Impact and Organizational Impact).

While *IT investment* has been widely discussed within the literature in terms of the productivity paradox [17] and creating value for the firm [23], few studies have examined this variable in terms of its relationship to IS success. We found few studies that addressed the direct relationship between IT investment and the effects of a specific IS.

Table 8. Number of Relationships Supporting Organizational Characteristics and IS Success Dimensions

Characteristic	System quality	Information quality	Service quality	Intention to use	Use	User satisfaction	Individual impact	Organizational impact	Summary N|S
Management support	N|S	-|S	-	-	N|SSSSS	NNNNN|SSSSSSSS	-|SSSS	-|SSS	7|22
Extrinsic motivation	-	-|S	-	N|S	-|SSSSSS	-	-	-	1|8
Management processes	-|SS	N|SS	-	-|S	N|SSS	N|-	-|SSS	N|SS	4|13
Organizational competence	-	-|S	-	-	N|SSSSSS	-	-	N|SS	2|9
IT infrastructure	-	-|SS	-	-	-|SSSSS	N|-	-	N|SSSS	2|11
IT investment	-	N|-	-	-	-|S	N|-	-	N|-	3|1
External environment	N|-	-	-	N|S	NNN|SS	-	N|-	N|SS	7|5
IS governance	-	-	-	-	-|S	NN|S	-	-	2|2
Organizational size	-	-	-	-	NNN|-	-|SS	-	-	3|2

Notes: N = not supported; S = supported; - = no studies.

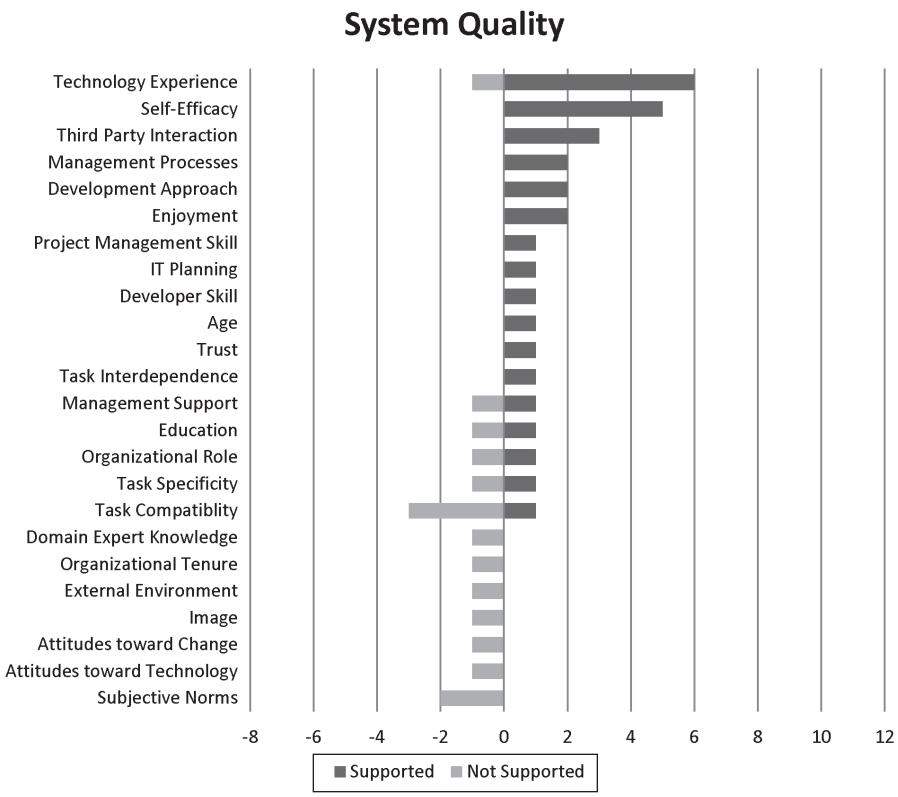

Figure 2. Independent Variables for System Quality

Antecedents of IS Success Dimensions

While the previous sections focused on identifying a taxonomy of factors that influence IS success, based on Leavitt's Diamond of Organizational Change [90], the following sections discuss the determinants of each of the IS success dimensions from the perspective of the DeLone and McLean Model [37]. The purpose of this section is to analyze the 140 empirical studies to gain a deeper understanding of what we know and do not know about the factors that influence IS success.

System Quality

As a measure of success, System Quality considers the technical aspects of a system, including convenience of access, system functionality, reliability, response time, sophistication, navigation ease, and flexibility, among others. Several antecedents have been studied as predictors of System Quality with mixed results. Figure 2 identifies these antecedents of System Quality, sorted by the number of studies examining each relationship. The length of the bar on the righthand side of the graph identifies the

number of supported relationships; the bar on the lefthand side identifies the number of results that did not find a relationship between the constructs.

The most widely studied, and the most robust, predictors of System Quality are the characteristics of the users of the system, specifically, *attitudes toward technology, technology experience,* and *self-efficacy.* This suggests that user's perceptions of System Quality will be directly related to the user's technical abilities and self-confidence. While this finding from the previous research is intuitive, it does offer some implications for practice. While managers cannot always change the level of technology experience of their users, it is possible to influence the users' attitudes, self-efficacy, and experience through training or other activities to help the users feel more comfortable with the system.

Although *user involvement* has been often studied for its impact on IS success, user involvement on System Quality specifically has not been studied. As discussed in later sections, user involvement has been examined extensively as a determinant to User Satisfaction and Individual Impact, but the study of user involvement as a predictor to the quality of the system is lacking.

Information Quality

IS are designed to generate relevant and accurate information. The definition of information quality encompasses measures of accuracy, precision, currency, timeliness, sufficiency, understandability, conciseness, among others. These measures capture how well systems assist users in making business decisions. As important as information quality is to an IS, few studies have examined the predictors of Information Quality as demonstrated in Figure 3.

While generating quality information is the primary purpose of any IS, few studies have explored the variables that affect Information Quality. This is a significant gap in the IS research. Quality information is a foundation of good decision making and positive outcomes, yet we know little about the variables that lead to improved Information Quality. More research is needed in order to understand better how to influence Information Quality.

Service Quality

The Service Quality construct in the updated DeLone and McLean IS Success Model [37] refers to the service quality provided by the IS department across all of its services. While IS support has expanded to include a portfolio of customer-facing e-commerce and Web 2.0 systems, Service Quality becomes an important dimension of IS success [129]. Yet we found no studies that considered the determinants of Service Quality for a specific IS. The few studies that did identify determinants of Service Quality considered the overall quality of the service provided by the IS department for all applications and services rather than for a specific IS. Responsiveness and empathy are likely to be important to customer/users when they need help with a specific

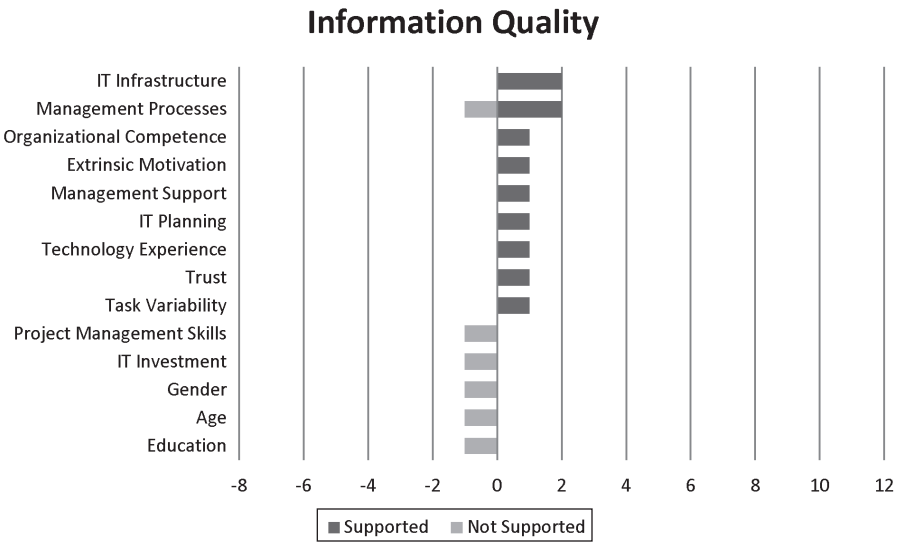

Figure 3. Independent Variables for Information Quality

system; therefore, more attention should be given to the study of variables that have an impact on Service Quality of an individual IS.

Intention to Use

If a system is to be considered successful, it must be used in the work environment for which it was intended. Although use can be measured directly, this is not to say that a direct measure of use is always possible or ideal. For this reason, it can be helpful to consider Intention to Use, or the users' belief about their likelihood to use the IS, as a measure of IS success. Figure 4 shows the independent variables that have been studied related to Intention to Use.

The most studied variable to predict an individual's Intention to Use an IS is the user's *attitude toward technology.* Two-thirds of studies that examined this relationship found that users' attitudes do influence their Intention to Use the system. *Subjective norms* is also a widely studied predictor of Intention to Use, but it too has received mixed support in the literature. Both attitudes and subjective norms have been studied because of their incorporation in the Technology Acceptance Model [33]. There is mixed support for the degree to which a technology supports users' tasks (i.e., *task compatibility*) serves as a determinant of Intention to Use. While one might expect *task compatibility* to positively affect Intention to Use, an insufficient number of studies have investigated this relationship.

The only determinant of Intention to Use that received strong or moderate support is *self-efficacy.* Users with more confidence about their capabilities to use the system are more likely to intend to use the system. With self-efficacy being an important predictor

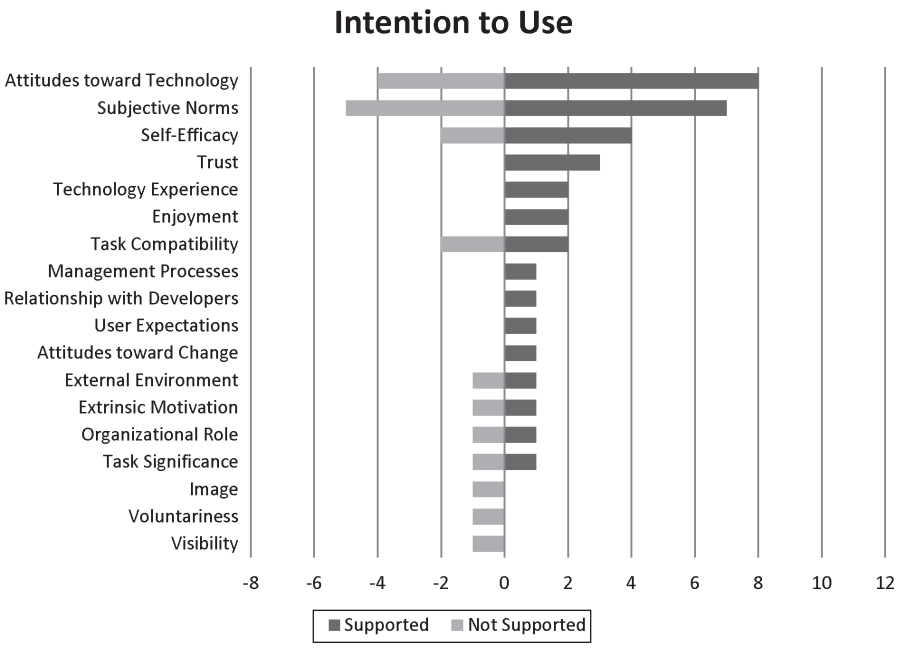

Figure 4. Independent Variables for Intention to Use

for several dimensions of IS success, including Intention to Use, it becomes even more important for management to offer proper training and support for IS.

Use

The construct of System Use has been measured with a variety of approaches within the literature [121]. System Use has been measured by considering the frequency of use, depth of use, duration of use, appropriateness of use, system dependence, actual use, and self-reported use, among others. The measurement and conceptual understanding of the system use is complex [19]; however, it is a well-studied construct with many determinants. Figure 5 shows the independent variables that have been studied related to Use.

Decades of research have suggested that there are certain characteristics of individuals that affect the use of an IS. As Figure 5 indicates, System Use is influenced by multiple variables across several categories, including task, user, organizational, and project characteristics. There is moderate support for the relationship between *task compatibility* and the various measures of Use. Studies have also examined the relationship between the *self-efficacy* of a user and IS Use, in that a user's self-confidence about an IS will influence his or her use of the system. User *attitudes toward technology* is also a determinant of system Use. *Management processes,* such as the culture, bureaucracy, or change control processes, also affect system Use. When management invokes processes that encourage open communication or strongly conveys the benefits

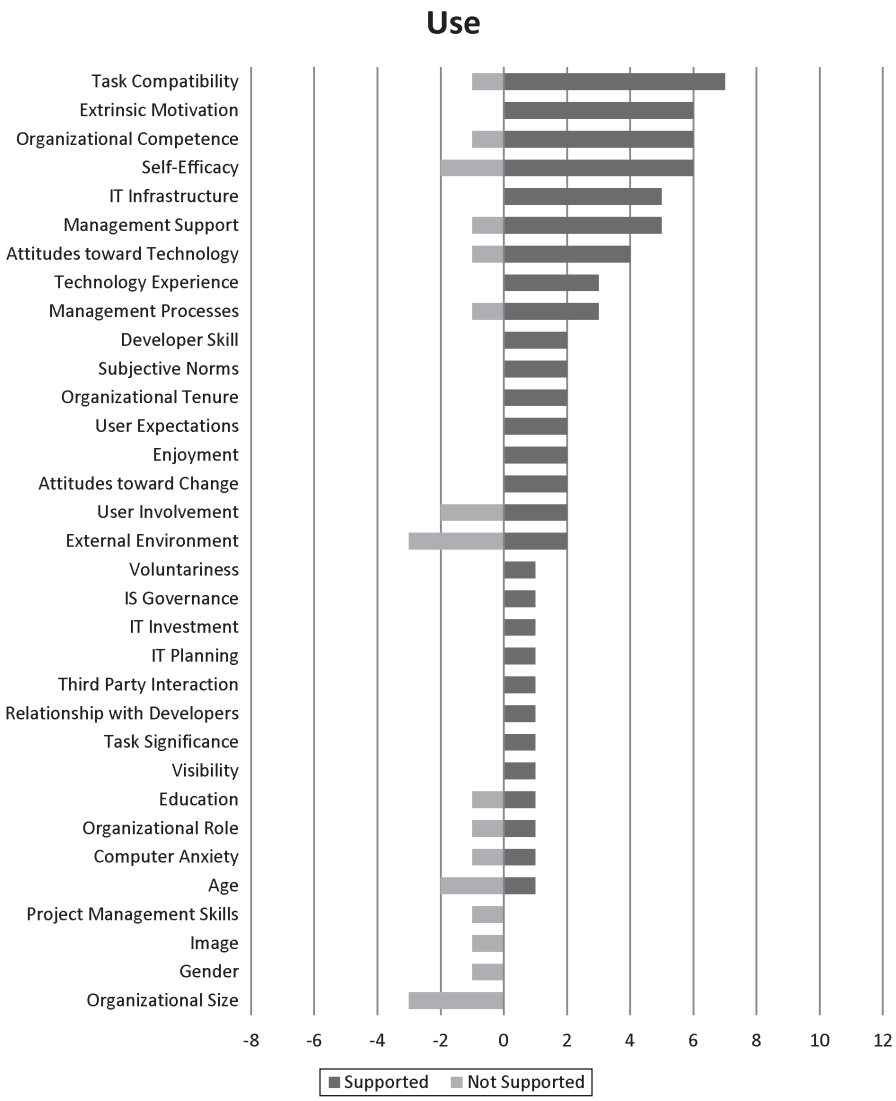

Figure 5. Independent Variables for Use

of the new IS, more use of the IS follows; however, these processes may lose their effectiveness in larger organizations [15]. *Management support,* the willingness of management to allocate time, resources, and encouragement for an IS, was a moderate determinant of Use.

The strongest determinants for Use include organizational competence, extrinsic motivation, and IT infrastructure. The knowledge possessed by the management of a firm about IS, known as *organizational competence,* is a strong predictor of Use. Management with higher levels of IT knowledge and competence affects the adoption of IS and the extent of Use of IS within the firm. The use of *extrinsic motivation,*

incentives or policies implemented by managers to encourage the use of an IS, is also a strong predictor of the use of an IS. Studies that examine the sophistication of the *IT infrastructure* have consistently found a positive relationship with Use.

The relationship between *user involvement* and Use had conflicting results and is worthy of further study. On the face of it, users who are more involved in the design and implementation of an IS are more likely to use that system.

System Use has been measured in a variety of approaches, ranging from self-reported use, to system dependence, to actual use. Because of the multiple approaches and challenges with measuring System Use as a construct [19], some of the conflicting results for determinants of System Use are likely affected by the different measures of system use adopted across studies.

User Satisfaction

In many contexts, System Use may be, if not mandatory, then at least necessary for users' performance of their job functions. In such contexts, it may be helpful to measure User Satisfaction with a given IS in order to understand IS success [60]. The relationships between success factors and User Satisfaction have been well studied. Figure 6 identifies the predictors of User Satisfaction.

There is strong support for *task compatibility* being a determinant of User Satisfaction. *Attitudes toward technology* is also supported as a strong determinant of User Satisfaction with all four studies finding support for this relationship. Users who hold reasonable *expectations* about an IS tend to be more satisfied with that system, suggesting the importance of the project manager in managing user expectations during the development of the system.

The most studied antecedent for User Satisfaction is *user involvement.* User involvement has long been associated with IS success [9, 68]. Our analysis shows that most of this research has focused on User Satisfaction as the dependent variable, with less research examining other dependent variables of IS success; but this is a moderate relationship since there are mixed results about this relationship. As expected, *task difficulty* has an *inverse* relationship with User Satisfaction in that the easier the task, the more satisfied the user is with the IS.

User determinants of User Satisfaction have been more thoroughly investigated in the literature than the task determinants. Determinants of User Satisfaction span multiple characteristics including task, project, organizational, and users. The most common determinants of User Satisfaction are within the control of the project manager and manager within the firm. These findings reinforce the need for both user involvement and management support of IS. This has long been argued in the systems development and project management literature, but these findings illustrate how critical these factors are in affecting User Satisfaction.

Net Benefits

In the updated IS Success Model, DeLone and McLean combined Individual Impact and Organizational Impact into a single variable, Net Benefits [37]. While this single

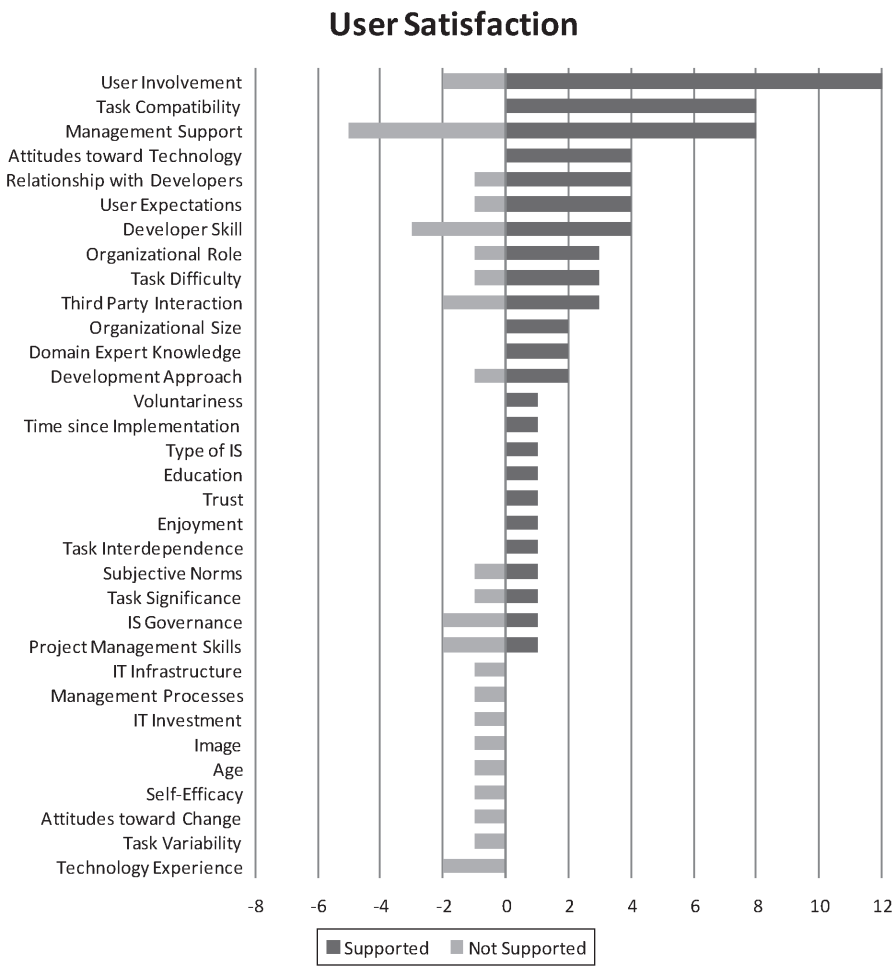

Figure 6. Independent Variables for User Satisfaction

construct is more parsimonious than the original model and provides for different levels of benefits (i.e., individual, group, organizational, societal), we analyzed the original DeLone and McLean [36] impact variables for this examination of determinants of IS success, namely, the individual and organizational levels.

Individual Impact

An IS is implemented to achieve various objectives for the organization, with many of these objectives specific to the individual using the system. Individual Impact has been measured in a variety of ways, including improvements in productivity, quality of decision making, and work practices. The predictors of Individual Impact are shown in Figure 7.

There is strong support for *task compatibility* as a determinant of Individual Impact. *Task compatibility* was found to be less relevant in improving productivity during the

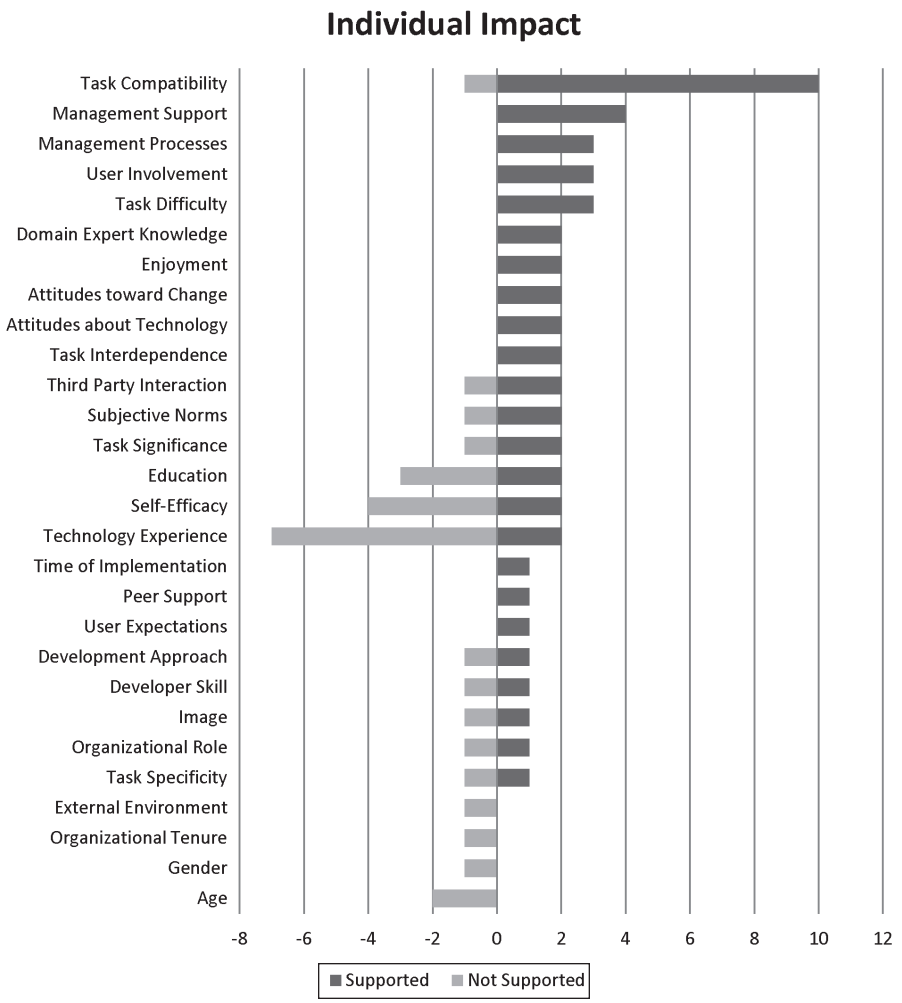

Figure 7. Independent Variables for Individual Impact

initial implementation of a system, but became more important as the system was adapted over time to better fit work practices and requirements [97]. Empirical studies have found that *management support* has an impact on the benefits of the IS, such as impact on the end-user's job [54, 153] and perceived usefulness of the IS [65, 85].

Yet several of the other antecedents of Individual Impact had mixed results, leaving many unanswered questions. *Self-efficacy* received mixed support, with two studies by the same author finding support for this relationship [29, 30] and three other studies finding no support [30, 82, 134]. One study [30], which contained conflicting results, found that the relationship between *self-efficacy* and Individual Impact is dependent on the kind of training given to users. Although *technology experience* is a predictor of other dimensions of success, such as System Quality, this variable has little to no effect on Individual Impact in the literature. *Education* as a determinant of Individual

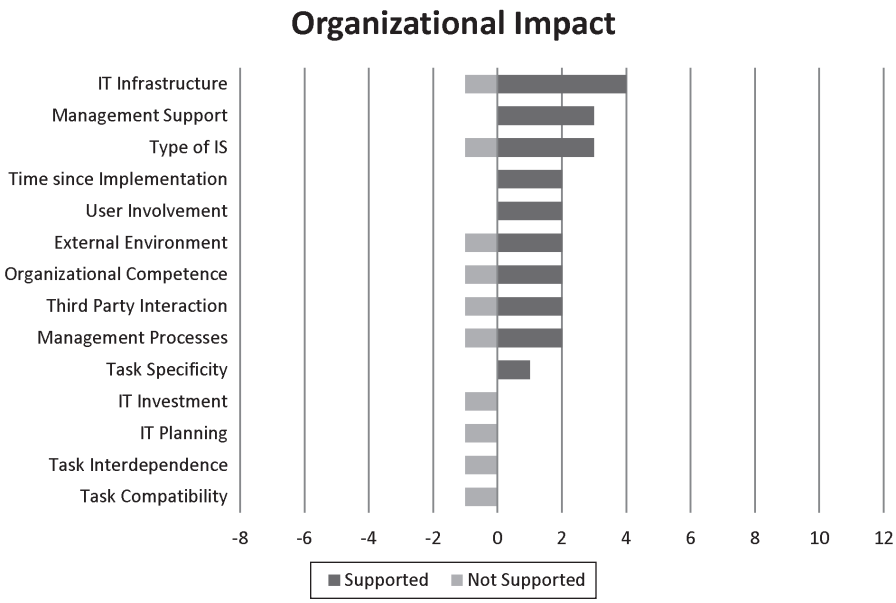

Figure 8. Independent Variables for Organizational Impact

Impact was, at best, mixed. However, these variables did not exhibit enough support to be identified as moderate or strong antecedents of Individual Impact.

Organizational Impact

When an organization commits to implementing, using, and supporting an IS, the organization often does so because some type of positive organizational impact is desired, such as improved profitability or productivity. As shown in Figure 8, only a few studies have studied the effects of a specific IS on the organization.

Four studies support the relationship between the sophistication of the *IT infrastructure* and the Organizational Impact of an IS. The only study with conflicting results found that the IT infrastructure had a significant relationship with measures of Organizational Impact, such as cost savings and financial performance, but not with the ability of the organization to improve service [94].

There are other determinants that are worthy of further study. The *type of information system* implemented was found to be a determinant of Organizational Impact in two studies, with mixed results in a third study. It may be that certain categories of IS (e.g., enterprise resource planning, customer relationship management, among others) have the ability to have more definitive and measurable effects on the organization. *Management support* was found to influence the Organizational Impact of a system, further suggesting the importance of management in the development and implementation of IS, but more studies are necessary to further validate this relationship. More research is needed to investigate the relationship between various success factors and the organizational benefits derived from individual IS.

Discussion

As DeLone and McLean concluded in 1992, there is no one, single measure of IS success; it is a multidimensional construct. Similarly, this study demonstrates that there is no one, single determinant of IS success. There is no "magic bullet" that can be used to cause IS success. However, there are several success factors that consistently enhance IS performance, whereas other, potential success factors are understudied and represent an important gap in our knowledge and provide an opportunity for future research. First, we will explore the key IS success determinants that we found in the collective empirical research. Second, we will identify the important gaps in our understanding of success determinants as well as areas for future research.

Key IS Success Determinants

As described above, there are several determinants that influence IS success. Table 9 summarizes the determinants that have been found to consistently relate to IS success (across *all* dimensions of IS success) or determinants that have been found to be related to a *specific* dimension of IS success.[4] Antecedent variables having "strong support" are those supported 90 percent or more of the time. Antecedent variables identified as having "moderate support" are constructs that are supported 67 percent to 89 percent of the time.

The results of Table 9 reveal that some determinants of IS success are found to be related only to specific dimensions of IS success (e.g., Technology Experience is only an antecedent to System Quality, but to no other dimensions of IS success, and not to overall IS success). Other antecedents are related only to overall IS success, but not a specific dimension (e.g., Domain Expert Knowledge is an antecedent of only overall IS success, but not to any specific dimensions of IS success because of a lack of study between Domain Expert Knowledge and specific measures of IS success). Other variables are determinants of IS success both for multiple dimensions of IS success as well as overall IS success (e.g., User Expectations is related to overall IS success and, more specifically, User Satisfaction). Table 9 also highlights dependent variables of success that are still unknown. For example, while there are studies that examine Information Quality as a dependent variable, our analysis did not find any consistent antecedents of Information Quality; therefore, this column is blank in Table 9. Our insights for managers and researchers based on this analysis are discussed further in this section.

Managerial Implications

The findings illustrated in Table 9 have important implications for managers. Several determinants of IS success received strong support across empirical studies; and these determinants, as outlined above, deserve special managerial attention. Some of these determinants are within the control of project managers, IS managers, and senior managers. Others may be outside of the control of managers, such as user characteristics,

Table 9. Antecedents of Specific Dimensions of IS Success

Antecedents			Specific Dimensions of IS Success							
Category	Determinant	Overall IS Success	System Quality	Info. Quality	Service Quality	Intention to Use	System Use	User Sat.	Ind. Impact	Org. Impact
Task	Task Compatibility	Moderate					Moderate	Strong	Strong	
	Task Difficulty	Moderate						Moderate		
User	Attitudes Toward Technology	Moderate	Moderate				Moderate	Strong		
	Enjoyment	Strong								
	Self-Efficacy		Strong			Moderate	Moderate			
	Trust	Strong								
	User Expectations	Strong						Strong		
	Technology Experience		Strong							
	Organizational Role	Moderate								
Project	User Involvement	Moderate						Moderate		
	Relationship with Developers	Moderate								
	Domain Expert Knowledge	Moderate								
Organizational	Management Support	Moderate					Moderate		Strong	
	Management Processes	Moderate					Moderate			
	Extrinsic Motivation	Strong					Strong			
	Organizational Competence	Moderate					Strong			
	IT Infrastructure	Strong					Strong			Moderate

but managers may still be able to influence some of these determinants. For example, *attitudes* are "user characteristics," but studies have shown (e.g., [50]) that project managers can influence these attitudes through setting proper expectations.

To use these results, managers should identify which IS success outcomes are most critical for their IS. Once these success outcomes are identified, the manager can identify antecedents that have consistently been associated with that success dimension (see Table 9). For example, Use may be the most critical success variable for a voluntary knowledge management system since it is necessary for individuals to use the system in order to achieve the desired benefits. Therefore, managers should focus their attention on organizational competence, IT infrastructure, and extrinsic motivation as the strongest predictors of Use, with task compatibility, attitudes toward technology, self-efficacy, management support, and management processes as moderate predictors of Use. Even though managers may not be able to influence organizational competence or IT infrastructure, they may be able to influence rewards and incentives that can affect the use of a knowledge management system. Managers can also work to develop training programs to influence self-efficacy and provide strong management support to influence positive usage of the system. IS with different purposes and goals may focus on different IS success variables. In these situations, managers should attempt to influence the success factors that have been associated with the desired systems outcomes to improve the likelihood of IS success.

Research Implications

Our comprehensive and integrative study of previous research has comparable findings to prior studies that have examined the independent variables of IS success. For example, in a meta-analysis, Sabherwal et al. [126] found that management support, technology experience, user attitudes, and user involvement affected one or more of variables of IS success. Given their different methodological approach, there are some differences between Sabherwal et al.'s and our findings. In Table 9, we identified several determinants of IS success, such as task compatibility, user expectations, IT infrastructure, among others, that were not identified in Sabherwal et al.'s study.

While our study confirms and extends the findings of previous comprehensive reviews, it also brings to light important gaps in our understanding of the causes of IS success that merit future investigation. In the next two sections, we identify some of those gaps and present a road map for future research related to the factors that can determine the success of IS.

Gaps in Our Knowledge of IS Success Determinants

While our study identified several independent variables that are well studied and consistently associated with IS success, it also revealed significant gaps in our knowledge of what causes IS success. Some variables of interest are understudied and others have generated mixed result that may be due to inconsistencies in measurement. Furthermore, research on the determinants of some key dimensions of IS success are lacking.

For example, few studies have explored the variables that improve Information Quality even though generating quality information is the primary purpose of any IS, representing a significant gap in the IS research. Information Quality is also a key determinant of Use and Net Benefits. The importance of Information Quality is gaining increased recognition in the social media context. Scott et al. [129] have found that Information Quality is a critical determinant of public value among citizens using governmental Web sites to participate in open government. Information is the core reason for IS, and Information Quality is particularly important to classes of IS related to business intelligence, data-driven decision making, among others. More research is needed in order to better understand how to positively influence Information Quality.

We found no studies that investigated the determinants of Service Quality for a specific IS. To the extent that responsiveness and empathy are important to users when they need help with a specific system, more attention should be given to the study of variables that have an impact on Service Quality of IS. In research on the Web environment, Scott et al. [129] demonstrated that Service Quality is a key determinant of success for customers and citizens alike. The lack of study of determinants of this success dimension is a critical omission. The need for more studies of the determinants of Service Quality for specific IS will only grow because of the increased numbers of customer-facing IS and e-commerce systems being developed.

In terms of determinants of System Quality, the characteristics of the individuals who use the IS, such as their *technology experience, self-efficacy,* and *attitudes toward technology,* were identified as important in our study. However, there are additional determinants that conceptually would seem to influence System Quality, such as *developer skill, development approach,* and *user involvement,* but the research is sparse in examining these relationships. Better software development processes that result from skilled developers, appropriate software development methods, and involvement from users should result in a system that functions better technically.

Many studies that consider Intention to Use as an IS success variable rely on theories such as the Technology Acceptance Model [33], Theory of Reasoned Action [43], or Theory of Planned Behavior [3] for their theoretical reasoning; therefore, most of the determinants for Intention to Use are the characteristics of the individuals using the IS. It is also likely that other variables, beyond user characteristics, would influence Intention to Use. For example, one might expect that *task compatibility* would have an impact on a user's Intention to Use, but few studies have been conducted; and those that have, have had mixed results regarding the impact of *task compatibility.* Project and organizational variables such as *user involvement* or *management support* could certainly influence Intention to Use, yet these relationships have also not been adequately studied in the IS success literature.

Impacts on System Use have been widely studied; 80 percent of the value of an IS is realized from its use, while only 20 percent is determined by its development [107]. Therefore, variables that influence Use are important. As a dependent variable, System Use has been measured in a variety of approaches, ranging from self-reported use, to system dependence, to actual use. Because of the multiple approaches and challenges with measuring System Use as a construct [19], some of the conflicting results for

determinants of System Use are likely affected by the different measures of System Use adopted across studies. This suggests the importance of consistent measurement of dependent variables to develop a collective understanding of the significance of determinants of IS success. *User involvement* has had mixed results as a determinant of Use and has been understudied. Our understanding of the relationship between an IS and the tasks it is designed to support is another example of a gap in our knowledge of IS success factors. For Net Benefits, the determinants are varied. For Individual Impact, *task compatibility* and *management support* were associated with positive individual outcomes. Interestingly, the user's *experience with technology* was *not* found to be a determinant of Individual Impact, even though this variable has been shown to be a determinant for several other aspects of IS success. This finding seems to be contrary to logic and experience, and should be examined in future studies.

For determinants of Organizational Impact, only *IT infrastructure* is found to have a positive influence on Organizational Impact. More research is needed to investigate the relationship between other success factors and the Organizational Impact derived from individual IS. One of the most important issues for management is the direct relationship between *IT investment* and IS payoff (Organizational Impact). Only one study in our literature review investigated this important relationship. Other studies have examined the effect of IT investment on the organization, but often as a mediating or moderating factor, not as a direct relationship. Ultimately, systems are developed to positively affect the organization in some way; yet at this point, we have done a poor job of understanding what task, user, social, project, and organizational characteristics influence Organizational Impact. This is a critical oversight in the current literature on IS success.

The research gaps noted above represent numerous opportunities for future research that would improve our knowledge of what causes IS success.

Future Research Road Map

Based on the findings in the previous section on the key topics, we identify four areas for future research: interactions among antecedents, antecedents of specific IS success dimensions, specific antecedents, and project management and IS success.

Interactions Among Antecedents. As discussed at the end of the last section, an important area for future research is the study of the interactions among success factor variables. Both Sociotechnical Theory [14] and Organizational Change Theory [90] support the likelihood of there being interactions among these variables. It is therefore likely that the interactions among user, task, and structure characteristics may contribute to higher—or lower—levels of success.

Antecedents of Specific IS Success Dimensions. Researchers need to identify antecedents that are likely to have a positive influence on Information Quality and Service Quality to address this critical gap in our current knowledge.

The relationship between task (e.g., *task compatibility*), project (e.g., *user involvement*), and organizational (e.g., *management support*) variables and Intention to Use

needs to be explored to allow managers to better understand how to motivate users and customers to be interested in using IS.

IS are ultimately designed and implemented to improve organizational outcomes. The IS field still suffers from a lack of research studies that test associations between success factors and the positive organizational effects or outcomes provided by specific IS. As firms continue to struggle with identifying the Net Benefits that they hope to achieve from their large investments in individual IS, researchers need to contribute more toward our collective knowledge in this area.

Specific Antecedents. The lack of association between users' *technology experience* and Individual Impact needs further research to better understand the relationship or lack of relationship between this success factor and positive results for the individual user.

The impact of *user involvement* on System Quality, Information Quality, and System Use needs further study. The impact of the upstream variables (i.e., determinants of user involvement [67]) has received extensive study, but more research should examine the downstream effects in terms of how *user involvement* affects different variables of IS success.

More research is needed to explore the relationship between IT investment in a specific IS and the individual and organizational effects of that IS. To date, most of the research examining IT investment is related to investment of the IS function, not the specific IS itself.

Research should also examine the impact of social variables, such as *subjective norms,* on the success of IS since the preponderance of research on social characteristics relates to technology acceptance, rather than IS success.

Project Management and IS Success. More exploration of the impact of project variables such as *developer skills, development approach,* and *user involvement* on System Quality is needed to determine the relationships between the project management tasks and the resulting technical quality of the system. Further research exploring the impact of project variables such as *IT planning, development approach, project management skills,* and *domain expertise* on the success of resulting systems is warranted.

Some research has focused on the role of project factors as moderators rather than as direct influencers of IS success. For example, *time since implementation* [16, 145] and *voluntariness* of an IS [16, 120, 145] are often found as moderator variables rather than predictors of IS success. Additional research could explore these project factors, among others, to determine whether these variables are better described as moderators or direct determinants of IS success.

Limitations

In our study, we examined and integrate a wide array of previous research studies. It could, however, be argued that we neglected certain areas of the success research in our review. Our study focused on the studies centered around IS effectiveness and IS success as opposed to the IS adoption and acceptance literature. This means that

most of the studies included in this review cited DeLone and McLean [36, 37] or other related models (e.g., [122, 130]) as at least a part of their theoretical basis. Studies that focused exclusively on acceptance models, such as the Technology Acceptance Model [33] or Unified Theory of Acceptance and Use of Technology [148], would not appear in our analysis because of our focus on the broader topic of success rather than simply on acceptance. We also made a choice to focus on studies that have been published since 1992 (i.e., the date the original DeLone and McLean model was published). Studies prior to 1992 were not part of this study. However, we are confident in the validity of our findings, given the large number of studies examined over an extended time frame and because our findings are consistent with other studies that have examined determinants of IS success.

Another limitation of our work is that our analysis focused only on *direct* relationships between specific determinants and IS success. Some studies were eliminated from the final analysis because they dealt with *indirect* effects only. Since we considered only the direct effects of independent variables on IS success, we have not explored the interactions among those variables. Using Leavitt's Diamond of Organizational Change to achieve our results, as shown in Figure 9, we see that it is likely that there are many interactions among the supported determinants of IS success.

For example, by having *users involved* in the development process (i.e., project characteristic), it is likely that *user expectations* can be better managed (i.e., user characteristic). Furthermore, *user involvement* can also help to ensure that the IS is *compatible with the tasks* supported by the IS (i.e., task characteristic). Examining these potential relationships further, we could also suggest that *management support* (i.e., organizational characteristic) could encourage user involvement that would lead to these relationships. Identifying the nature and effect of the relationships among these independent variables is outside of the scope of our study; however, success factor interactions are an important area for future research.

The studies we included cover multiple levels of analysis, different types of IS, and different contexts to identify important determinants of IS success at a very high level. This study is an overview of these determinants of IS success, with a focus on breadth. The depth must come in future work that examines some of these relationships in more detail, particularly those with conflicting results or to identify which determinants are the most important predictors of IS success.

Finally, our goal in this paper is not to test theory, per se. Our goal is to identify variables that have proven to affect IS success consistently across contexts; our approach is not deterministic, but rather suggestive.

Conclusions

In 1987, DeLone and McLean set out to investigate the *dependent variable* in IS research. They reviewed nearly 200 IS research papers, published between 1981 and 1987; and in 1992, they published their findings [36] in the form of the D&M IS Success Model. The model hypothesized that there were six interrelated variables or components of IS success: System Quality, Information Quality, Use, User Satisfaction,

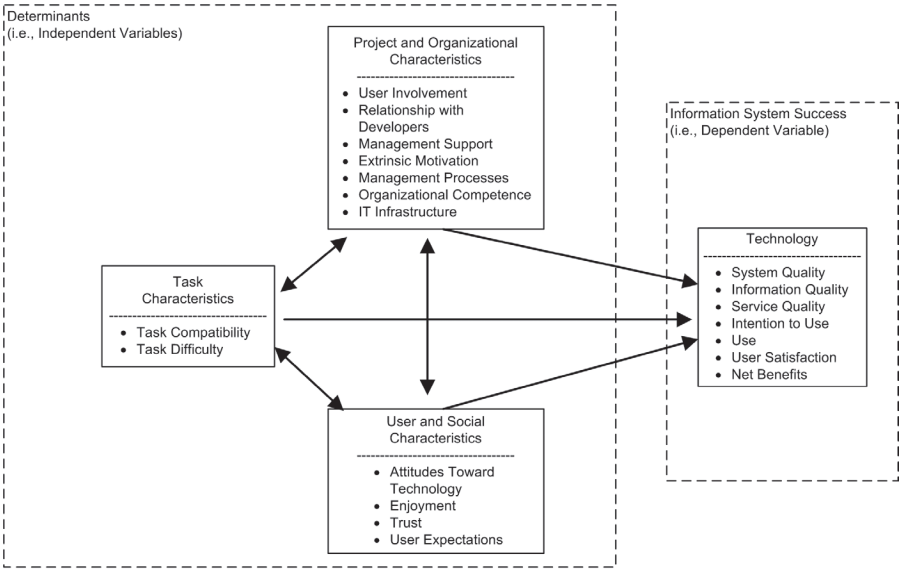

Figure 9. Determinants of IS Success

Individual Impact, and Organizational Impact. In developing the model, DeLone and McLean challenged other researchers to (1) suggest new features or dimensions of the model and (2) conduct empirical research to validate—or invalidate—the model.

In 2003, DeLone and McLean published their second major study [37], which was a ten-year update to their original study. This paper found that there was indeed substantial empirical support for the model, with a large number of papers either testing the model directly or comparing with the other success-model formulations. Moreover, the dimension of Service Quality was added to the model as well as splitting the dimension of Use into Use and Intention to Use and collapsing Individual Impact and Organizational Impact into the single, more encompassing dimension of Net Benefits.

The research reported in this third paper is designed to answer a new question: If the D&M IS Success Model is a reasonably robust description of the dependent variable of IS research, then what are the independent variables that "cause" IS success? In other words, what determinants have been shown to relate positively to IS success? Are there factors, particularly those that are under the control of management, that can act as levers to improve the chances of success of their IS investments?

As a result of our integration of 140 IS success studies during a recent 15-year period, we found 43 variables that have been posited as determinants of IS success. We then grouped these 43 factors into five determinant categories (Task, Individual, Social, Project, and Organizational). Among the 43 variables, we highlighted the "important" success factors that consistently have been demonstrated to influence IS success across many studies (see Table 9 and Figure 9). We also identified the many gaps in our knowledge of success determinants as opportunities for further research

on *variables of interest* that have been understudied. These findings provide a useful road map for researchers interested in exploring the factors that are currently found to affect IS success as well as the factors that are worthy of further research.

We invite future researchers to examine the results of our study, to identify and test the propositions and research questions suggested by our findings, and to study the success determinants that have been understudied to date. It is through these efforts that we can aid managers in their quest for IS success. The more that we learn about the factors that influence IS success, the more that we, as researchers, are able to help organizations implement successful IS.

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NOTES

1. A relevant finding is any result from a quantitative or qualitative study that considers a direct relationship between an antecedent of IS success and one of the measures of IS success as defined by DeLone and McLean [36]. Moderating relationships, interaction effects, or any other nondirect relationships were not recorded. If both the independent and dependent variables were measures of IS success (e.g., System Quality predicting Individual Impact), the relationship was not recorded. Furthermore, if the dependent variable was not a measure of IS success (i.e., an antecedent of IS success predicting another antecedent of IS success), this was not recorded in the document.

2. One antecedent variable from Sabherwal et al. [126] that was not included in this study is Facilitating Conditions. This is a mediating variable and as such is not a direct determinant of IS success.

3. Unlike our analysis described in the section "Analyzing Relationships" in which studies were identified as being supportive (1.0 points), nonsupportive (0.0 points), or mixed (0.5 points), Tables 4–8 represent the hypotheses from each study; therefore, a study with mixed results for the same relationship (because of the use of multiple measures for the same variable or a longitudinal study) would appear twice, with one entry as N and another as S, in the same cell. Tables 4–8 are a representation of the data in the tables within the Appendix.

4. Tables 4–8 (and the Appendix tables) contain the data used to calculate the percentages that inform Table 9. Tables 4–8 show the level of support and nonsupport for both specific IS success dimensions as well as a Summary column. The Summary column represents the level of support between the antecedent and overall IS success dimension (across all dimensions). The Overall IS Success column in Table 9 is consistent with the Summary column information in Tables 4–8. The specific IS success dimensions in Table 9 are also consistent with their corresponding columns in Tables 4–8.

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Appendix: Summary Tables of Determinants of IS Success

Table A1. Task Characteristics and IS Success

Task characteristic measure	Relationships with IS success	
	Dimension of IS success	Citations
Task compatibility	System quality	Supported: [149]; not supported: [25, 59, 134]
	Intention to use	Supported: [44, 83]; not supported: [1, 25]
	Use	Supported: [1, 39, 83, 87, 98, 117, 135]; not supported: [52]
	User satisfaction	Supported: [12, 57, 58, 70, 71, 73, 91, 123]
	Individual impact	Supported [12, 25, 27, 52, 59, 70, 71, 97, 117, 134]; not supported: [97]
	Organizational impact	Not supported: [46]
Task difficulty	User satisfaction	Supported: [48, 154, 155]; not supported: [55]
	Individual impact	Supported: [41, 99, 153]
Task interdependence	System quality	Not supported: [80]
	User satisfaction	Supported: [77]
	Individual impact	Supported: [80, 143]
	Organizational impact	Not supported: [46]
Task significance	Intention to use	Supported: [82]; not supported: [82]
	Use	Supported: [99]
	User satisfaction	Supported: [55]; not supported: [58]
	Individual impact	Supported: [145, 153]; not supported: [155]
Task variability	Information quality	Supported: [77]
	User satisfaction	Not supported: [48]
Task specificity	System quality	Supported: [109]; not supported: [80]
	Individual impact	Supported: [80]; not supported: [109]
	Organizational impact	Supported: [46]

Table A2. User Characteristics and IS Success

User characteristics measure	Relationships with IS success	
	Dimension of IS success	Citations
Attitudes toward technology	System quality	Not supported: [149]
	Intention to use	Supported: [2, 25, 27, 69, 76, 93, 105, 138]; not supported: [76, 105, 137, 138]
	Use	Supported: [21, 54, 87, 151]; not supported: [151]
	User satisfaction	Supported: [4, 54, 55, 154]
	Individual impact	Supported: [54, 153]
Attitudes toward change	System quality	Not supported: [105]
	Intention to use	Supported: [82]
	Use	Supported: [74, 98]
	User satisfaction	Not supported: [74]
	Individual impact	Supported: [82, 117]
Enjoyment	System quality	Supported: [56, 152]
	Intention to use	Supported: [93, 142]
	Use	Supported: [29, 146]
	User satisfaction	Supported: [35]
	Individual impact	Supported: [32, 152]
Trust	System quality	Supported: [92]
	Information quality	Supported: [156]
	Intention to use	Supported: [92, 116, 156]
	User satisfaction	Supported: [96]
Computer anxiety	Use	Supported: [110]; not supported: [29]
Self-efficacy	System quality	Supported: [59, 82, 134, 144, 152]
	Intention to use	Supported: [25, 61, 137, 138]; not supported: [27, 82]
	Use	Supported: [29, 61, 110, 137, 138, 152]; not supported: [110, 137]
	User satisfaction	Not supported: [155]
	Individual impact	Supported: [29, 30]; not supported: [30, 82, 134, 156]
User expectations	Intention to use	Supported: [61]
	Use	Supported: [61, 99]
	User satisfaction	Supported: [31, 89, 115, 127]; not supported: [89]
	Individual impact	Supported: [133]

(continues)

Table A2. Continued

User characteristics measure	Relationships with IS success	
	Dimension of IS success	Citations
Technology experience	System quality	Supported: [2, 56, 80, 109, 134, 144; not supported: [109]
	Information quality	Supported: [45]
	Intention to use	Supported: [61, 81]
	Use	Supported: [39, 87, 140]
	User satisfaction	Not supported: [58, 89]
	Individual impact	Supported: [30, 109]; not supported: [2, 30, 49, 80, 109, 134, 156, 160]
Organizational role	System quality	Supported: [2]; not supported: [18]
	Intention to use	Supported: [82]; not supported: [82]
	Use	Supported: [18] (inverse relationship); not supported: [18]
	User satisfaction	Supported: [5, 58, 91]; not supported: [5]
	Individual impact	Supported: [18] (inverse relationship); not supported: [160]
Education	System quality	Supported: [2]; not supported: [18]
	Information quality	Not supported: [45]
	Use	Supported: [18] (inverse relationship); not supported: [18]
	User satisfaction	Supported: [58]
	Individual impact	Supported: [18, 159]; not supported: [2, 18, 160]
Age	System quality	Supported: [18] (inverse relationship)
	Information quality	Not supported: [45]
	Use	Supported: [18] (inverse relationship); not supported: [18, 101]
	User satisfaction	Not supported: [58]
	Individual impact	Not supported: [18, 160]
Gender	Information quality	Not supported: [45]
	Use	Not supported: [110]
	Individual impact	Not supported: [160]
Organizational tenure	System quality	Not supported: [2]
	Use	Supported: [72, 87]
	Individual impact	Not supported: [2]

Table A3. Social Characteristics and IS Success

Social characteristics measure	Relationships with IS success	
	Dimension of IS success	Citations
Subjective norms	System quality	Not supported: [80, 105]
	Intention to use	Supported: [76, 105, 137, 138,* 145, 147, 148]; not supported: [25, 76, 103, 145, 147]
	Use	Supported: [99, 103]
	User satisfaction	Supported: [105]; not supported: [25]
	Individual impact	Supported: [105, 145]; not supported: [80]
Image	System quality	Not supported: [105]
	Intention to use	Not supported: [1, 105] (inverse relationship)
	Use	Not supported: [1]
	User satisfaction	Not supported: [105]
	Individual impact	Supported: [145]; not supported: [105]
Visibility	Intention to use	Not supported: [1]
	Use	Supported: [1]
Peer support	Individual impact	Supported: [85]

* Taylor and Todd [137] and Taylor and Todd [138] used the same set of data set in both of these studies. In [137], the authors considered experience as a mediator. In [138], the authors assessed multiple competing models. Rather than counting the findings from this research program multiple times, each result is counted once in the table.

Table A4. Project Characteristics and IS Success

Project characteristics measure	Relationships with IS success	
	Dimension of IS success	Citations
User involvement	Use	Supported: [28, 87]; not supported: [54, 108]
	User satisfaction	Supported: [5, 6, 28, 31, 54, 55, 89, 91, 97, 113, 154, 155]; not supported: [13, 106]
	Individual impact	Supported: [54, 62, 153]
	Organizational impact	Supported: [42, 104]
Relationship with developers	Intention to use	Supported: [116]
	Use	Supported: [84]
	User satisfaction	Supported: [84, 91, 113, 127]; not supported: [106]
Third-party interaction	System quality	Supported: [47, 65, 149]
	Use	Supported: [87]
	User satisfaction	Supported: [34, 58, 141]; not supported: [34, 96]
	Individual impact	Supported: [47, 65]; not supported: [13]
	Organizational impact	Supported: [34, 141]; not supported: [34]
Developer skill	System quality	Supported: [112]
	Use	Supported: [28, 54]
	User satisfaction	Supported: [54, 57, 91, 154]; not supported: [28, 106, 155]
	Individual impact	Supported: [54]; not supported: [153]
Development approach	System quality	Supported: [100, 111]
	User satisfaction	Supported: [111, 159]; not supported: [13]
	Individual impact	Supported: [111]; not supported: [111]
IT planning	System quality	Supported: [20]
	Information quality	Supported: [20]
	Use	Supported: [20]
	Organizational impact	Not supported: [40]
Project management skills	System quality	Supported: [150]
	Information quality	Not supported: [150]
	Use	Not supported: [28]
	User satisfaction	Supported: [97]; not supported: [28, 106]
Domain expert knowledge	System quality	Not supported: [112]
	User satisfaction	Supported: [111, 154]
	Individual impact	Supported: [112, 153]

Project characteristics measure	Relationships with IS success	
	Dimension of IS success	Citations
Type of IS	User satisfaction	Supported: [88]
	Organizational impact	Supported: [24, 88, 95]; not supported: [95]
Time of implementation	User satisfaction	Supported: [123]
	Individual impact	Supported: [75]
	Organizational impact	Supported: [46, 75]
Voluntariness	Intention to use	Not supported: [1]
	Use	Supported: [1]
	User satisfaction	Supported: [127]

Table A5. Organizational Characteristics and IS Success

Organizational characteristics measure	Relationships with IS success	
	Dimension of IS success	Citations
Management support	System quality	Supported: [65] Not supported: [149]
	Information quality	Supported: [85]
	Use	Supported: [21, 22, 54, 85, 87]; not supported: [28]
	User satisfaction	Supported: [4, 31, 34, 54, 89, 106, 119, 154]; not supported: [28, 55, 88, 141, 155]
	Individual impact	Supported: [54, 65, 85, 153]
	Organizational impact	Supported: [24, 34, 141]
Extrinsic motivation	Information quality	Supported: [85]
	Intention to use	Supported: [26]; not supported: [26]
	Use	Supported: [85, 98, 99, 108, 119, 146]
Management processes	System quality	Supported: [134, 150]
	Information quality	Supported: [11, [85]; not supported: [150]
	Intention to use	Supported: [156]
	Use	Supported: [74, 85, [136]; not supported: [15]
	User satisfaction	Not supported: [74]
	Individual impact	Supported: [49, 134, 143]
	Organizational impact	Supported: [24, [40]; not supported: [40]
Organizational competence	Information quality	Supported: [11]
	Use	Supported: [7, 15, 21, 22, 114, 157]; not supported: [114]
	Organizational impact	Supported: [11, [40]; not supported: [40]
IT infrastructure	Information quality	Supported: [11, 101]
	Use	Supported: [7, 28, 98, 114, [136]
	User satisfaction	Not supported: [28]
	Organizational impact	Supported: [12, 40, 94, [157]; not supported: [94]
IT investment	Information quality	Not supported: [139]
	Use	Supported: [157]
	User satisfaction	Not supported: [139] (inverse relationship)
	Organizational impact	Not supported: [139]

Organizational characteristics measure	Relationships with IS success	
	Dimension of IS success	Citations
External environment	System quality	Not supported: [134]
	Intention to use	Supported: [82]; not supported: [82]
	Use	Supported: [114, [157]; not supported: [114, 136, 157]
	Individual impact	Not supported: [134]
	Organizational impact	Supported: [11, 46]; not supported: [11]
IS governance	Use	Supported: [28]
	User satisfaction	Supported: [91]; not supported: [28, 88]
Organization size	Use	Not supported: [7, 28, 157] (inverse relationship)
	User satisfaction	Supported: [28, 91]