The 3-D Model of Information Systems Success: the Search for the Dependent Variable Continues

J. BALLANTINE, University of Warwick
M. BONNER, Victoria University of Wellington
M. LEVY, University of Warwick
A. MARTIN, University of Warwick
I. MUNRO, University of Warwick
P.L. POWELL, University of Warwick

Research into the issue of information systems (IS) success is vital if IS is to demonstrate its worth. Predicated upon success not being a random variable, a number of models which attempt to delineate success and its causes have been proposed. One of the more complete and better known is that of DeLone and McLean (1992). This model has been used as a basis for empirical research in information systems success. Since its development other researchers have refined and extended the model. This paper attempts to take the analysis further. It evaluates the DeLone and McLean model on a number of dimensions, and a new model is proposed which fundamentally extends DeLone and McLean’s work. The new 3-D model is described and its contribution to further research assessed.

The many well-publicised information systems (IS) failures and the paradox of high investment and low productivity returns has brought issues of success causes and success measurement to the fore. Predicated upon success not being a random variable, a number of models which attempt to delineate success and success causes have been proposed. One of the more complete and better known is that of DeLone and McLean (1992). This model has been used as a basis for empirical research, and has been refined and extended by a number of researchers.

DeLone and McLean’s model of information systems success is based on the work of Shannon and Weaver (1949) and Mason (1978), together with a study of 180 published papers which address the issue of IS success. Their analysis leads them to propose an interrelated set of six success constructs which, taken together, dominate previous IS research. This paper briefly introduces the DeLone and McLean model and its contribution, then presents a critique on a number of issues. A new model, the 3-D model, that extends the original is presented which, it is suggested, both overcomes some of the limitations identified, and can be used as a basis for further research.

The DeLone and McLean Model

The DeLone and McLean model (Figure 1) proposes six major dimensions of information systems success: system quality; information quality; use; user satisfaction; individual impact; and organizational impact. Using the six dimensions, they review the conceptual and empirical literature and present a descriptive model of IS success, in addition to discussing the implications of searching for the dependent variable of success. The DeLone and McLean model is a positive development in furthering research in IS success in several respects. First, it consolidates previous research. Second, it classifies the measures of information systems
success into plausible groupings and so has intuitive appeal. Third, it begins to identify different stakeholder groups in the process (Lyttinen and Hirschheim, 1987). Fourth, it has been considered a suitable foundation for further empirical and theoretical research, and has met with general acceptance as such. The issue now is to evaluate this model and build upon the foundations offered.

A number of the researchers who have employed the DeLone and McLean model suggest that it is incomplete in certain areas. For example, Seddon and Kiew (1994) suggest that user involvement is a fundamental factor which should be present. Their empirical findings confirm some of the causalities identified in the model but do not confirm others. Seddon (1995) reaffirms his dissatisfaction with the original DeLone and McLean model, which, he argues, focuses on “muddled thinking” with respect to the term IS use, and proposes another variant which separates IS success from IS use, and further cautions that use is not synonymous with success. He separates benefits from individual and organisational impact. He questions the notion of causality, preferring to use the term influence, and suggests that DeLone and McLean have confused issues by attempting to deal with both causality and temporal effects in a single model. The effects of IS are not inevitable and to assume so is to betray a technical positivistic perspective; the preference of influence shows a perspective which recognises that the key players in information systems are people rather than systems. Seddon thus implicitly admits that the model may not be complete by suggesting that “all other things being equal, higher levels of expectations will lead to higher levels of IT use” (p.16). He also introduces the influencing factor of expectations and perceptions, adopting again a much more subjective philosophical stance than DeLone and McLean’s model admits. In line with this, he also introduces a factor which is the user’s personal experience of using a system.

Bonner (1995) also revises the DeLone and McLean model and tentatively introduces the concept of information awareness. He also mentions user quality in terms of knowledge skills and abilities. His recognition of the people element is a welcome addition to the model. Bonner also suggests that the case study described in his paper supports the DeLone and McLean model. However, although the chosen case does not disprove the model, it supports it only weakly. Information and system quality in the case are shown to be inadequate, but so, independently, are all the other factors. A more powerful example might be a case where despite good quality information and system, it failed because of, say, failure to ensure user satisfaction. Indeed a whole range of cases would be needed to adequately support the model.

**Critical Analysis of the DeLone and McLean Model**

This section critically assesses the DeLone and McLean model from a number of different viewpoints, exposing the need for a broader model.

**Delone and McLean’s Own Reservations**

DeLone and McLean do not claim that their model is definitive, and indeed invite further validation: “The success model clearly needs further development and validation before it could serve as a basis for the selection of appropriate IS measures” (p.88). Their own reservations point the way for a critical examination of their assumptions and boundaries. For example; “To be useful, a model must be both complete and parsimonious” (p87); this paper argues that the model is insufficiently complete. “The selection of success measures should also consider the contingency variables such as the independent variables being researched; the organisational strategy, structure, size, and environment of the organisation being studied; the technology being employed; and the task and individual characteristics of the system under investigation” (p.88). Thus DeLone and McLean recognise the limited perspective of their model which the proposed model attempts to redress: “Researchers who neglect to take these factors into account do so at their peril” (p.87). This paper argues that

![Figure 1: I/S Success Model (Delone and McLean, 1992, p. 87)](image-url)
these factors are critical to systems success and need to be incorporated within a model.

**The Source Material**

Although the DeLone and McLean source of 180 papers is impressive in quantity, there is inevitably a tempting assumption of completeness and representativeness in the views and perspectives expressed. However, whether or not the views are complete, the DeLone and McLean model is bound to be limited by these historical views. No claim is made that the model is created from first principles and intrinsic logic. In this way there is a danger, often present in research, of perpetuating conventional wisdom as expressed in the literature, especially if the research is on a concept as elusive as success.

**Taxonomy, Framework or Model?**

DeLone and McLean attempt to produce a mechanism for identifying those factors that contribute to IS success. In order to do this they produce a taxonomy which has, or is, "a fairly parsimonious framework" (p.63), which in turn then has, or is, categories. In the same paragraph there is reference to lists, tables and classifications; later these are models; "the categories of the taxonomy and the structure of the model" (p.87); "it must incorporate and organise". "In addition to its explanatory value, a model should also have some predictive value" (p.87) There is no doubting the worth of what is being attempted in the original model; if it were possible to find the dependent variable and determine factors which influence success, then this would be a major achievement. As a prelude to furthering this work however, there is a requirement for its goal(s) to be highlighted more clearly. That is, what is actually sought, how it will be identified and how will whatever it is be evaluated? Thus the only test of the DeLone and McLean model can be a pragmatic one which asks the question "better for what purpose?".

**Use of the Model**

Bonner (1995) uses the Delone and McLean model to help explain an IS failure post-hoc, but also cannot resist the temptation to use a case study to justify the model. The original title "the search for the dependent variable" does invite the model to be the focus of research, rather than using a proven model to explain or even predict the success or failure of a particular IS. Again, this use begs the question of what measure is used to judge a system success if the model itself is under test. Though accepting that model validation is an iterative process, it is suggested that the current stage of this process needs to be clarified, communicated and understood. Seddon (1995) too finds confusion between the use of the model for prediction and that for evaluation.

Evaluation needs to depend on purpose and entails the need to evaluate credibility which encompasses completeness, consistency and coherence. Completeness implies that no significant elements are omitted. Consistency requires that it makes explicit causal relationships. Coherence implies the use of a sound theoretical framework. It seems that DeLone and McLean’s model, whether intended or not, has been used primarily as a definitive model on which to base empirical research. However, that research has found the model to be conceptually incomplete and research findings to be limited in their power.

**Definitional and Subjectivity Elements**

Information and systems quality do not exist in the absence of their relevance to individual users and the organisation. Indeed, by some definitions (Mingers, 1996), information itself does not exist except when used for a purpose. In discussing IS success, DeLone and McLean do not distinguish between data and information. Despite this, they implicitly accept the key role of the user in evaluating information: "understandably, most measures of information quality are from the perspective of the user of this information and are thus fairly subjective in character" (p.65). However, the model they present measures information quality at the technical level of the system, which explicitly ignores the user of the information. IS research now accepts that technical system quality is necessary but not sufficient to ensure information system success (Lyytinen and Hirscheim 1987); yet the DeLone and McLean model might be seen as suggesting that technical system quality is sufficient.

Use of the term quality shows the necessity of taking a holistic view of the information system. Quality means fitness for purpose; thus the quality of the system or information cannot be judged in isolation, but only relative to whether they fulfil their intended purpose. Thus they cannot be judged except by knowing their purpose, which in turn must be defined in terms of the organisation and the user. This means that the use and user satisfaction boxes in the model are better shown as subsuming the system and information quality boxes, certainly in terms of any meaningful measurement. DeLone and McLean accept that the most widely employed measures are from use and user satisfaction as mentioned above; they accept their face validity, note reliable tools for measurement of these factors, and point out that "most of the other measures are so poor: they are either conceptually weak or empirically difficult to obtain" (p.69).

**Derivation and Logic of the Model**

DeLone and McLean claim that their model of six categories of IS success provides "a logic as to how these categories interact“(p.87). However their proposed taxonomy has been presented without significant discussion of its underlying epistemology and logic. Indeed, the description of their methodology in categorising success is, "To decide...which measures fit in which categories, one of the authors of this paper and a doctoral student (at another university) reviewed each of the studies and made their judgments.
indeed, the plan for a successful system must start not with system quality and information quality, but at the other end of the model. Planned organisational impact must come first, working backwards in terms of the DeLone and McLean model, to identify the necessary individual impact, including identifying what the system and information requirements actually are, then working out how the user will need to use and interact with the system. Finally, appropriate information needs to be captured and maintained, and appropriate technical processing performed. Thus, if the model intends to show, or is interpreted as showing, a process towards planning a successful system, then it is back to front.

**Cause and Effect**

Confusion easily arises in this debate between which are the independent and which are the dependent variables of IS success. DeLone and McLean do not help when they turn the focus of the paper from the dependent variable (as in the title) into the identification and classification of independent variables, which are apparently related (and thus not independent of each other). For example, it may be problematic to maintain user satisfaction and individual impact as entirely discrete measures of success. The idea that individual impact is necessarily dependent upon user satisfaction is highly questionable. In fact, it is more likely the case that user satisfaction is an effect of the system’s impact on the individual, rather than vice versa as DeLone and McLean suggest. The category of user satisfaction may be an effect of both the individual impact of the IS and the organisational impact, and so does not neatly fit in between these two categories causally or otherwise. “The rationale for attempting to define the dependent variable in IS success studies is so that the operative independent variables can be identified and thus used to predict future success” (p.83) Thus there are still two interrelated questions which remain unanswered: what is (are) the dependent variable(s)? and what are the independent variables? This paper re-examines this issue by suggesting that there are more independent variables than the DeLone and McLean model presents, and that the choice of dependent variable depends very much on which perspective the actor takes. The 3-D model presented here attempts to clarify the identities of dependent and independent variables.

**Emergent Problems**

The above problems are further compounded by confusion between different levels of analysis within the model. In the model, the ultimate category for measuring the success of an information system is its organisational impact. Although this claim is fairly conservative, the actual construction of this category may be criticised on two grounds. First, the category has been formulated almost entirely in monetary terms. There is no logical reason for doing so, and if one adopts a more holistic perspective, then there are plenty of reasons for including a far broader range of factors. Although economic

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<th>Stage of Communication</th>
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<td>Production</td>
<td>System Quality</td>
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<tr>
<td>Product</td>
<td>Information Quality</td>
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<td>Influence on Recipient</td>
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**Table 1**
constraints are crucial for survival, an organisation may be considered to be successful in many other terms, such as quality of working life, community relations, and a concern for its environment.

Of equal importance are the supposed causal relationships within the model which lead to the construction of this final category. For example, organisational impact is seen to be the causal effect of many individual impact measures. An analysis of this relationship using systems concepts shows this to be erroneous. Consider the concept of emergence: this identifies that different properties of the object under investigation emerge at different levels of analysis. In terms of DeLone and McLean’s model, any impact on the organisational level is an emergent property of what is happening to the parts of the organisation, that is, the individual impacts. So there is no direct causal relationship between these categories as suggested by DeLone and McLean, but rather, a different level of analysis is being performed. Furthermore, there is no temporal cause-effect relationship here since the category of organisational impact is an emergent property of individual impacts and must therefore be simultaneous with that category.

These points are all the more important given the way in which human factors are considered within the model. The logic represented by the model implies that any preceding factors inevitably result in a final category which is dominated by financial measurements. Thus, the value of an IS is erroneously reduced to predominantly financial considerations, as are the consideration of any other “human factors”.

**Contingent Variables**

Whilst recognising the importance of various contingent variables, DeLone and McLean do not address how these might effect the applicability of their model. For example, the existing model does not address fully how the nature of corporate-strategic business unit (SBU) relations adopted by organisations, which in turn will have implications for IS structure within organisations, might limit the usefulness of the model. Goold and Campbell (1987) identify four common styles of corporate SBU relations which have relevance when measuring IS success. Their four styles are strategic planning, financial control, strategic control and centralised. The style adopted has implications for the type of IS structure developed. For example, in a financial control style the development of centralised IS might be required to ensure there is adequate control from the centre. On the other hand, in a strategic-planning style a distributed IS structure might be more appropriate. Organisations thus need to consider the appropriateness of their IS structure given the style of corporate SBU relations adopted. Whilst the DeLone and McLean model does not specifically address the issue of corporate SBU relations and the resulting implications for IS structure, their model would appear to be more relevant to a centralised IS structure since it implies the existence of centralised systems skills.

In addition, the nature of the IS structure developed within organisations is likely to have implications on the impact of IS, both at individual and organisational level. For example, in determining the success, or otherwise, of a centralised system it is important to recognise that such a system is likely to have a much wider organisational impact than, for example, a decentralised system. Thus in any model of success it is important to recognise the particular level of analysis within which IS success is being examined.

A further contingent variable which needs consideration in the development of a model of IS success is the decision making authority and degree of empowerment of those using IS. DeLone and McLean do not consider the extent to which decision making authority has an effect on IS success. For example, compare the use of IS at an operational as opposed to strategic level, the latter is more likely to have a greater organisational impact than the former, as managers at senior levels will have authority to make and implement decisions which could potentially result in major impact. The degree of impact on the organisation is affected as much by broader factors as by the IS.

**Measures**

While the original DeLone and McLean model recognises six dimensions of systems success, the resulting model fails to identify those measures which might be adopted within each dimension to determine IS success. Further, they provide little insight into how one might identify measures which might be adopted in practice. In so doing they do not recognise the need to adopt a balanced set of measures across the six dimensions of success, which in turn are likely to be contingent on the variables discussed earlier. Additionally, however, there is a need to recognise the effect of interactions between the measures used to reflect success and the means of managing these. For example, it is difficult to see, in practice, how to obtain a truly objective measure of user satisfaction reflecting success, as user satisfaction itself is intrinsically dependent on, for example, information quality and system quality, which, in turn, is dependent on user participation and identification of user needs. Thus whilst DeLone and McLean recognise the importance of adopting measures of success across a range of dimensions, which in itself encourages an atomistic approach to measuring systems success, the model is not holistic in nature.

**Learning**

DeLone and McLean provide a uni-directional model which moves from system and information quality to organisational impact. While it is clear that it is essential to measure organisational impact of IS, the impact upon organisational learning is not discussed. Many researchers argue that IS have wider impacts than at first thought. This has led to a recognition that it is not sufficient to automate existing
operations. As Zuboff (1988) argues, information technology is reflexive. The data that is produced enables organisations to review their activities through better understanding of those activities, in other words to informate. This may lead to the need to change business processes (Galliers, 1993).

Organisational systems are dynamic, and any change will change the system itself; this is true for IS as much as for other systems. Benefits from information systems are found to be considerably different from those anticipated when the systems are first proposed (Farbey et al., 1992). Ballantine et al. (1995) argue that measurement of IS has to be carried out in the context of a learning environment which recognises the dynamism inherent in organisations and in implementation of new systems. Myers (1994) states that IS success is subjective and open to interpretation. He proposes that information systems success is achieved when an information system is perceived to be successful by stakeholders and other observers. This provides for the dynamic nature of information systems and the need for learning to be part of the process of measurement of success. Senge (1990) shows that organisations which are able to consider a system holistically rather than ascribe blame are more likely to be successful. The implication in the DeLone and McLean model is that success is necessary at each stage otherwise the next stage will not be successful. While DeLone and McLean argue for a simple model (which, ceteris paribus, is unarguable), it is not sufficient to only move in one direction. Unless individuals and the organisation can learn from experience and develop better systems and recognise better information quality then it is unlikely that the measurement of outcome will serve any useful purpose. Seddon (1995) also recognises the importance of the feedback loop.

**External Focus**

Following from the above, IS benefits are not only perceived from stakeholders within the organisation. For example, the expectations of external stakeholders such as customers may be raised as a result of systems changes. Heskett et al. (1994) argue that service sector industries gain increased profitability through ensuring that the internal systems (not necessarily IS) lead to satisfied employees who provide a quality service to customers who repay the company with increased loyalty which impacts positively on profitability. For many organisations IS provides a critical interface between the organisation and its customers and suppliers. Porter and Millar (1985) argue for recognition of the importance of the flow of information between all parts of an organisation and its external partners. Kanter (1994) points to the increasing demand for information sharing between organisations in order to gain what she calls collaborative advantage. There is little acknowledgment of the role of external players and their need for information success in the DeLone and McLean model except to recognise that some difficulties are involved in “isolating the effect of the IS effort from the other effects which influence organisational performance” (p.74). Information gained from systems is more likely to be used in the wider context of supporting value chain activities and more open management than for purely internal consumption.

**Model Extension and Refinement**

**Towards a Revised Logic**

Based on the above it is clear that the DeLone and McLean model, while a valiant attempt, needs developing. The following are an attempt to restructure their taxonomy: first, alter the casual relationships between the categories of the taxonomy; second, account for the systemic nature of organisations and third; maintain a critical awareness of the dimensions of the taxonomy and their limitations.

The first two have been addressed by Bonner (1995) as discussed earlier. Despite this, Bonner (1995) leaves the logic of DeLone and McLean’s model unchallenged and attempts to squeeze his extra categories into their existing model. Therefore, the revised model developed here attempts to distinguish between factors which measure the success of the parts from those which measure the success of the whole, without imputing direct causality. Second, it distinguishes between factors which concern the quality of the information system and the factors which concern the success of the organisation itself. The revised model presented below attempts to represent a more complete and plausible model for understanding IS success. The model is first described, and then its role and contribution is discussed.

**The 3-D model of Information Systems Success**

The new model attempts to improve the understanding of the concept of IS success by separating success into three fundamental dimensions or levels: the technical Development level, the Deployment level, and the Delivery of business benefits. Hence it is termed the 3-D model (see figures 2 and 3). Figure 2 shows the key elements while figure 3 shows the detailed model.

In the model, Filters act between the levels of IS effectiveness and contain influences which inhibit or encourage the adoption of the system at the next higher level. For example, user experience, involvement and expectations which are factors in the implementation filter, will have an effect on the adoption of the system at the deployment level. An important point, however, is that the filters act independently of the quality of the system at lower levels.

Influencing factors are identified which collectively determine the quality of the information system within their respective levels. Some factors may work at more than one level. Not all factors have to be positive in order to achieve a positive result overall. There may be inter-relationships between factors both within and across levels. The term influencing factors, or just factors, is preferred to variables
Figure 2: The 3-D Model of Information Systems Success

Figure 3: The 3-D Model Expanded
because they are not independent, they are certainly not the dependent variables, and any implication of causality is avoided. Influencing factors can be considered to be endogenous or exogenous. Endogenous factors of success are those which can be considered to be within the remit and control of the actors at the respective levels and might include, for example, user skills and the development process and methodology adopted. Exogenous factors are those which cannot be so considered, for example, political and economic factors.

At the development level, a computer system is developed, presumably after a strategy study or feasibility study has been conducted. Success at this level is influenced by a variety of endogenous (internal to this level) influencing factors related to the complexity of the system, the quality of project management, the quality of the technology used, the development methodology used, the degree of user involvement, the professional skills and experience of the development staff, and the quality of the data. The output from this level is a technical system, whose quality is variable but is determined according to the criteria outlined above. The resulting technical system enters the “implementation filter”. Exogenous factors, not under the control of the development staff, also influence the process of implementation, such as other existing IS. The implementation filter results in the acceptance or the rejection of the technical system. Thus a technically excellent system, but one in which users have not been involved, might be rejected by users and fail to result in a used information system at the deployment level. There might be similar results if the system was imposed rather than offered, or because other information sources are perceived as more valuable by users. In this case the IS could be considered successful at the development level, but not at the deployment level (nor, in this case, at the delivery level). Conversely it could also be that a low quality technical system is still successfully deployed due to the support of a business champion, business imperative or by management dictat. This might be the case for instance either for a strategic business initiative, or a regulatory change by government.

A successful, or otherwise, implemented system enters the deployment level. Here a significant number of different factors influence how much and how well the system is used in terms of generating information. In particular the user is a central influencing factor at this level. The technical system serves the user, whether an individual or a group, which hopefully improves the performance of their decision making and their role in the organisation, and thus delivers benefits to the business. The success of this deployment can be influenced by such factors as user satisfaction with the system and with the information generated, support and maintenance services for the system, the quality of the information generated, i.e. its relevance, timeliness, accuracy etc. (Zwass, 1992). The skill of users and the resources deployed for implementation can also influence the acceptance of the system. Depending on the type of task, the information generated by the system may be more or less appropriate, which will affect its success or failure.

An IS which is successfully used might still fail to deliver the business objectives, and, if that is the measure of its success, there are further hurdles to be overcome. The first is the integration filter; the elements in this filter determine whether or not the use of the information system actually works within the organisation. It may be prevented from doing so by an organisation structure which has no ear to this source of information, or a culture which does not recognise the potential contribution from a computer system. The status of the individual or group who possesses the information may not be sufficiently high for their enhanced potential contribution to be recognised, and thus the IS may not achieve its business objectives. This filter includes many of the contingency factors.

As long as there is a degree of integration of the used system with the organisation’s decision making structure, the IS can begin to deliver business objectives, thus impacting at the delivery level. Forces which can help here are the active support of a senior manager who is the project champion, as well as sensitive change management and re-organisation where necessary. The role of benefits management can also help in achieving success by improving the fit between the system and the organisation. The level of resources available and the way output from the system is used will also affect the success of the system. The alignment of individual and business objectives is a key issue at this stage in measuring success. At the delivery level, the issues and forces are not particularly IS-oriented; they are forces which are at work in any change process which aims to enhance business performance.

It could be considered that having permeated so far, the IS could be considered a success. At this level it could be so; however even achieving its business objectives might not result in increased business performance in the marketplace, due to factors entirely exogenous to the business, those in the environment filter. These influencing factors include competitor movements as well as political, social and economic factors. This final level is included in the model since it has implications for measurement of success; for example, should market share not actually increase as a result of using the IS, it may not be appropriate to label the IS a failure at any but the top level.

Over and above the levels of achievement of success, there is an issue of learning through time and experience. Thus, many of the factors which have an effect on development, deployment and delivery will probably be affected by previous experiences with IS and the stage of maturity of the organisation in IS terms. Further, if the organisation is a learning organisation, it will have in place procedures and people who monitor the success or otherwise of any change process and adapt in order to improve the processes. This is represented by the learning feedback loop in figure 2.
Many of the influencing factors presented in the 3D model could be analysed and broken down into other factors. For example, in the development level, project management could be subdivided into issues related to correspondence, process and technical (Lyttinen and Hirscheim, 1987), while development process includes the quality of requirements analysis, system design, programming, testing, and the methodology used. The level of aggregation shown here has been chosen in order to present a more holistic perspective which could be obscured by too much detail. There is already a large amount of detail, indeed this is a fundamental point, that the identification of IS success is more complex than a 6-factor model can portray.

**Discussion and Evaluation of the 3-D Model**

Evaluation is needed to assess whether the new model is an improvement on the original DeLone and McLean model. It can be seen that the model was inspired by and is an extension, albeit fairly fundamental, of DeLone and McLean’s. Many of their factors of success are included in the model, and it retains and strengthens the separation of technical and human elements. The lower emphasis of cause and effect and greater emphasis on the three dimensions make a contribution to understanding of IS success in the following ways:

- Although an ideal success route can be identified through this model i.e. success at all three levels, the model does support more complex contingencies. A system may be a success at one level, yet at the next level success may not be apparent, either because the organisational filters have inhibited the assimilation into the next level, or because factors in the next level have not contributed positively. A further example, this time at the deployment and delivery levels, would be a system which is successfully implemented and may be to the satisfaction of the user, yet might still not achieve business benefits if the user’s objectives have little in common with the business objectives, or if the user is not of sufficient status to bring his/her newly found IS-generated business insights to bear on colleagues, or if the business objectives have changed. Conversely, success at a higher level may be achieved despite failure at a lower level - an example at higher levels of the model might be a poorly used IS at the deployment level which might still deliver business benefits because a senior manager might be able to exploit what little information emerged, for a particular purpose. Thus no single influencing factor may be either necessary or sufficient to ensure success at any level.

- Some progress is made in the confusion between dependent and independent variables. The influencing factors are the closest equivalent to dependent variables, but here the contribution is to separate the outcome at these levels. The factors will influence the measurement of success at respective levels (though the model does not attempt to prescribe 'how' - but, to emphasise, success identified at one level will not guarantee success at another.

- Earl (1989) recognises relevant stakeholders of IS as employees, management, shareholders, customers, suppliers, government and the public. The 3-D model presented recognises the needs of these stakeholders at different levels, and shows how their views of success and failure may not be consistent with each other, as explained above.

- It is appropriate to consider different methods and measures in order to evaluate success at the different levels. For example traditional measures such as technical efficiency, reliability and response time are appropriate measures at the development level. At the deployment level, user satisfaction is probably the ultimate measure of success, as suggested by DeLone and McLean. This impact could be on an individual or a group. At the delivery level, the achievement of the business objectives for the system are the key measure. Evaluation is a more problematic and complex task at any level, but the paper suggests that this model at least takes a first step at eliminating unnecessary confusion by identifying the different types of influence at work in determining IS success.

The primary purpose of this model is to communicate that IS success is not simple, and to help to conceptualise a broader view; as such its role is as a conceptual awareness model. It is hoped that it will prove to be a firmer foundation for basis for research in this topic, first by helping to point towards more appropriate and fundamental measures of IS success, second by assisting in the formulation of further quantitative research on success, and third by enhancing the usefulness of subsequent analysis and discussion. The design of appropriate measures of success at each of the three levels of the 3D model would seem a reasonable next step forward.

The model can also be used for planning or evaluating IS success. In a similar way to the use of DeLone and McLean’s model, a plan for a new system should be made top down, first identifying business objectives in the light of known environmental activities; inhibiting factors (for example culture and user involvement) within filters identified and their effects minimised, whilst positive factors within filters should be encouraged and exploited. Attention should be given to the filters in particular, in order to ensure that success at one level is translated into impact at the next level. Monitoring the delivery of IS success is likely to use the model bottom up, though noting that this is not a direct cause and effect process.

The model draws a wider boundary around the notion of the information system than DeLone and McLean, and thus it
can place other views in perspective. It does not mean that a narrower perspective is necessarily inappropriate in a particular context, but it invites the researcher to be aware of the wider context and therefore be more aware of contingent factors from the environment.

Conclusions

DeLone and McLean set out on a quest for a dependent variable in order to tackle the issue of IS success. They do not claim that their model is definitive and thus, this paper has picked up the baton. DeLone and McLean's model, whilst having contributed to the understanding of IS success, is limited in a number of respects, particularly in presenting too narrow a view of the scope and impact of an information system, and neglecting the other factors which interact with any business change. The new model presents a richer and more complete picture of the scope and impact of IS. This model may increase the validity and credibility of empirical work, although undoubtedly making it more challenging. The model fits with existing theories of IS success but extends them primarily by separating the different dimensions of the development, deployment and delivery levels. A new focus is now required on what might be appropriate measures of success at each level and overall, and on how to plan appropriate research methodologies to measure these.

Acknowledgments

We are grateful to John Arthur of Warwick Business School, Clare Tagg and others at the first conference of the UK Academy of Information Systems and the anonymous referees for comments on earlier versions.

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