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THE INFORMATION SYSTEMS ACCEPTANCE MODEL: A META MODEL TO EXPLAIN AND PREDICT INFORMATION SYSTEMS ACCEPTANCE AND SUCCESS

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Abstract

Under-used and never-implemented information systems represent wasted investment. This paper proposes a new model – the Information Systems Acceptance (ISA) model - to explain and predict information systems (IS) acceptance. The ISA model integrates three sets of factors influencing IS acceptance: software characteristics; implementation processes; and system use, user satisfaction and system outcomes. These sets of factors are drawn from well-established frameworks: Rogers' (1995) Diffusion of Innovations (DOI), Land's (1994) Guidelines for Successful Implementation of Information Systems, and DeLone and McLean's (2003) Model of Information Systems Success (ISS). By building on established theories, the ISA model incorporates and organises previous research, overcomes some of the limitations associated with these individual theories, and assembles IS acceptance factors into a comprehensive, understandable and useable conceptual framework. The ISA model gives managers a tool to evaluate and predict the likely success of an IS, and acts as a diagnostic aid in preventing potential problems. We demonstrate the ISA model by using it to explain acceptance levels of a quality systems software application implemented in ten organisations.

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INTRODUCTION

Successful information systems (IS) implementation and use is problematic. While it would be expected that the mechanics of systems introduction would be well understood and appropriately conducted (after some 30 years of IS implementations), this is clearly not the case. For example, in 2002 at the Royal Melbourne Institute of Technology (RMIT) in Australia, a $47 million dollar student administration system was scrapped three years after its implementation. The government investigation found that:

> …RMIT did not manage the project appropriately, had a poor implementation plan, little senior management involvement, poor corporate governance and a lack of accurate documentation (Ketchell 2003).

The factors (such as those described above) that lead to IS failure are well known; similarly, the pre-requisites for IS success (for example, senior management support; a match between system capabilities and organisation characteristics; appropriate change management strategies) are also well known. Advice on how to select and implement information systems can be found in numerous texts (see, for example, Lucas 2000; Boddy, Boonstra & Kennedy 2005). The puzzle is this: if the factors that influence systems success and acceptance are well recognised, why are system failures still common?

The problem is partly attributable to the complexity of IS implementation which involves, and is affected by, many factors. These include software; hardware; perceptions and needs of individuals, groups and organisations; resources; organisational culture and politics; critical mass; and system use. Because of the size and complexity of the problem, most researchers have focused on individual factors influencing systems acceptance and success, or on the interactions between a small set of factors. For example, the relevance of critical mass in IT diffusion has been explored by Markus (1987) and Lou, Luo & Strong (2000). The role of organisational culture, power and authority has been investigated by Zuboff (1988). Political considerations have been investigated by Kramer (1981) and Markus (1983). Usefulness and ease of use was studied by Davis, Bagozzi and Warshaw (1989) in the Technology Acceptance Model (TAM). Since then, extensions have been made to TAM to incorporate other constructs (see, for example, Hubona & Geitz 1997; Gefen & Keil 1998; Dishaw & Strong 1999; Matheison, Peacock & Chinn 2001; Moon & Kim 2001).

Research into individual components contributing to IS acceptance is clearly essential to validate the influence of each component. But a piecemeal approach is ultimately inadequate; the IS community requires a model that integrates all potential components and their interactions. Because the IS domain lacks an overarching framework to explain systems success, it is difficult to understand the role each component plays in relation to the other pieces. For practitioners, the overwhelming plethora of components renders a strategic approach to IS implementation problematic. For researchers, a fragmented approach makes it difficult to determine whether relevant research issues have been overlooked (Cooper & Zmud 1990). Further, a lack of a common understanding in a research domain makes '…comparisons difficult and the prospect of building a cumulative tradition for I/S research similarly elusive' (DeLone & McLean 1992: 60). A framework that integrates the components and their effects is required by researchers and practitioners.

The remainder of the paper is organised as follows. The next section describes the research project (of which this paper is one part) and provides the background to the current paper. Following this we describe the research methods used to establish the initial data set, and the four-stage process to develop and test the ISA model. We then examine the model's implications for practitioners and academics before concluding with limitations and suggestions for future research.

THE RESEARCH PROJECT

The model presented in this paper was a major outcome of a research project investigating the capacity of quality systems software (QSS) to empower or disempower users. QSS is a groupware product designed to support organisational quality programs such as certification to ISO 9000[1]. Like all IT innovations, use of QSS has a range of consequences: positive and negative; tangible and intangible; short-term and long-term, direct and indirect; planned and unplanned. The purpose of the original research was to determine the degree and kind of empowerment QSS gave to users within an organisation. However, during data analysis, it became clear that the organisations were experiencing a wide range of outcomes as a result of QSS use. Organisations where the system was used comprehensively gained greater benefits than organisations where use was more occasional. The need to determine the reasons behind the differing levels of use at each organisation led the following question:

What are the factors that contribute to QSS use?

While this question was in addition to the original research question, answering it was necessary to explain the results arising from the original project. To examine this question we used a four-stage process. First, the project's data set was searched for evidence relating to factors affecting QSS acceptance. Second, the literature was searched for models relating to system acceptance. However, extant models failed to account for all the factors arising from the data. Consequently a third stage was required: the development of more comprehensive model. The final stage involved applying the new model to the original data set to test its useability, degree of fit and explanatory capacity.

Development of the initial data set: research methods

The initial project data set was drawn from a preliminary action research project undertaken in a single organisation over twelve months, and ten further case studies. The organisations' sizes and industry sector are presented in Table 1 below. Pseudonyms were used for both organisations and respondents in order to maintain confidentiality. During the case studies, semi-structured interviews were held with the main users of the QSS application in each organisation. The same QSS application was in use at all organisations. The first part of the interview was designed to obtain general demographic details and information concerning the organisation's implementation of its QSS. The next two sections asked about interviewee experience, positive and negative, of QSS use, and the interviewee's perspective of QSS impact on people throughout the organisation generally.

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[1] A full description of QSS is presented in Seen *et al* (2004).

Table 1: Company and interview position details

Company Pseudonym	Industry Type	Company Size at Interview Site Small (≤50 employees) Med (51≤100) Large (101+)	Position of Interviewees
AlumCo	Manufacturing: alumina refiner	Large	ISO Co-ordinator; Document Controller
AppliCo	Manufacturing: electrical appliances	Medium	Customer Liaison Manager; Appliance Production Manager
FleetCo	Service: vehicle fleet management	Large	National Standards Manager
PharmaCo	Service: pharmaceutical retailer	Medium	Quality Associate
DrinkCo	Manufacturing: beverage producer	Large	Quality Control Supervisor; Analytical Services Manager
ThermalCo	Manufacturing: insulation	Large	Quality Systems Co-ordinator
AcoustiCo	Manufacturing: insulation producer	Small	Administration Manager
MetalCo	Service: metallurgical services	Small	Quality and Technical Manager
FabriCo	Manufacturing: fabric	Small	Administration Manager
HandleCo	Manufacturing: doorware	Medium	Quality Manager; Quality Engineer

Company documents and records relevant to the stated objectives of the project were also collected during this phase. Telephone calls to respondents were made in order to follow up leads and to clarify issues. The qualitative data was analysed using techniques advocated by Miles and Huberman (1994). These included highlighting text and inserting comments on transcriptions; identifying similarities and differences and displaying these in matrices; collecting evidence in relation to particular themes in further waves of data collection; developing tentative generalisations; and comparing these generalisations to established theory. *NVivo* (v1.2 by QSR International) facilitated these activities. Results from the first set of analysis relating to the effect of QSS on people and organisations have been reported in Seen *et al* (2004) and Seen (2005).

STAGE ONE: SEARCHING AND ANALYSING THE PROJECT DATA SET

Where the initial trawling of the project data set focused on the effect of QSS on people and organisations, this second interrogation sought evidence relating to QSS acceptance within the case study organisations. Analytic activities similar to those described above revealed that most factors relating to QSS acceptance fell into two categories: those relating to QSS characteristics (such as the software's capacity to meet user needs and ease of use), and those relating to implementation processes or organisational issues (such as the provision of resources, organisational culture and vendor support). A list of these factors is shown in Table 2.

Table 2: Summary of factors affecting QSS acceptance levels at case study organisations

QSS characteristics	Implementation processes/Organisational issues
Ability of QSS to meet user needs in areas such as information quality maintenance, information access and quality systems management.	Purpose behind QSS acquisition communicated Management use of the QSS
Close fit between QSS and organisational IT policy, infrastructure, user work preferences and work type.	Values of managers reinforcing QSS use
Software soundness, intuitive user interface, and sufficient functionality	Resources provided to support QSS use
Ability to experiment with QSS without changes having permanent effect	Substantial planning, positive interactions with vendor, and provision of training

The factors listed in Table 2 all affected users' degree of acceptance of the QSS application deployed at the case study site. In general, when these factors were present, the QSS application achieved wider acceptance within the organisation. An analysis of these factors and their effect on software acceptance is discussed in a later section of this paper.

STATE TWO: SEARCHING FOR RELEVANT MODELS

With analysis of the data set having identified two major groups of factors, the challenge became one of explaining and reconciling these categories. A search of the literature uncovered two models useful in explaining these two categories: Rogers' (1995) DOI theory, and Land's (1994) Information Systems Implementation (ISI) theory. A third theory – DeLone and McLean's (2003) Information Systems Success (ISS) model – provided a framework through which the theories could be linked, and also brought in issues relating to user intentions, user satisfaction, and the effects of system outcomes. Combining and refining these three models offered a useful means for analysing the issues affecting QSS acceptance within the case study organisations. While other theories were available (for example, Cooper and Zmud (1990); Grover and Goslar (1993); Venkatesh and Davis (2000) and Gallivan (2001)) these three frameworks were selected because their simplicity allowed intuitive comprehension and they already incorporated many IS acceptance factors. Critical mass theory (Oliver, Marwell & Teixeira 1985) was also relevant in explaining QSS uptake within the case study organisations.

The following sections present a brief review of these four theories. Only the aspects most relevant to IS acceptance are presented here.

Critical mass effect on groupware acceptance and use

Achieving a critical mass of users is a key for successful groupware acceptance (Lou, Luo & Strong 2000 citing Ehrlich 1987, Markus 1990, Markus & Connolly 1987 and Grudin 1994). Rogers (1995: 313) also explains the importance of critical mass to groupware:

> An interactive innovation is of little use to an adopting individual unless other individuals with whom the adopter wishes to communicate also adopt. Thus, a critical mass of individuals must adopt an interactive communication technology before it has utility for the average individual in the system.

Rogers (1995) suggests that critical mass is generally achieved at between 10-20% of the target population; Markus (1987) argues that 16% is the tipping point. Interactive media researchers, Bair & Mancuso (1985) and Hiltz (1984), consider that an absolute number of users – about 30 – suffices for interactive media (Markus 1987).

These percentages and absolutes were borne out in the current research. The two organisations with the highest number of frequent users (AlumCo: 150 users (about 20% of the organisation) and AppliCo: 30-40 users (about 30%)) experienced greater and a wider range of benefits compared with the other organisations, none of which had more than four frequent users. Lou, Luo and Strong (2000) showed that of the independent variables perceived ease of use, perceived usefulness and perceived critical mass, the last was shown to have the largest total effect on intention to use, and strongly influenced the two other variables. The implication for managers is that achieving a critical mass of users should be given high priority during implementation. The DOI, ISI and ISS models help to explain factors that influence the change from a few early adopting individuals to use by the majority.

The diffusion of innovations (DOI) model

DOI theory, initially developed in the 1960s and based on research in many different domains, can be used to explain the rate at which an innovation is adopted, and why it is or is not used. Its applicability to IS innovation has been firmly established (Duncan 1974; Keen & Scott Morton 1978; McFarlan & McKenney 1982; Kwon & Zmud 1987). Dick (2002) pointed out that it has been promoted as a theory relevant to IS by a number of authors: Tornatzky and Klein (1982), Leonard-Barton (1988), Van de Ven (1991) and Fichman and Kemerer (1993). Since its development, it has been used in a number of studies within the IS domain including Brancheau and Wetherbe (1989), Kaplan *et al* (1991) and Dick and Rouse (1995). These authors have used it to explain the adoption (or non-adoption) of software applications, and software development technologies and methodologies such as computer-aided software engineering (CASE), and the Personal Software Process (PSP).

The portion of Rogers' (1995) DOI model of interest to us argues that the rate of adoption is dependant upon five characteristics of the innovation: 'relative advantage'; 'compatibility'; 'complexity'; 'trialability' and 'observability'. DOI theory posits that if an innovation:

- offers advantages over the existing situation;
- is compatible with existing beliefs and needs;
- is easy to use;
- can be trialled; and
- its results are observable,

then it is more likely to be rapidly adopted.

The information systems implementation (ISI) model

Roger's DOI model explains an innovation's acceptance by analysing the innovation's characteristics. However, implementation processes also affect a new system's acceptance in the workplace (Land 1994). Clement (1993: 323) suggests that '…the implementation strategy is much more important than any particular characteristic of the technology'. Only if a system is successfully implemented can outcomes from its use be realised.

The ISI model (Land 1994) is based upon research designed to determine the factors most important in determining a user group's successful adoption of a new system. 'Successful' means that 'the new system is accepted in the work place as the way of doing the tasks that the system has been designed to carry out…or is invoked as a support tool on a regular basis' (Land 1994: 275).

Land's model recognises that the introduction of a technological innovation is essentially a change process that requires planning and managing, and is affected by six groups of factors:

- Motivation for introducing the new system
- Commitment to the system
- Organisational culture
- The management of the implementation process
- The 'distance' between the existing system and the replacement system
- The technology itself

Land argues that the motivation for the new system is important because failure to clarify the motivating factors or to share the reasons behind the acquisition reduces the motivation of stakeholders to work with the system. Strong management commitment to the new system is likewise essential because this determines the level of resources provided to support the new system, and the extent to which managers themselves use the system.

Land also found that an important feature of successful implementation is a sharing of values - a common organisational culture - among stakeholders. Without shared values, transformations are difficult to achieve. The concept of organisational culture is similar to the concept of 'motivation for the new system', which also relies on the sharing and aligning of objectives to motivate users to accept the new system, and also relates to 'compatibility' within the DOI model. In terms of the management of the implementation process, Land points out the necessity of stakeholders understanding the implementation process, and being clear about their own role in it.

The distance between the existing system and the new system is '…a notional measure of the extent of the change…' (Land 1994: 276). This concept is related to Rogers' 'complexity' factor; if a system is difficult to use, the distance to travel will be greater. Land found that to traverse the distance the user had to have strong motivation and perceived positive payback from making the change. The issue of 'distance' also relates to 'management commitment': if there is little distance between the two systems, then fewer resources and less change in management and staff behaviour is required to implement the new system.

'Technology' plays an important role in determining the success or failure of a new system. Land determined that the most important technology related factors were (i) the extent to which the new system delivered the expected functionality; (ii) the actual performance of the system in terms of factors such as response time, security, and help facilities; and (iii) the way skills in using the system could be acquired, with incremental learning favoured over the necessity of having to acquire large blocks of skills in order to use the system. These issues are all raised within Rogers' (1995) DOI theory under 'relative advantage', 'complexity' and 'trialability'.

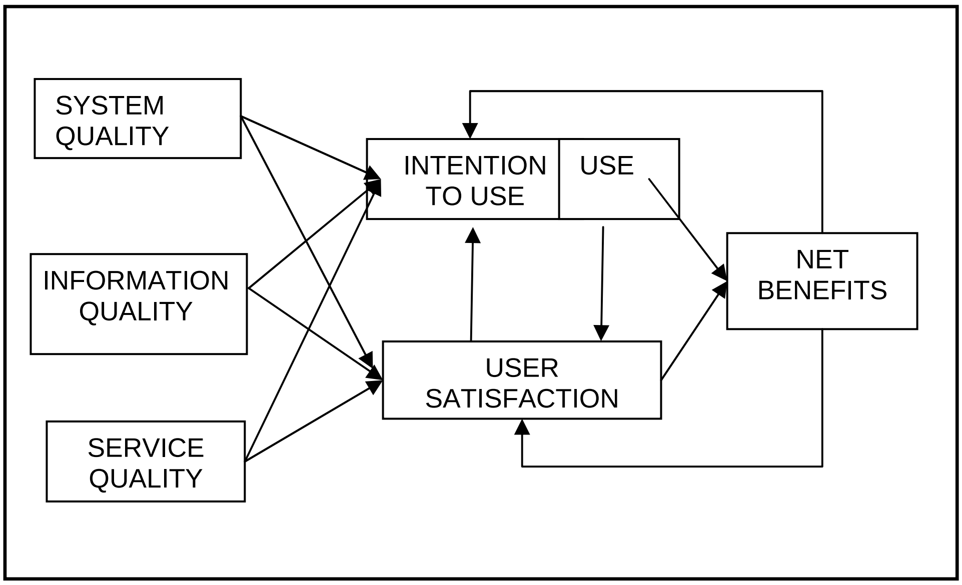
The information systems success (ISS) model

Rogers' DOI model and Land's ISI theory delineate the technology and implementation factors related to IS adoption. However, these theories lack a 'cause and effect' framework that shows the relationship between these factors and technology adoption and use. For this purpose, a third IS model – the Information Systems Success (ISS) model proposed by DeLone and McLean (1992; 2003) – is used. The value of this model is that it shows the relationship between various factors, system use, and outcomes.

The ISS model provides a framework comprising factors that influence MIS effectiveness. Originally resulting from a review of 180 previous studies, the ISS model has been validated in the years since its inception with 16 subsequent studies substantiating most of the model's associations (DeLone & McLean 2003). The model focuses on factors that are *part of* success at various levels, rather than variables that *cause* success. However, the causal aspect of the model recognises that success at certain levels then causes success at other levels.

The ISS model revised in 2003 (presented in Figure 1) includes the variables of system quality, information quality, service quality, intention to use/use; user satisfaction and net benefits. The term 'net benefits' is used to encompass the outcomes resulting from system use. DeLone and McLean (2003: 22) use the word 'net' because '…no outcome is wholly positive, without any negative consequences'. They also state that, depending on the context, '…different actors, players, or stakeholders may have different opinions as to what constitutes a benefit to them'. For some stakeholders, 'net benefits' may be negative; for example, jobs may be deskilled even while productivity increases. The context will also determine the level at which 'net benefits' is to be considered; for example, at an individual, departmental, hierarchical, organisational and/or national level.

Figure 1: Updated ISS Model (DeLone and McLean 2003)



The ISS model can be interpreted as follows. The system can be evaluated in terms of 'system quality', 'information quality' and 'service quality'. Singularly and jointly, these characteristics affect subsequent 'use' or 'intention to use' and 'user satisfaction'. That is, '…users and managers experience these features by using the system and are either satisfied or dissatisfied with the system or information products' (DeLone & McLean 2003: 11). The authors go on to explain that:

> "Use" must precede "user satisfaction" in a *process* sense, but positive experience with "use" will lead to greater "user satisfaction" in a *causal* sense. Similarly, increased "user satisfaction" will lead to increased "intention to use," and thus "use."

As a result of using the system, certain outcomes will be achieved. If the outcomes are positive, then use of the system will be reinforced. However, even if the 'net benefits' are negative, the feedback loops are still valid. Negative outcomes are likely to lead to decreased use, and possible cessation of the system. DeLone and McLean (2003: 11) finish by saying that:

> A high-quality system will be associated with more use, more user satisfaction, and positive net benefits… More use of a poor quality system would be associated with more *dissatisfaction* and negative net benefits.

The ISS model, in essence, has three components: the creation of a system, the use of the system, and the consequences of this system use. DeLone and McLean (2003: 16) note that each of these components:

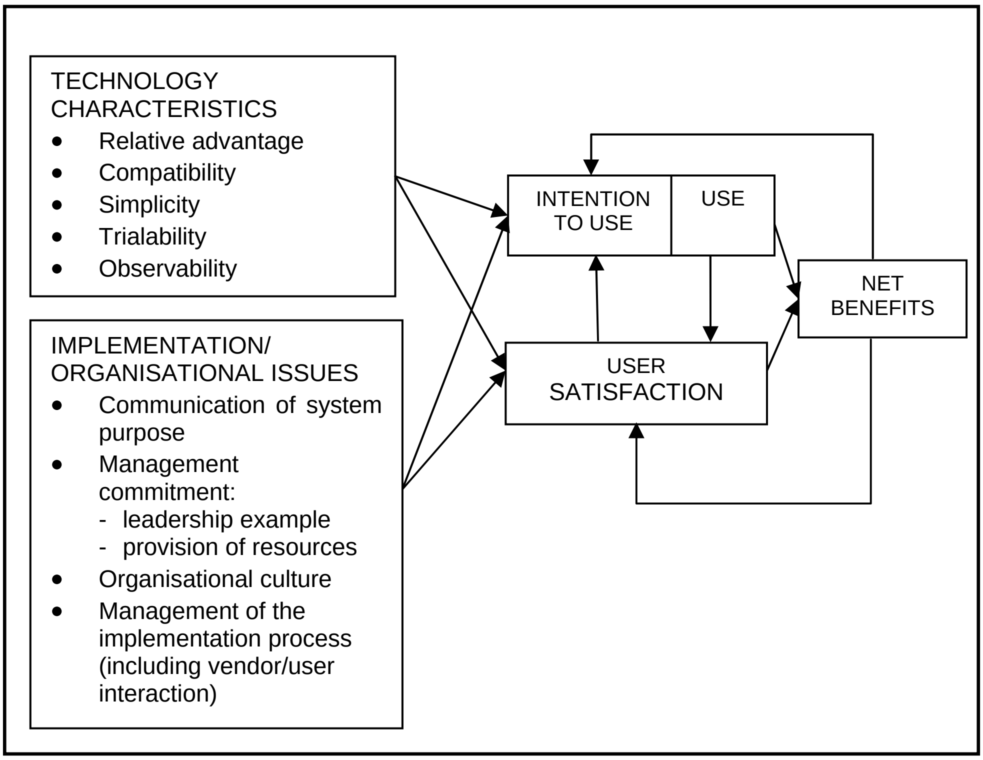
… is a *necessary, but not sufficient, condition* for the resultant outcomes(s). For instance, without system use, there can be no consequences or benefits. However, with system use, even extensive use, which is inappropriate or ill-informed, there may also be no benefits.

STAGE THREE: RECONCILING THE EXTANT MODELS AND DEVELOPING THE ISA MODEL

Individually, the DOI, ISI and the ISS models all have limited ability to explain technology acceptance (this was not, after all, the original intent of these models). None of these theories, individually, covers all of the issues that affect technology acceptance. A limitation of the DOI model is that, while it provides a framework to enable analysis of an innovation, it does not comprehensively address implementation issues (with the exception of the role of the change agent or champion) that also affect the acceptance of an innovation (Kwon & Zmud 1987). DeLone and McLean (2003) note that their ISS model has been criticised for not incorporating management control variables such as user involvement and top management support. Conversely, a criticism levelled at IS implementation theories is they generally neglect theory related to diffusion of innovations (Kwon & Zmud 1987).

These limitations made it necessary to draw upon all three models in order to assemble a framework that could explain the factors influencing QSS acceptance and level of use at the case study organisations of our research project. This integrated model - entitled the IS Acceptance (ISA) model - is shown in Figure 2. In the ISA model, Rogers' DOI model forms the basis of the 'technology characteristics' group of factors, while Land's ISI theory underpins the group of 'implementation/organisational issues'. Together, these feed into DeLone and McLean's feedback loops.

Figure 2: ISA Model



DeLone and McLean's (2003) three factors of 'system quality', 'information quality' and 'service quality' have been subsumed into the wider range of factors presented in Rogers' (1995) DOI theory, and Land's (1994) ISI theory. The original three characteristics are all represented within these broader theories. For example, 'system quality' depends on factors such as consistency of user interface, ease of use, and quality of documentation, all components of the 'complexity' dimension of Rogers' (1995) model. 'Information quality' depends on the relevance, timeliness and accuracy of information which can be analysed using Rogers' 'relative advantage' variable. 'Service quality' depends on the reliability, responsiveness, knowledge and empathy of staff supporting the technology. These issues are covered by Kwon and Zmud's (1987) 'designer-user interactions' factor, and can be included within Land's 'management of the implementation process'.

Land's 'distance' concept has been omitted because it is already reflected in Roger's 'complexity' factor and Land's 'management commitment' factor. Similarly, Land's 'technology' factor is omitted because Rogers' five variables already focus on technology characteristics. We rename 'motivation for introducing the new system' as 'communication of system purpose' to improve clarity. We replace 'complexity' with 'simplicity' to make all five technology characteristics positive.

The model can be interpreted as follows. The new system possesses certain characteristics (shown by the 'technology characteristics') in terms of (i) the advantages it offers over the *status quo*; (ii) compatibility with existing systems and organisational mores; (iii) ease of use; (iv) capacity for experimentation by users; and (v) observability of its outcomes. Users will develop expectations of the technology (initially through vendor demonstrations, reviews in industry journals, through training and information sessions or by seeing the technology in use by colleagues or at other organisations) that will influence their intention to use the technology. If the expectation is positive, users are more likely to use the software.

Organisational implementation issues are also relevant to 'intention to use'. For example, failure to clarify management objectives related to the technology's acquisition, or to share the reasons behind the objectives, reduces the intention of users to work with the technology. Even if users have developed negative expectations of the software as a result of the 'technology characteristics' which would normally discourage use of the software, management support (or enforcement), manifest in 'leadership example', may positively influence 'intention to use'. Resources provided by management (for example, to fund training or software customisation) will assist implementation processes and may help to overcome problems related to 'technology characteristics' such as a low degree of 'simplicity'. The degree to which values are shared within a business (that is, 'organisational culture') will also influence 'intention to use' with a higher degree of commonality resulting in greater 'intention to use'. Finally, the planning and execution of implementation activities, including vendor (or designer) interaction with users can affect 'intention to use'. A negative interaction will reduce 'intention to use' while a positive interaction will increase 'intention to use'.

A positive experience with the software creates user satisfaction that will then lead to increased 'intention to use' and thus 'use'. Use of the system will create 'net benefits'. If these are positive, the feedback loops reinforce subsequent 'use' and 'user satisfaction'. However, if the 'net benefits' are negative, the feedback loops will act to decrease 'use' and 'user satisfaction', and possibly lead to discontinuance of the system.

The integrated model described above was used in the research project to explain the factors affecting acceptance of a groupware product – QSS – at the case study sites. However, we suggest that the ISA model offers a comprehensive framework that is relevant to IS in general. The ISA model is a useful tool to analyse the issues affecting IS acceptance within organisations. The following analysis demonstrates how the integrated model can be used to explain IS acceptance.

STAGE FOUR: TESTING THE ISA MODEL BY USING IT TO ANALYSE CASE STUDY DATA

Technology characteristics analysis

Table 3 presents an evaluation of the QSS application in use at the case study organisations based on its technology characteristics. The analysis is based on the QSS experiences reported by the fourteen respondents at the ten case study sites. The same QSS application was in use at all the organisations. The evidence on which the evaluation is based can be found in Seen (2005).

Table 3: Evaluation of 'technology characteristics' of QSS in use at case study sites

	Relative Advantage	Compatibility	Simplicity	Trialability	Observability
AlumCo	H	H	L	M	M
AppliCo	H	M	L	M	M
FleetCo	M	L	L	L	L
MetalCo	M	L	L	L	L
AcoustiCo	L	L	L	M	M
PharmaCo	M	M	L	L	L
DrinkCo	L	L	L	L	L
ThermalCo	M	L	L	L	L
FabriCo	L	L	L	L	L
HandleCo	L	L	L	L	L
Overall Rating	M	L	L	L	L

H = High rating

M = Moderate rating

L = Low rating

The QSS offered 'relative advantage' compared to previous mechanisms for most organisations in maintaining information currency and managing organisational quality systems. In some organisations these advantages were diluted when individuals preferred to use alternative sources of information such as other software applications or people, or when managers failed to realise the effort involved in these tasks without IT support. While the costs of deploying an innovation can also detract from the 'relative advantage' it offers, interviewees did not perceive that the effort to implement the QSS was atypical for an information system. In general, they believed that this effort was offset by the advantages of using QSS. Overall, in terms of 'relative advantage', the QSS at the case study sites rated 'moderate'.

In terms of 'compatibility', the QSS application at a number of sites was ill-matched on several fronts. It was incompatible with existing IT infrastructure and policies; users' skills and previous software experience; managerial work that is people, rather than computer, oriented; and users' need for routine information and flexibility within the software. A mismatch between the QSS and the needs of users reduced the intention to use the QSS. In terms of 'compatibility', the QSS at the case study sites rated 'low'.

The QSS in use at the case study organisations possessed a low degree of 'simplicity'. This was caused by technical problems, limitations within some of the software functions, and the unfamiliar appearance of the software's interface. The lack of 'simplicity' negatively influenced users' experience of using the software, causing a low level of satisfaction and consequently limiting the use of the software. In terms of 'simplicity', the QSS at the case study sites rated 'low'.

The 'trialability' of the QSS can be considered at two levels. Because of the software's modular design, it was possible for organisations to deploy only required functions. When the experience was satisfactory, users trialled further functions. On a more micro level, however, the QSS was not amenable to experimentation because users feared permanently damaging or altering corporate data. The nature of QSS is such that transactions cannot be undone as though never performed. This discouraged use. In terms of 'trialability', the QSS at the case study sites rated 'low'.

In terms of 'observability', the outcomes of using the QSS were most visible to those closely involved with it. Its advantages in terms of reducing the burden associated with managing organisational quality systems, capturing improvement ideas, monitoring the status of work and/or training new staff was obvious to those familiar with the system. These outcomes were not as apparent to irregular or non-users. The QSS's level of 'observability' limited the wider organisational community's intention to use the software. In terms of 'observability', the QSS at the case study sites rated 'low'.

DOI theory would predict that, as the QSS application at the case study sites overall rated poorly in terms of the technology characteristics, all ten cases would fail to use, and thus not accept, the software. Certainly the lack of positive technology characteristics explains why the QSS application was not frequently used at the majority of sites. Yet the QSS was implemented and widely used at two of the ten case study sites. This provides evidence that technology characteristics alone do not adequately explain system acceptance.

Implementation/organisational issues analysis

The Implementation/Organisational Issues section of the ISA helps to explain the difference between the levels of QSS use at the case study sites. An analysis of these issues is shown in Table 4. The bottom line of the table indicates the level of QSS acceptance within the ten organisations.

Table 4: Implementation issue analysis of case study organisations

	AlumCo	AppliCo	FleetCo	MetalCo	AcoustiCo	PharmaCo	DrinkCo	ThermalCo	FabriCo	HandleCo
Management motivation for QSS use										
To administer quality system	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
To support improvement	✓	✓	✓	×	×	×	×	×	×	×
Management motivation communicated	✓	✓	✓	▪	✓	✓	▪	✓	✓	✓
Commitment to QSS										
Management use of QSS	✓	✓	×	×	×	×	×	×	×	×
Provision of wider range of resources	✓	✓	×	×	×	×	×	×	×	×
Organisational culture										
Range of signals to support QSS use	✓	✓	×	×	×	×	×	×	×	×
Shared values	✓	✓	✓	▪	▪	✓	×	×	▪	✓
Company-wide improvement/quality focus	✓	✓	✓	▪	▪	✓	✓	×	▪	▪
Management of implementation process										
Considered and planned	✓	✓	▪	▪	✓	×	▪	▪	✓	×
Positive interaction with vendor	✓	✓	▪	✓	✓	×	×	▪	✓	×
QSS successfully adopted	✓	✓	×	×	×	×	×	×	×	×

✓ indicates the factor was present
× indicates the factor was not present
▪ indicates inconclusive evidence, or the factor was not consistently present across the organisation

As Table 4 shows, AlumCo and AppliCo were the only two companies to demonstrate all five implementation/organisation factors, and the only two companies where the QSS application was extensively used. Table 4 also shows where management fully endorsed use of the QSS to support the quality system, both by example and by providing resources, and provided a range of signals to support QSS use, the QSS application was successfully adopted. In the other organisations, despite the presence of factors such as a positive interaction with the vendor, communicated motivation for QSS use, or a quality-focused organisational culture, use of the QSS application was limited. This suggests that of all these factors, management commitment and an organisational culture where signals uniformly promote QSS use are probably the implementation factors most critical to QSS adoption.

In summary, the QSS application at the case study sites had low levels of 'compatibility', 'trialability', 'observability' and 'simplicity'. For most sites, this combination offset the 'relative advantage' offered by the software, reducing 'user satisfaction', and consequently negatively affecting employees' 'intention to use' and actual 'use' of the software. However, at the two sites where all five elements of implementation/organisational issues were present, the disadvantages associated with the technology characteristics were overcome. This provides evidence that both sets of variables are necessary to explain overall acceptance.

CONCLUSIONS AND IMPLICATIONS FOR MODEL USE

The ISA model helps to fill a gap recognised by Briggs, Nunamaker & Sprague Jr (1997) who called for (among other things) further research into groupware adoption and diffusion. Although the model in this paper has been tested using case study data based on organisations using QSS (a groupware product), it can be applied to all types of software and information systems. While work is required to validate the model further, at this point it meets the criteria espoused by DeLone and McLean (1992: 87):

> To be useful, a model must be both complete and parsimonious. It must incorporate and organize all of the previous research in the field, while, at the same time, be sufficiently simple so that it does not get caught up in the complexity of the real-world situation and thus lose its explanatory value… In addition to its explanatory value, a model should also have some predictive value.

The ISA model provides a comprehensive view of the issues being surveyed, and organises existing research into a more understandable and coherent whole. Along with providing a foundation for further work, this structure promotes greater understanding of IS acceptance issues. The ISA model also provides a foundation for further work because it draws on constructs from three well-accepted models where individual relationships within the original models have frequently been validated. This leaves researchers free to concentrate on the bigger picture knowing that the details have already been proved and accepted. The ISA model is parsimonious, (thus facilitating comprehension and usability), and has predictive value, as the following section demonstrates.

Potential applications of the ISA model

The ISA model gives managers a tool to evaluate and predict the likely success of IS deployment, and can act as a diagnostic aid in preventing potential problems. By evaluating the proposed system in terms of its technology characteristics, and by evaluating the organisation in terms of the items listed under implementation organisational issues, managers are able to determine the likelihood of the system being accepted within the organisation. Thus informed, managers could ascertain the likely difficulties of implementing the proposed system. If necessary, changes could be made to either the technology or to organisational factors to enhance the chance of implementation success. For example, if evaluation of the proposed system revealed high ‘relative advantage’, but also low ‘simplicity’ due to a difficult-to-use interface that would negatively impact users’ ‘intention to use’ and ‘satisfaction’ with the product, then it would be appropriate to reduce perceived complexity by modifying the interface or providing additional training. If neither time nor resources were available to modify the system or schedule training, it might be more prudent to delay system implementation until further resources were available, rather than invest in a system unlikely to succeed.

LIMITATIONS AND FUTURE RESEARCH

The conclusions presented here have limitations intrinsic to the research approach. As an interpretive case study, its findings are generalisable to a theory, rather than a population (Yin 1994).

For this research, the same QSS product was in use at all of the case study sites. This was necessary in order to limit the amount of variation in the research. In general, this would restrict the generalisability of results to situations involving software products with similar functions. However, because our framework is drawn from extant models whose validity has been well demonstrated, we believe the ISA model has validity beyond the QSS domain. We suggest this model be applied to a number of different technologies to test whether this is indeed the case.

Factors other than those included in the ISA model presented in this paper affect IS acceptance. For example, task characteristics and organisational size are not included in the ISA model, although their relevance to acceptance has been demonstrated (Cooper & Zmud 1990; Rogers 1995). However, inclusion of all known factors would render the model unwieldy and unusable. For further research we suggest a comparative study between the ISA model and prior research to ensure that the most influential independent variables have been included. We also suggest a survey of the meta models to identify whether other model combinations offer similar benefits in terms of presenting a comprehensive picture of the issues involved in IS acceptance.

In practical terms, the development of more refined diagnostic tool based on the ISA model to help predict IS acceptance would help managers considering implementing information systems. Use of such an instrument would enhance the chances of appropriate software being acquired and successfully deployed.

All models are wrong, but some are useful (Box 1979). An IS is a major investment. Any model that increases our understanding of IS acceptance and use is valuable. If a system is not used, the only outcomes will be wasted investment and increased cynicism.

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