

# ICT Evaluation in the Irish Higher Education Sector

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**Abstract:** The Information and Communications Technology (ICT) evaluation literature now spans several decades. Nonetheless, evidence continues to suggest that there remains a lack of formal ICT evaluation practices within organisations. Several challenges exist, not least the social and political contexts within which evaluation takes place and limitations in existing evaluation techniques. However, while ICT evaluation exercises have spanned many fields of study, an in-depth review of the ICT evaluation literature revealed that there is a paucity of ICT evaluation studies within the Higher Education sector. The 14 Irish Institutes of Technology (IoTs) have recently undergone an extensive transformation of their ICT systems. A national project launched by the Department of Education and Science and the Council of Directors of the IoTs performed a nationwide implementation of a suite of integrated Information Systems for library, human resources, finance and student management functions in order to standardise the ICT systems of the IoT sector. Yet, at the time of research, no formal evaluation of this project had been completed. This paper advances the body of ICT evaluation knowledge in the tertiary education sector through evaluating the impact of the Student MIS implementation within the IoTs. The research study was interpretive in nature; case studies based on multiple evidence sources were conducted in five IoTs. Analysis of the evidence led to the distillation of 15 findings on the Student MIS implementation which were centred on five key project areas – system selection, system development in the Irish IoTs, system commissioning, ex-post performance at system start-up and at the time of research. The 15 findings uncovered either support existing research in the ICT evaluation field or further advance the body of ICT evaluation theoretical knowledge. This paper makes a number of valuable contributions. It enhances understanding of ICT evaluation in tertiary education. It discusses the difficulties involved in operationalising a standard ICT system in multiple diverse organisations and provides lessons with respect to managing the difficulties experienced in large-scale government projects.

**Keywords:** ICT investment management, ICT evaluation, ex-post evaluation, MIS, ICT in tertiary education

## 1. Introduction

ICT evaluation is underpinned by numerous complexities. ICT's pervasive nature makes evaluation of its impacts problematic. Further, limitations in evaluation techniques and the political and social contexts in which evaluation takes place pose additional challenges (Nijland, 2003). Evidence exists of a lack of formal ICT evaluation in organisations. In fact, it is frequently suggested that many organisations engage in indifferent and haphazard ICT investment evaluation practices. Evaluation techniques may be used ritualistically, under-used or not applied at all (Hughes and Jones, 2003). Decades of research in the ICT evaluation arena has not resolved this issue. As a result, Nijland (2003) suggested that ICT evaluation is one of the most important unresolved concerns in information management.

In order to enhance understanding of ICT investment evaluation, research remains active across many fields of study. However, ICT evaluation research in Higher Education Institutions is somewhat overlooked. For example, in the five years 2002-2006 of the European Conference on Information Technology Evaluation (ECITE), 16 of the 238 papers published addressed issues related to the Higher Education sector. The majority of those papers discussed teaching practices and issues associated with enhancing a student's learning experiences, for example Day and Bobeva (2006), Kontio (2006). Research evaluating the ICT systems that support student administrative operations is somewhat neglected. Of the 16 ECITE papers mentioned, five papers focused on evaluating these systems. These included Carcary (2006), Carcary et al (2006b), Gemmell and Pagano (2003), Nurmi and Hallikainen (2004) and Todorova (2006). Further research is required in this area as these systems represent the means for competitive parity with or advantage over other educational establishments.

The aim of this paper is to advance the body of ICT investment evaluation knowledge in the tertiary education sector through evaluating the impact of a large-scale standard Student MIS implementation in the Irish Institutes of Technology (IoTs). This paper discusses the key findings that were distilled from the Student MIS evaluation processes undertaken. It highlights the extent to which those findings advance the existing body of ICT investment evaluation knowledge and discusses the importance of the study's theoretical contributions.

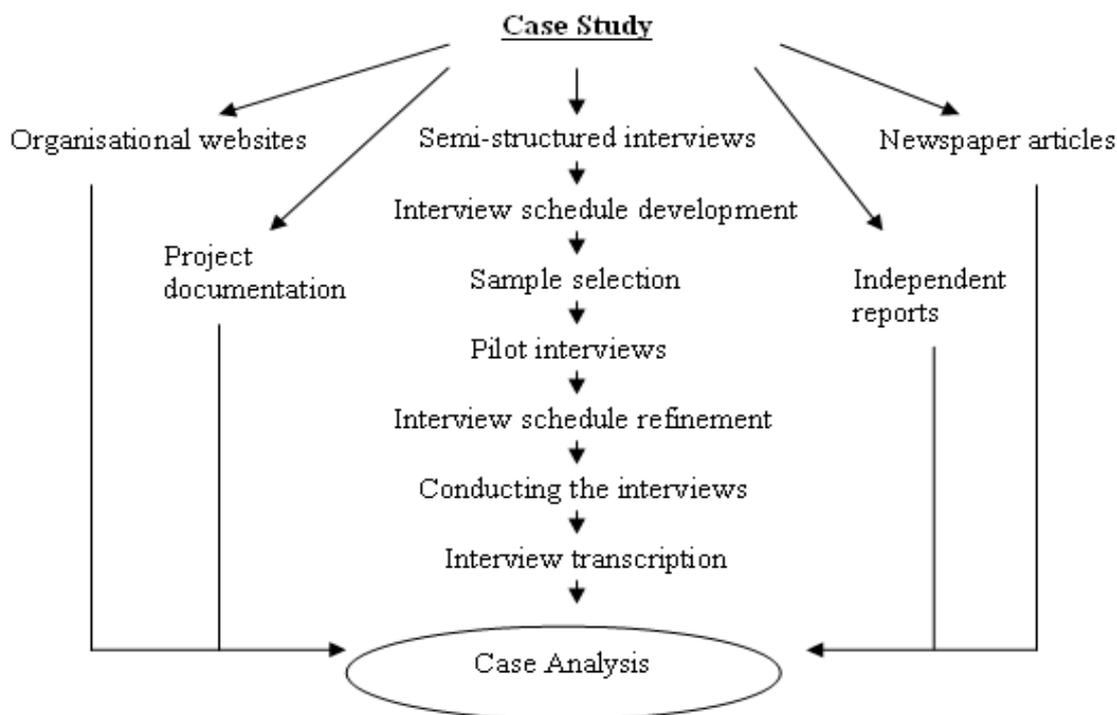
## 2. Background to the MIS project in the IoT Sector

A proposal to investigate a collaborative acquisition of a MIS for the Irish IoT sector was initially raised in 1991/1992. This system sought to support new modes of education delivery, support IoT administrative operations, improve services to all stakeholders, streamline workflow and improve organisational communications and competitiveness. The project involved representatives from the Department of Education and Science (DoES) and the Council of Directors of the Irish IoTs. The initiative resulted in the implementation of a suite of integrated Information Systems (IS) for library, human resources, finance and student management functions in 15 Institutions. These systems were rolled out to the IoT sector in a series of implementation waves between 2000 and 2006. In an attempt to maintain a common national standard system design, a central MIS team was responsible for all system development. Any required system changes were managed through a central system change request process. Hence, the majority of IoTs did not have system development autonomy.

This paper outlines the findings from empirical research that evaluated the Student MIS. This MIS was oriented towards the US market and was anticipated to cater for all stages of a student's interaction with an IoT. The system had comprehensive functionality for course and subject management, student data, admissions application processing, student registration, maintenance grants payment, accounts receivable and fees assessment, examinations and academic history, student progression and graduation.

## 3. Research methodology

The research methodology was interpretive in nature. The interpretive paradigm offered the opportunity to develop an in-depth understanding of the ICT system's impact; it facilitated the capture of contextual depth and detailed, nuanced descriptions; and avoided the unproblematic, value-free view of organisations associated with positivist approaches. The study's research methodology is outlined in Figure 1. The case study was the selected research method and was based on data collected from five sources – organisational websites, project documentation, newspaper articles, independent reports and semi-structured interviews.



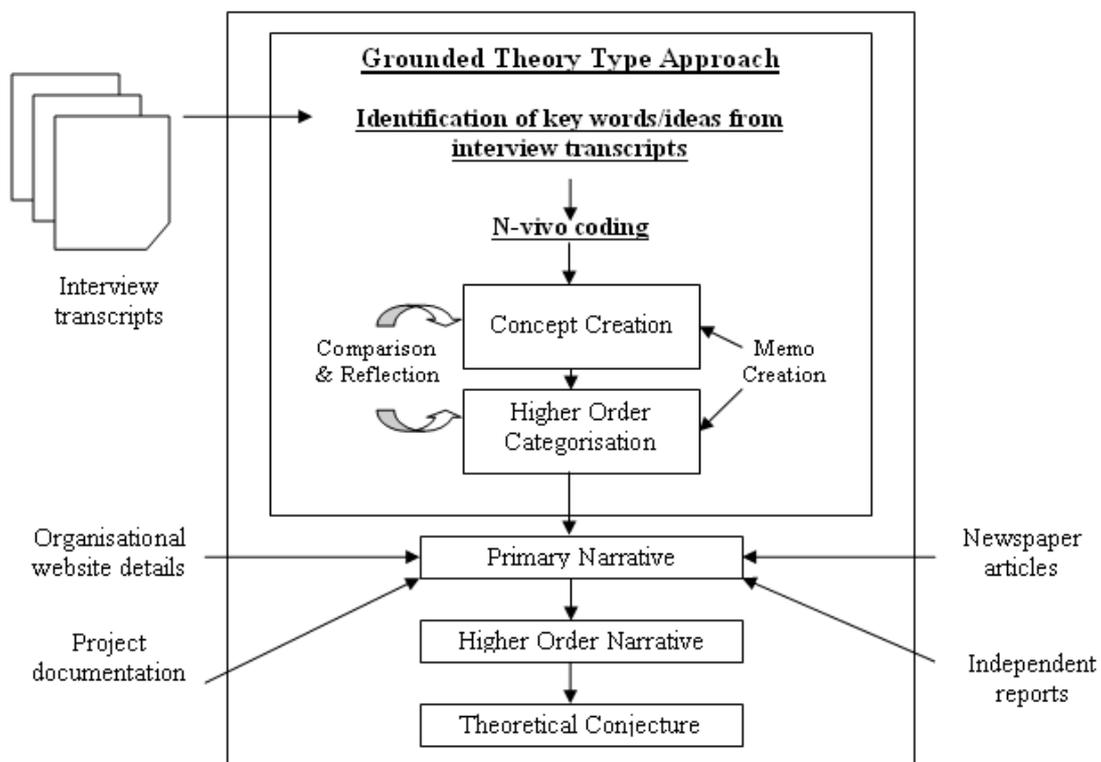
**Figure 1:** Research methodology

Case studies were conducted within five IoTs. Purposive sampling was used in case site selection as this sampling strategy ensures that key research themes are addressed and that diversity in each category is explored. The five case sites were selected due to their diversity in a number of respects.

They participated in different implementation waves, were geographically dispersed and differed in their student population sizes and academic programme offerings. The following points give a brief synopsis of the five case sites:

- Site One was one of the first IoTs to implement the student MIS. This site had significant in-house MIS team capabilities, who were responsible for system implementation, support and phased system development.
- Site Two was a member of the first implementation wave. Due to difficulties experienced with the central change request process, its in-house MIS unit also developed additional functionality to meet end-user needs.
- Site Three was a member of the second implementation wave. This IoT was smaller than the previous two sites and had more limited technical resources.
- Site Four was the smallest IoT examined in this study and was also a member of the second implementation wave. Its project team experienced a number of personnel changes during the implementation effort.
- Site Five was a member of the final implementation wave. It experienced difficulties in resourcing a dedicated project team and its initial system start-up date was delayed. At the time of research, the system was used to a limited extent and work was ongoing in implementing core functionality.

Within those IoTs, 49 semi-structured interviews were carried out between 30 November 2005 and 24 May 2006 with senior management personnel, MIS team personnel and system end users. The selected informants were closely involved in the ICT project and had in-depth knowledge of the subject area. Each interview lasted between 60 and 90 minutes, was recorded with the informants' permission and was later transcribed. The informants were given the opportunity to verify the transcripts prior to analysis. Further, the supporting documentation was valuable in corroborating the evidence collected in the semi-structured interviews. It provided a means of triangulation in that it supplied specific details, and helped to augment and substantiate the interview data. The data analysis process is outlined in Figure 2.



**Figure 2:** Qualitative data analysis

Data analysis was carried out using a variant of Glaser and Strauss's (1967) grounded theory method. GT is one of the most widely used qualitative frameworks in business and management studies (Alvesson and Sköldbberg, 2000). This GT analysis was supported by a Computer Aided

Qualitative Data Analysis Software (CAQDAS) package called N-vivo. The N-vivo package facilitates efficient data indexing and management, and supports analysis through for example relationship and model exploration. As outlined in Figure 2, the interview transcripts were initially imported into this software. Examination of these transcripts led to key words/ideas being identified and these were coded using N-vivo. Groupings of these codes that contain similar content are referred to as concepts in GT. As coding progressed, it became apparent that many concepts were related and these were reclassified into a series of categories (i.e. broad groups of similar content that are later used to generate theory) and related sub-categories using N-vivo's hierarchical tree structure. This organised related concepts in relation to the overall research and facilitated greater understanding of the body of evidence through examining the key themes. Memo creation to clarify ideas and identify relationships between categories, constant concept comparison and iterative reflection on what was already coded were important steps in this coding process.

The key concepts and categories identified through N-vivo coding, as well as important details from the other four sources of case study evidence were synthesised into a detailed cross-case primary narrative of the Student MIS project. Narratives play an important role in the social world; they are a form of knowledge and communication (Czarniawska, 2004) as complex situations can be better understood in story format. Hence, they enable a researcher to shape various interview stories into a coherent account of the key themes. Through significant reflection on the primary narrative, it was reduced to the principal findings or themes. Reflection on the primary narrative involved considering three questions: "*what does the text say?*" "*why does the text say what it does?*", and "*what is my understanding of what is taking place?*". This approach was useful in providing a conceptual separation of three ways of examining the primary narrative and in expanding my interpretation over a series of stages. The processes involved in distillation of the key findings involved both creativity and flexibility. Diagrammatic representation was important in understanding the phenomenon's diversity and in exploring relationships and complex processes. The findings are presented in the following section.

## **4. Findings**

Due to the extensive nature of the project, findings on several different aspects were uncovered. These centred on the following areas:

- Evaluation of system selection;
- Evaluation of system development for the Irish IoTs;
- Evaluation of system commissioning;
- Evaluation of ex-post performance in the early years;
- Evaluation of ex-post performance at the time of research.

### **4.1 Evaluation of system selection**

Given the project's scale and complexity, finding a suitable MIS would have proved a difficult challenge anywhere. However, it appears that system selection was not conducted with the level of care that needs to be associated with such a large-scale project. The analysis of the evidence suggested the following:

- *Finding One:* The system selection team led to a non-optimal decision.

The central system selection team of 12 representatives from eight IoTs was not the most appropriate team composition. The lack of broader IoT input and consultation mechanisms led to the perception in some IoTs of the system being imposed on the sector. The team members' knowledge of some administrative operations was limited, and while they were familiar with how their respective IoTs operated, adequate time was not made available to fully understand the vagaries across the sector.

- *Finding Two:* The evaluation system, based on a scoring mechanism used in tender evaluation, was not sufficiently in-depth or was not applied with the necessary rigor.

Given the project's scale, a rigorous scoring procedure was required. However, it appeared a number of mistakes were made in the scoring of tender proposals. Prior to the final evaluation phase, 13 of the 14 tenders received were erroneously discounted. While the team recognised both advantages and disadvantages of the selected MIS, they took an over optimistic view of its capabilities. This was a misguided decision because neither the MIS's Finance nor HR modules were implemented. Had the

main focus not been on acquiring a fully integrated system to address all functional areas, a more appropriate system for the Irish education market may have been chosen.

- *Finding Three:* One system to meet the needs of 15 Institutions inevitably caused problems.

Similarities between IoTs were exaggerated. Hence, the MIS reflected a compromise for each IoT. This resulted in operational changes across the sector. While changes were anticipated, the magnitude of those changes could have been reduced with some systems tailoring.

## 4.2 Evaluation of system development for the Irish IoTs

The tailoring of the Student MIS for the Irish education system included both pre- and post-commissioning development, performed by a central project team. This central structure was beneficial from a number of perspectives. It was more economical and resource efficient in terms of software costs and staffing requirements. It alleviated the need for IoTs to recruit specialist technical personnel to develop the system and it promoted development of specialisations in areas of the project. It provided for shared development costs and access to a common pool of scarce, expensive and skilled ICT resources and facilities. Collaboration also allowed for a common approach towards software maintenance and training. However, analysis of the evidence collected suggested that the IoTs did not appreciate the merits of the centralised approach:

- *Finding Four:* The change request process to the central MIS project team for ex-post system development was unnecessarily bureaucratic.

Changes refused by the central project team, on the basis that they were not required by the majority of IoTs, resulted in some sites using functionality they found to be unsuitable. Because any tailoring was designed to meet common requirements, the changes made were often compromises on specific needs.

- *Finding Five:* The bureaucracy of system change requests resulted in IoTs deviating from the common system standard.

Additional in-house developments became a favoured option in some IoTs for addressing the inflexibility of central system adaptation. Those developments were viewed as compromising the common system design approach in that they were ad-hoc and non-standard across the sector. However, they were necessary to enhance system utilisation.

- *Finding Six:* A compromise between centralised control and IoT autonomy in system development would have improved acceptance of the central structure.

Lack of support for site-specific customisability was problematic from IoT perspectives. Local tailoring was required for 15 autonomous Institutions. Merits existed in finding a balance between IoTs relinquishing control to the central project team and having freedom to customise the system.

## 4.3 Evaluation of system commissioning

Commissioning of the Student MIS across the IoT sector resulted in considerable work for both the central team and individual IoTs. Analysis of this process suggested the following findings:

- *Finding Seven:* Lack of preparation for system commissioning within the IoTs gave rise to negative stakeholder perceptions.

Preparation for the Student MIS was neglected in four case study sites. The amount of work involved in system changeover was not understood. It can be inferred from some staff comments that their lack of input detracted from their willingness to embrace the system. Staff commitment was essential in a project of this scale and an increased level of involvement would have improved system acceptance, the project experience and its end result.

- *Finding Eight:* The additional work involved in implementing a bespoke system was not considered.

The switch in focus from the single integrated solution that was initially envisaged increased project workloads and complexity. As opposed to one integrated system, four different systems were implemented concurrently in the IoTs. The work involved in integrating those third party systems was underestimated.

- *Finding Nine:* There was inadequate cross-learning between the IoTs.

Intra-organisational learning across the various implementation waves was sub-optimal. IoTs were not fully aware of the problems encountered by other sites. Greater communication would have helped those implementing the system to prepare for difficulties.

#### **4.4 Evaluation of ex-post performance in the early years**

The period following system commissioning reflected a dramatic change in IoT operations. The following finding was noted:

- *Finding Ten:* The operations of a complex ICT solution resulted in multiple problems across the IoT sector.

Any major system changeover will give rise to a period of disruption. Given this project's scale and in many cases the transition from basic systems, problems were to be anticipated. 11 key problems were uncovered (see Figure 3) and these were linked to a number of issues, including the system's complexities, lack of system configuration, lack of IoT preparation, and loss of IoT control to the central structure. While difficult to anticipate all eventualities, some problems could have been minimised through greater project management on both an IoT and national level.

#### **4.5 Evaluation of ex-post performance at the time of research**

At the time of research, the system had been used a number of years in the IoTs studied. Hence, a greater understanding of the system's impact was possible by the knowledge informants. The following findings were determined:

- *Finding Eleven:* A period of system use resulted in evolution of the original problems.

System usage over a number of years resulted in significant improvements across case study sites. However, while many of the original problems had changed or been overcome, some new problems had also appeared. This highlighted that achieving benefits from a new system is an on-going challenge.

- *Finding Twelve:* The early disbandment/scaling back of project teams impacted IoT's ability to exploit the system.

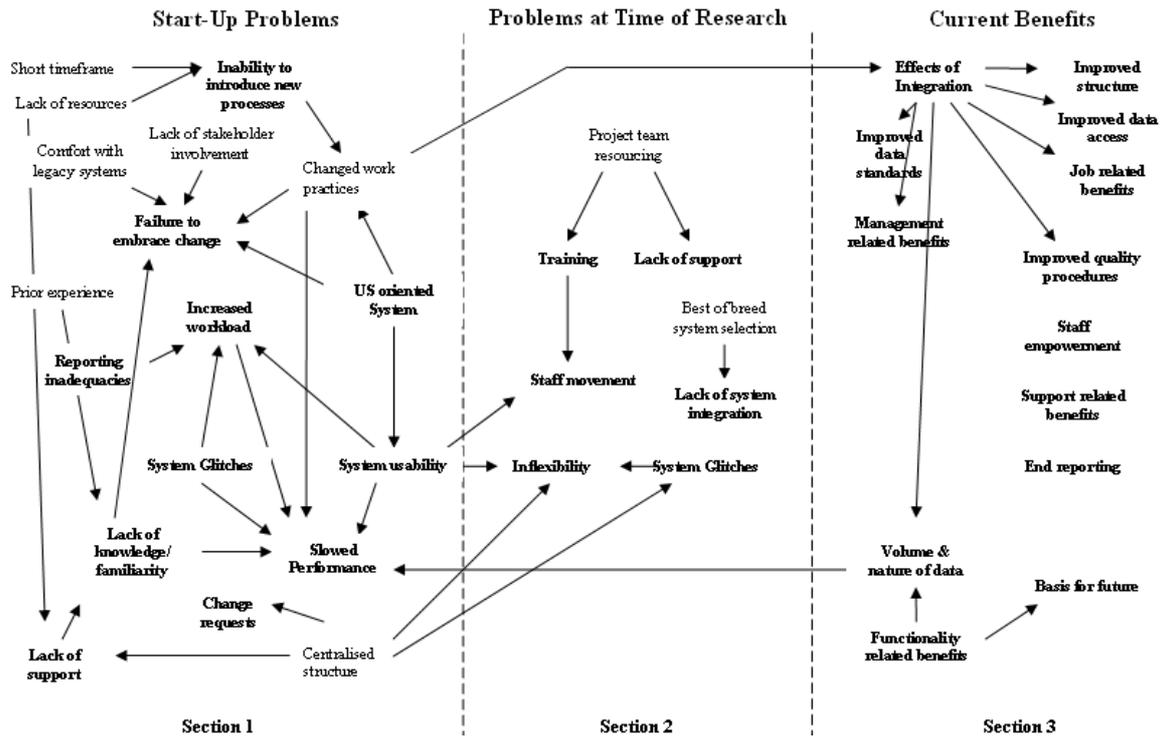
In those IoTs that disbanded their project teams shortly after system rollout, there were little resources to support problems and exploit system capabilities. Hence, ICT operational risk was increased through a limited system knowledge base. A change in mindset was required by the central project team and IoT senior management to escalate project support to a long-term priority issue.

- *Finding Thirteen:* Some of the problems encountered during system implementation resulted in a better understanding by the IoTs of what could be achieved and thus paved the way for greater benefits being subsequently delivered.

Although there were many problems associated with the system's introduction, the ensuing years allowed staff to become sufficiently familiar with the system to obtain a not insignificant flow of benefits. The majority of these benefits were as a result of system capabilities and integration and the elimination of barriers between functional departments. Benefits included for example improved structure, data standards and data access; job and management related benefits; improved quality procedures; and staff empowerment; and the MIS also served as a platform for future IoT ICT developments. Possibly even greater benefits would have accrued had the need to integrate a number of third party systems not arisen. Some benefits experienced were not direct system benefits but were accrued as a result of the implementation and the way in which the system was managed.

- *Finding Fourteen:* Many of the problems and benefits experienced were interconnected.

An examination of the issues revealed that different problems and benefits were sometimes interconnected. Certain issues were catalysts for other problems/benefits occurring. This is highlighted in Figure 3, which shows the problems at system start-up, problems at the time of research, and benefits, and the interconnections between them. (Note: The text highlighted in bold refers to the key issues identified by informants, while the non-bold text identifies issues that contribute to these problems/benefits occurring).



**Figure 3:** Problem/benefit interconnections

There are three sections to Figure 3. In the first section, the issues that produced difficulties immediately following system start-up are shown (*Finding Ten*). The arrows connecting these issues indicate how some of them had direct affects on others. Of special note was IoTs' inability to introduce new processes at the time of system start-up and this was due to the lack of operational IoT personnel involved in the project and the short timeframe for each implementation wave. Despite the initial inability to streamline processes, the system's rigid nature and its orientation towards the US market forced administrative staff to change their work practices. These new work practices, together with factors such as lack of stakeholder involvement, comfort with the legacy systems, and lack of knowledge and familiarity to mention a few, led to a failure to embrace change within the IoTs (*Finding Seven*). Poor usability levels, reporting inadequacies and some glitches in system modules increased staff workload. This greater workload slowed staff performance. Performance was further degraded by staff's lack of system knowledge and changed work practices among other factors. The central project team gave rise to the issue of change requests (*Finding Four, Five*). The central team's lack of support and lack of IoT resources impaired end-users system knowledge and familiarity at the time of commissioning.

In the second section of Figure 3 the problems that were current at the time of this research are shown. These were fewer in number compared with system start-up, but new problems were also apparent (*Finding Eleven*). However, some were caused by original system start-up issues. For example, the central team's inability to resolve system glitches resulted in this problem remaining. These system glitches, poor system usability and unresolved change requests lead to inflexibility across the IoTs. The scaling back or disbandment of project teams gave rise to a lack of support and training issues (*Finding Twelve*). Lack of training was particularly important in staff movement; many skills were non-transferable due to the system's poor usability.

In the third section of Figure 3, the benefits experienced at the time of this research are shown (*Finding Thirteen*). The system's integration was the catalyst for other benefits such as improved data standards, data access, structure and quality procedures; job and management-related benefits; and benefits from the volume and nature of data stored. The system's in-depth functionality provided a platform for the future and stored greater data volumes.

The integration of the three sections in Figure 3 shows that problems and benefits were also intertwined and influenced each other. Despite the initial problems associated with changing work

practices, the ability to overcome this issue enabled the benefits of system integration to be realised. On the other hand, while the MIS increased data volume was an important benefit, it gave rise to slowed staff performance initially. This interconnectivity suggested the need to overcome problems and capitalise on benefits as they arose, in order to promote a more favourable long-term project outcome.

- *Finding Fifteen*: System functional capabilities and IoT operational requirements were misaligned.

The main challenge facing the IoTs was the misalignment between what the system was used for at the time of research and what it was capable of delivering, and between IoT requirements and the extent to which they were met. IoTs use of the Student MIS fell short of system potential. A module by module examination within the five IoTs revealed that modules were exploited, partially exploited or completely untouched. Hence, IoTs were not leveraging the system's potential advantages. While a longer timeframe and further resources were needed to use all capabilities, the issue was more complex than this. It was also due to the system's inability to meet some IoT requirements. A module by module examination within the five IoTs revealed that modules either met all requirements, some requirements or were unsuited. In order to further capitalise on system potential, functional-operational alignment needed to be evaluated in a continuous participative manner by key stakeholder groups. This would increase awareness of unexploited system capabilities and identify those modules that required development by the central project team in order to meet IoTs' needs.

## **5. Advancing the body of ICT evaluation literature**

Throughout this section, the contribution of the above findings to the ICT evaluation literature is assessed. It establishes the extent to which the existing literature informs the findings on the five project areas evaluated, and how the ICT evaluation field of research is enhanced.

### **5.1 Contribution of findings on system selection**

The ex-ante ICT investment evaluation process is well documented in the literature. Organisations emphasise positivist evaluation approaches that establish numerical ex-ante measurements of expected system impacts. Chen and Hirschheim (2004) suggested that these positivistic approaches constituted 81% of published empirical material on ICT evaluation. However, these approaches are increasingly regarded as an inappropriate basis for evaluation (see for example Berghout and Renkema, 2001; Serafeimidis and Smithson, 2003). They seek to arrive at a "yes"/"no" decision regarding proposed projects and are typically performed using traditional financial metrics such as the payback period, net present value or internal rate of return (Farbey et al, 1999; Gwillim et al, 2005). Greater than 86% of CFOs studied by Paul and Tate (2002) relied on these methods for project evaluation. The type of ex-ante evaluation performed for the Student MIS project did not mirror this traditional approach. There was no attempt to reduce the system's impact to a financial estimate. Rather the ex-ante assessment resulted in a series of high-level statements of what the system hoped to achieve.

Although the literature suggests that ex-ante assessments are most evident in practice (Willcocks and Lester, 1999a), it appears that the type of evaluation performed is often superficial and of little value in being able to understand the systems operational impact. The financial reductionist approach often ignores softer system impacts; any attempt to address project intangibles through ranking and scoring is subject to manipulation in order to serve stakeholders self interests. Similarly, the type of high-level Student MIS evaluation method based on scoring is of limited value. *Finding Two* on system selection advances the body of ICT evaluation literature by demonstrating how scoring is an inappropriate tool for comparing different software systems in an ICT implementation project that involves multiple autonomous organisations. Many well-established methods have emphasised the importance of scoring in order to capture intangible system impacts, for example the Balanced Scorecard (Kaplan and Norton, 1992) and Information Economics (Parker and Benson, 1988). However, this research highlights how scoring is more complex and of questionable value when several independent organisations are involved in selecting a single system and when a non representative group of individuals is involved in the scoring process (see *Finding One* and *Three*). Due to differences in their operational practices, it is likely that each autonomous body will score potential systems differently.

Hence, the traditional financial reductionist approach to ex-ante evaluation and the scoring procedure and high-level evaluation associated with the Student MIS project appear of questionable merit as a basis for benchmarking ex-post performance. Inadequacies in ex-ante evaluations may in part explain

the reason for limited organisational ICT evaluation exercises throughout the project lifecycle and ex-post. In other words, many ex-ante assessments are not conducted in the level of detail that enables organisations to monitor actual system performance against original expectations.

## 5.2 Contribution of findings on system development for the Irish IoTs

*Finding Four* to *Finding Six* advance the body of ICT evaluation research through highlighting the difficulties experienced by autonomous organisations when procedures for system adoption and utilisation are controlled by a central body. These areas have not previously been addressed in the ICT evaluation literature. A centralised approach to a common system implementation is of economical value; however it has consequences for efficiently operationalising the system throughout all organisations. This research highlights that due to operational vagaries in multiple autonomous bodies, flexibility for local system tailoring and centralised support for site specific customisability in some areas is required. This would help alleviate the perception that system developments represent compromises on organisational requirements and would provide for more effective system utilisation and exploitation.

## 5.3 Contribution of findings on system commissioning

*Finding Seven* discusses the negative impact of the lack of system commissioning preparation within the IoTs. This issue had previously been addressed by many authors, for example Hillam and Edwards (2001) who argued that user perception is poorly considered in the ICT investment process, and Markus (2004) who outlined how negative stakeholder perceptions towards work practice, business process and ICT changes had significant consequences for organisational change efforts driven by technology. Further, Serafeimidis and Smithson (2003) emphasise the importance of stakeholder involvement in promoting their commitment and project acceptance.

The literature cites several examples of failed/troubled ICT projects. For example, depending on the project sample studied, authors have reported various ICT project failure rates, for example 15% (Al-Shehab et al, 2005) and 25% (Keil et al, 2000). Smith and Keil (2003) reported that 74% of software development projects were troubled; Al-Shehab et al (2005) suggested that 51% of projects experienced budget and timescale overruns and deficient functionality, while Keil et al (2000) stated that 30%-40% demonstrated project escalation. The issue of ICT project failure and escalation can have significant organisational consequences. For example, Bannister et al (2002) reported that approximately 80% of companies that suffer catastrophic systems failure do not survive. For those companies whose system's fail, ICT can be a "*strategic burden*" (Kwon and Watts, 2006: 328) or a "*millstone around their necks*" (Remenyi et al, 2004: 362). Examples of high-profile ICT project failures include the Taurus project in the London financial markets (Willcocks and Lester, 1999b) and the Denver International Airport baggage handling system (Montealegre and Keil, 2000). Despite significant reports in the literature on troubled ICT investments, there is little discussion of how the sub-optimal selection of a system ex-ante may impact the system's commissioning and ultimately the project's outcome. *Finding Eight* highlighted how it can give rise to an alternative course of project action and the need to select different products/modules. This makes original ex-ante estimations inaccurate. In the Student MIS project the switch in focus from one integrated solution to several third party systems resulted in significant increased workloads that were not previously anticipated.

*Finding Nine* provides further insight into a common system implementation in multiple organisations. This project highlighted that implementations supported by a central unit do not always benefit from learning acquired in system installation at each site. The need for communication and information sharing on issues uncovered, in order to promote intra-organisational learning, is an important contribution in improving common system commissioning in multiple autonomous organisations. These areas were previously unexplored in the literature.

## 5.4 Contribution of findings on ex-post performance in the early years

*Finding Ten* on the period following system commissioning centred on the problems resultant from the ICT implementation. Much existing research discusses the problems associated with new system introduction, for example Al-Shehab et al (2005); Benamati and Lederer (2001); Currie and Parikh (2006); Pan et al (2004); Reich and Benbasat (2000); Smith and Keil (2003); Wilcocks and Lester (1999b). However, this research also identified some issues unique to a common system implementation and the ex-post impact of sub-optimal system selection.

## **5.5 Contribution of findings on ex-post performance at the time of research**

*Finding Eleven* discusses the evolution of original problems following a period of system use. This issue had previously been addressed in the literature, for example, Remenyi et al (2007) highlighted that system impacts evolve over time, thereby increasing the difficulties in identifying in advance all system implications. *Finding Twelve* highlighted organisational inability to exploit system potential due to the early disbandment of support structures. The need for ongoing support is addressed in depth in the literature. For example, Berghout and Nijland (2002) and Remenyi et al (2007) discussed its importance during the operational phase of a system's lifecycle. *Finding Thirteen* centred on the benefits resultant from system implementation. The literature contains many examples of ICT investment benefit potential. For example, according to Hirschheim and Smithson (1999), system introduction leads to economic, organisational, management and social consequences; Crowston and Myers (2004) suggested that ICT can radically transform organisations and industries; and Piccoli and Ives (2005) stated that ICT helps create competitive advantage through efficiency improvement and organisational differentiation. ICT benefit categories and the benefit realisation process are also well documented in existing research (Ashurst and Doherty, 2003; Bannister, 2005; Cronk, 2005; Ward and Peppard, 2002).

The discussion of problem and benefit interconnectivity in *Finding Fourteen* advances the existing body of knowledge. The recognition that unresolved problems can result in further difficulties; that benefit identification and realisation can give rise to greater rewards; and that problems and benefits impact each other is a new contribution to ICT evaluation research. The catalytic nature of system impacts emphasises the importance of early problem resolution and benefit realisation. Further, the impact of functional-operational misalignment (*Finding Fifteen*) in leveraging system benefit potential is not clearly addressed in the literature. Some research discusses the match between system capabilities and organisational requirements, see for example Avram (2001) and Saastamoinen (2005). However, existing research has not explored this issue in depth or suggested how it may be addressed.

## **6. Conclusions**

The research findings presented in this paper provided in-depth insights into a large-scale standard ICT system implementation in multiple autonomous Higher Education Institutions. Further, the paper discussed how those findings advance the existing body of ICT evaluation literature. This paper's theoretical contributions are valuable on a number of levels.

Firstly, the research considers the issue of ICT evaluation in a much under researched business sector and takes a step in addressing the paucity of academic ICT evaluation literature in Higher Education. Increasing the body of literature on the evaluation of Higher Education support systems provides a frame of reference for Higher Education Institutions and increases understanding of the ICT investment evaluation process in Higher Education. Secondly, it increased understanding of the challenges involved in implementing and operationalising a standard system in multiple organisations that have diverse requirements. Thirdly, it helped identify a number of difficulties experienced in large-scale government projects. It identified areas of learning in relation to system selection and project management that may help minimise similar issues in future government projects and improve final project outcomes.

## **References**

- Al-Shehab, A.J., Hughes, R.T. and Winstanley, G. (2005). Modelling risks in IS/IT projects through causal and cognitive mapping. *Electronic Journal of Information Systems Evaluation*, **8**, (1), 1-10.
- Alvesson, M. and Skoldberg, K. (2000). *Reflexive methodology – new vistas for qualitative research*, Sage Publications, London.
- Ashurst, C. and Doherty, N.F. (2003). Towards the formulation of a 'best practice' framework for benefits realisation in IT projects. *Electronic Journal of Information Systems Evaluation*, **6**, (2), 1-10.
- Avram, G. (2001). Evaluation of investments in e-commerce in the Romanian business environment. *Electronic Journal of Information Systems Evaluation*, **4**, (1).
- Bannister, F. (2005). When paradigms shift: IT evaluation in a brave new world. *Electronic Journal of Information Systems Evaluation*, **8**, (1), 21-30.
- Bannister, F., McCabe, P. and Remenyi, D. (2002). How much did we really pay for that? - the awkward problem of Information Technology costs. *Electronic Journal of Information Systems Evaluation*, **5**, (1).
- Berghout, E. and Nijland, M. (2002). Full lifecycle management and the IT management paradox. In *Make or break issues in IT management*, (ed. D. Remenyi and A. Brown), pp. 77-107. Butterworth Heinemann, Oxford.

- Berghout, E. and Renkema, T.J. (2001). Methodologies for IT investment evaluation: a review and assessment. In *Information Technology evaluation methods and management*, (ed. W. Van Grembergen), pp. 78-97. Idea Group Publishing, London.
- Carcary, M. (2006). Ex-Post evaluation and review of the implementation of a student Management Information System (MIS) at Limerick Institute of Technology: a case study. In (Ed. A. Brown and D. Remenyi), *Proceedings of the 13<sup>th</sup> European Conference on Information Technology Evaluation*, pp 111-120, Genoa, Italy, 28<sup>th</sup>-29<sup>th</sup> September, Academic Conferences, Reading.
- Carcary, M., Long, G. and Remenyi, D. (2006b). A first evaluation of a new student Management Information System (MIS) at an Institute of Technology in Ireland. In (Ed. A. Brown and D. Remenyi), *Proceedings of the 13<sup>th</sup> European Conference on Information Technology Evaluation*, pp 121-129, Genoa, Italy, 28<sup>th</sup>-29<sup>th</sup> September, Academic Conferences, Reading.
- Chen, W. and Hirschheim, R. (2004). A paradigmatic and methodological examination of Information Systems research from 1991 to 2001. *Information Systems Journal*, **14**, 197-235.
- Cronk, M. (2005). Generic management principles for maximising ICT value? In (Ed. D. Remenyi), *Proceedings of the 12<sup>th</sup> European Conference on Information Technology Evaluation*, pp. 157-164. Turku, Finland, 29<sup>th</sup>-30<sup>th</sup> September, Academic Conferences, Reading.
- Crowston, K. and Myers, M.D. (2004). Information Technology and the transformation of industries: three research perspectives. *Journal of Strategic Information Systems*, **13**, 5-28.
- Currie, W.L. and Parikh, M.A. (2006). Value creation in web services: an integrative model. *Journal of Strategic Information Systems*, **15**, 153-174.
- Czarniawska, B. (2004). *Narratives in social science research – introducing qualitative methods*, Sage Publications, Thousand Oaks, London.
- Day, J. and Bobeva, M. (2006). Using a Balanced Scorecard approach for evaluating an integrated learning environment for undergraduate dissertations. In (Ed. A. Brown and D. Remenyi), *Proceedings of the 13<sup>th</sup> European Conference on Information Technology Evaluation*, pp 198-207, Genoa, Italy, 28<sup>th</sup>-29<sup>th</sup> September, Academic Conferences, Reading.
- Farbey, B., Land, F. and Targett, D. (1999). Evaluating investments in IT: findings and a framework. In *Beyond the IT productivity paradox*, (ed. L.P. Willcocks and S. Lester), pp. 183-215. Wiley, Chichester.
- Gemmell, M. and Pagano, R. (2003). Adoption of higher education management Information System – findings from a UK study. In (Ed. E. Berghout and D. Remenyi), *Proceedings of the 10<sup>th</sup> European Conference on Information Technology Evaluation*, pp. 253-262. Madrid, Spain, 25<sup>th</sup>-26<sup>th</sup> September, MCIL, Reading.
- Glaser, B.G. and Strauss, A.L. (1967). *The discovery of Grounded Theory: strategies for qualitative research*, Aldine De Gruyter, New York.
- Gwillim, D., Dovey, K. and Wieder, B. (2005). The politics of post-implementation reviews. *Information Systems Journal*, **15**, 307-319.
- Hillam, C.E. and Edwards, H.M. (2001). A case study approach to evaluation of Information Technology/Information Systems (IT/IS) investment evaluation processes within SMEs. *Electronic Journal of Information Systems Evaluation*, **4**, (1).
- Hirschheim, R. and Smithson, S. (1999). Evaluation of Information Systems: a critical assessment. In *Beyond the IT productivity paradox*, (ed. L.P. Willcocks and S. Lester), pp. 381-409. Wiley, Chichester.
- Hughes, J. and Jones, S. (2003) Reflections on the use of Grounded Theory in interpretative Information Systems research. *Electronic Journal of Information Systems Evaluation*, **6**, (1).
- Kaplan, R. and Norton, D. (1992). *Translating strategy into action: the balanced scorecard*, HBS Press, Boston, MA.
- Keil, M., Mann, J. and Rai, A. (2000). Why software projects escalate: an empirical analysis and test of four theoretical models. *MIS Quarterly*, **24**, (4), 631-664.
- Kontio, J. (2006). How implementation of an Information System has impacted teaching process in Turku university of applied science. In (Ed. A. Brown and D. Remenyi), *Proceedings of the 13<sup>th</sup> European Conference on Information Technology Evaluation*, pp 316-323, Genoa, Italy, 28<sup>th</sup>-29<sup>th</sup> September, Academic Conferences, Reading.
- Kwon, D. and Watts, S. (2006). IT valuation in turbulent times. *Journal of Strategic Information Systems*, **15**, 327-354.
- Markus, M.L. (2004). Technochange management: using IT to drive organisational change. *Journal of Information Technology*, **19**, March, 4-20.
- Montealegre, R. and Keil, M. (2000). De-escalating Information Technology projects: lessons from the Denver international project. *MIS Quarterly*, **24**, (3), 417-447.
- Nijland, M., (2003). IT cost benefit management improvement from a critical perspective. *Electronic Journal of Information Systems Evaluation*, **6**, (1).
- Nurmi, A. and Hallikainen, P. (2004). Evaluation Process of an outsourced joint Information System development project in Finnish universities – Learning proactive Evaluation Practices. In (Ed. D. Remenyi), *Proceedings of the 11<sup>th</sup> European Conference on Information Technology Evaluation*, pp 299-307, Amsterdam, The Netherlands, 11<sup>th</sup>-12<sup>th</sup> November, Academic Conferences, Reading.
- Pan, G.S.C., Pan, S.L. and Flynn, D. (2004). De-escalation of commitment to Information Systems projects: a process perspective. *Journal of Strategic Information Systems*, **13**, 247-270.
- Parker, M. and Benson, R. (and Trainor, E.) (1988). *Information economics: linking business performance to Information Technology*, Prentice Hall, Englewood Cliffs, New Jersey.

- Paul, L.G. and Tate, P. (2002). *CFO mind shift: technology creates value*, CFO Publishing Corporation, Boston, MA.
- Piccoli, G. and Ives, B. (2005). IT-dependent strategic initiatives and sustained competitive advantage: a review and synthesis of the literature. *MIS Quarterly*, **29**, (4), 747-776.
- Reich, B.H. and Benbasat, I. (2000). Factors that influence the social dimension of alignment between business and Information Technology objectives. *MIS Quarterly*, **24**, (1), 81-113.
- Remenyi, D., Bannister, F. and Money, A. (2007). *The effective measurement and management of ICT costs and benefits*, (3<sup>rd</sup> edn). Elsevier CIMA Publishing, Oxford.
- Remenyi, D., Griffiths, P.D.R. and Diniz, E.H. (2004). The manager in the field and Information and Communications Technology success. In (Ed. D. Remenyi), *Proceedings of the 11<sup>th</sup> European Conference on Information Technology Evaluation*, pp. 359-370. Amsterdam, The Netherlands, 11<sup>th</sup>-12<sup>th</sup> November, Academic Conferences, Reading.
- Saastamoinen, H. (2005). Exception-based approach for Information Systems evaluation: the method and its benefits to Information Systems management. *Electronic Journal of Information Systems Evaluation*, **8**, (1), 51-60.
- Serafeimidis, V. and Smithson, S. (2003). Information Systems evaluation as an organisational institution – experiences from a case study. *Information Systems Journal*, **13**, 251-274.
- Smith, H.J. and Keil, M. (2003). The reluctance to report bad news on troubled software projects: a theoretical model. *Information System Journal*, **13**, 69-95.
- Todorova, N. (2006). The role of organisational memory in IS evaluation. In (Ed. A. Brown and D. Remenyi), *Proceedings of the 13<sup>th</sup> European Conference on Information Technology Evaluation*, pp 485-492, Genoa, Italy, 28<sup>th</sup>-29<sup>th</sup> September, Academic Conferences, Reading.
- Ward, J. and Peppard, J. (2002). *Strategic planning for Information Systems*, (3<sup>rd</sup> edn). Wiley, Chichester.
- Willcocks, L.P. and Lester, S. (1999a). Information Technology: transformer or sink hole?. In *Beyond the IT productivity paradox*, (ed. L.P. Willcocks and S. Lester), pp. 1-36. Wiley, Chichester.
- Willcocks, L.P. and Lester, S. (1999b). In search of Information Technology productivity: assessment issues. In *Beyond the IT productivity paradox*, (ed. L.P. Willcocks and S. Lester), pp. 69-97. Wiley, Chichester.

# The Dilution of Effort in Self-Evaluating Development Teams: Agile Loafing

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**Abstract:** Attempts to resolve the problems in software development have concentrated on the tools and methodologies used, despite an acceptance by many that it is a sociological problem. An example of this is the procedures and processes surrounding evaluations within projects, yet ultimately it depends on individuals more than process. This paper examines one of the sociological factors inherent in a software development team to determine its impact on evaluation within a project. Social loafing occurs where individual members of a team demonstrate a tendency not to work as hard as they could or should. This “slacking off” occurs because the team provides a degree of anonymity – the individual feels their lack of work will be hidden from evaluation within the overall output of the team. Some authors purport that Agile Software development teams have low incidences of social loafing (though these are opinions rather than research findings); the contrary can also be argued. An examination of the philosophy behind Agile Software Development, demonstrated by the Agile Manifesto, highlighted the possibility of occurrences of social loafing brought about by the Agile values. Agile espouses the importance of cohesive teams, the empowerment of these teams, and the collective ownership and self-evaluation of work by the team. These values map onto factors which are described as affecting social loafing. An investigation of two teams over an eight month period examined if the Agile values could lead to incidences of social loafing, specifically when their work is being evaluated. The investigation determined that the opposite was actually the case. This paper then goes on to determine why the findings go against the initial hypothesis and to show the impact this can have on those evaluating software development projects.

**Keywords:** teams, agile software development, social loafing, self-evaluation, participant observation, sociological factors

## 1. Introduction

The development and evaluation of Information Systems relies heavily on the individual developers, yet the main area of concentration appears to be on the methods and tools used in a project. Code reviews, or inspections, are an example of this concentration, where procedures have evolved or have been proposed; an example of this is a statistical process for control of code reviews proposed by Nelson and Schumann(2004). Many authors accept that there is a need to refocus on the teams of developers rather than the processes they follow. Martin (2003, p.4) describes it best by stating that “*a good process will not save the project from failure if the team doesn’t have strong players.*” Strong players on their own, though, will not guarantee success. Teams of software developers bring with them problems in how the team work and how they evaluate their own work. One particular concern with teams is the possibility, if not prevalence, of social loafing in teams. Social loafing occurs when an individual lessens their effort when in a group or team. A developer may lessen their effort because they perceive that other members of the team will take on the extra load, or they may believe that the team gives them anonymity as the team is being evaluated as a unit rather than the individual being evaluated.

A review of existing literature on social loafing highlighted a potential problem for development projects using an Agile Methodology. The Agile methodologies espouse empowering cohesive groups to take collective ownership of their work and responsibility for evaluating that work. These map directly onto factors that are described as likely to cause social loafing. This study describes two case studies, undertaken by the authors, that examined the occurrence of social loafing in team evaluations. The two cases were projects that were based on the Agile philosophies, yet one project’s application of the Agile methods was diluted by the need to adhere to company standards and processes (for code reviews in this case). Based on existing literature, it was hypothesised that the project that more closely followed the Agile philosophy would be more likely to demonstrate occurrences of social loafing during evaluations. After eight months of observation and interviews with key informants, doubts were cast on this hypothesis.

In the next section, a review of existing literature on Agile software development is presented, along with its approach to evaluation within projects. The phenomenon of social loafing is then explained,

and the possibility of its impact on evaluations within Agile projects is then examined. The research approach to determine if this impact exists is then presented, along with a description of two case studies where the teams' evaluations of their work were examined. Finally conclusions are presented with suggestions as to how social loafing can impact on evaluations within software development projects and proposals as to how these can be mitigated or taken into account.

Note that, throughout this paper, the terms group and team are both used. While the words group and team are often used interchangeably, the distinction is that a group is a collection of individuals with a common aim, whereas a team has the additional attribute where the skills of each member fit in with those of the others towards a specific purpose. This research concentrates on teams based on the definition above, but the word 'group' is used herein when describing previous research that examined groups as a collection of individuals rather than being specifically restricting to teams.

## **2. Social loafing in an agile environment**

While 'software crisis' may be extreme, the term was first used at a NATO conference in Germany in 1968 (Hazzan and Tomayko, 2003), and "*despite impressive technical advances in tools and methodologies and the organizational insights provided by many years of research, IS failures remain all too common*" (Wastell, 1999, p.582). The response to these failures has been an attempt to introduce engineering principles to software development, and these principles are visible in a wide variety of methodologies in use. Where evaluating code, Fagan inspections, first described in Fagan (1999), are a well used example of using a process as an engineering fix. Despite this work, the problems in software projects still remain; studies have continually shown that improvements resulting from the introduction of these advances have been disappointing (Finnegan and Murray, 1999, p 91). Glass (2003) agrees that the improvements have been disappointing, regarding much of the promises of increased productivity as hype. Bahli and Buyukkurt (2005) acknowledge the importance of teams in information systems development, yet state that there has been little research to date. Specific to evaluating code, Rodgers *et al.* (1998) acknowledge the positive influence teams have on code evaluations yet ultimately propose further tool development. Sawyer and Guinan (1998) argue that software development needs to be refocused from the production elements to the social aspects of development. As determinants of software development performance, methodology and tool use have less of an affect than the socialization of developers in the team. Domino *et al.* (2003, p.44) put it succinctly - "*software development is a human endeavour*"

This research concentrates on the social aspect of software development, specifically examining the software development team and the impact that the team can have on the development process and the evaluation of the output. In doing so, we concur with the view of Jones and Hughes (2003) that "*IS evaluation is a socially embedded process in which formal procedures entwine with the informal assessments by which actors make sense of their situation*"

### **2.1 The importance of teams to Agile software development.**

Argyle (1989) describes how work is predominantly performed in groups. Software development is no different; teamwork is the basis of software development projects. Martin (1991, p.155) describes the common view that "*better team working leads to better performance*", while Jones and Roelofsma (2000, p.1129) state that "*teamwork is essential if competitive advantage is to be achieved.*" The positive endorsement of teams by researchers has been translated into practice. Research by Finnegan and Murray (1999) showed that practically all organisations develop software in teams. More 75% of all development is performed in teams in 98% of organisations.

Agile software development concurs with this belief in the value of teams, placing teams at the centre of the agile methodologies. Highsmith (2004) emphasises the importance of a good team for the success of agile projects, while Hazzan and Tomayko (2003) describe XP (eXtreme Programming – one of the most commonly used Agile methods) as being based on team interaction – more so than other software development methodologies.

The basic principles of agile methodologies are qualified in Abrahamsson *et al.* (2002) as:

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation

- Responding to change over following a plan

These principles are referred to as the 'Agile Manifesto' and form the core values of the Agile methodologies. The first principle of Agile software development highlights the importance of teams (the interaction of individuals) to agile software development. The importance of teams is seen by the devolution of power to the software development teams and the expectation that the team as a unit is responsible for development. Code is collectively owned (Hazzan and Tomayko, 2004), fostering a democratic approach with regard to responsibilities. Allied with this collective ownership is the trust shown to developers where they are empowered rather than monitored and controlled. Schuh (2004) specifically associates agile with empowerment and trust, to the extent that the team has responsibility for the delivery of all functionality (Cohn, 2004). The team is also expected to evaluate their own work, and this is one of the unique areas of Agile. Rather than the traditional code reviews to evaluate work, Agile proposes that the team self-evaluate using a variety of methods. Pair programming is one such method, where while one developer codes, a second developer inspects the code alongside the first developer. In effect, this is code evaluation in real-time, which Cockburn (2001) describes as a continuous code review. Even if the pair-programming process is not used by the team, the emphasis has moved from traditional formalised evaluations to informal self-evaluations by the team; the concept of self-evaluation by Agile teams is noted in Turk *et al.* (2005). To allow this level of empowerment, there is a requirement for well functioning cohesive teams. Auer *et al.* (2003) describe this as Agile's need for an effective social network, Boehm and Turner (2003) describe it as the need for good interaction, while Highsmith (2004) talks about jelled teams.

## 2.2 From Agile to social loafing

In the 19<sup>th</sup> Century, Triplett (1897) found that the mere presence of others, cyclists in his experiment, improves performance – the dynamogenic theory. Zajonc (1968) found that the performance of other tasks than the physical ones investigated by Triplett improved in the presence of others; the term he uses to describe this is social facilitation. Interestingly, Baron *et al.* (1999) describe how Zajonc found the same effect in other animals, including cockroaches – although it is not the aim of this research to compare software developers to cockroaches!

While the positive benefits of teams is noted by many researchers, research into groups has often produced paradoxical findings (Baron *et al.*, 1999). Researchers have noted the positive and negative aspects of teams, often based on the same attribute where one researcher notes its positive impact and another notes its negative impact. So, while teamwork brings obvious benefits, it should be noted that it can also bring problems. Nunamkaer *et al.* (1997) propose that, while teams are vital in many situations, teams bring with them their own problems. For example, a team of four people will not perform four times better than one individual. This shortfall in the team's performance is described as process loss, where a team does not act in the most effective way. Other forms of losses in team activity include coordination loss, where the team does not effectively coordinate the work, and motivational loss, where the team members do not try as hard as they would as individuals (Baron *et al.*, 1999). Part of these problems can be explained by the difference between the ideal of teams and the reality of teams. Robbins and Finely (1998, p.51) differentiate ideal teams and real teams. Ideal teams comprise "*perfect people whose egos and individuality have been subsumed into the greater goal of the team.*" Real teams, the reality of teams in the workplace, "*are made up of living, breathing, and very imperfect people.*"

While social facilitation, described above, brings positive effects to teams, its opposite – social loafing – will reduce a team's performance. "*Social loafing is the tendency for people in a group to slack off—i.e., not work as hard either mentally or physically in a group as they would alone*" (Thomson, 2003, p100). Human nature dictates that, as individuals, we are all capable of slacking off, given the opportunity. The ability to hide in a team, where our lack of effort may not be noticed, gives us this opportunity. Brooks and Ammons (2003) use the term free riding to describe social loafing, identifying its prevalence in group based projects in education. It should be noted, though, that Mulvey and Klein (1998) differentiate social loafing and free-riding. Free-riding, although very similar to social loafing, involves the perception of a team member that other team members will put in sufficient work, making their own contribution less necessary. Mulvey and Klein do accept, though, that the terms are generally used interchangeably.

Moving from the general principle for all teams, to the specifics of Agile teams, it appears that the Agile principles should mitigate against, if not completely eliminate, social loafing in teams. Rising and

Janoff (2000) argue that the small teams inherent in Agile projects should mitigate against social loafing, while Whitworth and Biddle (2007) argue that increased awareness of accountability to the Agile team should also lower the incidences of social loafing. Based on this, social loafing should not be a problem in Agile teams, but, in both of the research above, these are offered opinions rather than research findings. In fact, the opposite could also be argued, as discussed below.

Williams et al (1993) describe the factors that affect social loafing:

- Social loafing increases when evaluation of the work is based on team, rather than individual performance.
- Social loafing is less likely to occur if the work is interesting.
- Group cohesiveness can reduce social loafing (also noted in Liden *et al.* (2004)). Williams *et al.* (1993) and Mulvey and Klein (1998) did find, though that social loafing can occur in cohesive groups, where group members trust each other to do their tasks. This level of trust means that individual performance is not monitored by the trusting team, allowing the opportunity for loafing (this appears pertinent to Agile teams).

Pearce and Ensley (2004) add further to this by stating that role ambiguity is a further cause of social loafing while Landy and Conte (2004) argue that a lack of monitoring can lead to social loafing. The factors influencing social loafing above, imply a potential problem in software development teams adopting an agile methodology.

The agile methodologies stress the empowerment of, and trust in, the team, to the extent that the team monitors itself to a large extent, and evaluates its own work. The agile team is responsible as a unit for the development of the user requirements, so the group is evaluated as a whole, as opposed to individual evaluation of the team members. Collective ownership, for example the collective ownership of code, allows for a degree of anonymity for the individual developers. Further, the requirement of a cohesive team is often noted as a necessity for an agile team. These traits of agile software development match closely two of the three factors which affect social loafing: group evaluation and group cohesiveness. The second factor of social loafing – interesting work – does not appear to be restricted specifically to agile methodologies as there is nothing in the agile philosophy which addresses how agile development would be more or less interesting than traditional development.

### **3. Research approach**

A longitudinal study of the development project was undertaken, using participant observation of two agile development teams as its primary method. The study concentrated on how the teams evaluated their work, while noting other factors which may be impacting on this self-evaluation. The first project concerned the design and development of a knowledge management system for a European government organisation. A team of seven developers and one project manager were involved in the project, the first phase of which lasted eight months. The second team, of eight developers, was based in a large multinational telecommunications company, developing fault tolerant applications. The choice of similar team size for both cases was deliberate. The aim was to eliminate a further factor of social loafing where there is a correlation between an increase in social loafing and an increase in the size of the group (Williams *et al.*, 1993). As both teams were of similar size, the size of the team could be removed as a contributing factor. Further, the team sizes were the same as those studied by Clutterbuck *et al.* (2009) who also examined evaluation in an Agile setting.

Participant observation was chosen as the method for identifying the presence of social loafing. Participant observation is relevant where “*the phenomenon is obscured from the view of outsiders*” (Jorgensen, 1989, p.12). Asch (1952) goes further than this, by arguing that observations of groups can discover areas that even group members themselves are unaware of. Social loafing may be an effect that an individual, or team, are unaware of.

The first development team was observed over an eight-month period. Both researchers had roles in the team. In longitudinal research, observations lasting weeks or months allow the researcher to develop a relationship with those being studied, which goes beyond a superficial short-term relationship (Gurney, 1991; Fetterman, 1991). Describing those performing research as participant observers, Burgess (1982) argues in that their activities involve sharing “*in the lives and activities of those whom they study and take roles which are effective in the setting under study.*” Integration into

the group under study is vital in participant observation (Ezey, 2003). "*Participation allows you to experience activities directly to get a feel of what events are like, and to record your own perceptions*" (Spradley, 1980, p.51).

As in this study, others have used participatory observation to investigating agile software development projects. Martin *et al.* (2004) describe interpretative in-depth case studies as the best method of investigating agile software development. A qualitative approach was used in another investigation of the characteristics of an agile team, involving participant observation, described in Robinson and Sharp (2004). Examining two specific cases provided insights that may not be visible in other research methods. A benefit of the trust gained by the researcher is the ability to examine areas that may be secret or concealed. It is the "*taken for granted*" that is worth observing, for it is the seemingly trivia of daily work that influence organisations (Schwartzman, 1993, p.4). It is this everyday life that provides a description of reality (Jorgensen, 1989).

The second team was observed by one of the researchers, with a working role in the team, and supplementary details were elicited from two key informants in the team – a developer and a team leader - in monthly meetings. There is considerable justification for the use of key informants - examples include: Kumar *et al.* (1993), Schwenk (1985), and Holloway and Tordres (2003) - and key informants have been used to examine social influences (Jasperson *et al.*, 1999) and projects (Van Fenema, 1997).

#### **4. Observations and analysis**

The first software development team studied were involved in the development of a knowledge management system for use in a Government department. The design of this Information System was informed by the experiences of the team in developing a Knowledge Management System (KMS) for the United Nations. The majority of the team had worked together on the previous project and was highly rated by the customer. Despite the success of the United Nations project, the team decided that it needed to introduce a more formalised approach to development, while ensuring that the approach was not overly rigid. Based on this criteria they chose to adopt an Agile approach to development.

The second case chosen for study was a large US multinational telecommunications company, which designs and manufactures a range of products, from cell-phone switches and base stations, to mobile telephone products. Its software division develops software used in the monitoring, control and operation of mobile phone networks throughout the US, Europe, the Middle East, and Africa. It is significant that the organization's policies and culture recently promoted software process improvement initiatives, such as Agile approaches. The team developed system administration applications for the installation, upgrade, and maintenance of a large application which monitored mobile phone networks.

The two cases were chosen because, while both had adopted an agile approach, they were sufficiently different. The knowledge management project team followed the agile philosophy to a greater extent than the telecommunications project team. The telecommunications project team used a diluted version of agile, as they had to ensure compliance with company standards. TL9000 is a communications standard, which Clancy (2002) describes as necessary for telecommunications companies, which was used by the organisation. In addition, as the telecommunications company was regularly audited for CMM accreditation, there were a variety of processes that the project team had to follow. Of interest to this research were the processes and procedures concerning evaluation of work. The primary process here were Fagan inspections (described in Fagan (1999)), which was the process for the evaluation of code and the software as a whole. This went somewhat against the agile philosophy of individuals and interactions over processes and tools, but it was still considered to be an agile project; others describe code inspections taking place in an Agile project (cf. Fitzgerald, Hartnett and Conboy, 2006). Various authors would agree that, although the agile philosophy had to be altered to take the enforced company processes and standards into account, this still constitutes an agile approach. The two cases therefore present two views of an agile approach: an adoption of the agile philosophies by the knowledge management project team and a partial adoption of the agile philosophies by the telecommunications team. Based on the nature of these projects, it was hypothesised that the more formalised, monitored, and audited telecommunications project should demonstrate a lower likelihood of social loafing. The researchers had access to both formal and informal meetings where the teams evaluated their work. Field notes were kept during the period

of the project, which was later analysed for the prevalence of social loafing in the knowledge management project, yet this was, in fact, not what was observed. Evaluation was observed at two levels within the project: evaluation of the team by others, and the self-evaluation by the team of their work. These were seen in two major aspects of both projects:

- The evaluation of and by the teams through bug reports
- The evaluation of and by the teams through reviews of the work done

#### **4.1 Evaluation of the team through bug reports**

Fixing bugs, and the evaluation of this work, was handled differently in both projects. The telecommunications team worked within the company process of PR (Problem Report) lists. The team had a list of PR's, based on their project, which was maintained centrally by the project management office; the project management office had overall responsibility for multiple projects within the company. As such, they monitored the team for the number and severity of PR's; each PR was assigned to an individual developer who was the assigned "owner" of the relevant code or feature. This was due to existing processes in the company, prior to the team adopting Agile, but was not used to evaluate individuals. The Quality group within the organisation was supportive of the team's adoption of the Agile philosophy of collective ownership, yet still maintained PR lists against individuals as this was the policy in the other, non-Agile, teams in the company; the quality group, though, agreed with the principle of PR's being the responsibility of the team as a whole.

Despite agreement from the Quality group that individual evaluation of PR numbers against individuals was a formality rather than a process for the team, it appeared to have a different affect than intended. The PR list contained all PR's for the team and the principle agreed by the team was that any developer could fix any PR. It was accepted that certain PR's were better fixed by certain individuals, but on average this would still have been spread evenly across the developers. Over the timeframe of the research, it became clear from monitoring the list, which the researcher was given access to, that the principle of collective ownership was not strictly adhered to. The norm throughout the project was that developers fixed the PR's that were listed against their name. Developers did fix PR's assigned to other team members, but this was the exception rather than the norm. If a developer was on holiday, sick, or temporarily unavailable, another team member would take the PR and work on it. There was no formal, or informal, rule as to when to work on another's PR, but the developers themselves were aware of when their colleagues were unavailable and took ownership.

It was initially unclear as to why the developers only took on another's PR if they were absent. They were willing to cover an absent colleague, yet not to take collective ownership at other times. It became clear, over time, that the team manager was having an impact. When the project management office queried the team, through the team manager, about the number of PR's, the team manager used the list to determine who to ask about an individual PR. Even though technically there was collective ownership of all PR's, having names assigned to PR's directed the team manager to each individual. As this happened regularly throughout the project, the developers came to recognise that the only time they would be evaluated on a PR was when their name was assigned to it (even if the naming was only a formality). The team manager was asked about this and he seemed genuinely unaware of what he was doing. He accepted the concept of collective ownership and merely used the names in the PR list as a simple way of finding out what was happening with a PR. This ultimately led to a form of social loafing within the team, even if it was not at a conscious level. It was relatively easy to "hide behind" the PR list rather than take collective ownership. The developers felt that the only evaluation of their work on PR's was based on the list with names assigned (even though the name on the list was a formality).

The Knowledge Management team had a different approach to the evaluation of the bug list. This listed bugs in the code, yet was not assigned individually against a developer. Bugs were, in general, fixed by whichever developer was available at the time. On occasion, certain bugs were informally assigned to a particular developer as they would have been assumed to have been the expert in the particular area. There were no formal rules as to when this assignment would occur, and was generally based on a developer requesting help, as was seen in the following conversation.

*Developer 1: Did you write the code that checks for valid input into this function.*

*Developer 2: Yes, I wrote that.*

*Developer 1: Can you explain how this section works as there is a bug in it I am looking at.*

*Developer 2: Actually I will take that. I think I know what the problem is.*

Conversations, such as this, were common and lead to different developers concentrating on different areas of the code, but it did not restrict others from working problems in those areas. An interview with the tester confirmed observations that the bug fixing load was fairly spread amongst the team. He acknowledged that developers worked bugs that they themselves did not “own” and even volunteered to take work from a team member who appeared overloaded. The tester mentioned that this was because the developers did not want to let the team down by not taking their fair share of bug fixing work. At meetings, where bugs were discussed, individual developers were not associated with a PR. The project manager discussed the bugs with all team members and asked for information from the whole team as opposed to individuals. It was clear to all developers, and the project manager in many cases, who “owned” the PR, but the team, rather than the individual, was held responsible and evaluated as such. Over the period of the research, it was clear that, each developer took an equal share of responding to queries about bugs from the project manager. At times, certain developers seemed to have more input into these meetings, but this averaged out over the project.

Despite previous research suggesting that team based evaluation would lead to social loafing, the cohesion of the team mitigated against this and lead to the situation where allegiance to the team overcame tendencies towards loafing.

## **4.2 Evaluation of work through reviews**

The team members of the knowledge management project demonstrated that the collective ownership of the project did not have a detrimental effect. A specific example during the development of the graphical user interface highlights how the individual members of the team did not slack off (to use the term of Thomson (2003)). The project manager had a concern with the design of the graphical user interface. At an informal meeting where the team evaluated their work, the team gathered to evaluate the design of the graphical user interface. If social loafing had occurred, the developers could have “hidden” within the group as the GUI was developed by the entire team – collective ownership. Rather than hiding within the group, one developer demonstrated a degree of ownership of the GUI by disagreeing quite forcefully with the opinion of the project manager. There was no need for this developer to “stand out from the crowd” as he was not the sole owner of the GUI, yet he did so. Further to this, the other developers in the team joined in the defence of the GUI. Each developer defended the GUI as a collective, rather than individuals hiding within the group. The argument itself was quite forceful, with raised voices, and continued for nearly an hour. When asked about this disagreement, a few days after the event, one developer said that he felt that “our work was being called into question.” It is interesting to note the use of the word “our” as it highlights that the team defended the work of all the team members during the evaluation. Analysis of the field notes showed further examples of this “team defence”, although the GUI incident above was the most vociferous argument – other disputes tended to be more amicable. This collective defence also highlights a high degree of cohesion among the team members. The knowledge management project team should have shown signs of social loafing, due to the evaluation of the team rather than the individual and the high cohesion of the team, yet the team demonstrated what would be better defined as social facilitation rather than social loafing. Rather than demonstrating that a team adopting an agile philosophy will be inclined towards social loafing during an evaluation of their collective work, the observations demonstrated the opposite.

It was anticipated at the start of this research that social loafing would be limited in the telecoms by the presence of individual versus group evaluation (as was required by company processes and standards). Added to this was the lower cohesion in the telecommunications project team that also should have reduced the likelihood of social loafing. It should be noted that that this team was a cohesive team, it simply did not have as much autonomy as the first team. Again, the observations, and interviews with key informants, did not show a reduction in social loafing as expected. Code reviews were highlighted as a potential example of social loafing when it was suggested by the author that there should be group ownership of the code reviews, which is more in line with the agile philosophy. Traditionally, code reviews assisted a particular developer, but problems with the code were evaluated against this individual rather than the team. The response to the suggestion of group ownership of code reviews was met with extreme disapproval. The author, in a team meeting, made

the suggestion and the project team members shouted down the suggestion. Based on their response to the suggestion, the team leader immediately dropped the idea. The author, though, noted the response and further investigated the code review process.

Social loafing was quite apparent in this process (and was quite probably the reason why the team members did not want to change the process.) While the team always assisted the developer who would be evaluated on the code, their assistance was limited to the duration of the code review. It was noted that the responsible developer's colleagues rarely read the code before the meeting – most could clearly be seen reading the code and marking problems during the meeting. They were assisting their colleague but only to the extent that they had to. Their role was to evaluate the work and provide feedback and suggestions to their colleague, which they did, but as their work prior to the review was not seen, it was not a whole-hearted effort. A team lead, or technical lead, would often be in attendance at a code review so the developer's colleagues performed what was required of them at the review. They were in effect being evaluated on their performance at the review, by the team lead, so they performed as expected during the review (in fact the work in these reviews was often exceptionally good). As their work prior to the review was not seen (and therefore not evaluated), they did not appear to put in the work beforehand.

What was significant were the responses from the two key informants on this observation. The developer informant agreed that he, and his colleagues, "slacked off" from the work before the code review. Interestingly, though, the second key informant – the team leader – was not actually evaluating the team during the code review, as he was himself guilty of the team's crime. The team leader admitted that he too was busy reading and analysing the code during the review, as he had not read the code before the review. He had not noticed that the majority of the team were doing the same.

A further example of loafing was seen in the telecommunications team and, again, it was related to processes. The team leader key informant admitted that he was influenced by his discussions with the author on social loafing and became more aware of it in his team. An observation made by the team leader was that he noticed that the developers sometimes "hid behind" the company processes. The developers sometimes (and he stressed sometimes) used the company's processes as a method of avoiding evaluation. If a developer was late in delivering some required functionality, the company's processes could be blamed. The team leader described this as akin to the statement "I was only following orders." Although existing research on social loafing does not mention process compliance as a factor, this "process loafing" does appear to be having a similar impact as social loafing. Pugh (1993) made a similar observation when describing the dynamics of organisations. Pugh found that, in some cases, processes that are used to evaluate and ensure uniformity of performance can create a tendency to hide behind the rules.

## **5. Conclusions and recommendations for future research**

This paper does not posit that the use of Agile software development methodologies are the panacea for the social problems that occur in development team evaluation and self-evaluation. Nor does it posit that formalised standards and processes for evaluations will give rise to these social problems. The longitudinal aspect of the overall research (much of which lies outside of the domain of this paper) showed the benefits and problems with both formalised and Agile approaches. What is clear, though, is that they can have an impact on social loafing, and the effectiveness of evaluations of, and self-evaluations by, the team. Again, the use of the word "can" is important. It is impossible, even with the benefits of longitudinal research, to make generalisations from two case studies. We restrict our findings to state that the choice of a formal or an Agile approach can impact the incidences of social loafing in evaluations and self-evaluations. The two main findings of this paper are:

- A highly cohesive software development team, with a sense of ownership of their work, is less likely to demonstrate social loafing. The Agile software development methodologies promote this cohesion and sense of ownership. This leads to more effective self-evaluation of work within the project.
- Individual monitoring and evaluation of software developers can have a negative impact on the team. Previous research predicts that individual, versus group, evaluation will lower social loafing. What was actually found was that individual evaluation allowed those not the focus of the evaluation to engage in social loafing. The Agile software development methodologies advocate the evaluation of the entire group as a unit.

Based on these two findings, how teams are evaluated and how they evaluate themselves are impacted by the use of Agile methods. The use of Agile allows for better evaluations by the team of their own output. Conversely, how a team is evaluated is also impacted by the use of Agile. Evaluation of the team, as opposed to the individual, reduces the ability to hide within the team.

The Agile philosophies of empowerment and group ownership appear to be overcoming a tendency towards social loafing during evaluations. The team that fully adopts an Agile philosophy tend to work better as a unit by supporting each other rather than hiding within the group. The ability to remain anonymous within the group (a diffusion of responsibility) appears to be mitigated by the cohesion of the group. Landy and Conte (2003) argue that a lack of monitoring can lead to social loafing. While the Agile methodologies may appear to have a lack of monitoring and evaluation of the individual, Barker (1988) does provide an explanation. Although not addressing social loafing, Barker notes how the social control exerted by a self-managing and self-evaluating team can exert a greater level of control over an individual than the traditional command and control management structure. Development processes that strive to ensure adherence, by monitoring and evaluating the individuals in a software development team, do not appear to be as effective at eliminating social loafing as the Agile philosophy of empowerment and collective ownership. So how we evaluate our work, and how others evaluate us, is impacted positively by the cohesive and empowered teams espoused by Agile. For those managers ultimately responsible for evaluating developers and their work, the move to empowering the team and evaluating the team collectively, can bring positive benefits to a project.

## References

- Abrahamsson, P., Salo, O., Ronkainen, J., and Warsta, J. (2002) *Agile software development methods. Review and analysis*, VTT Publications. Finland.
- Argyle, M. (1989) *The social psychology of work*, Penguin Books, Middlesex, England.
- Asch, S. (1952) *Social Psychology*, Prentice-Hall, NJ, USA.
- Auer, K., Meade, E., and Reeves, G. (2003) The rules of the game. In Maurer, F., Wells, D. (eds) *Extreme programming and agile methods – Xp/Agile universe 2003*. New Orleans, Springer-Verlag. Berlin, Germany, pp35-42.
- Bahli, B., and Buyukkurt, M. (2005) Group performance in information systems project groups: An empirical study. *Journal of Information Technology Education*. Volume 4. pp97-113.
- Barker, J. (1988) Tightening the iron cage: Concertive control in self managing teams. In Van Maanen, J. (ed) *Qualitative studies of organizations*, Sage Publications. CA, USA, pp126-158.
- Baron, R., Kerr, N., and Miller, N. (1999) *Group process, group decision, group action*. Open University Press. Buckingham, UK.
- Boehm, B., and Turner, R. (2003) Rebalancing your organizations agility and discipline. In Maurer, F., and Wells, D. (eds) *Extreme programming and agile methods – Xp/Agile universe 2003*. New Orleans, Springer-Verlag. Berlin, Germany, pp1-8.
- Brooks, C., and Ammons, J. (2003) Free riding in group projects and the affects of timing, frequency, and specificity of criteria in peer assessments. *Journal of Education for Business*, Volume 78, No. 5, pp268-272.
- Burgess, R. (1982) Some role problems in field research, In Burgess, R. (Ed) *Field research: A sourcebook and field manual*, George Allen and Unwin Publishers, London, UK, pp45-49
- Clancy, B. (2002) Are there real benefits from TL9000. *Quality Times*, Volume 1, No. 3, pp7-9.
- Clutterbuck, P., Rowlands, T. and Seamons, O. (2009) A case study of SME web application development effectiveness via Agile methods, *Electronic Journal of Information Systems Evaluation*, Volume 12, Number 1, pp13-26.
- Cockburn, A. and Williams, L. (2001) The costs and benefits of pair programming, In Succi, G. and Marchesi, M. (Eds) *Extreme Programming examined*, Pearson Education, NJ, USA, pp223-243.
- Cohn, M. (2004) *User stories applied for agile software development*. Addison-Wesley. MA, USA.
- Domino, M., Collins, R., Hevner, A. and Cohen, C. (2003) Conflict in collaborative software development, 2003 SIGMIS Conference on Computer Personnel Research ACM Press, Philadelphia, USA, pp44-51.
- Ezey, P. (2003) Integration and its challenges in participant observation. *Qualitative Research*, Volume 3, Issue 2, pp191-205.
- Fagan, M. (1999) Design and code inspections to reduce errors in program development, *IBM Systems Journal*, Volume 38, No. 2-3, pp258-287.
- Fetterman, D. (1991) A walk through the wilderness: Learning to find your way, In Shaffir, W. and Stebbins, R. (Eds) *Experiencing fieldwork: An inside view of qualitative research*, Sage Publications, CA, USA, pp87-96.
- Finnegan, P., and Murray, J. (1999) Managing IS Staff: The key to improved systems development. in Adam, F., and Murphy, C. (eds) *A managers guide to current issues in information systems*, Blackhall Publishing, Dublin, Ireland, pp 91-103.
- Fitzgerald, B., Hartnett, G. and Conboy, K. (2006) Customising agile methods to software practices at Intel Shannon, *European Journal of Information Systems*, Volume 15, No. 2, pp200-213.
- Glass, R. (2003) *Facts and fallacies of software engineering*, Pearson Education, MA, USA.

- Gurney, J. (1991) Female research in male-dominated settings: Implications for short-term versus long-term research, In Shaffir, W. and Stebbins, R. (Eds) *Experiencing fieldwork: An inside view of qualitative research*, Sage Publications, CA, USA, pp53-61.
- Hazzan, O., and Tomayko, J. (2003) The reflective practitioner perspective in extreme programming in Maurer, F., and Wells, D. (eds) *Extreme programming and agile methods – Xp/Agile universe 2003*. New Orleans, Springer-Verlag, Berlin, Germany, pp51-61.
- Hazzan, O., and Tomayko, J. (2004) Human aspects of software engineering. in Eckstein, J., and Baumeister, H. (eds) *Extreme programming and agile processes in software engineering. 5th International Conference*. Germany, Springer-Verlag, Berlin, Germany, pp303-311.
- Highsmith, J. (2004) *Agile project management*. Pearson Education. MA, USA.
- Holloway, I. and Todres, L. (2003) The status of method: flexibility, consistency and coherence, *Qualitative Research*, Volume 3, No. 3, pp345-357.
- Jasperson, J., Sambamurthy, V. and Zmud, R. (1999) Social influence and individual IT use: Unraveling the pathways of appropriation moves, *20th International Conference on Information Systems Association for Information Systems*, North Carolina, pp113-118.
- Jones, S. and Hughes, J. (2003) An exploration of the use of grounded theory as a research approach in the field of IS Evaluation, *Electronic Journal of Information Systems Evaluation*, Volume 6, Number 1.
- Jones, P. and Roelofsma, P. (2000) The potential for social contextual and group biases in team decision-making: biases, conditions and psychological mechanisms. *Ergonomics*, Volume 43, No. 8, pp1129-1152.
- Jorgensen, D. (1989) *Participant observation: A methodology for human studies*, Sage Publications. CA, USA.
- Kumar, N., Stern, L. and Anderson, J. (1993) Conducting inter organizational research using key informants, *Academy of Management Journal*, Volume 36, No. 6, pp1633-1651.
- Landy, F., Conte, J. (2004) *Work in the 21st century*. McGraw-Hill, NY, USA.
- Liden, R., Wayne, S., Jaworski, R. and Bennet, N. (2004) Social loafing: A field investigation, *Journal of Management*, Volume 30, No. 2, pp285-304.
- Martin, R. (1991) Working in groups. in Smith, M (ed) *Analysing organisational behaviour*. Macmillan Press. London, UK. pp154-177.
- Martin, R. (2003) *Agile software development. Principles, patterns, and practices*. Prentice Hall. NJ, USA
- Martin, A., Biddle, R., and Noble, J. (2004) When XP met outsourcing in Eckstein, J., and Baumeister, H. (eds) *Extreme programming and agile processes in software engineering. 5th International Conference*. Germany. Springer-Verlag, Berlin, Germany, pp51-59.
- Mulvey, P., Klein, H. (1998) The impact of perceived loafing and collective efficacy on group goal processes and group performance. *Organizational Behaviour and Human Decision Processes*. Volume 74, No. 1. pp62-87.
- Nelson, S. and Schumann, J. (2004) What makes a code review trustworthy?, *Proceedings of the 37th Annual Hawaii International Conference on System Sciences*, Hawaii, IEEE, NJ, USA.
- Nunamaker, J., Briggs, R., Mittleman, D., Vogel, D. and Balthazard, P. (1997) Lessons from a dozen years of group support systems research: A discussion of lab and field findings, *Journal of Management Information Systems*, Volume 13, Number 3, pp163-207.
- Pearce, C., Ensley, M. (2004) A reciprocal and longitudinal investigation of the innovation process: The central role of shared vision in the product and process innovation teams. *Journal of Organizational Behaviour*, Volume 25, No. 2, pp259-278.
- Pugh, D. (1993) Understanding and managing organizational change. in Mabey, C., and Major-White, B. (eds) *Managing change*. Second edition, Paul Chapman Publishing, London, England, pp108-112.
- Rising, L. and Janoff, S. (2000) The scrum software development process for small teams, *IEEE Software*, Volume 17, No. 4, pp26-32.
- Robbins, H., and Finley, M. (1998) *Why teams don't work*. Orion Publishing. London, England.
- Robinson, H., and Sharp, H. (2004) The characteristics of XP teams. in Eckstein, J., and Baumeister, H. (eds) *Extreme programming and agile processes in software engineering. 5th International Conference*. Germany, Springer-Verlag. Berlin, Germany, pp139-147.
- Rodgers, T., Vogel, D., Purdin, T. and Saints, B. (1998) In search of theory and tools to support code inspections, *Proceedings of the 31st Hawaii International Conference on System Sciences*, Hawaii, IEEE, NJ, USA, pp370-378.
- Sawyer, S., Guinan, P. (1998) Software development: Processes and performance. *IBM Systems Journal*, Volume 37, No. 4, pp552-569
- Schuh, P. (2004) *Integrating agile development in the real world*. Delmar Thomson Learning, NY, USA
- Schwartzman, H. (1993) *Ethnography in organizations*. Sage Publications, CA, USA.
- Schwenk, C. (1985) The use of participant recollection in the modelling of organizational decision processes, *Academy of Management Review*, Volume 10, No. 3, pp496-503.
- Spradley, J. (1980) *Participant observation*. Holt, Rinehard, and Winston. NY, USA.
- Thompson, L. (2003) Improving the creativity of organizational work groups. *Academy of Management Executive*, Volume 17, No. 1, pp96-111.
- Triplett, N. (1897) The dynamogenic factors in pacemaking and competition, *American Journal of Psychology*, Volume 9, Number 4, pp507-533.
- Turk, D., France, R. and Rumpe, B. (2005) Assumptions underlying Agile software development processes, *Journal of Database Management*, Volume 16, No. 4, pp62-87.

- Van Fenema, P. (1997) Coordination and control of globally distributed software development projects: The GOLDD case, *8th International Conference in Information Systems Association for Information Systems*, Atlanta, pp474-475.
- Wastell, D. (1999) Learning dysfunctions in information systems development: overcoming the self defences with transitional objects, *MIS Quarterly*, Volume 23, No. 4, pp581-600.
- Whitworth, E. and Biddle, R. (2007) The social nature of agile teams, *Proceeding of Agile 2007*, Washington DC. pp26-26.
- Williams, K., Karau, S., and Bourgeois, M. (1993) Working on collective tasks: Social loafing and social compensation. in Hogg, M., and Abrams, D. (eds) *Group motivation: Social psychological perspectives*. Harvester Wheatsheaf, Hertfordshire, UK, pp130-148.
- Zajonc, R. (1968) Social facilitation. in Cartwright, D., and Zander, A. (eds) *Group dynamics*. Harper & Row Publishers. NY, USA, pp63-73.



# Evaluating the Performance of Electronic Marketplaces: an Exploration of the Ownership Impact

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**Abstract:** In evaluating the performance of electronic marketplaces, research has focussed on the impact of factors such as IT, marketplace process design and competition. However, such research has neglected the impact of ownership upon electronic marketplace performance. This paper explores the issue of electronic marketplace ownership and contributes to the literature by revealing four distinct aspects of ownership of electronic marketplaces; investor structure, investor objectives, investor commitment and governance efficiency. Using a multiple case approach, the paper evaluates the performance of seven electronic marketplaces in order to determine the relationship between marketplace performance and ownership. The study reveals a multitude of investor objectives for their marketplace investment, broadly categorised as; transactional, financial or fear. The analysis reveals that investor objectives impact upon investor commitment levels with those investors interested in the transactional benefits of electronic marketplaces being most committed. Analysis also reveals that investor objectives impact upon how efficiently a marketplace is governed. Both investor commitment levels and governance efficiency in turn impact upon electronic marketplace performance in terms of the volumes traded on the electronic marketplace, electronic marketplace adoption levels and electronic marketplace revenues and profitability.

**Keywords:** electronic marketplace, performance evaluation and improvement, ownership, investor structure

## 1. Introduction

Researchers (Kumar & Van Dissel, 1996; Gallivan and Depledge, 2003; Howard et al. 2003; Fahy et al., 2007) note that organisations are motivated to introduce inter-organisational systems by the desire to reduce supply chain uncertainties and transaction costs, increase resource utilisation, and diffuse products and services into new markets. Taking an economic perspective, researchers (Galbraith, 1973; Malone et al., 1987; Clemons & Row, 1992) have noted that IT reduces co-ordination cost and transaction risk, and allows organisations to benefit from economies of scale. It is commonly acknowledged in the IS literature that IT reduces the buyer's costs associated with conducting market transactions, including searching for suppliers, information seeking, and negotiating contracts (Grover & Ramanlal, 1999; Choudhury and Karahanna, 2008). In particular, IT lowers the cost of acquiring information about prices and product characteristics (Smith et al., 2000). In addition, IT, through providing buyers with knowledge of the market, encourages competition among suppliers and facilitates buyers in obtaining the best price possible (Bakos, 1991; Dewan et al., 2007). Information technology also reduces the perceived complexity of products (Malone et al., 1987; Bakos, 1991), allowing buyers to search and compare complex products by providing information in a manner which is easy to interpret, thereby enabling buyers to switch among alternative suppliers in the market (Malone et al, 1987; Bailey et al., 2007). In addition, IT reduces asset specificity, enabling a broader range of customers to receive customised products (Grover and Ramanlal, 1991). Nevertheless, product customisation, enabled by IT networks, could allow sellers to exploit buyers, while increased outsourcing could reinforce a seller's monopoly by sustaining higher prices (Grover and Ramanlal, 1999; Bailey et al., 2007). In addition, open market structures could be exploited by suppliers to create captive buyer networks that can sustain higher prices (Grover and Ramanlal, 1999).

Given the focus in the literature on the respective benefits to buyers and sellers, it is not surprising that ownership and control of electronic markets and hierarchies was considered the same thing, and classified as being either buyer or seller biased (Malone et al., 1987). However, during the 1990s, researchers such as Bakos (1991), Hess and Keremer (1994) and Lee and Clark (1996) noted the increased number of third-party market makers which electronically co-ordinated inter-organisational activities. Such intermediaries are independently owned and use complex IT to aggregate market system knowledge and facilitate transactions. A key feature of such intermediaries, classified as electronic marketplaces (Dai & Kauffman, 2002; O'Reilly and Finnegan, 2005; Soh et al., 2006), has been poor performance and a high failure rate (Klueber et al. 2001 Soh et al., 2006; Son and

Benbasat, 2007), making evaluating and improving electronic marketplace performance an issue worthy of research (Corsten and Hofstetter, 2001; Soh et al., 2006). For the purpose of this research we build on the work of Dai and Kauffman (2002) and Soh and Markus (2002) to define an electronic marketplace as:

*“a revenue generating intermediary organisation that electronically provides value added communication, brokerage and integration services to buyers and sellers of direct and/or indirect products and/or services in specific horizontal or vertical markets by supporting basic market functions, meeting management needs for information and process support, and/or operating the required IS/IT infrastructure”.*

The ownership of such intermediaries has been widely discussed in the business press in conjunction with the success or failure of particular marketplaces. However, academic research on the ownership of electronic marketplaces is descriptive; focusing on an electronic marketplaces ownership structure (Lennstrand et al., 2001; Greiger, 2003) and bias (i.e. buyer, seller, neutral). Indeed, White and Daniel (2003) report a dearth of research that explores the ownership of electronic marketplaces in detail. In particular, in evaluating electronic marketplaces, the relationship between ownership and performance remains unexplored.

This paper uses a grounded theory approach to explore the relationship between the ownership of an electronic marketplace and its performance. Based on case studies of seven electronic marketplaces, it reveals that ownership is a multi-faceted issue consisting of investor's objectives and structure, investor commitment levels and governance efficiency. It demonstrates that investors' objectives and structure impact upon investor commitment levels and governance efficiency. Furthermore, it reveals that these two factors; investor commitment levels and governance efficiency, impact upon electronic marketplace performance, reflected through electronic marketplace adoption levels, volumes traded through electronic marketplaces and the electronic marketplaces financial performance.

## **2. Theoretical grounding**

The objective of this research is to explore the ownership issue in the evaluation of electronic marketplaces; specifically the relationship between ownership and performance. Given the dearth of existing research on this topic, a grounded theory approach was adopted. Urquhart (2001) notes that a misconception of the approach is that researchers do not review literature when seeking to build theory from the data. However, Strauss and Corbin (1990: 55) state that *“choosing the right literature in tandem with doing analysis one can learn much about the broader and narrower conditions that influence a phenomenon. However, any categories, hypotheses and so forth, generated by the literature have to be checked out against real (primary) data”*. Indeed Straus and Corbin (1990) believe that the interplay of reading the literature, analysing it, and then moving out into the field to research the phenomena, can yield an integrated picture and enhance the conceptual richness of the theory. This approach was adopted for the study by first considering existing theories of ownership and performance in the organisational theory and IS fields.

### **2.1 Conceptualising performance**

Given the view of an electronic marketplace as an organisational intermediary, we examined the concept of evaluating performance in the organisational literature. In this literature, higher performance implies an organisation is meeting its objectives (Otley, 1999). It also implies revenue growth (McNair et al., 1990; Norreklit, 2000), improved customer relationships (McNair et al., 1990; Kaplan and Norton, 1996), improved productivity among employees (McNair et al., 1990), and return to its owners (Brealey & Myers, 2003). In applying these concepts to this study, we consider electronic marketplace performance as:

*“the extent to which the electronic marketplace provides and improves value for its owners, how efficient it is in performing its tasks and meeting its objectives, while continuing to innovate, grow and expand”.*

The next task was to consider how performance could be evaluated. In the management literature, the balanced scorecard (Kaplan and Norton, 1992; 1996) is a well regarded performance model which integrates financial and non-financial measures. The scorecard translates the vision and strategy of a business unit into objectives and measures in four different areas: financial, customer, internal business process, and learning and growth perspectives. The financial perspective identifies how the company wishes to be viewed by its shareholders. The customer perspective determines how the

company wishes to be viewed by its customers. The internal business process perspective describes the business processes at which the company has to be particularly adept in order to satisfy its shareholders and customers. The organisational learning and growth perspective involves the changes and improvements which the company needs to realise its vision (Kaplan and Norton, 1996). While criticisms have been levelled at the balanced scorecard in relation to its usefulness as a strategic management tool (Norreklit, 1999), its consideration of both financial and non-financial perspectives proved to be a useful lens for evaluating electronic marketplace performance.

## **2.2 Conceptualising ownership**

It is evident that the issue of ownership has been used in the electronic marketplace literature to categorise electronic marketplaces based on ownership structure and bias, and has been shown to impact upon access to marketplaces. In relation to ownership structure, Lennstrand et al. (2001) argue that an electronic marketplace may be owned either by venture capitalists, a consortium of traditional companies within an industry, or a single company within an industry. In the context of those marketplaces owned by venture capitalists, they state that they are typically neutral as such parties have no specific loyalty to either buyers or sellers. They point out that a consortium ownership structure is built around a number of 'bricks and mortar' type organisations who come together and collaborate in order to establish a marketplace. They argue that such marketplaces have the transactions (the ability to put large volumes through the marketplace), but do not possess the technology. Finally, they state that in relation to bias, both the consortium and single company ownership structures, by their very nature favour either buyers or sellers. Researchers argue that ownership determines entry and promoted content. Kambil and Van Heck (1998), in relation to the traditional Dutch flower auctions, note that Dutch growers were able to refuse entry to non Dutch growers by the fact that they owned the marketplace. In the Dutch flower industry, a key factor in the emergence of Teleflower (an electronic marketplace) was the fact that Teleflowers' participants were not allowed engage in the traditional Dutch marketplaces at certain times of the year. Kambil and Van Heck (1998: 17) agree that "*the emergence of Teleflower could probably have been avoided if the buyers had an ownership stake and greater influence in the traditional Dutch auctions*". In this case, the ownership structure of these marketplaces meant that the owners of the traditional Dutch auctions voted to deny access to foreign growers (Kambil and Van Heck, 1998).

## **3. Data gathering and analysis**

The unit of analysis for this study was the individual marketplace, studied as part of a multiple case study strategy. 'A case study examines a phenomenon in its natural setting, employing multiple data collection methods to gather information from a few entities. The boundaries of the phenomenon are not clearly evident at the outset of the research and no experimental control or manipulation is used' (Benbasat et al., 1987). The case study approach is one of the most commonly used research methods in the information systems field (Benbasat et al., 1987; Eisenhardt, 1989; Darke et al., 1998). It aims to obtain an in-depth understanding of the phenomenon and its context (Cavaye, 1996). Case studies enable researchers to investigate pre-defined phenomena without explicit control or manipulation of any variables (Yin, 1994; Cavaye, 1996; Darke et al., 1998). They serve to capture the reality and richness of organisational behaviour in detail (Galliers, 1992; Gable, 1994). Researchers such as Benbasat et al, (1987) and Eisenhardt (1989) argue that multiple case designs are desirable when the intent of the research is to build theory; as with this study. In particular, Eisenhardt (1989) argued that constant comparison across cases, obtaining data from numerous sources and reconciling this with the literature, presents the opportunity of creating new, novel theory. Furthermore, a multiple case design can help to ensure generalisation of research findings (Benbasat et al, 1987), replicability (Darke et al., 1998) and prediction (Benbasat et al., 1987; Darke et al., 1998), thereby strengthening research.

Seven electronic marketplaces were selected for this study. Marketplaces were selected using the directory of electronic marketplaces provided by emarketservices ([www.emarketservices.com](http://www.emarketservices.com)), an independent body involved in promoting electronic marketplaces, approved and funded by the European Union. Four of the marketplaces studied; BTTransact, IBX, Eutilia and Proceedo were rated by emarketservices as being among the top 20 marketplaces worldwide. A three phase data gathering strategy was adopted. Phase one involved the researchers conducting a thorough archival search to determine the existence of public domain material on each of the study sites. Phase two incorporated an onsite visit to interview marketplace personnel. Phase three consisted of follow up

interviews in order to clarify specifics and verify the analysis. A brief overview of each marketplace together with the personnel interviewed is presented in table 1.

**Table 1:** Marketplaces and personnel interviewed

Marketplace	Overview	Interviewees
BTTransact	Indirect Goods to the British and Irish market	Senior Manager , Manager
Comdaq	Operates in numerous commodities markets including (coffee, cocoa, metals etc)	Chairman, Director
Dealcotton	Trading of raw cotton for international buyers and sellers.	President and CEO, Head of Business Development, Chief Financial Officer, Director CIS operations, Chief Communications Officer
Eutilia	Sourcing of goods for buyers which operate in the European utilities sector	Chief Executive Officer, System Delivery Programme manager, Chief commercial officer, Auction manager, Business analyst, Chief Financial Officer
Globalcoal	Operates both physical and financial markets for the trading of coal on international markets	Chief Executive Officer, Chief Operations Officer, Chief Technology Officer
IBX	Facilitates trading of indirect goods for customers who operate in the Nordic market	Chief Communications Director.
Proceedo	Facilitates trading of indirect goods for customers who operate in the Nordic market	Chief Executive Officer, Vice President, 2 Project Managers

Content analysis was undertaken using grounded theory coding techniques proposed by Strauss and Corbin (1990) and exemplified by the work of Orlikowski (1993) and Urquhart (2001). This approach necessitates the researchers to be immersed in the data (Glaser and Strauss, 1967) and to draw on existing theoretical knowledge without imposing a theory (Corbin and Strauss, 1990; Urquhart, 2001). It thus encourages the researcher to be flexible and creative (Sarker et al., 2000) while imposing systematic coding procedures (Strauss and Corbin, 1990). The first step (open coding) involved the data being examined 'line by line' to ascertain the main ideas. Each idea deemed to be important was highlighted in the transcript and given a unique identifier, with a suffix appended to the code to indicate the interviewee. These ideas were then grouped by meaningful headings to reveal categories and sub-categories/properties, with suffixes added to the code to indicate subsequent passes through the data. The next step (axial coding) is the process of determining hypotheses about the relationships between a category and its subcategories e.g. conditions, context, action/interaction strategies and consequences. At this stage, memos and integrative diagrams (cf. Urquhart, 2001) were used to help structure the process and to combine the threads of the emerging analysis. The focus then turned to the data to assess the validity of these hypothesised relationships. Relational and variational sampling (cf. Strauss and Corbin, 1990) was used to select data for this analysis. This process continued in an iterative manner and resulted in the modification of categories and relationships. Finally, selective coding was undertaken to identify the relationships between categories using hypothesised conditions, context, strategies and consequences. Discriminate sampling (cf. Strauss and Corbin, 1990) was used to select data to examine strong and weak connections between categories. The issues of trustworthiness (validity) and replicability (reliability) (cf. Denzin and Lincoln, 2000) were addressed as follows. First, the data analysis approach utilized a rigorous coding and memoing processes providing an audit trail of the process by which conclusions are reached. Second, the coding was undertaken by one of the researchers and verified by the other. Third, venting (cf. Goetz and LeCompte, 1984) was used as results and interpretations were discussed with key informants.

#### **4. Findings**

A chronological presentation of the ownership structures of each electronic marketplace is presented in table 2, with an overview of marketplace performance in table 3<sup>1</sup>. Analysis revealed that ownership issues only impact upon electronic marketplace performance in two of four performance evaluation categories derived from the balanced scorecard concept; financial and customer. Therefore, the performance figures presented in table 3 refer only to these performance categories. Analysis revealed four distinct aspects to electronic marketplace ownership; investor structure, investor

<sup>1</sup> Since the study was conducted, the following marketplaces ceased to trade: DealCotton (2006), Eutilia (2006) and BT Transact (2007)

objectives; investor commitment levels and governance efficiency. These aspects are now considered.

**Table 2:** Chronological overview of electronic marketplaces ownership

Marketplace	Ownership
BtTransact	Founded in 2000. 100% of share capital is owned by British Telecom (BT).
Comdaq	Since its foundation in 1999, Comdaq has been privately owned by an entrepreneur.
Dealcotton	Founded in 2001, initially 100% owned by Dealcottononline 2002: Changed owners, and now 100% owned by Cotton US <sup>2</sup>
Eutilia	Founded in 2001, by 11 of the leading utilities (buyers) in the European utilities market. Change in 2004 with a reduction in the number of investors to 6.
Globalcoal	Founded in 2001 and owned by 8 of the largest players involved in the coal market (4 producers and 4 consumers)
IBX	Founded in 2001 by Ericsson and SEB. Novo Nordisk became an investor in 2002
Proceedo	Founded in 1998: Original investors included the management team 1999- 2000: 100% owned by Investor AB 2001- Kinnevik Group through its subsidiary Tele2

**Table 3:** Overview of performance

Marketplace	Financial Aspects	Customer Aspects
BtTransact	Turnover increased from £400k in 2000 to £5m in 2004. Net loss reduced from £1.2m in 2000 to 900k in 2004.	No of buyers and suppliers remained fairly static throughout this period
Comdaq	Operating loss increased from £20,000 in 2000 to £70,000 in 2004 <sup>3</sup> .	No of trades remained relatively static at around 20 per annum between 2000 and 2003
Dealcotton	Turnover increased by over 75% between end 2001 and 2004.	Commissions increased from \$125,000 at end of 2001 to \$1.375m in 2004. Volumes increased from 50,000 bales in 2000 to 850,000 in 2004. No of participants increased from 4 at end of 2001 to 25 in 2004.
Eutilia	Net loss decreased from approx €15m in 2002 to €2m in 2004.	Number of active buyers increased from 24 in 2003 to 300 in 2004
Globalcoal	Turnover increased by £1m between 2001 and 2003.	Operating loss decreased by approx. £300,000 during this period. Tonnage traded on the physical and financial markets remained relatively static
IBX	Revenue increased by over 50M (Swedish Kroner) between 2001 and 2004. From an operating loss of 100M Swedish Kroner in 2001, IBX expect to breakeven by mid 2005.	The number of transactions increased by approx 150% between 2002 and 2004. The number of buyers utilising IBX increased from 4 at end of 2001 to 30 by 2004, the number of suppliers from 33 in 2001 to over 500 in 2004.
Proceedo <sup>4</sup>	Revenues have increased from 1.8 m Swedish Kroner in 1999 to almost 20m by 2004. Operating losses decreased dramatically between 2000 and 2004.	No of buyers increased from 2 in 1999 to 74 in 2004. No of suppliers has increased from 3 in 1999 to 1200 in 2004. No of transactions has increased by approx. 200% year on year since 2001.

#### 4.1 Investor structure and objectives

Investor structure refers to the ownership structure implemented by marketplaces (whether it is owned by a single organisation or a consortium), and investors background, i.e. are they buyers, sellers, or entrepreneurs. Investor's objectives refer to the reasons why participants invest in the marketplace. A consortium-based ownership structure was adopted by all marketplaces studied, except BTTransact, Comdaq and Proceedo. Electronic marketplace designers believed that an investor structure, comprising large organisations who are key players in the target market, would help guarantee success. This theme is emphasised by Eutilia's Systems Delivery Programme Manager who maintained that the consultants and management team that designed Eutilia believed that being

<sup>2</sup> Cotton US is a company whose owners are the Texuna Group and entrepreneurs (Thomas and Douglas Bell).

<sup>3</sup> Approximate figures. Not verified by Comdaq staff.

<sup>4</sup> Approximate figures. Not verified by Proceedo staff

backed by eleven of the largest utilities in Europe (with a potential €20 billion market) would “*guarantee its success*”. However, the consultants who designed Eutilia did not question the rationale for these utilities’ investment decisions or their expectations. Investors were not asked if they accepted and understood Eutilia’s role in the market. Similarly, four of the largest producers and four of the largest consumers of coal in the world invested in Globalcoal, thereby opening up to Globalcoal a potential “*multi-billion pound market*” (Globalcoal’s President). As with Eutilia, investors had a limited amount of input into the marketplaces value proposition. This resulted in investors having a wide range of investment objectives and expectations. Such objectives can be categorised as: financial, procurement, and the risk of being ‘left out’.

Financial objectives refer to instances where an investor’s key reason for investing in the electronic marketplace is the hope of making a substantial return on investment. Venture capitalists, Dealcottononline (Dealcotton) and Investor AB (Proceedo), were motivated by the prospect of financial returns on their investment. Thus, the respective marketplaces were expected to perform well from a financial perspective in order for profits to be distributed to investors. However, due to poor participant uptake, the performance of these marketplaces initially suffered (see table 3). Between 1999 and 2001, Proceedo was owned by the Investor AB Group, one of the largest venture capitalist organisations in the Nordic region with a substantial portfolio of organisations throughout Europe. Their objective for Proceedo was for it to grow as quickly as possible, expand throughout Europe and maximise the Return on Investment (ROI) for Investor AB. Proceedo reported significant financial losses in 1999 (3,548,000 Swedish Kroner) and 2000 (26,439,000 Swedish Kroner). As a result Proceedo was unable to distribute dividends to Investor AB. When launched in 2001 Dealcotton was 100% owned and governed by Dealcottononline, a venture capitalist organisation whose goal was to maximise their return on investment. Dealcotton suffered a loss of £1m in 2001. Only four participants were actively using Dealcotton and only 50,000 bales of cotton were traded, well below expectations. Such financial losses meant that money was not available to distribute to investors as dividends. Certain investors in BTTransact, Comdaq, Eutilia, Globalcoal and IBX wished to utilise their respective electronic marketplaces for procurement purposes. BTTransact was owned by British Telecom (BT) who wished to utilise BTTransact to meet their procurement needs for indirect goods. Much of the liquidity on Comdaq Metals market was due to certain investors utilising the marketplace for procurement purposes. IBX’s investors: Ericsson, SEB, Deutsche Post, Lufthansa, and Novo Nordisk were interested in utilising the electronic marketplace as the vehicle by which all their internal procurement was conducted. However, only some investors in Eutilia and Globalcoal used the respective marketplaces for procurement purposes.

Another key reason for electronic marketplace investment relates to the risk of being left out. This is illustrated in both Eutilia and Globalcoal. For example, once Globalcoal became operational, it soon emerged that the primary reason for many of their eight investors investing was the “*fear of being left out*” (Globalcoal’s CEO). Analysis also revealed that certain investors did not fully realise what the electronic marketplace would do for their business. Indeed, according to management in Globalcoal and Eutilia, particular investors believed that the design of the electronic marketplaces was not aligned with their interests. It was the perception of management that the transparency which Globalcoal brought to the coal market was perceived by producers (four of which were investors in Globalcoal) not to be in their best interests as it hindered them from getting the best deal possible. In addition, the aggregation and pre-qualification of suppliers by Eutilia was perceived as a threat to the jobs of personnel in the procurement departments of certain utilities that had invested in the marketplace.

## **4.2 Investors commitment levels**

Investor commitment level is defined as the level of commitment which an investor has in relation to actively utilising the electronic marketplace. The analysis revealed that investor objectives are reflected in investor commitment levels. Furthermore, the level of investor commitment impacts upon electronic marketplace performance; in terms of volumes traded, number of transactions, adoption levels, revenues and profitability. Overall, the greater the commitment levels among investors, the better the electronic marketplace performs.

Analysis revealed that the least committed grouping were those investors that were purely interested in financial gain. Investor AB took the decision in 2001 that they were no longer willing to support Proceedo and withdrew their financial support. This resulted in Proceedo being placed into administration, and brought about a change in ownership structure. Within a few weeks of being

placed into administration, Proceedo was bought out by one of Investor AB's key competitors: the Kinnevik group through its subsidiary Tele 2 AB, a leading pan European telecom company. Similarly, in the Dealcotton case, lack of financial return led to Dealcottononline abandoning their commitment to Dealcotton, which brought about a change in ownership. In late 2001, Dealcottononline sold Dealcotton to Cotton US for a nominal fee. For large organisations, the size of the investment necessary to become part of a consortium that owns an electronic marketplace, relative to the risk of being left out, is very small. Yet, such investors can be uncertain about both their investment and the fear of being left out. For example, Globalcoal's eight investors included four of the largest producers and four of the largest consumer's of coal worldwide. While each owned between 10% and 15% of Globalcoal's share capital, the size of the investment relative to the size of these organisations was small. Relatively speaking these organisations had not invested a lot of money in Globalcoal. For example, Globalcoal was set up for £3.5 million initially which its President stated is "*buttons really for organisations of this size and that's part of the issue. You got a company too small to register in their case*". This suggests that commitment levels were quite low. Similarly, Eutilia was initially set up and backed by eleven of the largest utility companies in Europe. While initial impressions would have one believe that this would lead to Eutilia being quite successful with a ready made market worth €20 billion, this did not happen. Five of the initial investors did not utilise Eutilia's services at all. Eutilia's Commercial Manager speculated that the reason why these organisations took a share in Eutilia without actively utilising their services was that for such large organisations the required investment (€8m) was very small in comparison to the risk of being left out. This lack of commitment meant that by late 2003, six of the founding members along with the Eutilia management team, decided that there needed to be a change in the investor structure. Eutilia's Commercial Manager stated that "*some investors were fed up with the incompetent nature of Eutilia*". A small number of the founding members agreed to buy out the other members; the resultant change in ownership structure led to a reduction in the number of investors from eleven to six.

In contrast, investors whose objective for their marketplace was procurement demonstrated high levels of commitment. Ericsson and SEB were the primary investors in IBX, investing €15 million in equity capital in 2000. The key to the success of the investor structure was reflected in the decisiveness and harmony amongst both Ericsson and SEB in relation to their objective for IBX. Both regarded IBX as important for procuring their indirect goods. They regarded their investment in IBX as long term and perceived IBX as aligned with their business strategies. Prior to the establishment of IBX, Ericsson had operated their own proprietary eprocurement solution for a number of years. Indeed, many senior personnel within IBX had been involved in designing and operating the Ericsson solution as they were employed by the company at the time. Ericsson believed that there were further efficiencies to be gained by getting other buyers involved. Hence, the association with SEB and the foundation of IBX. Both Ericsson and SEB were highly committed to utilising IBX. The key to the success of this investor structure was, according to IBX's Communications Director, that these parties are "*not only investors but customers as well*". Their understanding that further efficiencies could be realised through obtaining the commitment of other large organisations meant a further change in IBX's ownership structure. In late 2001, Novo Nordisk became the third significant shareholder in IBX, obtaining 10% of the share capital. Ericsson and SEB did not have a problem with the dilution of the ownership structure as their primary objective was to "*get revenues up and running and getting customers in*" (IBX's Communications Director).

#### 4.2.1 Investor commitment levels and impact upon electronic marketplace performance

The decision by an investor whether or not to utilise an electronic marketplace greatly impacts upon electronic marketplace performance. Electronic marketplace management have found that a successful mechanism for obtaining commitment from investors is to get these parties to sign commitment agreements. Commitment agreements mean that investors have a contractual obligation to commit specified volumes to the electronic marketplace for a specified period of time. Since its foundation, IBX's investors have been highly committed to actively using the marketplace and have all signed commitment agreements. IBX management believed these high levels of commitment to be crucial to its performance. Each investor signed a three year service level agreement with a firm rollout plan for a specified amount of that organisations' procurement spend. IBX's Communications Director stated that "*over 80% of revenues in the initial year were contracted volume from our shareholders, which was a very safe way of developing the company*". In 2001, with just four active buyers, Ericsson and SEB being two, IBX's revenue was 51 Million Swedish Kroner (table 3). Novo Nordisk (who became an investor in late 2001) signed a commitment agreement and actively used IBX for procurement. The commitment of these three investors was deemed to be instrumental by

IBX's Communications Director in further increasing adoption rates (among both buyers and suppliers), and improving the electronic marketplaces financial performance. According to IBX's Communications Director, the commitment of these investors was critical in increasing revenues from 51.7 MSEK in 2001 to 100 MSEK in 2003 and increasing the numbers of buyers (4 in 2001) and suppliers (33 in 2001) to 30 buyers and 500 suppliers in 2004.

Low levels of commitment among investors, reflected in low volumes traded by these investors through an electronic marketplace, impacts upon the marketplace's revenue and adoption levels. For the 2002 and 2003 financial years, Globalcoal had an operating loss of approximately £1m per annum. Globalcoal's President stated that *"if we could get these guys to put half of their uncommitted tons through us, we would have a totally different scenario in terms of our traded volumes and profitability"*. The importance of investor commitment agreements is further reiterated by Globalcoal's Chief Operating Officer who stated: *"the biggest single fault with the way that Globalcoal was initially set up was that there was no contractual market making obligation on the shareholders"*. This, he suggested, was a key reason why Globalcoal operated at a financial loss during this period and why volumes traded on its markets<sup>5</sup> were not higher. Eutilia recorded significant operating losses in the 2002 and 2003 financial years (€10m and €15m respectively). During this period, Eutilia's investors had not signed commitment agreements. The fact that five of Eutilia's investors were not committed to utilising the electronic marketplace for procurement purposes had a negative impact upon revenues and profitability and contributed to these losses.

The importance of investor commitment to electronic marketplace performance is further illustrated by the Proceedo case. Proceedo's performance suffered because they were not utilised initially by the Investor Group. When the Kinnevik Group took over ownership in 2001, the companies within the Kinnevik group, including Tele2AB, did not procure goods through Proceedo. This meant that Proceedo continued to operate at a financial loss and the predicted trading volumes and participant numbers did not materialise. Proceedo's President stated that *"the first question that every potential customer asks is why do Tele 2 AB not utilise your services?"* This impacted upon Proceedo's adoption levels and stifled growth. Proceedo's President insisted that it was crucial that Proceedo got Tele2 AB to commit in order to improve Proceedo's performance. In 2004, Tele2AB signed a commitment agreement to utilise Proceedo. Performance dramatically improved, as reflected in an increase in the number of suppliers utilising Proceedo.

The success of commitment agreements as a mechanism for ensuring high levels of investor commitment is supported by the evidence from Dealcotton's change in ownership in 2002. The new owners (US cotton) signed a commitment agreement which provided liquidity (in number of bales) to the Dealcotton marketplace. Dealcotton's previous owners, Dealcottononline, had no such agreement. This change helped contribute to a 600% increase in the number of bales traded through Dealcotton between 2001 and 2003, and a massive increase in revenues for Dealcotton. Comdaq's performance suffered because their owner was unable to put significant volumes through the electronic marketplace. This significantly hampered their financial performance. While BT did not sign a commitment agreement with BTTransact, it was BT's policy to utilise BTTransact for the entire organisation's indirect goods needs. BTTransact management stated that this commitment contributed to BTTransact's financial performance. To summarise, our analysis reveals that investor commitment levels impact upon electronic marketplace performance as illustrated in volumes traded, adoption levels and revenues.

### **4.3 Governance efficiency**

In the context of this study, governance efficiency refers to how efficiently decisions are made and consensus achieved by the electronic marketplace's Board in relation to business strategy. This section illustrates that investor's objectives for their electronic marketplace investment impact upon electronic marketplace governance efficiency, with electronic marketplace governance efficiency in turn impacting upon electronic marketplace performance. This was illustrated in the Eutilia, Globalcoal and IBX cases.

Both Eutilia and Globalcoal were owned by a consortium of investors. The governance structure was one where each investor voted a single representative onto the Board. There was evidence in both of

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<sup>5</sup> Electronic marketplaces may operate one or more electronic markets for various products where there is a distinct demand to do so.

these cases that a Director's agenda was predominately influenced by the investors which they represented. There were 11 members on Eutilia's board until 2003. Each investor nominated a single participant to the board. However, two groupings emerged centred around procurement objectives. Eutilia management believe that six of the eleven investor's main objective was to utilise Eutilia to meet their procurement needs. However, the other five were very indecisive. This impacted upon the commitment levels of all investors, with the first grouping (six investors) unwilling to fully commit to Eutilia while such indecisiveness existed among other investors. This resulted in a "*total lack of efficiency in relation to policy formulation...certain directors just sat there and did nothing...in many cases this very much reflected their investors' indecision in relation to their marketplace investment*" (Eutilia's Business Analyst). Investors' diverse range of agendas, communicated through their nominees on Eutilia's board, meant that there was much indecision in relation to policy formulation and decision making. Until the change in ownership in 2004, obtaining agreement among board members proved to be very difficult. The change in ownership structure came into effect in March 2004 and its impact at board level was quickly evident. With the reduction in the number of investors from 11 to 6, and the size of Eutilia's board being reduced by 5 members, governance efficiency and decisiveness improved. The Commercial Manager stated that "*decisiveness among investors... [was then] much better*". In particular, policy formulation became much more decisive. This was reflected in the decision to abandon transaction services<sup>6</sup> in 2004 and Eutilia's strategy to solely focus on its supplier optimisations service (SOS)<sup>7</sup>. Analysis revealed that this change had a positive effect on electronic marketplace performance. Revenues increased by over 30% between 2003 and 2004; the number of active buyers increased by over 200; the number of suppliers by over 2000; and Eutilia was operating at breakeven by late 2005.

This situation can be contrasted with IBX. In IBX, each investor also has a representative on the Board. However, there was agreement among investors in relation to their objectives for IBX. According to IBX's Communications Director there was "*consensus among investors, reflected at board level in relation to policy formulation for IBX*". This "*single mindedness is reflected in decisions (to get new investors involved for example)*" (IBX's President). This has greatly contributed to IBX's success in terms of getting organisations to adopt and utilise IBX.

These cases demonstrated that investor's objectives for their electronic marketplace investment impacts upon how efficiently the electronic marketplace is governed. The greater the consensus among investors in relation to their objectives, the more efficient the governance of the electronic marketplace. The analysis reveals that governance efficiency of electronic marketplaces impacts upon electronic marketplace performance in terms of trading volumes, adoption levels and revenues.

## **5. Conclusion**

As demonstrated by the poor performance and high failure rates associated with electronic marketplaces (cf. Klueber et al. 2001 Soh et al., 2006; Son and Benbasat, 2007), there is a need to improve understanding of evaluating and improving electronic marketplace performance. However, in evaluating the performance of electronic marketplaces, research has focussed on the impact of factors such as IT, marketplace process design and competition, while the relationship between ownership and performance remains unexplored.

This study has revealed four distinct aspects of the ownership of electronic marketplaces; investor structure, investor objectives, investor commitment and governance efficiency that are pertinent to evaluating the performance of electronic marketplaces. We conclude that investor objectives affect both investor commitment and governance efficiency, which in turn impact the performance of electronic marketplaces as reflected in trading volumes, adoption levels, revenues and profitability (Figure 1).

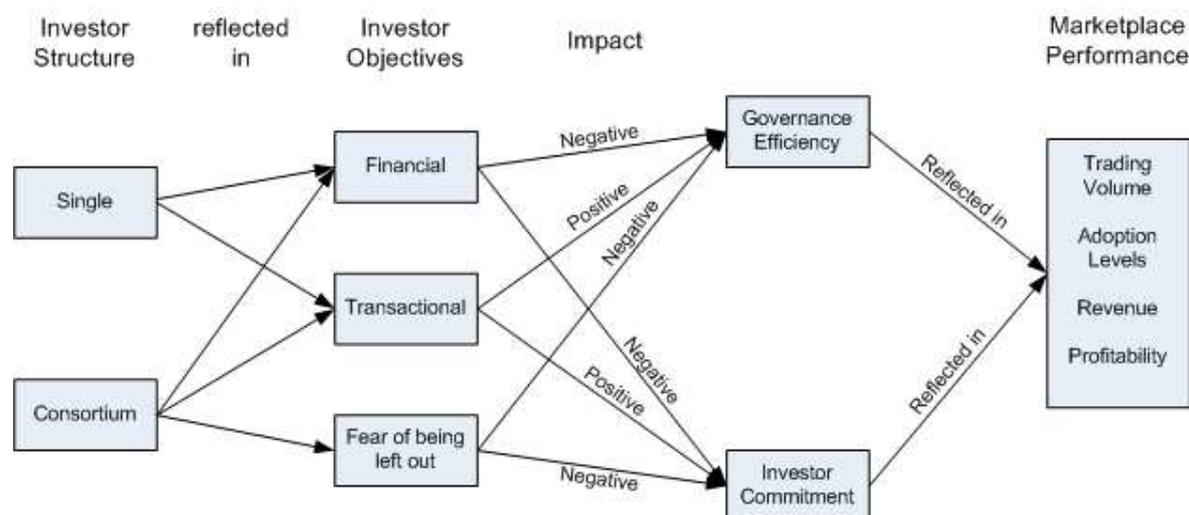
Investor objectives can be broadly categorised as; transactional, financial or fear. Investors interested in the transactional benefits of electronic marketplaces tended to be more committed to the success of the marketplace than those investors whose involvement was due to financial speculation or the

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<sup>6</sup> Transaction services enabled the fulfillment of electronic transactions using pre-negotiated prices and service levels set by trading partners in private catalogues.

<sup>7</sup> The SOS consists of four key components; supplier scan, pre-qualification, e-tendering and e-auctions.

fear of being left out. We conclude that a consortium ownership structure with a diverse range of investment objectives results in lower commitment levels across all investors. In general, it appears that investor commitment levels are at their highest when all investors in the marketplace wish to use the marketplace for transactional (procurement) purposes. The impact of investor commitment levels on performance is reflected in the volume of products traded through the marketplace, the number of transactions, adoption levels and marketplace revenues.



**Figure 1:** Impact of electronic marketplace ownership on performance

We conclude that investor objectives impact upon how efficiently a marketplace is governed. In particular, structures where investors have a broad range of objectives result in indecision in relation to policy formulation and decision making. However, in scenarios where there is accord among investors, in relation to utilising the marketplace for transactional purposes, strategy formulation and decision making is much more decisive. Governance efficiency affects performance as reflected in volumes traded, adoption levels and revenues. Indeed our analysis revealed that having a Board that's decisive, results in the marketplaces value proposition being continuously reviewed and in cases where resolute decisions were taken, increased volumes, increased adoption levels and improved revenues occurred.

Finally, this research study represents a suitable response to the call for research by White and Daniel (2003) on electronic marketplaces, and also contributes to parallel research on evaluating the success of electronic business and commerce (e.g. Singh and Byrne, 2005; Pather *et al.*2006). In particular, this study has provided a foundation for further study of ownership in the context of evaluating the performance of electronic marketplaces. However, it is exploratory in nature and the findings of this research study should be further tested in order to develop theory in this area.

## 6. References

- Bailey, J.P., Faraj, S. and Yuliang Y. (2007) The Road More Travelled: Web Traffic and Price Competition in Internet Retailing. *Electronic Markets*, vol. 17 No. 1, pp. 56-67
- Bakos, Y. (1991) 'A Strategic Analysis of Electronic Marketplaces', *MIS Quarterly*, vol.15, no.3, pp. 295-310.
- Benbasat, I., Goldstein, D.K., and Mead, M. (1987) 'The Case Research Strategy in Studies of Information Systems', *MIS Quarterly*, vol.11, no.3, pp. 369-386.
- Brealey and Myers (2003) *Principles of Corporate Finance*, Irwin/McGraw-Hill
- Cavaye, A. (1996) 'Case Study Research: A Multi-faceted Research Approach for IS', *Information Systems Journal*, vol. 6, pp. 227-242.
- Clemons, E. K., and Row, M. C. (1992) 'Information Technology and Industrial Cooperation: The role of changing Transaction Costs', *Journal of Management Information Systems*, vol. 9, no. 2, pp. 9-28.
- Choudhury, V. and Karahanna, E. (2008) "The Relative Advantage of Electronic Channels: A Multidimensional View" *MIS Quarterly*, vol. 32 no. , pp.179-200.
- Corsten, D. and Hofstetter, J.S. (2001) 'After the hype: The emerging landscape of B2B exchanges', *ECR Journal - International Commerce Review*, vol.1 no.1, pp. 50-59
- Darke, P., Shanks, G. and Broadbent, M. (1998) 'Successfully completing case study research: combining rigor, relevance and pragmatism', *Information Systems Journal*, vol. 8, pp. 273-289.
- Dai, Q and Kauffman, R. (2002) 'Business Models for Internet-Based B2B Electronic Markets' *International Journal of Electronic Commerce*, vol. 6, no. 4, pp. 41-72.

- Denzin, N.K. and Lincoln, Y.S. (2000) The Discipline and Practice of Qualitative Research. In Denzin, N.K. & Lincoln, Y.S. (Eds.) *Handbook of Qualitative Research*. Sage Publications, Thousand Oaks, CA.
- Dewan, R., Freimer, M. L. and Yabing J. (2007) 'A Temporary Monopolist: Taking Advantage of Information Transparency on the Web' *Journal of Management Information Systems*; vol. 24, No. 2, pp.167-194
- Eisenhardt, K. M. (1989) Building theories from case study research. *Academy of Management Review*, vol. 14, pp. 532-550.
- Fahy, M., Feller, J., Finnegan, P. and Murphy, C. (2007) 'Complexity and Context: Emerging Forms of Collaborative Inter-Organizational Systems' *Journal of Information Technology Theory and Application*, vol. 8 no.4, pp. 1-12.
- Gable, G. (1994) 'Integrating Case Study and Survey Research Methods: An Example in Information Systems', *European Journal of Information Systems*, vol. 3, no. 2, pp.112-126.
- Galbraith, J. (1973) *Designing Complex Organizations*. Reading, MA: Addison-Wesley
- Galliers, R.D. (1992) 'Choosing Information Systems Research Approaches', in *Information Systems Research: Issues, Methods and Practical Guidelines*, Galliers, R.D. (Ed.) Alfred Waller Ltd., Henley-on-Thames, pp.144-162.
- Gallivan, M. J. and G. Depledge, (2003) 'Trust, control and the role of interorganizational systems in electronic partnerships', *Information Systems Journal*, vol. 13 no. 2, pp. 159-192.
- Greiger, M. (2003) 'Electronic marketplaces: a literature review and a call for supply chain management research', *European Journal of Operational Research*, vol. 144, pp. 280-294.
- Grover, V. and Ramanlal P. (1999) 'Six Myths of Information and Markets: Information Technology Networks, Electronic Commerce and the Battle for Consumer Surplus', *MIS Quarterly*, vol. 23, no. 4, pp. 465-495.
- Goetz, J.P. and LeCompte, M.D. (1984) *Ethnography and Qualitative Design in Educational Research*. Harcourt Brace Jovanovich, New York, NY.
- Hess, C.M. and Kemerer, C.F. (1994) 'Computerised loan origination systems: An industry case study of the electronic market hypothesis'. *MIS Quarterly*, vol. 18, no.3, pp. 251-275.
- Howard, M., R. Vidgen, and P. Powell, (2003) 'Overcoming stakeholder barriers in the automotive industry: building to order with extra-organisational systems', *Journal of Information Technology*, vol. 18 no. 1, pp. 27-43.
- Kambil and Van Heck, E. (1998) 'Reengineering the Dutch flower auctions: A framework for analyzing exchange organisations', *Information Systems Research*, vol. 9, no. 1, pp. 1-19.
- Kaplan, R. and Norton D. (1992) 'The Balanced Scorecard: Measures that Drive Performance', *Harvard Business Review*, vol. 70, no. 1, pp. 71-79.
- Kaplan, R and Norton D. (1996) 'Using The Balanced Scorecard as a Strategic Management System', *Harvard Business Review*, vol. 74, no. 1, pp 31-38.
- Klueber, R, Leser, F and Kaltenmorgen, N. (2001) 'Concept and Procedure for Evaluating E-Markets', in *Proceedings of the Seventh Americas Conference on Information Systems*, Boston.
- Kumar, K. and H.G van Dissel (1996) 'Sustainable collaboration: Managing conflict and cooperation in Interorganisational Systems', *MIS Quarterly*, vol. 20, no.3, pp. 279-300.
- Lee, H. G. and T. H. Clark (1996) 'Impacts of Electronic Marketplace on Transaction Cost and Market Structure', *International Journal of Electronic Commerce (IJEC)*, vol. 1, no.1, pp 127-149.
- Lennstrand, B., Frey, M., and Johansen, M. (2001) 'Analysing B2B eMarkets – the impact of product and industry characteristics on value creation and business strategies. In: *Proceedings of the ITS Asia-Indian Ocean regional Conference*, Perth, Western Australia, 2-3 July, pp. 14-23.
- Malone, T., Yates, J. and Benjamin, R. (1987) 'Electronic Markets and Electronic Hierarchies', *Communications of the ACM*, vol. 30, no. 6, pp. 484-497.
- McNair, C. J., Lynch, R.L. and Cross, K.L., (1990) 'Do financial and nonfinancial measures have to agree?' *Management Accounting*, November, pp. 28-39.
- Norrekli, H (1999) 'The balance on the balanced scorecard-a critical analysis of some of its assumptions', *Management Accounting Research*, vol. 11, pp. 65-88.
- O'Reilly, P. and Finnegan, P. (2005) 'Performance in Electronic Marketplaces', *Electronic Markets*, vol. 15, no. 1, pp. 23-37.
- Orlikowski, W.J. (1993) CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development. *MIS Quarterly*, vol. 17, no.3, pp. 309-340.
- Otley, D.T (1999) 'Performance management, a framework for management control systems research' *Management Accounting Research*, vol. 10, pp. 363-382.
- Pather S, Remenyi D and de la Harpe A (2006) "Evaluating e-Commerce Success – A Case Study" *The Electronic Journal of Information Systems Evaluation*, Vol. 9, no. 1, pp 15-26, available online at [www.ejise.com](http://www.ejise.com)
- Sarker, S., Lau, F. and Sahay, S. (2000) 'Building an Inductive Theory of Collaboration in Virtual Teams: An Adapted Grounded Theory Approach'. *Proceedings of the 33rd Hawaii International Conference on System Sciences*, pp. 38-56.
- Singh M. and Byrne J. (2005) "Performance Evaluation of e-Business in Australia" *The Electronic Journal of Information Systems Evaluation*, Vol. 8, No. 1, pp 71-80, available online at [www.ejise.com](http://www.ejise.com)
- Soh, C. and Markus, M. (2002) 'Business-To-Business electronic marketplaces: A Strategic Archetypes Approach' in *Proceedings of the Twenty-Third Conference on Information Systems, Barcelona*.
- Soh, C., Markus, M.L., and Goh, K (2006) 'Electronic Marketplaces and Price Transparency: Strategy, Information Technology, and Success', *MIS Quarterly*, vol. 30, no. 3, pp. 705-723.

- Son, J and Benbasat, I (2007) 'Organizational Buyers' Adoption and Use of B2B Electronic Marketplaces: Efficiency and Legitimacy Oriented Perspectives', *Journal of Management Information Systems*, vol. 24, no. 1, pp. 55-99.
- Smith, M., Bailey, J. and Brynjolfsson, E. (2000) 'Understanding digital markets: Review and assessment', In E. Brynjolfsson and B. Kahin (Eds.), *Understanding the Digital Economy*, MIT Press. pp 1-35.
- Strauss, A. and Corbin, J. (1990) *Basics of qualitative research: Grounded theory procedures and techniques*. London: Sage.
- Urquhart, C. (2001) 'An Encounter with Grounded Theory: Tackling the Practical and Philosophical Issues', in *Qualitative Research in IS: Issues and Trends*, E. Trauth (Ed.), Idea Group Publishing, pp. 104-140.
- White, A. and Daniel, E. (2003) 'Electronic Marketplace-to-Marketplace Alliances: Emerging Trends and Strategic Rationales', *ACM International Conference Proceeding Series, Proceedings of the 5th international conference on electronic commerce*, Pittsburgh, Pennsylvania, pp. 248-258.
- Yin, R.K. (1994) *Case Study Research, Design and Methods*, Sage Publications, Newbury Park.

# Is a Multi-Criteria Evaluation Tool Reserved for Experts?

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## Abstract:

The objective of this investigation was to determine whether the analytical hierarchy process algorithm is suitable for the evaluation of software by evaluators with little Information Technology experience. The scope of the research was the evaluation of two free and open source e-learning systems at the Open University of Tanzania using 33 stakeholders with diverse levels of Information Technology experience.

Both quantitative and qualitative research methods were used. The qualitative methods comprised participative observation and interviews. Questionnaires and the analytical hierarchy process, a multiple-criteria decision-making algorithm, represented the quantitative methods. The results showed that of the two e-learning systems evaluated, Moodle was preferred over ATutor. Furthermore it was found that the analytical hierarchy process algorithm is appropriate for the evaluation of software in a situation where Information Technology experience is limited. It is anticipated that the paper contributes to the theory and practise of decision making in developing countries such as Tanzania.

**Keywords:** free and open source software, e-learning systems, software quality, multi-criteria evaluation tool, analytical hierarchy process, novice user, developing country

## 1. Introduction

Finding suitable software for a specific purpose is a universal problem. Available software needs to be considered and some method found to determine which application is more suitable for the purpose of the application and the needs of the user. Evaluating available software for a specific purpose is in most cases left to software experts and the views of stakeholders are used only if the experts deem it necessary.

In the commercial world, software packages are developed for specific usages and the opinion of stakeholders' are valued and incorporated throughout the software development cycle. This is not the case with free and open source software (FOSS). FOSS is often developed by software specialists interested in a specific application (Nichols and Twidale, 2003). They develop software for this application and then make it freely available for everyone who is interested in adapting it or changing it for their own needs. Experts are able to adapt FOSS for their needs, however it is difficult for end-users to evaluate, choose an appropriate software application (from the many that are freely available on the Internet) and adapt it for their specific needs.

In many organisations the selection of FOSS is done by trial and error: Software packages are introduced and if they do not "live up to expectations" another package is found and introduced until most of the needs of the users are satisfied. However there are methods for the evaluation of software, for example the qualitative weight and sum (QWS) method, the analytical hierarchy process algorithm (AHP) etc. These methods, each with its pros and cons, are employed by software specialists to evaluate software.

The Open University of Tanzania (OUT) is a distance learning institution that is in the process of considering using e-learning system to distribute their study material and manage their students. Since this is a new approach, OUT is still in the process of appointing more Information Technology (IT) personnel to implement and maintain an e-learning system. Currently IT experience at OUT is limited; therefore if a method could be found where any stakeholder could participate in the evaluation of the software it would benefit this environment. It is from this stance that we evaluated two e-learning systems at OUT using the analytical hierarchy process algorithm. The reason for choosing AHP is because it allows the incorporation of both subjective judgments and objective decision-making. For the subjective evaluation we made use of 33 evaluators: 30 students (so-called stakeholders) and three IT experts or staff. These were the only stakeholders that had experience with both the e-learning packages that were being considered.

Our assumption is that AHP is a sophisticated tool which is generally used by technical users when evaluating software. The question that needs to be asked is: Can any user of a computer system, deployed in a developing country, be asked to participate in the evaluation of FOSS with AHP?

Traditional methods of software evaluation involve expert judgments (Boehm, 1981a). Usually an expert evaluates software independently; the results from different experts are then merged to find the most appropriate software for a specific purpose. This approach is subjective and can thus be biased according to Somerville (2004). A more objective approach was suggested by Basili, Caldeira, and Rombach (1994) who used the Goal Question Metric (GQM) paradigm to evaluate software. They found that the advantage of GQM is that it is very flexible. They however indicated that a disadvantage of GQM is that it can only be used by experienced users who can define and answer questions relevant to the purpose of the evaluation (which differs depending on the environments). A further disadvantage is that GQM neither allows for the comparison of software systems nor does it provide a means of combining different attributes into a single value for the sake of comparison.

To evaluate FOSS e-learning systems, Graf and List applied a qualitative weight and sum (QWS) method (Graf and List, 2005:164). QWS has the advantage of being simple and novice users can be used in the evaluation. However, its disadvantage is that it is subjective and it is complex to compare the evaluation of the different software packages. This is because symbols are used (rather than numerical values) when assigning software quality attributes.

Saaty (1980:78) showed that the AHP model can be used to solve any multi-criteria decision making problem. The advantage of using AHP is that it is simple and caters for a step-wise evaluation of software which makes it suitable for evaluating FOSS.

In developing countries the success of FOSS depends on the following factors:

- user acceptance (keeping in mind that users are from varied cultural and educational backgrounds with differing computer expertise).
- resources (since resources are scarce) and
- the quality of the software

These factors (mentioned above) impact on the evaluation of e-learning systems according to Wesson (2003:52). Other factors that may influence users' impression of the software may be the quality of the content/course materials available for the e-learning system being evaluated. Researchers have categorized the quality of software as either technological or pedagogical (Colace *et al.*, 2003). The focus of this paper is not on the pedagogical, but rather on the technical factors, that determine software quality. But what determines the quality of software? The quality of software is determined by: (i) the quality of the development process; (ii) the quality of the product as well as; (iii) the quality of the product-in-use (Fenton and Pfleeger, 1997:100). Manieri, Begin, Meglio, and Rippa (2008) argue that most FOSS applications are poorly documented in terms of requirement specification, system architecture use and system prototypes tested. Consequently it is difficult to determine the quality of the FOSS development process and thus the best way to evaluate FOSS software, is to consider the software product-in-use.

Nichols and Twidale (2003) argue that the rationale for involving novice users in the evaluation of software is that software developers of FOSS do not necessarily design and develop software with features that take the typical user into account. It is therefore important to involve the ordinary user in the evaluation process. Technical and non-technical users perceive software differently and thus we advocate the participation of all stakeholders to bridge the gap between the novice and the experienced user.

OUT uses traditional distance learning methods for teaching and learning (McHarazo and Olden, 2004:205). Currently there is an initiative to improve learning and teaching at OUT through the implementation of e-learning. Many FOSS e-learning systems are available on the Internet. From these, OUT chose ATutor and Moodle as the e-learning systems to test in a pilot project. The idea is to select one of these two for full implementation in the near future. This will enable OUT to have access to an inexpensive but effective e-learning system to support learning and teaching. However the cost of a FOSS e-learning system lies not only in the creation of content for the system, but also in the customization and the maintenance of the system.

E-learning is becoming an attractive alternative to traditional distance learning in Tanzania because of the recent growth of Internet usage (and coverage) (Isamuyo, 2006:10). Students scattered throughout the country will be able to access e-learning systems at work, Internet cafés, community centres, telecentres or at home. The use of blended learning, traditional learning and teaching complemented by e-learning, is thus an appropriate option for OUT. Furthermore the university as well as the government has enacted information communication and technology (ICT) policy to guide the incorporation of ICTs into teaching and learning, creating opportunities for e-learning.

We argue that, in order for the uptake and implementation of FOSS to be successful in Tanzania or another developing country, certain criteria of software quality must be considered. In our case study, we considered three software quality criteria, namely: usability, maintainability, and deployability, which we consider to be the most important criteria to consider in a developing country. These criteria depend on the environment and context where the system is implemented. They are not universal in all developing countries due to the difference in availability of resources, experience of users to maintain the systems and the environment where the software systems must be deployed.

The quality of software depends on the user's ability to interact with the software; the knowledge to maintain the software and the resources available to deploy the system in particular environment. These three criteria are quite challenging in Tanzania because of: (i) the computer illiteracy of the population; (ii) the low bandwidth of networks and; (iii) the fact that some user interfaces will be in a language which is foreign to the Swahili user (Swahili is the language spoken in Tanzania).

Both qualitative and quantitative methods were used in this study. The qualitative method comprised collecting data on site using participative observation and focused group interviews. Quantitative methods consisted of data collection using questionnaires and data analysis using AHP.

AHP, a multi-criteria decision-making (MCDM) algorithm, uses pairwise comparisons to derive weights (of importance) for the attributes identified (Saaty, 1980). AHP was used to evaluate two FOSS e-learning systems: Moodle and ATutor.

The results showed that the evaluation was consistent for the attributes that were identified for the criteria: deployability; maintainability and usability. It confirmed that ordinary users can be employed in the evaluation process and indicated that the e-learning package Moodle is preferred over ATutor.

## 2. Method

The basic steps for software product evaluation, as identified by Comella-Dorda *et al.* (2002:87), were followed. They involve planning the evaluation process; identifying criteria for evaluation; collecting data; and finally analyzing the data.

### 2.1 Planning the evaluation process

The participants were selected by means of purposive sampling (Van Vuuren and Maree, 1999:281). Purposive sampling was used because there were only a limited number of users, with the necessary experience, who could participate in the study. Thirty three participants from OUT (30 second year BSc. Information Communication Technology students and three IT lecturers) with experience in both ATutor and Moodle were selected to participate in the study. They were given a consent form to complete before taking part in the research project.

### 2.2 Identification of attributes that were used in the data collection

For the three main criteria (usability, maintainability, and deploy-ability), sub-criteria were identified as proposed in the literature (Boehm *et al.*, 1976b:595; Cavano and McCall, 1978:136; IEEE, 1998; ISO, 2001). For each of these sub-criteria, the authors and participants decided on attributes that best describe the selected sub-criteria. These attributes were combined with attributes identified in the literature (Coleman *et al.*, 1994; ISO, 2001; Bertoa and Vallecillo, 2002:65).

**Table 1:** The hierarchical structure of the quality attributes for the proposed evaluation

LEVEL 1	LEVEL 2	LEVEL 3
criteria	sub criteria	attributes

usability	learnability	time to configure
		time to expertise
		time to use
	understandability	assistance / training
		user documentation
		help system
		demonstration coverage
	operability	effort to operate
		tailorability
		administrability
	attractiveness	confidence
		error correction and prevention
		user control
		satisfaction
		general user support
		informative feedback to user
		compatibility with user conventions and expectations
		consistency of screen presentation
	usability compliance (conformance)	standardization
	complexity	complexity of the provided interface
maintainability	stability	occurrence of error
	analyzability	tracing error
	changeability	customizability
		extensibility
		portability
	testability	observability
		controllability
		accessibility
	trackability	look & feel
	flexibility	scalability
	upgradeability	easy to upgrade
deployability	portability	software system independence
		machine independence
	installability	ease of installation
	adaptability	suitability for personalization
		adaptivity
	configurability	technical documentation
	distributability	distributed system

The identified criteria, sub-criteria, and attributes were combined and used in the formulation of a questionnaire (some of the questions were adopted from a Software Usability Measurement Inventory (SUMI) questionnaire (Ryu, 2005: 192)).

Attributes which the authors felt were duplicated, were removed from the questionnaire. The aim was to come up with a list of representative attributes agreed to by all the participants (see Table 1).

### 2.3 Data collection

The questionnaire was refined by means of a pilot study. In the actual study participants were asked to complete the questionnaire and some of the participants were interviewed using open ended questions or probes. In addition, the authors took field notes (i.e. participative observation) during the

data collection process. This provided rich data which informed the research process. Focus groups helped to obtain a wish-list of weights for the criteria and sub-criteria (weights allocated to level 1 and level 2 of Table 1).

It was decided to use output from the questionnaire as input to the AHP method. This was done instead of allowing the users to directly use AHP (Turban, 1993:221). Some researchers might argue that this is not ideal but we did this to facilitate non technical users' involvement in the evaluation process.

## 2.4 Data analysis

All the questions in the questionnaire required categorical responses. Numerical values were arbitrarily allocated to these categorical responses (Stevens, 1946:679) (see Table 2). Mapping software quality phenomena to a numerical value is accepted in measurement theory and software measurement (Fenton and Pfleeger, 1997).

According to Turban (1993:221) defining intensities (measures) the way we did in this research, is the best approach to avoid comparison ambiguity associated with large number of criteria and alternatives.

**Table 2:** An example of the interpretation of the attribute symbols

Symbol	A	B	C	D	E
Nominal	Strongly agree	Agree	Disagree	Strongly disagree	I don't have enough information to answer
Scale	9	7	5	3	1

There are two methods for computing the combined group decisions in AHP: (i) first method by using either the arithmetic mean or geometric mean of individual respondents' comparison judgments (i.e. opinions) and (ii) second method by using either the arithmetic mean or geometric mean of the individually calculated priorities (Forman and Peniwati, 1998). The first method is used if the group of the respondents wants to act as a unit while the second method is used if the group wants to act as a combination of individuals. In our case study we used the first method.

### 2.4.1 Detailed explanation of data analysis

The collected data was analyzed empirically using AHP (Saaty, 1980) since AHP simplifies the quantification of software quality attributes and allows for a more objective evaluation process. In AHP a problem is decomposed into a number of hierarchical levels (similar to Table 1), these are then compared pairwise and prioritization is determined.

The pairwise comparison of elements in each level was done using Saaty's comparison technique (Appendix A and Appendix C show the technique used to obtain a pairwise comparison matrix from the numerical values of criteria, sub-criteria and attributes). After computing the pairwise comparison matrices for each of the levels of the hierarchy in Table 1, normalization matrices (Saaty, 1980) were calculated. From the normalization matrix, a priority vector was calculated. The priority vector (eigenvector) determined the relative ranking of the alternatives for each criterion. To check for consistency the Saaty's procedure was followed (see Appendix B). Checking for consistency of measurement is the basis of objective measurement for the subjective evaluations (Moses and Farrow, 2008:276).

## 3. Results

The AHP algorithm involves linear modelling during the analysis of data. The advantage of this algorithm is that it does not need many historical datasets (Cavano and McCall, 1978:137).

The linear equation used is as follows:

$$[c_1 \quad c_2 \quad c_3] \begin{bmatrix} a_{c_1} & b_{c_1} \\ a_{c_2} & b_{c_2} \\ a_{c_3} & b_{c_3} \end{bmatrix} = [P_a \quad P_b] \tag{1}$$

where: vectors **a** and **b** are alternatives with respect to a specific objective, and  $c_1$ ,  $c_2$  and  $c_3$  are the weights assigned to criterion 1, criterion 2 and criterion 3 respectively, and  $(a_{c_1}, b_{c_1})$ ,  $(a_{c_2}, b_{c_2})$ ,  $(a_{c_3}, b_{c_3})$ , are the priority of the alternatives **a** and **b** with respect to the three criteria. In our case ATutor and Moodle were represented by **a** and **b**; and  $c_1$ ,  $c_2$  and  $c_3$  were used to depict the criteria: usability, deploy-ability, and maintainability.

The result for equation (1) gives the total priority for each e-learning system (see Appendix D for the detailed calculation). Table 3 shows the ranked results. Moodle ranks above ATutor for each of the scales used.

**Table 3:** Ranking

Total Priority	
ATutor	Moodle
0.468554988	0.531445012

Finally the consistency indices for each pairwise comparison were computed and were equal to approximately zero (see Appendix B and Appendix C which means that all the pairwise comparison judgments were consistent (Saaty, 1980). It concurs with Moses and Farrow (2008:286) who argue that the best approach to validate results for subjective judgments is to check consistency.

#### 4. Discussion and conclusion

The objective of this study was to determine the suitability of the analytical hierarchy process algorithm in the evaluation of FOSS when the evaluators are mostly users with little technical IT experience. In the evaluation, qualitative methods (using participative observation and focus group interviews) were complimented by quantitative methods (questionnaires and AHP).

We have shown that AHP is suitable for evaluating software in a developing country where Information Technology experience is limited because of its simplicity, accuracy and flexibility in making a logical, consistent and informed decision.

Since the AHP algorithm involves linear modelling, contributing metrics values can in certain cases create a non-compensatory effect. This means that a system under evaluation might be ranked higher than another, even though one or more of its constituent criteria, sub-criteria, and attributes have lower weights than the system it is compared to. The use of the analytical network process algorithm (ANP) may remedy this effect as it takes the dependence of criteria, sub-criteria, and attributes at the same level of the hierarchy, into account.

AHP deals with crisp (real) values of evaluation judgments, but human reasoning is imprecise, uncertain and fuzzy (Mikhailov and Tsvetinov, 2004:23). Furthermore when the number of criteria considered increases, the number of pair-wise comparisons will increase geometrically. This can lead to inconsistencies or even that the AHP algorithm fails completely. Fuzzy AHP could address this problem and is proposed as a possible alternative method for imprecise problems or problems with more criteria. In a future study it will be investigated how ANP and Fuzzy AHP can complement the decision making of AHP.

The results of this study agree with the results from Graf and List (2005:165) who found in their study (using QWS) that Moodle is preferred above 36 FOSS e-learning systems. The stakeholders at OUT regarded usability as the most important criterion required for the successful implementation of an e-learning system (see Table 4).

In our study it has been shown that — with a well planned evaluation process, good data collection and analysis methods — both novice and technical users can be successfully involved in the evaluation of software. The results contribute to the theory and methodology of the evaluation of FOSS and can be used to design and develop a framework for the evaluation of FOSS for developing countries.

We feel that using AHP in a developing country is suitable because it simplifies a complex problem by breaking it up into smaller steps that can be understood by all. The steps of AHP includes: defining the goals and outcomes of the problem; decomposing the problem into a hierarchical structure of criteria, sub-criteria, attributes, and alternatives; computing pairwise comparisons; employing the Eigenvalue method to estimate relative weights; checking consistency and finally combining the relative weight to obtain the overall rating for the alternatives.

Deployability, maintainability and usability were the only criteria considered in this evaluation as they were assumed to be the most important criteria needed for the implementation of software in a developing country. Computer competency of technical users affects maintainability, bandwidth of networks affects deployability and the fact that the user interface is in a language foreign to the OUT user, affects its usability.

The subjective evaluation was consistent for the attributes identified for the criteria deployability; maintainability and usability. The evaluation was shown to be consistent since the computed consistency indices, for all pairwise comparisons, were equal to zero thus confirming that all stakeholders can participate in the evaluation process. Involving all stakeholders in the selection of software has the added advantage of greater acceptance of the system.

## 5. Appendix A: AHP computations

### 5.1 Pairwise comparison matrix

The first pairwise comparison matrix is obtained by comparison of criteria with respect to the objective.

<i>Objective</i>	<i>critterion 1</i>	<i>critterion 2</i>	<i>critterion 3</i>
<i>critterion 1</i>	$\frac{c_1}{c_1} = a_{11}$	$\frac{c_1}{c_2} = a_{12}$	$\frac{c_1}{c_3} = a_{13}$
<i>critterion 2</i>	$\frac{c_2}{c_1} = a_{21}$	$\frac{c_2}{c_2} = a_{22}$	$\frac{c_2}{c_3} = a_{23}$
<i>critterion 3</i>	$\frac{c_3}{c_1} = a_{31}$	$\frac{c_3}{c_2} = a_{32}$	$\frac{c_3}{c_3} = a_{33}$

(i)

Then three pairwise comparison matrices are computed with respect to the three criteria. In our case **A** can stands for ATutor and **B** for Moodle.

Pairwise matrix for alternative **A** and **B** with respect to criterion 1

<i>critterion 1</i>	<i>A</i>	<i>B</i>
<i>A</i>	$\frac{a_{c_1}}{a_{c_1}}$	$\frac{a_{c_1}}{b_{c_1}}$
<i>B</i>	$\frac{b_{c_1}}{a_{c_1}}$	$\frac{b_{c_1}}{b_{c_1}}$

(ii)

Pairwise matrix for alternative **A** and **B** with respect to criterion 2

<i>critterion 2</i>	<i>A</i>	<i>B</i>
<i>A</i>	$\frac{a_{c_2}}{a_{c_2}}$	$\frac{a_{c_2}}{b_{c_2}}$
<i>B</i>	$\frac{b_{c_2}}{a_{c_2}}$	$\frac{b_{c_2}}{b_{c_2}}$

(iii)

Pairwise matrix for alternative **A** and **B** with respect to criterion 2

<i>criterion 3</i>	A	B
	$\frac{a_{c_3}}{a_{c_3}}$	$\frac{a_{c_3}}{b_{c_3}}$
	$\frac{b_{c_3}}{a_{c_3}}$	$\frac{b_{c_3}}{b_{c_3}}$
	$\frac{a_{c_3}}{a_{c_3}}$	$\frac{b_{c_3}}{b_{c_3}}$

(iv)

### 5.2 Normalization matrix

After obtaining the pairwise comparison matrices, the next step is to normalise the matrices with respect to the weights, and then obtain the principal Eigenvector – which is the priority vector. We did this process for level 1, and then for the level 2. Then we computed the overall composite weight for the alternatives A and B, which is a normalization of weighted priority vectors.

Normalization is obtained first by computing the total of each column *j* in pairwise comparison matrix (Saaty, 1980) and then each row in a column *j* is divided by the column total ( $\sum_{i=1}^n a_{ij}$ ).

Normalization is given by the following expression:

$$a'_{ij} = \frac{a_{ij}}{\sum_{i=1}^n a_{ij}}, \quad i, j=1, 2, \dots, n \tag{v}$$

<i>Objective</i>	<i>criterion 1</i>	<i>criterion 2</i>	<i>criterion 3</i>
	$\frac{a_{11}}{\sum_{i=1, j=1}^3 a_{ij}}$	$\frac{a_{12}}{\sum_{i=1, j=2}^3 a_{ij}}$	$\frac{a_{13}}{\sum_{i=1, j=3}^3 a_{ij}}$
<i>criterion 2</i>	$\frac{a_{21}}{\sum_{i=1, j=1}^3 a_{ij}}$	$\frac{a_{22}}{\sum_{i=1, j=2}^3 a_{ij}}$	$\frac{a_{23}}{\sum_{i=1, j=3}^3 a_{ij}}$
<i>criterion 3</i>	$\frac{a_{31}}{\sum_{i=1, j=1}^3 a_{ij}}$	$\frac{a_{32}}{\sum_{i=1, j=2}^3 a_{ij}}$	$\frac{a_{33}}{\sum_{i=1, j=3}^3 a_{ij}}$

(vi)

After normalization, the sum of each column (j) of the matrix is equivalent to 1.

$$\sum_i^n a_{ij} = 1$$

<i>Objective</i>	<i>criterion 1</i>	<i>criterion 2</i>	<i>criterion 3</i>
	$\frac{a_{11}}{a_{11} + a_{21} + a_{31}}$	$\frac{a_{12}}{a_{12} + a_{22} + a_{32}}$	$\frac{a_{13}}{a_{13} + a_{23} + a_{33}}$
<i>criterion 2</i>	$\frac{a_{21}}{a_{11} + a_{21} + a_{31}}$	$\frac{a_{22}}{a_{12} + a_{22} + a_{32}}$	$\frac{a_{23}}{a_{13} + a_{23} + a_{33}}$
<i>criterion 3</i>	$\frac{a_{31}}{a_{11} + a_{21} + a_{31}}$	$\frac{a_{32}}{a_{12} + a_{22} + a_{32}}$	$\frac{a_{33}}{a_{13} + a_{23} + a_{33}}$

(vii)

In order to get the weight vector ( $w_i$ ) for the criterion 1, criterion 2 and criterion 3, we take the average of each row of the normalization matrix (assume the normalized matrix is  $a'_{ij}$ ). Therefore

$$\frac{1}{n} \cdot \sum_i^n a'_{ij} = w_i \tag{viii}$$

This process is done for the other matrices in order to obtain the weight vector for each element in the hierarchy.

It gave the weight vector for each pairwise matrix which represents the relative weights of each alternative  $p_j$  with respect to criterion  $i$  ( $i=1, 2, 3$ ).

### 5.3 Computing global priorities

This is the step where by the relative importance of each element within the level (local priorities) is merged/multiplied with the relative importance of each element in the parent level. This gives the global priorities for each alternative.

The computation for each alternative  $j$  ( $p_j$ ) is done in order to obtain the overall composite weight

$$\text{vector, which is given by } \sum_{i=1}^n z_{ij} \cdot w_i . \tag{ix}$$

where  $w$  is the weight vector or priority vector of the alternative software products and  $z$  is the weight vector of the criteria.

## 6. Appendix B: consistency checking

We implemented consistency checking as outlined by Saaty (1980). Checking consistency is done using the following mathematical formulae:

### First procedure

Let  $A$  be a pairwise comparison matrix for  $n$  criteria. Let  $w$  be the weight vector computed for  $A$ . Compute

$$Aw^T \tag{i}$$

### Second procedure

Let  $\lambda_{\max}$  be a maximum or principal Eigenvalue. Let  $n$  be the number of criteria. Compute the  $\lambda_{\max}$  given that the number of criteria is  $n$ .

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^n \frac{(Aw^T)_i}{(w^T)_i} \tag{ii}$$

### Third procedure

Let  $CI$  be the consistency index. Compute  $CI$

$$CI = \frac{\lambda_{\max} - n}{n - 1} \tag{iii}$$

### Fourth procedure

Let  $CR$  be the consistency ratio. Let  $RI$  be the random index.

If  $CI = 0$  then  $A$  is consistent; otherwise if the  $CR = \frac{CI}{RI} \leq 0.10$  then  $A$  is consistent enough. If  $CR =$

$\frac{CI}{RI} \geq 0.10$  then  $A$  is seriously inconsistent; the Random index  $RI_n$  for any square matrix is given as a constant value by Saaty (1980).

**Table 4:** Random Index (adapted from Saaty, 1980)

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

### 7. Appendix C: example how AHP computations were done

To obtain priority/ weight vector for level 1: respondents were asked to indicate the level of importance of three criteria usability, deployability and maintainability ( $c_1, c_2, c_3$ ) respectively. Then the mean of all the respondents were computed to obtain the input values for AHP. We got ( $c_1=9, c_2=7$  and  $c_3=7$ ) using scale shown in Table 2. After that the equation (i) from Appendix A was applied and we obtained the following pairwise matrix:

1	1.285714286	1.285714286
0.777778	1	1
0.777778	1	1

Then we computed normalization matrix using equation (vi) from Appendix A and we obtained the following matrix:

0.391304	0.391304348	0.391304348
0.304348	0.304347826	0.304347826
0.304348	0.304347826	0.304347826

After that the priority vector was computed using equation (ix) from Appendix A and we obtained the following weights for usability, deployability and maintainability:

0.391304348
0.304347826
0.304347826

This answer is reflected in level 1 of appendix D.

Then we checked the consistency using the formulae shown in Appendix B.

Equation (i) in Appendix B gave the following result:

1.173913043
0.913043478
0.913043478

The equation (ii) in appendix B was applied and we got  $=1/3*(1.173913043/0.391304348+0.913043478/0.304347826+0.913043478/0.304347826) = 3$

After this computation, we calculated the *CI* using equation (iii) in Appendix B and the answer was  $= (3-3)/2 = 0$  (the number of criteria (*n*) was 3)

This indicated that the consistency index was equal to 0 (means consistent judgments).

These computations were done for all hierarchy levels and the results are shown in Appendix D.

### 8. Appendix D: priority weight obtained after using AHP

LEVEL 1	LEVEL 2		LEVEL 3			
					ATutor	Moodle
			ATutor	Moodle	Priority	Priority
		Weight	0.5000	0.5000	0.0114	0.0114
	operability	0.0685	0.5000	0.5000	0.0114	0.0114
			0.6250	0.3750	0.0143	0.0086
	usability compliance	0.0685	0.2000	0.8000	0.0137	0.0548
usability	complexity	0.0880	0.5833	0.4167	0.0514	0.0367
0.3913			0.5000	0.5000	0.0110	0.0110
	understandability	0.0880	0.5833	0.4167	0.0128	0.0092
			0.4167	0.5833	0.0092	0.0128

LEVEL 1	LEVEL 2		LEVEL 3			
					ATutor	Moodle
			ATutor	Moodle	Priority	Priority
			0.5833	0.4167	0.0128	0.0092
	learnability	0.0098	0.5000	0.5000	0.0016	0.0016
			0.6923	0.3077	0.0023	0.0010
			0.5000	0.5000	0.0016	0.0016
	attractiveness	0.0685	0.5000	0.5000	0.0043	0.0043
			0.5000	0.5000	0.0043	0.0043
			0.4167	0.5833	0.0036	0.0050
			0.4667	0.5333	0.0040	0.0046
			0.4667	0.5333	0.0040	0.0046
			0.5000	0.5000	0.0043	0.0043
			0.1429	0.8571	0.0012	0.0073
			0.5000	0.5000	0.0043	0.0043
	portability	0.0830	0.1667	0.8333	0.0069	0.0346
			0.6429	0.3571	0.0267	0.0148
deployability	installability	0.0646	0.4375	0.5625	0.0282	0.0363
0.3043	adaptability	0.0461	0.5000	0.5000	0.0115	0.0115
			0.5556	0.4444	0.0128	0.0102
	configurability	0.0646	0.4375	0.5625	0.0282	0.0363
	distributability	0.0461	0.4375	0.5625	0.0202	0.0259
	stability	0.0609	0.4375	0.5625	0.0266	0.0342
maintainability	analyzability	0.0261	0.6364	0.3636	0.0166	0.0095
0.3043			0.4375	0.5625	0.0063	0.0082
	changeability	0.0435	0.5000	0.5000	0.0072	0.0072
			0.4667	0.5333	0.0068	0.0077
	testability	0.0435	0.5000	0.5000	0.0072	0.0072
			0.5000	0.5000	0.0072	0.0072
			0.5000	0.5000	0.0072	0.0072
	trackability	0.0261	0.5000	0.5000	0.0130	0.0130
	flexibility	0.0435	0.5000	0.5000	0.0217	0.0217
	upgradeability	0.0609	0.5000	0.5000	0.0304	0.0304
<b>Total</b>					<b>0.4686</b>	<b>0.5314</b>

### Acknowledgement

We would like to thank DAAD and UWC for financial support. Also the authors wish to thank the reviewers for their valuable comments and suggestions that contributed significantly to make this paper better.

### References

Basili, V.R., Caldiera, G. and Romback, H.D. (1994) 'Goal question metric paradigm', In J.C. Marciniak (Eds.), *Encyclopedia of Software Engineering*, vol.1, pp. 528-532, New York: John Wiley & Sons.

Bertoa, M.F. and Vallecillo, A. (2002) 'Quality attributes for COTS components', in: *Proceedings of the Sixth ECOOP Workshop on Quantitative Approaches in Object-Oriented Software Engineering (QAOOSE 2002)*, Malaga, Spain, pp. 54-66.

Boehm, B. W. (1981a) *Software engineering economics*. Prentice-Hall, NJ: Englewood Cliffs.

Boehm, B. W., Brown, J. R., and Lipow, M. (1976b) 'Quantitative evaluation of software quality'. In *Proceedings of the 2nd international Conference on Software Engineering* (San Francisco, California, United States, October 13 - 15, 1976). International Conference on Software Engineering. IEEE Computer Society Press, Los Alamitos, CA, pp. 592-605.

- Cavano, J. P. and McCall, J. A. (1978) 'A framework for the measurement of software quality'. in Jackson, S. and Lockett, J. A. (ed.), *Proceedings of the Software Quality Assurance Workshop on Functional and Performance Issues*, pp. 133-139.
- Colace, F., DeSanto, M. and Vento, M. (2003) 'Evaluating on-line learning platforms: a case study'. In *Proceedings of the 36th Annual Hawaii international Conference on System Sciences (Hicss'03) - Track 5* (January 06 - 09, 2003). HICSS. IEEE Computer Society, Washington, DC, pp. 5, 154.
- Coleman, D., Ash, D., Lowther, B. and Oman, P. (1994) 'Using metrics to evaluate software system maintainability'. *Computer*, vol. 27, no, 8, pp. 44-49.
- Comella-Dorda, S., Dean, J. C., Morris, E. and Oberndorf, P. (2002) 'A process for COTS software product evaluation', *Proceedings of the First International Conference on COTS Based Software Systems*, Springer-Verlag LNCS 2255, pp. 86-96.
- Fenton, N. E. and Pfleeger, S. L. (1997) *Software metrics - a rigorous and practical approach*, PWS Publishing Company.
- Forman, E. and Peniwati, K. (1998) 'Aggregating individual judgments and priorities with the analytic hierarchy process', *European Journal of Operational Research*, Volume 108, Issue 1, pp. 165-169
- Graf, S. and List, B. (2005) 'An evaluation of open source e-learning platforms stressing adaptation issues'. In *Proceedings of the Fifth IEEE international Conference on Advanced Learning Technologies* (July 05 - 08, 2005). ICALT. IEEE Computer Society, Washington, DC, pp. 163-165.
- IEEE (1998). Std. 1061-1998 IEEE standard for a software quality metrics methodology.
- ISO. (2001). ISO/IEC 9126-1, Software engineering - product quality - part 1: quality model, Geneva, International Organization for Standardization.
- Isamuyo, Z. (2006) '*Open access ICT infrastructure in rural Tanzania: prototype design*, Masters Thesis', Royal Institute of Technology (KTH), Stockholm, Sweden.
- Manieri, A., Begin, M.E., Meglio, A. Di. and Rippa, A. (2008) 'Automation in quality assurance environments', *The First International Conference on Open Source*, Qualipso Conference 2008, Rome, Italy
- McHarazo, A.A.S. and Olden, A. (2000) 'Fulfilling the learning resource requirements of students at the Open University of Tanzania'. *Journal of Librarianship and Information Science*, vol.32, no.4, pp. 204-214.
- Mikhailov, L. and Tsvetnikov, P. (2004) 'Evaluation of services using a fuzzy analytic hierarchy process', *Applied Soft Computing*, vol.5, no.1, pp. 23-33
- Moses, J. and Farrow, M. (2008) 'Tests for consistent measurement of external subjective software quality attributes', *Empirical Softw. Engg.*, vol.13, no.3, pp. 261-287.
- Nichols, D.M. and Twidale, M.B. (2003) 'The usability of open source software'. *First Monday*, vol.8, no.1.
- Ryu. Y.S. (2005) '*Development of questionnaires for electronic mobile products and decision making methods*'. PhD Thesis, Virginia Polytechnic Institute and State University.
- Saaty, T.L. (1980). *The analytic hierarchy process: planning, priority setting, resource allocation*, New York: McGraw-Hill International.
- Somerville, I. (2004) *Software engineering*, 6th edition (International Computer Science Series). Addison-Wesley.
- Stevens, S.S. (1946) 'On the theory of scales of measurement', *Science*, vol.103, pp. 677-680.
- Turban, E. (1993). *Decision Support and Expert Systems: Management Support System*, third edition, New York: Macmillan.
- Van Vuuren, D. and Maree, A. (1999) 'Survey methods in market and media research: applied methods for the social sciences', in Terre Blanche, M. and Durrheim, K. (ed.), *Research in Practice*, Cape Town: UCT Press.
- Wesson, J. (2003) 'Usability issues for e-commerce and e-learning: a developing country perspective', *Proceeding of the International workshop on Utility, Usability and Complexity of e-Information systems*, pp. 43-55

# An Evaluation of the Theory of Planned Behaviour in Consumer Acceptance of Online Video and Television Services

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**Abstract:** This study aimed at evaluating the applicability of the Theory of Planned Behaviour (TPB) model in predicting user acceptance of online video services. Few studies have applied the TPB model within this context, even though the model has proven to be effective in predicting technology adoption. Validating the TPB model would improve the understanding of both academics and practitioners of the most influential antecedents of user acceptance. Past studies have demonstrated the importance of integrating user needs and behaviour as a requirement for building successful user-centric online services. Structural equation modelling was used as the main statistical procedure for data analysis. The results of the study confirmed that the TPB model was viable in predicting user acceptance of online video services. The findings also revealed that perceived behavioural control was the highest contributor to predicting intention to use online video services. Attitude toward use and subjective norm were found to have moderate predictive power, mostly because online video services present obvious benefits to users and are consumed privately.

**Keywords:** technology adoption, online video, online television, web TV, Theory of Planned Behaviour, user acceptance of online videos

## 1. Introduction

Even though online video and TV are currently considered to form a niche market, their use among Europeans is growing rapidly. According to a study by Jupiter Research, between 2006 and 2007, the percentage of people watching videos online jumped from 11% to 28%, which suggests that online video can potentially reach a mass audience within five years (Mulligan, Banerjee and Thomas 2008). Another study by Forrester Research has confirmed this trend by forecasting a 350% growth in worldwide online video delivery between 2008 and 2013 (McQuivey, de Lussanet and Wilkos 2008). The Jupiter Research study indicates that France, with a use rate of 37%, is more advanced than other European countries in online video use. The time spent consuming online videos in France grew by almost 87% from 2006 to 2007, starting from an average of 38 minutes of online video consumption in 2006 and increasing to 71 minutes in 2007.

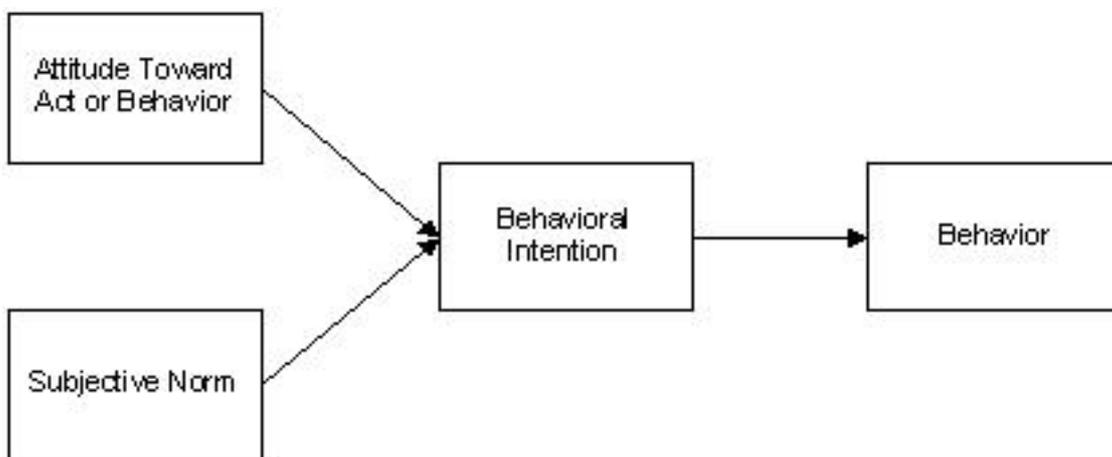
Over recent years, online video and TV services have become one of the most promising activities in terms of advertising revenues and premium service revenues. eMarketer has estimated that online video advertising will soar at a pace of 56% to 70% in the next five years (Hallerman 2008), suggesting that this type of service will out-compete any other online services in terms of potential advertising-based revenues. So far, the nascent online video consumer behaviour field has produced little research that increases the understanding of user acceptance of online video and TV services. However, it is critical for both online video service providers and advertisers to understand the processes involved in user acceptance in order to design sound strategies to yield revenues from these services. Studying the drivers of user acceptance for new technologies can greatly help increase the pace of adoption (Amberg, Fischer and Schröder 2005). For example, the US-based Hulu has been relatively successful in aggregating premium syndicated video contents online free of charge to users because the services are funded by advertising. Hulu's managers have understood that users would be willing to accept advertising exposure as long as they have access to premium contents that are legal and safe for every family member (TheEconomist 2009). The website's success would most likely not have been possible without this fundamental understanding of user behaviour.

In light of the rapid increase in online video and TV use, this study aims to contribute to the existing literature regarding online video user acceptance by applying the Theory of Planned Behaviour (TPB) model to predict online video acceptance in France. The TPB is particularly suitable for this type of study since it has been suggested to be an effective model in predicting online technology adoption among consumers (e.g. Goby 2006, Hsu and Chiu 2004, Hsu, Yen, Chiu and Chang 2006, Bagozzi, Dholakia and Mookerjee 2006). More generally speaking, the TPB seems to be an effective predictive

model in fields that lead to a certain degree of behavioural change from individuals. Even though research in technology adoption has used the TPB extensively, the literature contains little regarding its applicability to online video adoption. However, validating the TPB model in the context of online video consumption could help academics and practitioners better understand the social and behavioural antecedents of user acceptance. Structural equation modelling was used to test the validity of using the TPB in this context.

## 2. Literature review

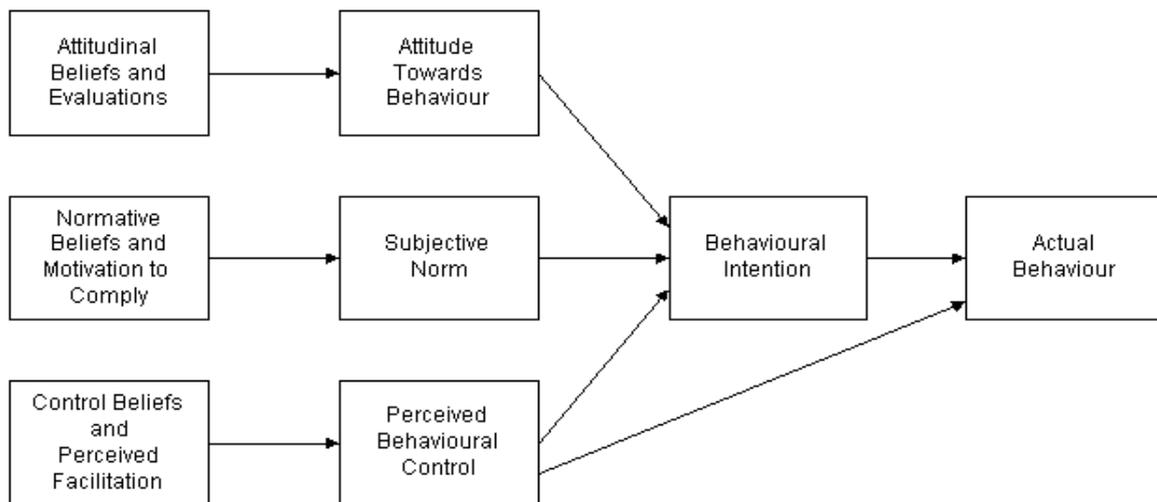
Early attempts at understanding determinants of attitude and behaviour led to the Theory of Reasoned Action (TRA), proposed by Fishbein and Ajzen (1975). The main tenet in the TRA (Figure 1) is that an individual's behavioural intention in a specific context depends on *attitude toward performing the target behaviour* and on *subjective norm*, which refers to "the person's perception that most people who are important to him or her think s/he should or should not perform the behaviour in question" (Fishbein and Ajzen 1975, p. 302). The TRA holds that the practical impact of subjective norm on behavioural intention is that an individual may choose to perform a specific behaviour, even though it may not be favourable to him or her to do so (Venkatesh and Davis 2000b).



**Figure 1:** The Theory of Reasoned Action (TRA) (Source: Fishbein & Ajzen (1975))

The difference in capacity of attitude vs. subjective norm to predict behavioural intention is contingent on the context. For example, attitude will be the main predictor of behavioural intention when self-influence is stronger than perceived subjective norm. On the other hand, subjective norm would be the main predictor of a behavioural intention for behaviours in which normative implications are dominant. Subjective norm may be more salient during the early stages of technology diffusion if users have limited knowledge that forms the attitude toward the use of the technology (Taylor and Todd 1995).

A number of studies have successfully applied the TRA to predict behavioural intention in technology acceptance (e.g. Sheppard, Hartwick and Warshaw 1998, Bobbitt and Dabholkar 2001, Davis, Bagozzi and Warshaw 1989, Yoh, Damhorst, Sapp and Laczniak 2003, Venkatesh, Morris, Davis and Davis 2003). However, despite the strong predictability of TRA across contexts, it became apparent that the problem of contradictory results regarding the confounding relationship between subjective norm and attitude, as well as the assumption that intention directly led to action without limitations, necessitated further conceptual advances. To address the aforementioned weaknesses, Ajzen (1991) introduced the Theory of Planned Behaviour (TPB) (Figure 2). The overall aim of the TPB is to attempt to predict deliberative and planned behaviour. The theory includes the construct *perceived behavioural control* as an addition to the TRA to take into account the more common situation in which individuals do not have complete voluntary control over their behaviour, such as when they lack skills or resources to perform a particular task (Armitage and Christian 2003, Ajzen 1991, Ajzen 1985). Summarized, the TPB posits that behavioural intention is a function of an individual's beliefs in three areas: (1) behavioural beliefs (Attitude toward Behaviour)– meaning their beliefs about the probable outcome of the behaviour; (2) normative beliefs (Subjective Norm) – meaning their beliefs about the normative expectations of significant others; and (3) control beliefs (Perceived Behavioural Control) – meaning the beliefs regarding absence or presence of factors that might facilitate or impede the performance of the behaviour (Ajzen 1991).



**Figure 2:** The Theory of Planned Behaviour (TPB) (Source: Ajzen (1991)).

The three antecedents in the TPB model are conceived to be influences, both direct and indirect, on a variety of behaviours through the mechanism of influencing behavioural intentions, and numerous reviews and meta-analyses conclude that the TPB is an effective theory (see Armitage and Connor 2001).

Since its introduction, the TPB has been used in numerous technology adoption contexts to predict and explain individual behavioural intentions as well as actual self-reported behaviour, both from the organizational and from the consumer perspective (e.g. Brown and Venkatesh 2005, Chau and Hu 2002, Chau and Hu 2001, Gentry and Calantone 2002, Venkatesh and Brown 2001, Pedersen 2005, Venkatesh et al. 2003). Recently, Liaw (2004) applied the TPB to the study of behavioural intentions to use search engines as a learning tool. Study of the consumer by use of the TPB is gaining momentum in behaviour toward digital technologies research: Goby (2006) studied online purchasing using the TPB, Hsu and Chiu (2004) used a decomposed version of the TPB to study electronic service continuance, and Hsu et al. (2006) used the TPB model to predict online shopping behaviour. Other studies have modified the TPB to specific contexts, such as consumers' adoption of broadband Internet (Oh, Ahn and Kim 2003) or bases of social influences in online environments (Bagozzi et al. 2006).

Since the current technology adoption literature shows little research on the applicability of the TPB model in the context of online video services acceptance, this study examines the TPB's ability to predict the behavioural intention to use online video and TV services in France. The hypotheses are therefore directly related to the classic TPB and are stated as follows:

**Hypothesis 1 ( $H_1$ ):** There is a positive and direct relationship between Attitude toward Use (ATT) and Intention to Use (INT).

**Hypothesis 2 ( $H_2$ ):** There is a positive and direct relationship between Subjective Norm (SUB) and Intention to Use (INT).

**Hypothesis 3 ( $H_3$ ):** There is a positive and direct relationship between Perceived Behavioral Control (BEH) and Intention to Use (INT).

### 3. Model development

#### 3.1 Methodology

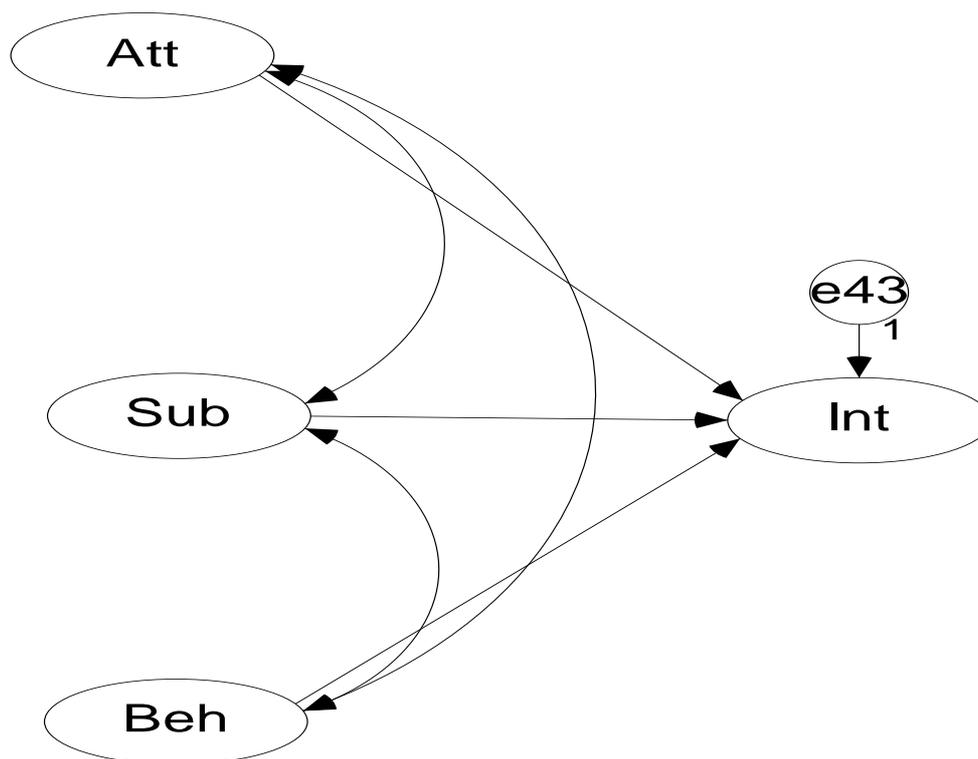
Structural equation modelling was used as the main statistical technique and data were collected through survey questionnaires. The questionnaire items were taken from existing studies (see references in Table 1), but adapted to fit online video services consumption behaviour. The questionnaire used a seven-point Likert scale and included 13 items which were translated from English to French by two bilingual professors of consumer behaviour and then back-translated by two different professors in the same area. The pilot test of the questionnaire was performed face-to-face

on a convenience sample of 109 online video users in France. Since the exploratory factor analysis (EFA) showed that the preliminary results were satisfactory on both convergent and discriminant validity tests, the questionnaire was then made available online, hosted by the website [www.thesisools.com](http://www.thesisools.com). The link to the online questionnaire was published on 10 Internet discussion forums on online video and television services. The 10 selected forums were associated to large television channels in France (i.e., TF1, France2, France3, Canal+, France5, M6, TMC, W9, NRJ, MCM). All of these television channels offered both online discussion forums and online video and catch-up services. The survey introduction required all potential respondents to have had previous experience with online videos. In total, 336 questionnaires were completed, of which 26 were not usable because of missing data, resulting in 310 as the final sample.

The data analysis was conducted in a three-stage process. First, reliability tests were performed for each factor. Upon satisfactory results, confirmatory factor analysis (CFA) with SPSS 14 was used to analyse the convergent, concurrent, and discriminant validity of the model. Once the model was validated, Amos 7 was used to test the overall fit of the structural model and to estimate the relationships between the independent variables (predictors) and the dependent variable (predicted) so as to accept or reject the hypotheses.

### 3.2 Structural model

The tested model is composed of three independent latent variables and one dependent latent variable (Figure 3). As noted in the literature review section, all constructs of the TPB model have been already measured and validated in several previous studies related to the adoption of new technology and services. This study uses the TPB model for predicting acceptance of online video and television services.



**Figure 3:** The structural model

Intention to use (INT) defines the objective to use a particular product or service in the future. Attitude toward use (ATT) refers to the degree of evaluative affect that an individual associates with using the target service. Subjective norm (SUB) is a person’s perception that most people who are important to her or him think s/he should or should not perform the behaviour in question. Perceived behavioural control (BEH) reflects people’s perception of their ability to perform a given behaviour. Table 1 shows the survey instrument, including the constructs and the items. The questionnaire asked participants to rate each statement using a seven-point Likert scale.

**Table 1:** TPB constructs and references

Constructs/items	References used
ATT: "In your opinion, using the use of online video and television services is..." Bad / Good Wise / Foolish Favourable / Unfavourable Harmful / Beneficial Negative / Positive	(Fishbein and Ajzen 1975, Taylor and Todd 1995, Battacherjee 2000, Pedersen 2005, Pedersen 2001, Pedersen 2002)
SUB: "Please indicate your opinion regarding the following statements from strongly disagree (1) to strongly agree (7)" People who influence my behaviour think I should use online video and TV services. People important to me think I should take advantage of online video and TV services. Others I know expect that people like me should use online video and TV services.	(Pedersen 2001, Pedersen 2002, Pedersen 2005, Taylor and Todd 1995, Ajzen 1991, Davis et al. 1989, Mathieson 1991)
BEH: "Please indicate your opinion regarding the following statements from strongly disagree (1) to strongly agree (7)" I am free to use the kind of online video and TV services I want to. Using online video and TV services is entirely my choice. I can choose the online video and TV services I want to use.	(Pedersen 2001, Pedersen 2002, Pedersen 2005, Taylor and Todd 1995, Ajzen 1991)
INT: "Please indicate your opinion regarding the following statements from strongly disagree (1) to strongly agree (7)" I have the intention to use online video and TV services in the next 6 months. I have the intention to use online video and TV services often in the next 6 months.	(Wang, Lin and Luarn 2006, Pedersen 2001, Venkatesh and Davis 2000a, Pedersen 2005, Venkatesh and Morris 2000)

## 4. Results of the study

### 4.1 Sample statistics

The sample distribution indicated a large proportion of respondents with a high level of education (30% have at least a master's degree) and a younger age (77% are 40 years old or less), which is consistent with the common assumption that early adopters of new technology or new technological services are often well educated younger people (Rogers 2003). All respondents have used at least one of the three main online video and TV services: 98% have already watched short online videos, 79% full-length online videos, and 55% web-TV. The sample also showed no sign of over-representation of a particular gender. Therefore, this relatively savvy sample was particularly suitable to this research.

### 4.2 Reliability tests

The reliability of the measurement instruments was evaluated using Cronbach's Alpha. A Cronbach's Alpha value of at least 0.7 is commonly seen as acceptable (Churchill and Brown 2006). The individual construct reliability tests reported scores above 0.74, which suggests that all constructs could be considered as reliable.

### 4.3 Confirmatory factor analysis

Passing KMO and Bartlett's test is a pre-requisite to factor analysis (Schumacker and Lomax 2004). The study's tests showed very good results, with a KMO score above 0.80 and a significant Bartlett's Test, signifying that the collected data are suitable for factor analysis (Table 2).

**Table 2:** KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.819
Bartlett's Test of Sphericity	Approx. Chi-Square	2018.580
	Df	78
	Sig.	.000

The CFA extracted four components corresponding to the four constructs in the TPB structural model. Convergent, concurrent, and discriminant validity tests are the most common tests for validating measurement instruments (Schumacker and Lomax 2004). Convergent validity verifies that the expected relationships between the items and factors are confirmed by the actual test results. Convergent validity was tested by observing factor loadings and the squared multiple correlations (SMC) of the items. The rotated component matrix showed four distinct factors with their respective items and SMC of 41%-81%, which confirmed convergent validity. All items loaded on their corresponding factor with loadings higher than 0.69, as shown in Table 3. The total variance explained after rotation of the four components accounted for 73% of the total variance.

Concurrent and discriminant validity tests ensure that acceptable patterns of correlations exist among the constructs of a model, which means that (1) the correlations among the three independent variables are significantly less than 1 to show that each is a distinct factor and (2) the correlations between the independent variables and the dependent variable must be positive and significantly high to show concurrent validity. As Table 4 shows, discriminant validity was confirmed as the inter-construct correlations among the independent variables are significantly below 1. Concurrent validity was also confirmed by the higher correlations between the independent variables and the dependent variable. In conclusion, the TPB model can be validated in this study.

**Table 3:** Rotated component matrix

	Component			
	1	2	3	4
INT1				.889
INT2				.864
BEH1			.775	
BEH2			.690	
BEH3			.829	
SUB1		.876		
SUB2		.824		
SUB3		.740		
ATT1	.701			
ATT2	.756			
ATT3	.851			
ATT4	.835			
ATT5	.850			

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 5 iterations.

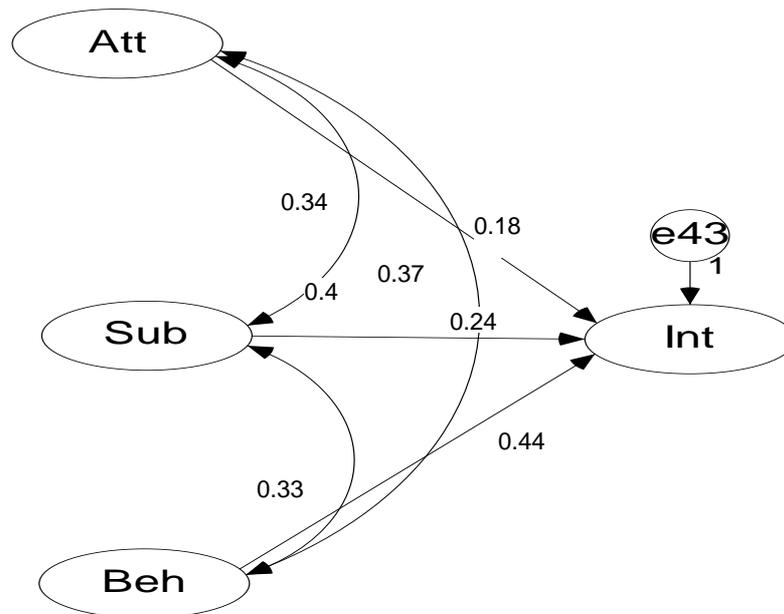
**Table 4:** Inter-construct correlations

			Estimate
Att	<-->	Sub	.339*
Att	<-->	Beh	.365*
Sub	<-->	Beh	.326*
Att	<-->	Int	.424*
Sub	<-->	Int	.443*
Beh	<-->	Int	.583*

\*All significant,  $p=0.001$

#### 4.4 Model fit and hypothesis testing

The structural equation modelling analysis reported satisfactory results in terms of model fit and significance of the relationships. The model fit analysis reported acceptable scores with 0.90 for NFI, 0.91 for TLI and 0.93 for CFI. A score of above 0.90 on these indices indicates a good fit (Garson 2006). These fit indices have been suggested to be more robust regarding sample biases than the commonly used GFI and AGFI (Schumacker and Lomax 2004, Garson 2006). Moreover, the RMSEA was also satisfactory with a score of 0.80 (Garson 2006). All relationships within the model reported significant p-values ( $p=0.000$ ). The final model with the regression weights is shown in Figure 4.



**Figure 4:** Final model with regression weights

H<sub>1</sub> stated that attitude toward use has a positive and direct relationship with intention to use. The regression weight between attitude toward use and intention to use was 0.18, with a significance level of 0.000. This result suggests that attitude toward the use of online video and TV services has a positive yet moderate effect on intention to use these services. Although H<sub>1</sub> was accepted, among the three independent variables, attitude was the lowest contributor to intention.

H<sub>2</sub> stated that there is a positive and direct relationship between subjective norm and intention to use. The regression weight between subjective norm and intention to use was 0.24, with a significance level of 0.000. H<sub>2</sub> was therefore also accepted. The last hypothesis (H<sub>3</sub>) stated that perceived behavioural control has a positive and direct relationship with intention to use. The regression weight between perceived behavioural control and intention to use was the strongest, with a score of 0.44 at the significance level of 0.000. This finding confirms the importance of the potential effect of perception of non-motivational factors on behavioural constraints to use online video and TV services. H<sub>3</sub> was accepted. The implications of these results are discussed in the next section.

#### 5. Discussion and implications

This study used the TPB model to predict user acceptance of online video and TV services. Despite a three-digit growth in online video and TV services over the span of a few years, little research has investigated the factors influencing the use of these services, and the findings of this study contribute to a better understanding of the antecedents of online video use. In particular, the findings can help practitioners understand and focus on the factors that contribute most strongly toward the use of online video and TV services. The results showed a greater influence of perceived behavioural control on intention to use this type of services. The effects of attitude toward use and subjective norm were positive, but more moderate. The lesser effect of attitude toward use may be explained by the evident benefits of watching videos online. Several recent consumer studies have confirmed that watching online videos and TV has become one of the favourite online activities for Internet users (Hallerman

2008, Mulligan et al. 2008). Since users actually perceive the benefits of using this service, their attitude is often highly positive and therefore has little predictive power for their intention to use the service.

The effect of subjective norm was also moderate. This result may relate to the personal nature of this type of service. Subjective norm depends on others' perception of one's behaviour. However, users are often alone when watching online videos (Mulligan et al. 2008). A common phenomenon is the use of this type of service at the workplace and at home when the main television is already used by another family member (Hallerman 2008). This usage context can partly explain the lower predictive power of subjective norm. In the absence of other parties in the usage context, the pressure of others on intention to use a particular service is weaker. A user watching online videos engages in little physical interaction with others. Therefore, the user is less concerned with how s/he would be perceived by others when using this type of service. Further, watching online videos may well be a common activity among her/his peer-group. The strong influence of perceived behavioural control suggests the importance of non-motivational factors in one's intention to use online video and TV services. These factors may relate to a perceived lack of skill in using the service, or to a lack of resources such as a suitable Internet connection, or even to the perceived complexity of a website. One general recommendation would be to reassure users regarding the ease of use and safe environment of a website that proposes these types of service. Another growing issue is the intrusiveness of misleading advertisements and unclear conditions of use of the website with respect to user privacy, which could seriously increase one's reluctance to use the service more frequently (Li and Lee 2002, Edwards, Li and Lee 2002). One example of the need for a user-friendly and safe environment was the recent shift made by the largest video websites from a software-based to a streaming-based service (TheEconomist 2009). Many websites, including Youtube and Hulu, found that many users did not trust the player or were simply reluctant to download it as the process would require them to follow a procedure perceived to be more complex or tedious. As a result, they now offer instant in-browser streaming videos rather than requiring users to download a player to view the videos. Video service providers and advertisers can overcome the perceived behavioural control obstacle by addressing these issues.

For academics, the implications lie in the lesser importance of attitude toward the use of a new service when the positive attitude toward this service is already established. The importance of subjective norm is also less influential when the service is of a more personal nature. This study suggests that, when investigating online video services, more emphasis should be put on the influence of perceived behavioural control. Even though this study has identified this variable as the strongest contributing factor in the TPB model, little is known regarding what non-motivational factors affect the intention to use online video and TV services, constituting the main limitation of this study. Other limitations lie in the relatively younger age (mostly under 40) and single nationality (French) of the sample. Recommendations for future research should address the influence, on various samples, of the non-motivational factors on intention to use with respect to these services.

## **6. Conclusion**

In the literature, the Theory of Planned Behaviour (TPB) has proven to be effective in predicting technology adoption. However, this model has never been applied to online video and television services. Given the exponential growth of this type of service, applying the TPB is appropriate, and this study uses the TPB to predict intention to use online video and television services. A structural equation modelling analysis of data gathered from a sample of more than 300 participants revealed that perceived behavioural control is the most influential factor. The results of this study suggest that practitioners and academics should focus their efforts on this particular factor.

## **References**

- Ajzen, I. (1985) From intentions to actions: A theory of planned behavior. IN KUHL, J. & BECKMANN, J. (Eds.) *Springer series in social psychology*. Berlin, Springer.
- Ajzen, I. (1991), "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, vol. 50, no. 2, pp. 179-211.
- Amberg, M., Fischer, S. & Schröder, M. (2005), "An evaluation framework for the acceptance of web-based aptitude tests", *The Electronic Journal of Information Systems Evaluation*, vol. 8, no. 3, pp. 151-158.
- Armitage, C. J. & Christian, J. (2003), "Special issue: On the theory of planned behaviour", *Current Psychology*, vol. 22, no. 3, pp. 187-280.
- Armitage, C. J. & Connor, M. (2001), "Efficacy of the theory of planned behavior: A meta-analytic review", *British Journal of Social Psychology*, vol. 40, no. pp. 471-499.

- Bagozzi, R. P., Dholakia, U. M. & Mookerjee, A. (2006), "Individual and group bases of social influence in online environments", *Media Psychology*, vol. 8, no. pp. 95-126.
- Battacherjee, A. (2000), "Acceptance of e-commerce services: the case of electronic brokerages", *IEEE Transactions on Systems, Man and Cybernetics*, vol. 30, no. pp. 411-420.
- Bobbitt, L. M. & Dabholkar, P. A. (2001), "Integrating attitudinal theories to understand and predict use of technology-based self-service: The internet as an illustration", *International Journal of Service Industry Management*, vol. 12, no. 5, pp. 423-450.
- Brown, S. A. & Venkatesh, V. (2005), "Model of adoption of technology in households: A baseline model test and extension incorporating household life cycle", *MIS Quarterly*, vol. 29, no. 3, pp. 399-426.
- Chau, P. Y. K. & Hu, P. J. (2001), "Information technology acceptance by individual professionals: A model comparison approach", *Decision Sciences*, vol. 32, no. 4, pp. 699-719.
- Chau, P. Y. K. & Hu, P. J. (2002), "Investigating healthcare professionals' decisions to accept telemedicine technology: An empirical test of competing theories", *Information & Management*, vol. 39, no. 4, pp. 297-311.
- Churchill, G. A. & Brown, T. J. (2006), *Basic Marketing Research*, The Dryden Press International, London, UK
- Davis, F. D., Bagozzi, R. & Warshaw, P. R. (1989), "User acceptance of computer technology: a comparison of two theoretical models", *Management Science*, vol. 35, no. 8, pp. 982-1003.
- Edwards, S. M., Li, H. & Lee, J.-H. (2002), "Forced exposure and psychological reactance: Antecedents and consequences of the perceived intrusiveness pop-up ads", *Journal of Advertising*, vol. 31, no. 3, pp. 83-95.
- Fishbein, M. & Ajzen, I. (1975), *Belief, attitude, intention and behavior: An introduction to theory and research*, Addison-Wesley, Reading, MA
- Garson, G. D. (2006) Structural equation modeling. North Carolina State University, College of Humanities and Social Sciences, <http://www2.chass.ncsu.edu/garson/pa765/structur.htm>, date accessed: 25/08/2006
- Gentry, L. & Calantone, R. (2002), "A comparison of three models to explain shop-bot use on the web", *Psychology & Marketing*, vol. 19, no. 11, pp. 945-955.
- Goby, V. P. (2006), "Online purchases in an infocomm sophisticated society", *CyberPsychology & Behavior*, vol. 9, no. pp. 423-431.
- Hallerman, D. (2008) Video advertising online: Spending and pricing. New York, eMarketer.
- Hsu, M. H. & Chiu, C. M. (2004), "Predicting electronic service continuance with a decomposed theory of planned behaviour", *Behaviour and Information Technology*, vol. 23, no. 5, pp. 359-373.
- Hsu, M. H., Yen, C. H., Chiu, C. M. & Chang, C. M. (2006), "A longitudinal investigation of continued online shopping behavior: An extension of the theory of planned behavior", *International Journal of Human-Computer Studies*, vol. 64, no. 9, pp. 889-904.
- Li, H., Edwards, S.M. & Lee, J.-H. (2002), "Measuring the intrusiveness of advertisements: Scale development and validation", *Journal of Advertising*, vol. 31, no. 2, pp. 37-47.
- Liaw, S. (2004), "The theory of planned behaviour applied to search engines as a learning tool", *Journal of Computer Assisted Learning*, vol. 20, no. pp. 283-291.
- Mathieson, K. (1991), "Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior", *Information Systems Research*, vol. 2, no. 3, pp. 173-191.
- Mcquivey, J. L., De Lussanet, M. & Wilkos, D. (2008) How video will take over the world. MA: Cambridge, Forrester Research.
- Mulligan, M., Banerjee, T. & Thomas, N. (2008) European Paid Content and Activity Forecast, 2008 to 2013, Jupiter Research.
- Oh, S., Ahn, J. & Kim, B. (2003), "Adoption of broadband Internet in Korea: The role of experience in building attitudes", *Journal of Information Technology*, vol. 18, no. 4, pp. 267-280.
- Pedersen, P. E. (2001) Adoption of mobile commerce: An exploratory analysis. *SNF-Report 51/01*. Bergen, Norway, Institute for Research in Economics and Business.
- Pedersen, P. E. (2002) The adoption of messaging services among Norwegian teens: development and test of an extended adoption model. *SNF-Report 23/02*. Bergen, Norway, Institute for Research in Economics and Business.
- Pedersen, P. E. (2005), "Adoption of mobile internet services: an exploratory study of mobile commerce early adopters", *Journal of Organizational Computing and Electronic Commerce*, vol. 15, no. 3, pp. 203-221.
- Rogers, E. (2003), *Diffusion of innovations (4th ed.)*, The Free Press, New York
- Schumacker, R. E. & Lomax, R. G. (2004), *A beginner's guide to structural equation modeling*, Lawrence Erlbaum Associates, Mahwah, N.J.
- Sheppard, B. H., Hartwick, J. & Warshaw, P. R. (1998), "The Theory of Reasoned Action: A meta analysis of past research with recommendations for modifications in future research", *Journal of Consumer Research*, vol. 15, no. 3, pp. 325-343.
- Taylor, S. & Todd, P. (1995), "Assessing IT usage: The role of prior experience", *MIS Quarterly*, vol. 19, no. 4, pp. 561-570.
- TheEconomist (2009) Hulu who? *The Economist. Feb 5<sup>th</sup> 2009*, pp. 25.
- Venkatesh, V. & Brown, S. A. (2001), "A longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges", *MIS Quarterly*, vol. 25, no. 1, pp. 71-102.
- Venkatesh, V. & Davis, F. (2000a), "A theoretical extension of the technology acceptance model: Four longitudinal field studies", *Management Science*, vol. 46, no. 2, pp. 186-204.
- Venkatesh, V. & Davis, F. D. (2000b), "A theoretical extension of the technology acceptance model: Four longitudinal field studies", *Management Science*, vol. 46, no. 2, pp. 186-204.

- Venkatesh, V. & Morris, M. G. (2000), "Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior", *MIS Quarterly*, vol. 24, no. 1, pp. 115-139.
- Venkatesh, V., Morris, M. G., Davis, G. B. & Davis, F. D. (2003), "User acceptance of information technology: Toward a unified view", *MIS Quarterly*, vol. 27, no. 3, pp. 425-478.
- Wang, Y., Lin, H. & Luarn, P. (2006), "Predicting consumer intention to use mobile service", *Information Systems Journal*, vol. 16, no. pp. 157-179.
- Yoh, E., Damhorst, M. L., Sapp, S. & Laczniak, R. (2003), "Consumer adoption of the internet: The case of apparel shopping", *Psychology & Marketing*, vol. 20, no. 12, pp. 1095-1118.

# The Influence of net Benefits on Collective, Innovative, Configural System use: a Case Study of Small-to-Medium Enterprises

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**Abstract:** In today's business world, Small-to-Medium enterprises (SMEs) increasingly join their larger counterparts in regarding use of Information Technology (IT) and Information Systems (IS) as fundamental to business operations. For SMEs, investment in packaged software that has not been customized to individual enterprise needs, allows ready access to much of the IT function enjoyed by their larger counterparts. However, given these systems are not exclusively tailored to the enterprise and further given the collective nature of the work-place in these enterprises, the likelihood increases for work-arounds and unexpected usage to occur to manage enterprise needs. Studies that explore system use typically focus on individual use. Using an interpretive case study approach, this study considers users of a common system in individually owned SMEs to explore evidence of collective, innovative, configural (CIC) use, the causes of this and its impact on fellow workers. Results provide insight into the role of systems as dynamic business tools and show that despite impacts on financial and operational reporting, CIC use occurs for reasons of operational efficiency and also out of frustration with system functionality. This provides some insight into attitudes concerning Use and Net Benefits in the IS Success Model, which in turn informs system evolution.

**Keywords:** collective use, work-arounds, innovative use, configural use, small-to-medium enterprises, net benefits

## 1. Introduction

In the past investment in Information Technology (IT) was regarded as a business opportunity wherein an enterprise could gain competitive advantage or even create barriers to entry for competitors in the marketplace. Today investment in IT is seen as an essential tool for operating enterprises. Much has been written about the management of IT systems in large enterprises (Brown and Magill, 1994; Xue et al., 2008). Here the focus has been on system use at the individual level (Doll and Torzadeh, 1991; Szajna, 1993) and at the corporate/strategic level (Earl, 1993). In these contexts systems are normally used as a means to achieve a goal. However, instances arise that result in the normal functioning of the system becoming an impediment to ready achievement of desired goals. The dynamic environments in which these systems are deployed highlight the impossibility of designing "systems which are appropriate for all users and all situations" (MacLean et al., 1990, p175). This motivates innovation in the way the systems are used. Slappendel (1996, p108) define innovation as "the process through which new ideas, objects and practices are created, developed or reinvented". Such innovative use in the ebb and flow of work-place interactions, when linked with dependence on the cooperative input of individuals, affects strategic reporting and record-keeping functions.

Given use relates to the user's view of IT quality (Ozkan, 2006), understanding use in all its forms is important in progressing a more positive approach to system design (Avital et al., 2006). Adding to this complexity is the fact that collectives, such as groups (Dennis et al., 2001; Easley et al., 2003), organizations (Devaraj and Kohli, 2003), even nations (Dedrick et al., 2003), use systems. Moreover, members of these collectives may use the system more or less frequently and for different purposes, but there can be stable patterns in their use. This is referred to as configural use. However, despite system usage (Barkin and Dickson, 1977) being reviewed over many years, research suggests we still know little about it (DeLone and McLean, 2003). Consequently there have been calls to deepen insights into IT artifacts through conceptualization of systems in new ways (Burton-Jones and Gallivan, 2007). The objective of this paper is to respond to this call by illustrating what evidence exists of collective, innovative, configural (CIC) use in Small-to-Medium Enterprises (SMEs), its causes and how it impacts fellow workers. This understanding would provide insight into the constructs Intention to Use and Net Benefits in the IS Success Model (DeLone and McLean, 2003).

Like their larger counterparts, the benefits afforded to SMEs by IT systems necessitate new structures and processes. However, these are mediated by the close and inter-dependent working relationships

in these enterprises. In this research an interpretive case study approach was used to understand CIC use in SMEs. This offers insight into human interpretations concerning IT systems (something that is fundamental in appreciating IT use, particularly given it's users who evaluate the fit between their tasks and software packages (Mathieson and Ryan, 1997)) and the processes that are intrinsically linked to their conception of work in these enterprises (Smith et al., 2007).

The importance of SMEs to the success of a country's national economy (Johnston and Loader, 2003) makes them a relevant research environment. For example, in Australia there are estimated to be around 130,000 SMEs. The annual turnover is between \$2-250 million; they pay around 15% of total tax collected; and contribute a further 12% of total tax through the withholding payments (Australian Taxation Office, 2008). Likewise in China they account for 60% of industrial output and employ about 75% of the workforce (The American Embassy in China, 2002), whilst another study of SMEs in 62 countries found that their share of total employment was well over 40%, with reports of 86% in Chile, Greece and Thailand (Beck et al., 2004).

In reporting on this study of CIC system use in SMEs, the paper is structured as follows. After outlining the literature regarding system use, the research questions are posed. Following this the methodology is outlined and findings that revealed institutionalized CIC system use at a number of SMEs are reported. The paper then concludes with comments about future research and the place of this study in the context of IT research.

## **2. Literature review**

### **2.1 Use**

Barkin and Dickson (1977 p1) first defined use as occurring when "the output from the information system is included in the Human Processing System of a decision maker". DeLone and McLean's (1992, pp64-80) later definition of use as the "recipient consumption of the output of an information system" is no less helpful as it's really only significant for voluntary use. Better clarification was provided by Burton-Jones and Straub (2006) who, in drawing upon this and work by Szajna (1993), and Subramani (2004), defined system use as an activity with three elements wherein an individual user employs one or more features of a system to perform a task. At an operational level an individual user can use the system in one of two ways, exploitatively (the routine execution of duties) and exploratively (the search for and use of innovative means to achieve results) (March, 1991). Whilst exploitative use is consistently concerned with the normal operations of an enterprise, often the deepest engagement is at the exploratory level. Therein innovation achieves outcomes not realizable with normal use, but which facilitate more immediate results like improved customer satisfaction.

The investigation reported on in this paper considered innovative behavior as far more challenging because:

- for operational users, innovation is usually the result of past frustration about lack of desired or timely outcomes;
- for manager/owner users, it may affect the integrity of data for decision-making; and
- for system developers, it may indicate system deficiencies.

Through its study this research aims to extend understanding about the consequences and drivers of the interplay between Net Benefits, Intention to Use and Use as detailed in the IS Success Model (DeLone and McLean, 2003).

### **2.2 Innovative use**

Given the ubiquity of IT and growth of off-the-shelf software packages that are less individualized to work-place requirements, the likelihood increases for innovations to become agreed and accepted ways of getting information into and out of an IT system. IT offers SMEs efficiencies in managing customers, financial record keeping and accountability for staff performance. Yet SMEs exhibit differences from their larger counterparts. In large organizations use is characteristically hierarchically segmented. In contrast in SMEs owner/managers use the systems for operational as well as reporting functions. Thus, for SMEs the extent of collective and cooperative system use is different and accordingly so too are the opportunities for an enterprise to accept and practise divergences from

normal system use. Consequently the opportunity for agreed innovation increases (Slappendel, 1996).

In exploring user's innovations the investigation was not concerned with work-arounds that may be a 'one off' response by an employee who has yet to master system functionality. Rather it sought to identify innovative use that has been hierarchically institutionalized as an acceptable/required way to handle a circumstance of system use. Investigation that explores the types, role and outcomes of such innovation offers rich opportunities to understand systems as dynamic tools that can be contextualized to their work-place.

Innovative use involves non-compliant user behaviors (Koopman and Hoffman, 2003), typically ad hoc strategies used to handle immediate and confronting problems (Gasser, 1986, p216). Here it offers a means to identify system dysfunctionality (Ciborra, 2002; Devaraj and Kohli, 2003) and even argue for system evolution (Zhang et al., 2005). For example, Diconsiglio (2008) investigated nurses working-around the barcodes on patients' arm bands when these codes could not be scanned because they were damaged. Here, given administering medication to patients is time critical, some nurses worked-around the problem by scanning duplicate wristbands, which they kept on their arms as a back-up; others simply carried pre-scanned pills. Similarly, the malfunction of an email system was overcome by locking the F9 key on the keyboard into a down position (Sharky, 2007). Both are examples of users dealing with a lack of system functionality in exploratory ways; however they differ from this investigation because there is no collective agreement across hierarchical levels to accept the practice as the normal way to achieve an outcome.

Whilst it is acknowledged that exploitative use should be valued as normal use of IT, it is important to focus on users' exploratory use of systems to advance literature about the inner workings and dynamics of IT use (Ciborra, 2002; Ferneley and Sobreperez, 2006) and the IS Success Model. This offers insight into the reasons for such acceptance in a cooperative/collective environment.

### 2.3 Collective use

Although system use has long been studied at the individual level (Davis et al., 1989), it is not the only way that system use occurs. Often groups of users work together, interacting in their use of a system to produce outputs that have been collectively generated and upon which they are collectively reliant. Indeed earlier research by Cross et al. (2002) found that workers relied on social networks rather than the internet or databases to find necessary information. This aspect of system use has largely been ignored and in contrast to the economic theory of collective action, which focuses on the provision of public goods, together with other collective consumption (Coase, 1937), collective use focuses more on the actual IS usage practices by workers in organizations, which can be driven by a number of factors including customer service. Arguably this area warrants further investigation and SMEs offer a rich environment in which to conduct such research.

In exploring this it is important to understand the distinction between individual and collective constructs. Morgeson and Hofmann (1999) define an individual as a person and a collective as an interdependent group of individuals with a collective goal direction. Further, in a multilevel construct, the system can be used differently at different levels: this becomes a collective when interaction occurs and interdependencies arise because two or more (entities) are mutually dependent on each other (Karsten, 2003).

Collective use, therefore, is more than social or task-related interaction among members of the collective. Collaboration, communication and coordination are essential components of any interdependency and constitute evidence of collective use (Burton-Jones and Gallivan, 2007). Further, they argued that collective use may take one of two forms: shared and configural. Shared constructs occur when individual use emerges at the collective level as homogeneous use among collective members. Configural constructs occur when members of the collective use a system more or less frequently and for different purposes, but there is a stable pattern to their use.

All of these theoretical constructs have relevance to IT use in SMEs where the workforce is not merely a group of individuals who use a system. Instead SMEs characteristically have several levels of users, with some members switching between functions. For example, some utilize the system operationally, like front office staff in accommodation enterprises: alternatively owners/managers use the system operationally when dealing with customer transactions, but switch to analysis/financial

functions for reporting. With the tendency towards off-the-shelf systems, the likelihood increases for agreed innovative use to work-around the lack of system functionality to achieve desired outputs. This relates to research by Sussman and Seigal (2003) who found that usefulness could be the mediating influence for workers in the knowledge adoption process. As a result it is hypothesized that collective use should exist, and when expected levels of agreed commonality of use are present, then that use should be both collective and configural. This impacts customer service and in turn customer service may impact use.

## **2.4 Customer service and SMEs**

A focus on customer service is often regarded as the best method to progress an enterprise (Rorholm, 2008) with twofold benefits. Firstly, research has shown that increased customer satisfaction is beneficial to an organization's productivity (Kwak, 2003; Rorholm, 2008); and secondly a focus on consistent customer service will create a point of difference between the enterprise and its competitors (Business Wire, 2009). With their limited marketing budgets, SMEs are very aware that costs associated with attracting customers are higher than those associated with retaining customers (Kwak, 2003; Rorholm, 2008); and that investment in the development of quality customer service relationships will improve customer loyalty, retention and in turn profitability (Ennew and Binks, 1996; Vandenbosch and Dawar, 2002). Thus, the relationship between customers and front-line service providers is regarded as more significant for SMEs than for larger organizations (Batt, 2000).

Secondly SMEs are less likely to use consultants or research and development to extend the functionality of IT systems (Miles, 2008). Budgetary constraints may be part of the reason. A separate comparative study of IT management of SMEs in Canada and the USA found that the robust exchange of information between managers and others in the organization was reflected in the organization's ability to use IT innovatively in operational and strategic ways (Montazemi, 2006). Similarly, Miles (2008) reported that project management and on-the-job innovation are common ways of achieving service innovation.

Thirdly, SMEs tend to take a less strategic view of the enterprise and are more reactive to immediate needs than longer term goals (Rangone, 1999; Sexton and van Auken, 1982). In fact, a business plan is a necessity for larger enterprises given their size and consequently the formal demands of financial providers and/or shareholders. For SMEs these financial undertakings are often backed by personal guarantees, so many owners opt for the ad hoc option of thoughts about the enterprise, which are sometimes not written and certainly not backed with strict budget accountability (Brailsford, 1995). As such, SMEs may watch the gross returns carefully, but not the detail (Brailsford, 1995). These factors all ultimately impact customer service and thus the individuals concerned as well as the organization as a whole. Moreover, they impact IS Success.

## **2.5 IS evaluation**

In attempting to structure the myriad of variables associated with the diversity of information systems, DeLone and McLean (1992) argued that there was little relevance in calculating input variables like user participation or level of IT investment with respect to information systems, if the dependent or output variable, IS Success or MIS Effectiveness, could not be calculated with similar accuracy. Herein IS success is "a value judgement made by an individual, from the point of some stakeholder" (Seddon, 1997 p83). Since DeLone and McLean's 1992 paper there has been much debate around the components of the IS Success Model and their operationalization (DeLone and McLean, 2003). However, the end of their model, which is concerned with Intention to Use, Use, User Satisfaction and Net Benefits has been least understood.

Given this background, from an IS evaluation perspective, it seems pertinent to ask:

- What evidence is there of CIC use in SMEs?
- What causes this type of use to occur?
- How does it impact fellow workers?

Answers to these questions provide deeper understanding about CIC use and offers some insight into its effect on the related components of the IS Success Model.

### 3. Research method and context

#### 3.1 Methodology

As already mentioned, an interpretive case study approach (Walsham, 1995) was used to understand the evidence of CIC use in SMEs, the causes that give rise to such use, and how it impacts fellow workers. This method has been used in a significant number of studies that cover a range of topics and issues (for example, Orlikowski and Baroudi, 1991; Carey, 2008). Given the relevance of the method in exploring social issues (Walsham, 1995) and the “how” and “why” questions where a researcher wants to investigate events or actions in real-life contexts and has little control over these events (Yin, 2003), it was relevant in this study in investigating evidence, causes and impacts of CIC use across a variety of SMEs. Here the method facilitates drawing out the subtleties of human interactions with a system, something that is only possible with rich data.

Accepting Yin's (2003) stance on case studies, evidence of use in this case study came from documents (in this case training manuals); interviews; direct observation; and physical artefacts (such as house-keeping lists and check-out reports). The focus was on capturing participants' interpretations as accurately as possible, whilst also allowing the normal social exchanges that occur in interviews to take place. Moreover, by positioning as an outside observer, any perception of having a personal stake in the results was removed.

Participants were motivated because their concerns about operationalizing aspects of the system (Walsham, 1995) were appreciated. For each interview detailed notes were taken so that a conceptual understanding of system use could evolve (Corbin and Strauss, 1990). Further, as the interviews progressed the questions were refined and new ones added to clarify emerging understanding. To improve validity, results from the initial analysis were shared with a senior independent expert of the system. Collaboration was felt to be effective because participants expressed their own ideas, yet challenged those of other people: their opinions developed understanding about system use; and moreover most commented that they benefited from the process (which was in line with Levina and Vaast, 2008).

#### 3.2 Research context: enterprises, system and participants

This study investigated SME tourist accommodation enterprises that are individually owned and operated, but are part of marketing groups called Beta and Omega. These SMEs were chosen because the author had practical familiarity with the context and because they operate in a dynamic environment. Both marketing groups are key players in one sector of the Australian tourism industry. Whilst neither Beta nor Omega mandate a particular transaction processing system, approximately 65% of enterprises have installed the same system, although each installation operates entirely independently, with no central server. This commonly used system is the focus of this study into collective IS use.

For Beta and Omega, the transaction processing system is the operational core, managing accommodation bookings, financial recording keeping and business reporting. Use is characteristically routine and structured. Further, activities that occur within the system are reported to accounting systems with financial information used, for example, to prepare daily banking. This system has been in use within the Beta and Omega groups for over 16 years, with multiple releases.

Participants in the study included front-office staff (operational level users) and site managers/owners (operational and managerial users). Most were confident users as they had at least 5 years' relevant experience in actual use of this system (many in excess of 10 years). The training provided to users varied, but included a combination of: what was provided at the time of installation; on-demand pre-booked telephone support; and refresher courses at annual conferences. Training was generally accessed by owner/managers, with front-office or operational level staff trained by their superiors. The remainder of users' knowledge was acquired on site as they experimented – usually by executing actual transactions, but sometimes by using the system in training mode.

Over a lengthy period, observations and interviews with 12 managerial and 25 operational users provided evidence of CIC use in the chosen SMEs. Interactions that occurred with participants took place in a friendly, collegial manner and were aided by copious notes, which facilitated the refinement

of questions in revisits. These revisits played an important role in clarifying understanding and enabled investigation of use that had not been fully appreciated in the first visit.

Participants were spread across 14 locations that were geographically dispersed and operationally different with respect to enterprise size, nature of bookings and managerial control. This meant that any common instances of innovative use were particularly interesting.

#### 4. Case study findings

Five main areas were identified where there was consistent evidence of users' CIC use with functionality of the transaction processing system to manage various circumstances (see Table 1). Explanations for the innovations varied, but were all driven by operational imperatives. Some said:

*"We could not let staff know about the discounted rates given to wholesalers (up to 50%) because otherwise our full fee customers could learn of it and want a cheaper rate"; or*

*"Late check outs are painful and not worth the effort in managing cleaning staff, but at off-peak times they keep a lot of customers very keen to return for weekends so we manage"; or*

*"Group bookings (a receptionist) are the commonest cause of front office error. One receptionist does one party and another does the next, so on one invoice you have credits for amounts paid and balance owing with that customer refusing to see how you can have this rolling balance until all have paid. Splitting this into separate bookings was the best thing we ever did"; or*

*"I (an owner) got really upset one day when a receptionist had again failed to charge a customer for half their account because they had moved units and she had overlooked the second account for this part of the stay. The customer had to be contacted and it was all very uncomfortable so I resolved to find a way around this. The office manager and I worked out a solution and we all agreed to use it".*

In Table 1 (see below), six types of CIC use are reported. Each was identified at more than one site. Moreover, each had the same motivation, being operationally driven to please customers despite implications for managerial reporting/analysis.

**Table 1:** Examples of CIC use in the transaction processing system and categorized implications for the enterprise\*

Functionality	Description of the functionality	User of the functionality	Problem	Collective, innovative, configural (CIC) use	Generalized implications/results (see Table 2 for practical consequences)
Pricing	Some bookings are sourced from wholesalers wherein the customer buys the holiday from the wholesaler and the enterprise needs to claim this payment less a commission fee from the wholesaler	Front office staff	The enterprise does not want the customer, nor office staff, to know the amount of commission and any discounts	1. Automatic pricing is overridden with the customer's receipt showing the amount owing as \$0. Customers are happy because they have already paid the wholesaler and have the receipt showing that no money is owed	When these payments are claimed they are banked without being entered into the reservation part of the transaction processing system. Thus occupancy is known, cash flow is inaccurate and returns per room are understated
	Customers may request a late check-out for an extra charge	Front office staff in conjunction with Owner/ Mangers	This functionality is not available as part of the standard package	2. The late check-out fee is debited to the customer's account by adding a miscellaneous charge	Inconsistencies may occur in the treatment of customers. The system does not recognize this when printing check-out reports (and in producing cleaning

Functionality	Description of the functionality	User of the functionality	Problem	Collective, innovative, configural (CIC) use	rosters) Generalized implications/results (see Table 2 for practical consequences)
Yield Management	This functionality enables rooms to be priced according to demand with increased prices in periods of demand	Owner/ Manager	Front office staff ignore price fluctuations when taking telephone reservations because they take bookings by checking availability not pricing	3. The enterprise is obliged to honor the quoted price and consequently needs to override the higher price when checking the customer in	Loss of revenue
Check-out	On the customer's departure date the system expects everyone to check-out by the normal 'check-out time'	Front office staff	Cleaning rosters are generated at the start of each day. These detail the rooms to be cleaned	4. Details regarding late check-outs need to be manually recorded on the roster to prevent cleaners disturbing customers	Customer complaints would occur without manual intervention
Group Booking	This functionality enables a number of accounts to be linked together on a single invoice	Front office staff	Members of groups often wish to settle their accounts separately and demand separate receipts to record this	5. In this situation the enterprise actively ignores the group booking functionality instead recording the bookings as a series of individual bookings i.e., Smith 1, Smith 2, Smith 3 etc.	Information about the value of group bookings is lost
Caravan Storage	When a customer stores a car or van onsite between visits, the system handles this with separate accounts	Front office staff	The customer wants one account rather than multiple accounts	6. Group functionality enables the customer's individual accounts to be linked to one master account for payment	Information about group bookings is distorted

\* All examples are in common use by at least one work-place.

By their very nature, once an enterprise started to manage a circumstance of functionality like those outlined above in a manner that differed from the normal functionality, it had to be collectively used in the organization or customer and staff problems were bound to arise. For each reported example, the system was collectively used at different, but yet integrated, vertical levels at two or more enterprises within Beta and/or Omega. Interactions between users at the relevant enterprises were ongoing as they grappled with the ramifications of system use. For example, owners/managers were aware of the implications of each use for analytical/reporting functions, but sanctioned those listed as being the best operational alternatives (see Table 2). This gave us insights into how interdependencies-in-use affected performance (Burton-Jones and Gallivan, 2007). As the reported examples are concerned with individual uses that emerge at a collective level in distinct outputs, it is argued, in Burton-Jones and Gallivan's (2007, p668) terms, that configural, collective system use had been observed, with glints of innovation (Slappendel, 1996).

**Table 2:** Implications for the enterprises from the CIC use

Collective, innovative, configural (CIC) use (from Table 1)	Specific implications for managerial analysis/financial reporting (comments from the sites investigated)
1. Automatic pricing is overridden with the customer's receipt showing the amount owing as \$0. Customers are happy because they have already paid the wholesaler and have the receipt showing that no money is owed.	For confidentiality, payments from the wholesaler are confirmed against client records, but the amounts are not credited into that part of the system (so staff cannot read them). Instead the cheques are entered into the MYOB file and banked. This means that analysis in that category of accommodation is accurate with respect to occupancy, but returns per unit are understated. We made \$50,000 per year from this so the effort and misreporting were significant.
2. The late check-out fee is debited to the customer's account by adding a miscellaneous charge	In charging the customer, some staff fail to read the notes in the IT file and consequently wrongly charge the customer or don't charge them at all. For a "walk up" booking requesting a late checkout, at times staff fail to add a note in housekeeping that will warn the house keeper about a later clean.  At \$10 per time charge does seem much, but you have to realize that you wouldn't have the rest of the booking otherwise (\$200-\$500).
3. The enterprise is obliged to honor the quoted price and consequently needs to override the higher price when checking the customer in	Manually over-riding a price in the system means that the price remains fixed and if the guest adds extra people or nights, the system will not alter the price. This means that staff have to remember to manually recalculate the bill or we lose money. Manual recalculation can produce errors and argument; and undue time spent at check-in.  The loss of income per booking was usually not great (\$20), but the angst and errors were not good for customer service at first point of contact.
4. Details regarding late check-outs need to be manually recorded on the roster to prevent cleaners disturbing customers	My guests are not happy if we do not offer this in off-peak times; and are not happy if they pay for being undisturbed and we overlook this and a cleaner knocks on the door. It costs management a lot of attention to detail.
5. In this situation the enterprise actively ignores the group booking functionality instead recording the bookings as a series of individual bookings i.e., Smith 1, Smith 2, Smith 3 etc.	Income per accommodation type is accurate, but in looking at sources of bookings, the role of groups is seriously under estimated. They are a major source of business for long weekends and Easter, but you only know this from the initial phone contact and by talking to guests. This affects marketing initiatives.
6. Group functionality enables the customer's individual accounts to be linked to one master account for payment	Group bookings as a source of business are mis-reported (this time upwards). We put up with it because it means that no one overlooks charging the guests for some of their stay and that used to cost us at least several hundred dollars per slip-up.

## 5. Insights from the case study

There are several notable outcomes arising from this case study. Firstly, there was variation in use of the common transaction processing system across different enterprises within Beta and Omega. This variation exists despite the well established nature of the system. Furthermore, evidence of both innovative and normal use was found. For example, looking at use of the group booking functionality, it was found that users in some SMEs used the functionality in innovative ways, whilst users in other SMEs opted to neglect the functionality altogether. Both represent work-arounds, but only one is innovative in nature.

Secondly, with respect to pricing functionality, a number of instances of user innovation were evident. Notably, it appears that some enterprises have been slow to adopt new approaches to market opportunities (such as wholesaler packages). In part some owners agreed that this failure was due to an inability to innovate around constraints of the system to handle the necessary transactions. Not only does this appear to impact negatively on the current operation of the enterprise, but it also hinders the ability of the enterprise to take advantage of new market opportunities because enterprises were unwilling to access new business opportunities when they perceived difficulties in operationalizing the system to accommodate the variation.

Thirdly, looking at use of the yield management functionalities, users in some enterprises used the system functionality faithfully. Others used the system ineffectively with obvious immediate negative effects on task performance as was the case when customers were quoted a price different from that in the system and manual overriding of the pricing functionality was the method used to manage this disparity. The same sorts of problems arose with the innovation created to handle the late checkout of customers. Here, once again, collective understanding and agreement were essential in managing this lack of functionality so that the customer was not affected.

Finally, where there was a consistent pattern in the examples of innovative use, these were typically performed at the front counter to manage customer transactions quickly and efficiently and/or to maximize customer satisfaction with the booking process. Delays, lack of clarity in the process and the production of incomprehensible invoices are not conducive to customer satisfaction (Yu, 2001). This pattern of using customer-friendly outputs had considerable impact on the reporting of data for both administrative and financial management records (see Table 2). Yet managers actively countenanced such outcomes.

Given the culture of service apparent in this case study, the decision to favor CIC use of the transaction processing system to ensure customer satisfaction is understandable. Moreover, in light of the fact that SMEs tend to take a less strategic view, their focus upon the immediacy of customer service (Appiah-Adu and Singh, 1998) explains the willingness by staff to collectively adopt innovative use as routine practice (configural use), despite the negative impacts on other reporting aspects of the enterprise function.

Results show that the SMEs who used the system in an innovative manner were among the more successful ones in their groups. As entrepreneurship has long been a characteristic of successful SMEs (Brailsford, 1995; Sheehan, 2006), this flexible attitude to IT use is unsurprising (the attitude to wholesaler packages is an example of this).

So in answer to the research question concerning what evidence was there of CIC use in SMEs, the support is clear: it occurs in a multitude of ways (see Table 1). In line with Slappendel (1996) there was evidence of agreed innovation. Moreover, this study has shown that in contrast to Gasser (1986), innovative use does not always involve ad hoc strategies. In fact these innovations can assume collective understanding and agreement amongst staff, such that they become common place so that customers are not affected. Understanding this type of use is important given it has managerial and thus organizational impacts. Moreover, capturing such deep understanding is important in system evolution. Yet, as with this case, system developers do not appear to be immersing themselves in the environments in which these systems are used to gather such deep insight which can enrich future versions of systems.

As for what causes this type of use, it would certainly seem to be driven by a desire to offer better customer service. Given customer service is seen as important for progressing an enterprise (Rorholm, 2008), this is perhaps unsurprising. However, those who used the system in this manner were operational users acting with management's agreement (again see Table 1). With respect to affects, given CIC use impacts financial, marketing and analytical reporting, owner/managers typically bear the ramifications. However, there are also individual impacts with flow-on consequences to fellow workers when they are directed by management to use the system in certain ways (see Table 2). Thus, there has been some conscious choices made about Net Benefits that could be gained from Use. Accuracy in reporting functions has been sacrificed to customer service: or in other words, environmental factors have directly affected Intention to Use, Use and Net Benefits.

Whilst the findings are insightful, there are caveats with the approach. Firstly, although multiple users were examined within the SMEs, these users were drawn from only two accommodation marketing groups (Beta and Omega). Secondly, given that approximately 65% of enterprises in these marketing groups used the same system, the focus was on users of one system. Thirdly, use of the system was mandatory in the enterprises studied. None of these caveats substantially detract from the findings reported in this paper. Instead they offer avenues for future research.

## 6. Future research directions

A logical extension to this study would be to take these understandings about CIC use and interdependencies-in-use and frame them as a set of specific questions in a survey administered to a

wider audience. Despite this investigation being carried out solely in Australia, the nature of the work environment and the relationship between users in SMEs within this service sector is likely to be quite universal. Therefore, replication of the study in other countries/other cultures should provide interesting data, allowing the study to evolve whilst still being executed within the existing methodological framework thereby making comparisons to support or reject the regularity of such practices in SMEs.

Reflecting on these findings in the context of DeLone and McLean's (2003) framework for conceptualizing the IS function, it is the components Intention to Use, Use (beyond Individual Use) and Net Benefits whose performance have been less understood. The proposed extension to this study (see above) would facilitate some understanding of these components through a practical study of users in their work environment. Moreover, by focusing on SMEs, there is the opportunity to talk with different types of users who are comfortable engaging with one another in the use of a common system, who share common frustrations with system functionality and who are likely to seek their own solutions rather than engaging consultants. Given that the literature to date has focused on larger organizations with more structured hierarchies and work demands, such an approach would be particularly informative.

Finally, this study raises interesting questions about the link between willingness to be innovative in system use and formal business planning in SMEs. Entrepreneurial skills have long been regarded as an advantage in the successful operation of SMEs and this study provides some thoughtful insights beyond the usual examples related to niche manufacturing or retail. Comparing the occurrence of innovative collective IT system use in SMEs with that in larger enterprises in the same service sector would be a further worthwhile extension.

## **7. Conclusion**

This research has attempted to investigate, using an interpretive case study approach, evidence of CIC use in SMEs, its causes and how it impacts fellow workers. In doing so, valuable insights are offered into use that occurs due to frustration with system functionality.

Further, with results demonstrating that SMEs can indeed be innovative in their use of IT, there is merit in investigating this to expand current understanding about system use beyond individual use. Like Venkatesh et al. (2008), this work goes beyond system use as a measure of IT functionality and sees use in terms of task performance and as a consequence of interaction in the context of the system, the task, the user(s) and their environment. The CIC use was accepted as the chosen preferred option from a choice between a happy customer and tidy reporting information. Realization that this Net Benefit (customer service) was better than normal exploitive use was what created the innovative intention to use and consequent use, with these attitudes and uses becoming the norm. Herein there is clear evidence of the role of environmental factors (customers and the demand for good service) directly affecting Intention to Use and Use through the influence of Net Benefits that is outside the functionality of the system itself. Thus, this study has extended understanding of the central components of the IS Success Model (DeLone and McLean, 2003). Indeed the case study may suggest that in a workplace where close and inter-dependent working relationships are present, Net Benefits may influence Intention to Use and Use more than User Satisfaction.

Finally, this study shows that SMEs can indeed be collectively innovative in their adoption of IT systems. Given the impossibility of designing systems to suit all users in all situations, this is perhaps unsurprising. In this study, like Slappendel (1996), innovation was facilitated by communication between an organization and its environment. Further, given their critical role in the success of national economies, SMEs provided a rich source of data for conceptualizing understanding about interdependencies in CIC system use. Systematic understanding of such use is fruitful for achieving better insights that can feed in to evolution of packaged software applications and increase system longevity.

## **References**

- (The) American Embassy in China (2002) China's small and medium enterprises: Room to grow with WTO. Retrieved January 11, 2009, from [www.usembassy-china.org.cn/econ/smes2002.html](http://www.usembassy-china.org.cn/econ/smes2002.html).
- Appiah-Adu, K., and S. Singh (1998) Customer orientation and performance: A study of SMEs. *Management Decision*, Vol. 36, No. 6, pp385-394.

- Avital, M.K. Lyytinen, R. Boland, B. Butler, D. Dougherty, M. Fineout, W. Jansen, N. Levina, W. Rifkin, and J. Venable (2006) Design with a positive lens: An Affirmative Approach to Designing Information and Organizations, *Communications of AIS*, Vol. 18, pp519-545.
- Australian Taxation Office (2008) Compliance program 2008-09, <http://www.ato.gov.au/corporate/content.asp?doc=/content/00155156.htm&page=38&H38&mnu=42758&mp=001>
- Barkin, S.R., and G.W. Dickson (1977) An investigation of information system utilization. *Information and Management*, Vol. 1, No. 1, pp35-45.
- Batt, R. (2000) Strategic segmentation in front-line services: matching customers, employees and human resource systems. *International Journal of Human Resource Management*, Vol. 11, No. 3, pp540-561.
- Brailsford, T.J. (1995) Small business plans, budgets and performance measures. *Businessdate*, Vol. 3, No. 3, pp1-5.
- Beck, T., A. Demircug-Kunt, and R. Levine (2004) SMEs, growth, and poverty: cross-country evidence, available at: [www.worldbank.org/research/projects/sme/Beck-SMEs\\_Growth\\_and\\_Poverty.pdf](http://www.worldbank.org/research/projects/sme/Beck-SMEs_Growth_and_Poverty.pdf).
- Brown, C.V., and S.L. Magill (1994) Alignment of the IS function with the enterprise: Toward a model of antecedents. *MIS Quarterly*, Vol. 18, No. 4, pp371-403.
- Burton-Jones, A., and M.J. Gallivan (2007) Toward a Deeper Understanding of System Usage in Organizations: A Multi-level Perspective, *MIS Quarterly*, Vol. 31, No. 4, pp657-679.
- Burton-Jones, A., and D.W. Jr Straub (2006) Reconceptualizing system usage: An approach and empirical test. *Information Systems Research*, Vol. 17, No. 3, pp228-246.
- Business Wire (2009) TigerDirect named "excellent in customer service". *Business Wire*, New York: Jan 20.
- Carey, J. (2008) Role misconceptions and negotiations in small business owner/web developer relationships. *Journal of Management and Organization*, Vol. 14, pp85-99.
- Ciborra, C.U. (2002) *The labyrinth of information*, Oxford: Oxford University Press.
- Coase, R. (1937) The Nature of the Firm, *Economica*, Vol. 4, No. 16, pp386-405.
- Corbin, J. and A. Strauss (1990) Grounded theory research: Procedures, canons and evaluative criteria. *Qualitative Sociology*, Vol. 13, No. 1, pp3-21.
- Cross, R., N. Nohria and A. Parker (2002) Six Myths About Informal Networks -- and How to Overcome Them. *MIT Sloan Management Review*, Vol. 43, No. 3, pp67-75.
- Davis, F.D., R.P. Bagozzi, and P.R. Warshaw (1989) User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, (7)2, pp. 982-1003.
- Dedrick, J.L., V. Gurbaxani, and K.L. Kraemer (2003) Information Technology and Economic Performance: A Critical Review of the Empirical Evidence, *ACM Computing Surveys*, Vol. 35, No. 1, pp1-28.
- DeLone, W.H. and E.R. McLean (1992) Information systems success: The quest for the dependent variable. *Information Systems Research*, Vol. 3, No. 1, pp60-95.
- DeLone, W.H., and E.R. McLean (2003) The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, Vol. 19, No. 4, pp9-30.
- Dennis, A.R., B.H. Wixom and R.J. Vandenberg (2001) Understanding Fit and Appropriation Effects in Group Support Systems via Meta-Analysis, *MIS Quarterly*, Vol. 25, No. 2, pp167-193.
- Devaraj, S. and R. Kohli (2003) Performance impacts of information technology: Is actual usage the missing link? *Management Science*, Vol. 49, No. 3, pp273-289.
- Diconsiglio, J. (2008) Creative "work-arounds" defeat bar-coding safeguards for meds. *Materials Management in Health Care*, Vol. 17, No. 9, pp26-28.
- Doll, W.J. and G. Torzadeh (1991) The measurement of end-user computing satisfaction: Theoretical and methodological issues. *MIS Quarterly*, Vol. 15, No. 1, pp5-10.
- Earl, M.J. (1993) Experiences in strategic information systems planning. *MIS Quarterly*, Vol. 17, No. 2, pp1-24.
- Easley, R.F., S. Devaraj and J.M. Crant (2003) Relating Collaborative Technology Use to Teamwork Quality and Performance: An Empirical Analysis, *Journal of Management Information Systems*, Vol. 19, No. 4, pp249-270.
- Ennew, C.T. and M.R. Binks. (1996) The impact of service quality and service characteristics on customer retention: Small businesses and their banks in the UK. *British Journal of Management*, Vol. 7, No.3, pp219-230.
- Ferneley, E.H. and P. Sobreperez (2006) Resist, comply or workaround? An examination of different facets of user engagement with information systems. *European Journal of Information Systems*, Vol. 15, No. 4, pp345-356.
- Gasser, L. (1986) The integration of computing and routine work. *ACM Transactions on Office Information Systems*, Vol. 4, No. 3, pp205-225.
- Johnston, K., and K. Loader (2003) Encouraging SME participation in training: Identifying practical approaches. *Journal of European Industrial Training*, (27)6, pp. 273-280.
- Karsten, H. (2003) Constructing interdependencies with collaborative information technology. *Computer Supported Cooperative Work*, Vol. 12, pp437-464.
- Koopman, P. and R.R. Hoffman (2003) Work-arounds, make-work, and kludges. *IEEE Transaction on Intelligent Systems*, Vol. 18, No. 6, pp70-75.
- Kwak, M. (2003) The True Value of a Lost Customer. *MIT Sloan Management Review*, Vol. 44, No. 2, p9.
- Levina, N. and E. Vaast (2008) Innovating or doing as told? Status differences and overlapping boundaries in offshore collaboration. *MIS Quarterly*, Vol. 32, No. 2, pp307-332.

- MacLean, A., K. Carter, L. Lovstrand, and T. Moran (1990) User tailorable systems: Pressing the issues with buttons. In *Proceedings of CHI '90*, New Orleans, LA.
- March, J.G. (1991) Exploration and exploitation in organizational learning. *Organization Science*, Vol. 2, No. 1, pp71-87.
- Mathieson, K. and T. Ryan (1997) Users' Evaluations of Packages: Demonstrations Versus Hands-On Use, *Electronic Journal of Information System Evaluation*, Vol. 1, No. 1.
- Miles, I. (2008) Patterns of innovation in service industries. *IBM Systems Journal*, Vol. 47, No. 1, pp115-128.
- Montazemi, A.R. (2006) How they manage IT: SMES in Canada and the U.S. *Communications of the ACM*, Vol. 49, No. 12, pp109-112.
- Morgeson, F.P. and D.A. Hofmann (1999) The structure and function of collective constructs: Implications for multilevel research and theory development. *Academy of Management Review*, Vol. 24, No. 2, pp249-265.
- Orlikowski, W.J. and J.J. Baroudi (1991) Studying Information Technology in Organizations: Research Approaches and Assumptions, *Information Systems Research*, Vol. 2, No. 1, pp1-28.
- Ozkan, S. (2006) A Process Capability Approach to Information Systems Effectiveness Evaluation, *Electronic Journal of Information System Evaluation*, Vol. 9, No. 1, pp7-14.
- Rangone, A. (1999) A resource based approach to strategy analysis in small-medium enterprises. *Small Business Economics*, Vol. 12, No. 3, pp233-248.
- Rorholm, J. (2008) Cater to the customer. *McLatchy-Tribune News*. Washington, Dec 30.
- Seddon, P.B. (1997) A respecification and extension of the DeLone and McLean model of IS success. *Information Systems Research*, Vol. 8, No. 3, pp240-253.
- Sexton, D.L., and P.M. van Auken (1982) Prevalence of strategic planning in small business. *Journal of Small Business Management*, Vol. 20, No. 3, pp20-26.
- Sharky (2007). Shark tank: Work arounds. *Computer World*. June 18. Retrieved 14 January, 2009, from <http://blogs.computerworld.com/sharky/20070618>.
- Sheehan, J. (2006) Understanding Service Sector Innovation. *Communications of the AC*, Vol. 49, No. 7, pp43-48.
- Slappendel, C. (1996) Perspectives on Innovation in Organizations. *Organization Studies*, Vol. 17, No. 1, pp107-129.
- Smith, H.A., J.D. McKeen and S. Singh, (2007) Developments in Practice XXVIII: Managing Perceptions of IS. *Communications of AIS*, Vol. 20, pp760-773.
- Subramani, M. (2004) How do suppliers benefit from information technology use in supply chain relationships. *MIS Quarterly*, Vol. 28, No. 1, pp45-74.
- Sussman, S.W. and W.S. Siegal (2003) Informational Influence in Organizations: An Integrated Approach to Knowledge Adoption. *Information Systems Research*, Vol. 14, No. 1, pp47-65.
- Szajna, B. (1993) Determining information systems usage: Some issues and examples. *Information and Management*, Vol. 25, No. 3, pp147-154.
- Vandenbosch, M. and N. Dawar (2002) Beyond Better Products: Capturing Value in Customer Interactions. *MIT Sloan Management Review*, Vol. 43, No. 4, pp35-42.
- Venkatesh, V., S.A. Brown, L.M. Maruping and H. Bala (2008) Predicting Different Conceptualizations of System Use: The Competing Roles Of Behavioral Intention, Facilitating Conditions, And Behavioral Expectation. *MIS Quarterly*, Vol. 32, No. 3, pp483-502.
- Walsham, G. (1995) Interpretive case studies in IS research: Nature and method. *European Journal of Information Systems*, Vol. 4, pp74-81.
- Xue, Y., H. Liang, W.R. Boulton (2008) Information technology governance in information technology investment decision processes: The impact of investment characteristics, external environment, and internal context. *MIS Quarterly*, Vol. 32, No. 1, pp67-96.
- Yin, R.K. (2003) *Case study research: Design and methods* (3<sup>rd</sup> ed.). Beverly Hills, CA: Sage Publications.
- Yu, L. (2001). What Really Makes Customers Happy? *MIT Sloan Management Review*, Vol. 42, No. 4, pp19.
- Zhang, P., J. Carey, D. Te'eni and M. Tremaine (2005) Integrating Human-Computer Development into the Systems Development Life Cycle: A Methodology. *Communications of AIS*, Vol. 15, pp512-543.