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25 Years of Research into the Management of eTechnology Projects

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Abstract

Over the last 25 years, information technology has evolved from intra-organizational systems to inter-organizational electronic technologies (eTechnology) that span organizations and industries and to extra-organizational systems delivered via the Internet, which involve individuals rather than organizationss. Project management research has largely sought reasons for project outcomes (Factor Research), and considered projects either as a process (Engineering Tradition) or as a form of organization (Social Science Tradition).

This meta-analysis of 284 research papers identified key findings that provide insights and guidance for eTechnology project management in different technical and organizational environments. As the management context of eTechnology projects changed and project implementation moved beyond the control of a single organization, research focus shifted to examining topics within inter-organizational environments. Although some shift in focus occurred towards the social aspects of eTechnology project management, there was comparatively little use of multiple levels of analysis or interdisciplinary research within the Social Science Tradition.

Keywords: Project Management, Methods, Information Technology, Research, Socio-Technical, Factors, Engineering Research, Social Science Research.

1 Introduction

One special characteristic of the Bled Conferences held in Slovenia since 1988 is interaction between practitioners and academics. Both groups benefit from the exchange. The papers, presentations and informal discussions about international industry and research experience provide insights into issues associated with managing projects in complex environments, and knowledge about electronic technologies (eTechnology) including systems that enable electronic data interchange (EDI), process business transactions electronically (eBusiness) and use the Internet (Web).

The Project Management Institute defines a 'project' as "a temporary endeavour undertaken to create a unique product or service" (Project Management Institute, 2000, p4). 'Project management' applies "knowledge, skills, tools and techniques to project

activities to meet project requirements [and] … is accomplished though the use of processes ... [which include] controlling" (p6). Project management must be appropriate for the context. "Context refers to the setting in which potential ... applications are identified and realised." (Krcmar et al. 1994, p202).

eTechnology is a 'socio-technical system' (Mumford, 1995). Socio-technical theory, developed by the Tavistock Institute, in particular Trist and Bamforth, ,(1951), proposes that information systems comprise both social and technical components, and, like other systems, are open to, and are influenced by, their environments. In relation to project management, "The technical subsystem comprises the devices, tools and techniques needed to transport inputs into outputs … the social subsystem comprises employees (at all levels) and the knowledge, skills, attitudes, values and needs … and authority structures that exist in the organization" (Akbari & Land 2012). The definition of social system includes the external environment including stakeholders (Doherty & King, 2005).

The context of eTechnology project management is shaped by both the organizational and technical environments. The organizational environment in which eTechnology projects are undertaken is determined by the characteristics of the organization(s) that take the role of 'project owner'. The governance structures and mechanisms that apply within the owner organization(s) directly affect the authority of the project manager and the controlling techniques available for directing resources, coordinating activities and achieving the required project outcomes. The technical environment, especially the type of technology and how it is implemented and used, determines the scope and the extent of its impact. The technology determines the technical skills required. The scope and extent of the impact influences the processes, tools and techniques used throughout the stages of the project lifecycle.

Some ICT is owned and implemented within a single organization and used by employees or other users over which it has authority (i.e. it is intra-organizational). Most eTechnology spans organizational and even industry boundaries (i.e. it is inter-organizational) and these projects are 'owned' by several organizations. When this eTechnology is implemented, users are not controlled by a single authority and may be nationally or even internationally dispersed.

Inter-organizational systems involve multiple organizations. Extra-organizational systems involve individual users as well (Clarke, 1992). Inter- and extra-organizational systems, including Web implementations, may be owned by one organization but used by external users, who are often required to interact with and/or contribute to its operation and/or content (e.g. input data for airline bookings). For this reason the different challenges of intra, inter and extra-organizational environments need to be understood by project managers (Cameron, 2005) and examined as separate levels of analysis for project management research purposes (Reimers, et al., 2004).

It has been argued (Soderlund, 2004) that project management research can be depicted as being undertaken within one or other of three traditions:

1. Reasons for project outcome or generic factors of project success (Factor Research).

2. Projects as tools for solving specific problems and, project management as a process and an application of engineering science and optimization theory (Engineering Tradition).
3. Projects as a form of organization (Social Science Tradition).

Each of these three research traditions can give rise to findings that provide insights into and guidance to support effective eTechnology project management. However, just as project management must be appropriate for the context in which it is undertaken, so must project management research. Researchers need to shift the focus of their research to reflect changes in management context if their findings are to support project management practitioners. For example, insights for practitioners managing inter-organizational projects are more relevant if research is not limited to issues that occur within a single-organization (i.e. intra-organizational research).

The aims of this paper are to:

1. Assess and reflect on the relative importance to the Bled community of research into eTechnology project management, over time and with changes in technology. (Refer to Section 3.)
2. Examine eTechnology project management research across multiple conferences, and identify shifts in focus that reflect differences in the management context due to changes in the organizational and technical environments. (Refer to Section 4.)
3. Examine findings from research within appropriate management contexts to identify insights and guidance that may support effective management of projects established to implement eTechnology. (Refer to Section 5.)

The outcomes of the study provide an evaluation of the Bled community's contribution to the practice of eTechnology project management over 25 years. The assessment provides a longitudinal study of eTechnology project management research and an important record of the challenges faced by practitioners as technology changed. The examination of research reveals shifts in research themes and focus that emerged with changes in the organizational and technical environments. Key findings of research undertaken within appropriate contexts are identified, resulting in a summary of insights and guidance for effective management of projects established to implement eTechnology.

2 Research Method

Meta-analysis was used to examine project management research papers published in the Bled conference proceedings between 1988 and 2011. In order to achieve the aims of this research, papers needed to be classified by time, context and their focus, i.e. the main topics to which they referred.

2.1 Research Process

Four different sources were used to locate relevant papers:

1. Electronic copies of research papers 2001-2011 in the Bled conference database [www.bledconference.org/index/php/domino.fov.uni-mb.si/proceedings] ('ecopies').

2. Conference proceedings for 1990-1994, 1996 and 1998-2000 ('hardcopies'). Proceedings for 1988-9, 1995 and 1997 were not accessed by the author for this research.
3. Abstracts in the spreadsheet titled "Bled eConference Research Volumes 1998-2011" [http://www.rogerclarke.com/EC/BledSearchPage/html] ('spreadsheet').
4. The author's PhD reference database, which includes abstracts and quotations from papers addressing research into eTechnology project management. These references include 53 papers from the Bled Conferences 1988-2006 ('references').

Four different methods were used to identify and select papers for the meta-analysis:

1. Utilizing automated computer searches on 'ecopies' in the Bled conference database using the key words 'project management', and combinations of 'management method', 'process', 'model', 'technique', 'tool', 'impact', 'success factors', 'organiz(s)ation' 'trading partners' and 'collaboration'. The 65 papers identified were downloaded and reviewed. However, automated searching proved inadequate because the sample did not include all relevant papers. Significantly, the automated searches failed to identify 75% of the Bled research papers from 2001-2006 previously included in the author's research 'references'.
2. Reviewing the author's 'references' identified an additional 16 relevant papers.
3. Reading 'hardcopies', searching for papers with a project management research focus and then transcribing the abstracts and relevant quotations. This added 73 papers to the selection.
4. Reading all abstracts in the 'spreadsheet' to identify any additional relevant papers. The names of the papers' authors were concealed to avoid bias arising from knowledge of their research interests. An additional 137 papers were reviewed. When practitioner experience was applied to determine how useful the research would be to a project manager within a specific context, 7 papers were rejected. As a result of this review, a further 130 papers were included in the meta-analysis.

The identification and selection process assessed 284 papers as relevant to research into the management of eTechnology projects. A list of all 284 papers is available from the author on request. Papers that examined projects established to implement eTechnology form a subset of this selection. The list of references include the 94 Bled conference papers cited in this paper.

The methods of analysis used by the author included categorizing papers, and classifying and coding the main topics discussed. Each paper was categorized by:

1. **Year** of publication.
2. **Management Context** of the project comprising the –
   a. **Technology** or type of technology referred to by the author (e.g. mCommerce included mobile phones, ICT included data management systems, etc.).
   b. **Organizational environment** in which the project management was undertaken. Projects controlled by a single organization were classified as having an intra-organizational environment (i.e. 'intra'). Projects 'owned' by

more than one organization were classified having an inter-organizational environment (i.e. 'inter'). Some papers referred to more than one organizational environment. Any industry involved was recorded, if named. 'Extra-organizational' was not added as a classification because the external users do not 'own' or have any control over project management.

Topics were classified according to criteria informed by the definition of project management and the three project management research traditions:

3. **Factor Research** sub-divided into -
   a. **Impact Analysis** categorized by whether the consequences of implementing the eTechnology were predicted to be intra or inter-organizational. Factors were coded (e.g. stakeholder impact).
   b. **Critical Success Factors** (CSFs) categorized by whether the inhibitors and drivers that affected project outcome were intra, inter-organizational or external (i.e. 'exter') (e.g. government regulations, infrastructure). CSFs were coded (e.g. cost-benefit).
4. **Engineering Tradition** sub-divided according to –
   a. **Project Lifecycle** stages of Initiation (planning and establishment phases), Development (design and build phases) and Implementation.
   b. **Processes, tools** and **techniques** were categorized by whether they were used within a single organization (intra), among organizations (inter) or with external stakeholders (exter) and when the project involved extra-organizational systems. Topics were then coded. (e.g. Business Process Re-engineering (BPR) for an industry EDI project was coded as a process used during the design phase of the Development Stage. The research focus was coded either intra or inter-organizational.)
5. **Social Science Tradition** sub-divided into –
   a. **Project Management Method** including the approach and techniques used by a project manager to direct resources, coordinate project activities and achieve outcomes.
   b. **Other Topics** including models and frameworks, and theories that may explain events or behaviour. Findings related to the economic and marketing disciplines were included within the scope of social science.

Categories for each of the 284 papers, and classification and coding of the 616 topics were entered into spreadsheets for further analysis. This data formed the basis of the meta-analysis. Tables provided in the Appendix summarise the results. Key findings described in the research papers were identified and examined. The concluding section presents a generalised distillation of insights and guidance for effective management of projects established to implement eTechnology.

2.2 Limitations of Research Method

The author acknowledges limitations in the research method, including:

1. Lack of independent review of the author's selection, categorization, classification and coding.
2. The likelihood of errors in the selection of papers, because the author may have:

- Overlooked a paper due to misinterpretation or misunderstanding of the main thesis and/or argumentation.
- Selected some papers due to a personal bias and interpretation of the definition of what constitutes 'project management'.

3. The likelihood of mistakes in categorizing the organization environment (e.g. Stakeholder analysis undertaken within an organization that did not refer to consultation with external users was categorized as an 'intra-organizational' process).
4. The likelihood of misinterpretation in classifying the research tradition used.
5. Lack of assessment of comparative relevance and significance of the 284 papers and 616 topics. A weighting process was not used due to the volume and complexity of papers and topics.

Because this paper reflects on the relative importance of eTechnology project management research and examines changes in focus over 25 years, it is argued that these limitations do not negate the findings.

3 Relative Importance of eTechnology Project Management

Conference papers reflect the interests and background of the authors and editors. Analysis of the affiliations of authors 1990-94, when papers were not separated into industry and research streams, found 52% (of the total 206 papers) were written by academics. Academics wrote 73% of the management papers selected for the meta-analysis. This could be interpreted as implying that practitioners were not more interested in project management than academics, but rather the reverse.

The percentage of Bled papers that discussed eTechnology project management was compared to the total number of papers published for each conference, in order to assess its relative importance as a topic-area. The graph at the top of Figure 1 shows the annual fluctuations in the percentages of eTechnology project management research papers in the proceedings. The conference themes for the years in which the percentage of relevant papers peaked were 'EDI: Business Strategy for the 90s' in 1991, 'Electronic Commerce in the Information Society' in 1998 and 'eIntegration in Action' in 2005. It appears unlikely that the peaks in the interest in eTechnology project management can be attributed mainly to conference themes.

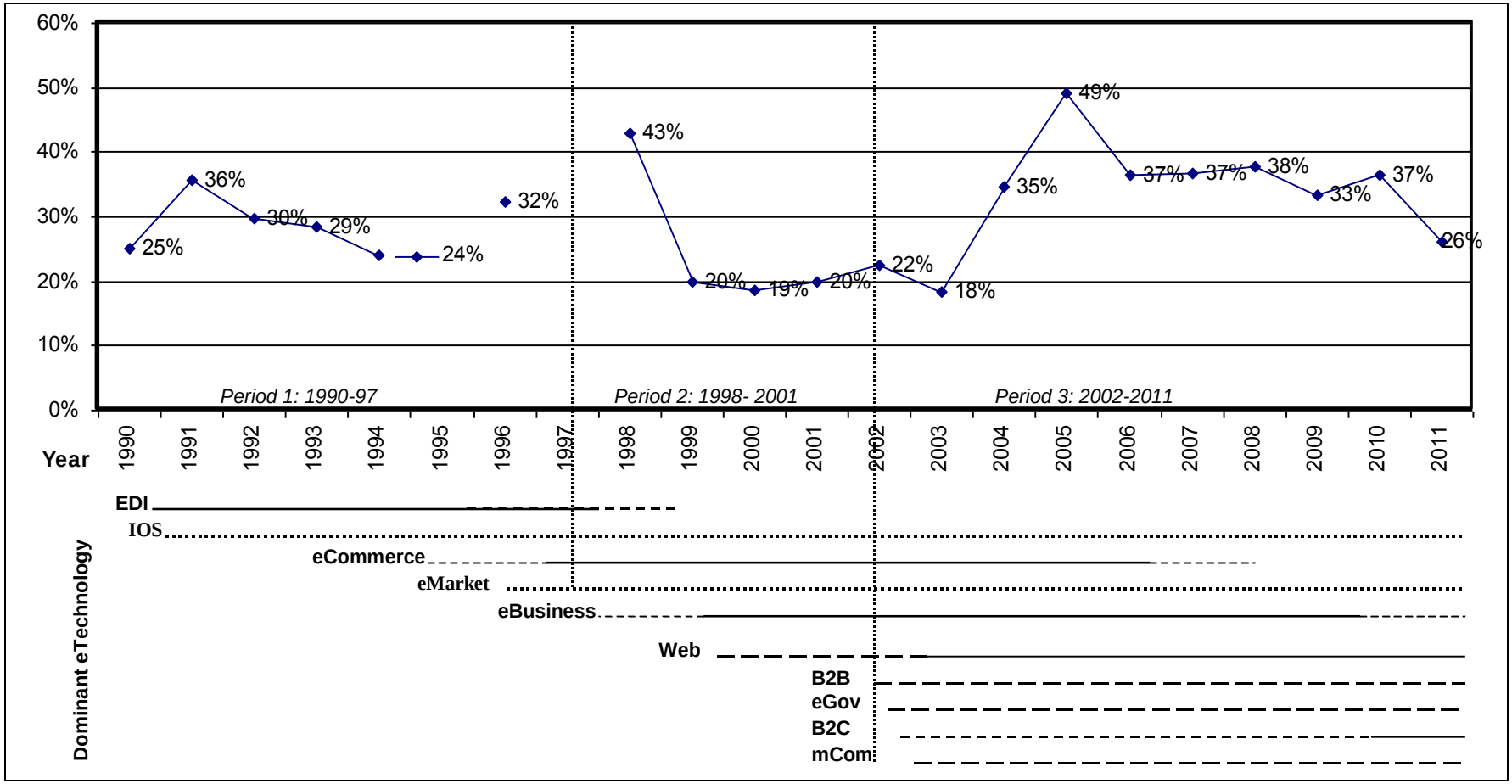

Figure 1: Percentage of Project Management Papers Published & Changes in eTechnology Over Time

The bottom of Figure 1 shows changes in the type of technology discussed over time. The strength of the line indicates the dominance of an eTechnology (i.e. a dotted line indicates few references). These changes suggests that there were three main phases:

Period 1: 1988-1997
Predominantly Electronic Data Interchange (EDI), Inter-organizational Systems (IOS), eCommerce1 (eCom) and electronic Marketplaces (eMarkets).

Period 2: 1998-2001
Predominantly the eTechnology used in Period 1 plus eBusiness2 (eBus).

Period 3: 2002-2011
All eTechnology with the exception of EDI. eTechnology applications are divided into Business to Business (B2B), eGovernment3 (eGov), Business to Consumer (B2C) and mobile Commerce (mCom).

Figure 1 shows that peaks in the percentage of project management papers occurred 2-5 years after changes in the dominant eTechnology. High failure rates for eTechnology projects may have spurred the peak of 49% in 2005. In 2005, industry sources estimated the failure rate of eBusiness projects to be as high as 80% of all projects initiated compared with 50-70% for other ICT projects4. In 2002, only 20% of partially government-funded eBusiness projects succeeded in achieving their objectives (McGrath & More, 2002) and practitioners estimated the failure rate [i.e. non-achievement of objectives even within extended timeframes] for all eBusiness collaborative projects[5] in Australia at 90% (Cameron, 2005). This suggests the relative importance of eTechnology project management research was affected by changes in the dominant eTechnology and the failure rates of eTechnology projects "which remained high over the 24 years of the Bled Conferences" (Benschop, et al., 2011).

Research papers on the management of eTechnology projects averaged 30% of total papers published 1988-2011. This shows that, despite fluctuations, the topic-area has been important to the Bled community of research over time.

4 Changes in Project Management Research Focus

It can be argued that shifts in the use of a particular research tradition indicate changes in researchers' interest in aspects of project management (e.g. use of Factor Research indicates interest in project outcome). The topics examined by researchers need to appropriately consider and reflect the differences and changes in the technical and organizational contexts of the projects being studied. Together, shifts in the use of

1. 'eCommerce' is the buying of goods and services (OECD, 2001).
2. 'eBusiness' is defined as "any process that a business organization conducts over computer-mediated network channels." (United States Census Bureau, October 2000).
3. 'eGovernment' is defined as electronic systems used by governments to provide access by citizens and organisations.
4. Sources include http://www.it-cortex.com/Stat_Failure_Rate.htm accessed 4 March 2006
5. A 'collaborative project' is "a project spanning a group of independent organisations that have made a commitment (whether formally or informally) to work together to achieve mutually agreed outcomes; in which participants anticipate varying degrees of longevity in the associations from one-off, via occasional, to consistent and long-term; and in which a moderate degree of rationalisation or re-engineering is intrinsic" (Cameron and Clarke 1996).

research traditions and variations in the technical and organizational environments show how research focus changed over time. To facilitate the examination of changes in research focus over time and with changes in project management context, papers were considered both across the full period and in the three phases outlined above..

4.1 Changes in Research Tradition

Figure 2 provides an overview of the research traditions used to examine topics related to eTechnology project management over time. In many papers, researchers chose to utilise more than one research tradition to investigate topics. (e.g. Factor Research was used to "consider the relationship of IS and management practices in retailing from the inter and intra-organizational IS dimensions" and the Social Science Tradition to propose theories of innovation diffusion as an explanation – Terpsidis, et al., 1998, p.1). For this reason, the basis of analysis in Figure 2 is percentages of the 616 topics and not of the 284 papers.

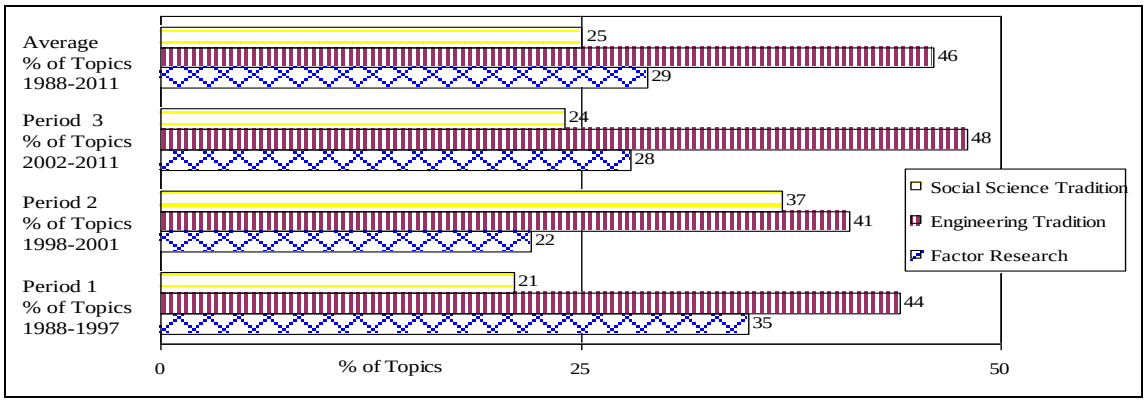

Figure 2: Overview of the Use of Research Traditions Over Time

The top bar cluster shows an average usage 1988-2011 of 29% for Factor Research, 46% for Engineering and 25% for the Social Science Traditions. However, there are interesting differences in the use of the research traditions among the three periods. Researchers were most likely to use the Engineering Tradition (44% of topics) and Factor Research (35%) in Period 1, when eTechnology projects broke new ground and failure rates were high. EDI, IOS and eCommerce implementation required new knowledge, skills, tools and techniques.

During Period 2, organizations considered the viability of eTechnologies like eMarkets, eBusiness, the Web, different forms of IOS and innovative ICT systems. Factor research in Period 1 had identified the importance of the social and organizational environments to project outcome. Significantly, by Period 2, researchers (e.g. Hunt & Swatman, 1998) recognised engineering processes associated with project management within the authority of a single organization were not appropriate for inter-organizational projects established to implement eTechnology. Hence, the increased interest in issues related to the Social Science Tradition (37% of topics).

Period 3 really was the period of 'e-everything'. Web applications, B2B, B2C eGovernment and most recently mCommerce joined the other technologies, with the exception of EDI, which had been superseded. The reason for the high use of the

Engineering Tradition in Period 3 may relate to the large amount of technical innovation and new eTechnology that emerged around 2002.

The traditions used by researchers differed across the periods. These shifts are compatible with changes in the challenges faced by project management due to technical innovation and the need to address social and organizational issues associated with project outcome. However, it is important to ascertain if the research focus also reflected the organizational and technical environments in which projects were undertaken.

The author used 20 years of experience as an eTechnology project management practitioner to estimate the comparative complexity and innovativeness of the eight technologies most commonly researched, and assessed the scope (i.e. number of organizations or stakeholders involved) and impact of the implementation. The resulting matrix in Figure 3 shows the percentage of papers that examined a particular technology (e.g. 23% of papers researched EDI which has both high organizational and technical complexity). Judged on the basis of the matrix it would be appropriate from an eTechnology project management perspective for EDI research to use both the Engineering and Social Science Traditions and focus on inter-organizational environments. The matrix can be used as a rough guide to how well changes in focus reflect differences in contexts related to the technical developments and organizational environments.

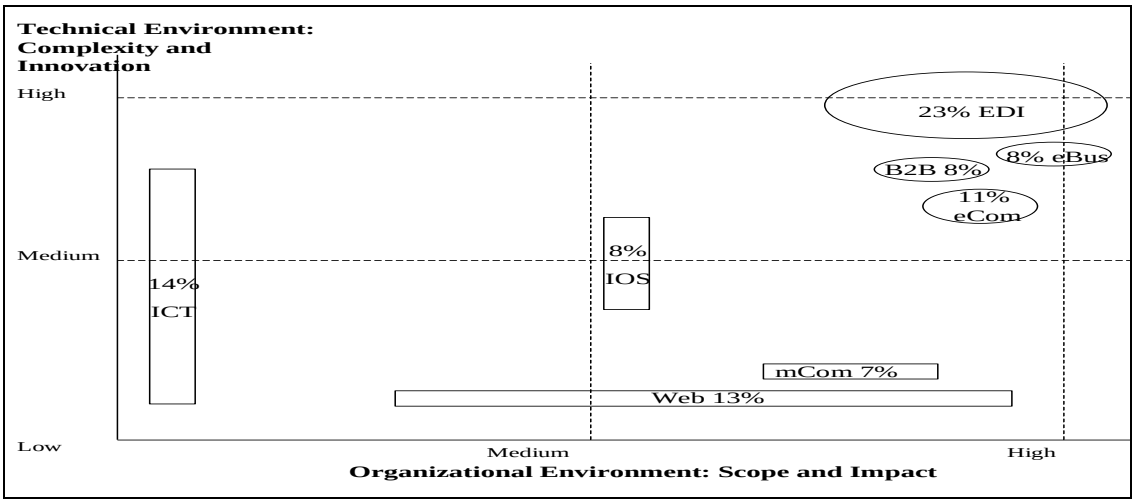

Figure 3: Relative Complexity of Context for Technologies at Time of Implementation

4.2 Changes in Technology

The clustered column graph at the top of Figure 4 categorises the 616 topics by the 11 technologies and identifies differences in the research traditions used. This analysis addresses the question of appropriateness of the research tradition for the particular technical environment. Eight papers examined two technologies and the topics to which they referred were divided accordingly. The technologies are arranged in the order in which they emerged within the Bled Conferences papers. The years and numbers of papers in which the technology was discussed are included under the graph to provide perspective.

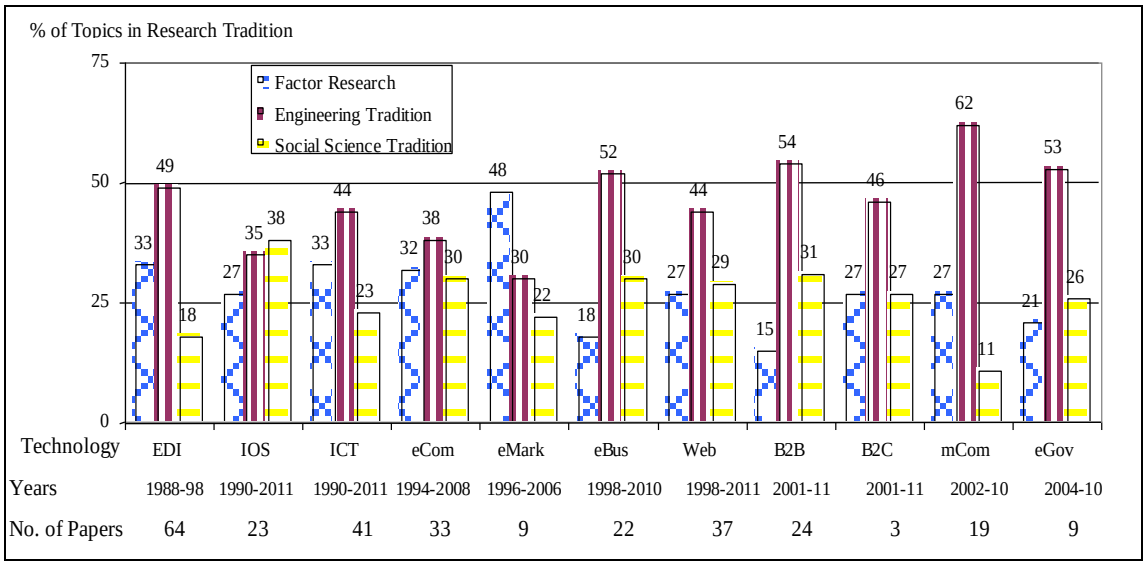

Figure 4: Use of Research Traditions to Examine Topics Related to eTechnology

EDI, the main technology (23% of all papers and 81% of papers in Period 1), enabled the exchange of defined data, using agreed standards, in the form of structured messages among trading partners (e.g. between exporters and shippers). Of the 64 papers that studied EDI project management, 33% of topics were examined using Factor Research, 49% using Engineering and 18% the Social Science Tradition. EDI was technically very complex when first implemented because it converted data into digital format and transmitted messages across proprietary communications networks. Interconnectivity and interoperability were often technically challenging. Use of the Engineering Tradition was appropriate in Period 1. High failure rates for EDI implementations soon spurred Factor Research. The take-up rate of EDI was very low and slow. In Australia, it took seven years and the provision of EDI translation services for the Tradegate projects to reach a critical mass of 80% of transactions in the international trade and transport industry (Cameron & Clarke, 1996).

IOS (8% of papers) were initially proprietary systems, often used to link suppliers to a large company via a specified communications network or Value Added Network (VAN). Successful implementation required inter-organizational cooperation. By 1990, researchers recognised the importance of both understanding and addressing organizational factors and the social environment affected by IOS. This is reflected in the use of the Social Science Tradition.

Most ICT research (14% of papers) discussed new technologies like Radio Frequency Identification (RFID). ICT was included in this meta-analysis because it was often integrated with eTechnology. Use of the Engineering Tradition was appropriate. The need to understand the factors affecting implementation of innovative ICT led to the use of Factor Research for 33% of topics.

From 1994, researchers considered eCommerce (11% of papers). EDI was a precursor to eCommerce. Although many of the technical difficulties of eCommerce had been addressed in EDI implementations, high failure rates induced researchers to focus on Factor Research. After identifying the importance of social and organizational factors

for successful implementation, the Social Science Tradition gained importance. eMarket research focused on the reasons for its lack of success.

eBusiness implementations (8% of papers) were more complicated technically than eCommerce because the variety and complexity of transactions was greater. Translating a range of data types from diverse organizations and integrating intra and inter-organizational processing systems across businesses was technically complex. B2B projects faced similar challenges to eBusiness and the use of the research traditions is similar.

The small number of B2C papers makes analysis unreliable. Web research, on the other hand, comprised 13% of papers. Initially this technology was considered primarily as a communications network and examined within the Engineering Tradition. Later, tools were required to measure Web performance. Factor Research identified CSF for websites, and the Social Science Tradition was used to consider stakeholder needs.

Most mCommerce research used the Engineering Tradition (e.g. business models and analysis tools and techniques) in preference to identifying CSFs (27% used Factor Research) or examining the social environment and behaviours of end-users by using the Social Science Tradition (26%). The high use of the Engineering Tradition for eGovernment related to assessing tools and techniques for examining the feasibility of specific ICT for use by stakeholders, mitigating risk, auditing and monitoring.

Comparison of Figures 3 and 4 suggests the Social Science Tradition, the basis of most organizational research, is under-represented in studies of eTechnology project management, especially for EDI and mCommerce implementations. However, eCommerce, B2B and eBusiness researchers did give greater emphasis to the Social Science Tradition. This may have been as the result of lessons learnt from EDI implementations about the importance of social issues and adopting project management methods and processes appropriate for inter-organizational environments.

4.3 Changes in Organizational Environment

The author, *a priori*, anticipated that as eTechnology evolved and fewer projects were 'owned' and implemented by a single organization, project management research focus would shift towards the inter-organizational environment. The author assumed less research in all three research traditions would be focussed within a single organization so that the average percentage of topics within the intra-organizational environment for each period would reduce over time.

The first bar cluster in Figure 5 shows changes in average percentages in each research tradition of all topics from 1988-2011 that were examined within an intra-organizational environment. The lower of the four bars shows that over the 25 years, an average of 48% of eTechnology management project topics were examined within the intra-organizational environment. Over half the topics (51%) in the Engineering Tradition and 48% of Factor Research related to the intra-organizational environment. As expected, research in the Social Science Tradition (29%) was least likely to restrict investigation to a single organization.

The average percentage of topics examined in the intra-organizational environment in each period reduced from 59% in Period 1 to 43% in Period 2, and was 44% in Period 3. The reduced focus on the intra-organizational environment of the Engineering and

Social Science Traditions over time indicates researchers gradually (but arguably too slowly) came to recognise the importance of considering the inter-organizational environment of projects. The reasons for the increase in the share of Factor Research undertaken within the intra-organizational environment in Period 2 are unclear.

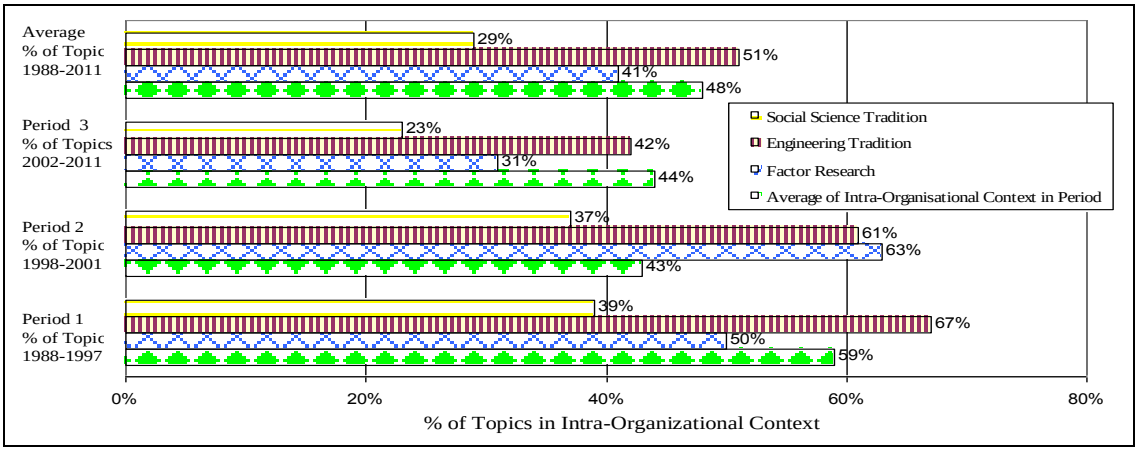

Figure 5: Intra-organizational Environment Used by Research Tradition Over Time

Figure 6 shows the percentage of topics that were examined within a single organization, categorised by technology. Research in the intra-organizational environment is shown in the left hand column of each cluster. The other three columns show percentages of totals in each research tradition for each technology (e.g. 69% of researchers who used the Engineering Tradition to examine EDI topics, did so within the intra-organizational environment).

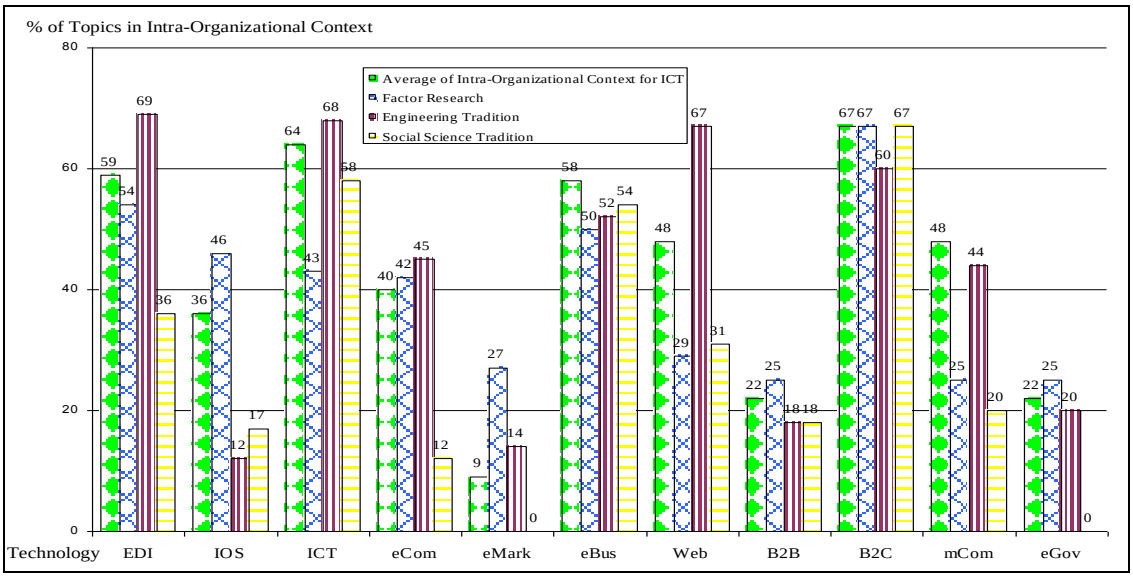

Figure 6: Intra-organizational Environment Used by Research Traditions for eTechnology

Most EDI research examined topics from the intra-organizational perspective even though successful implementation required inter-organizational cooperation. This can be partially explained by the way EDI was introduced initially, as hub and spoke

implementations driven by a single large organization. Other research confirms this statistical observation: "The majority of studies of EDI adopt the perspective of an individual corporation" (Clarke 1991, p.339). Figure 6 shows that eGovernment, B2B and eMarkets were the technologies most likely to be examined in an inter-organizational environment. Appropriately, IOS (64% of topics) and eCommerce (60%) focussed on the inter-organizational environment. Surprisingly only 42% of eBusiness project management topics were discussed within an inter-organizational environment.

Because ICT is largely intra-organizational, it is logical that 64% of topics considered projects within a single organization. B2C represented only 1% of papers are hence the results are inconclusive. It could be argued that because the Web and mCommerce are usually implemented by a single organization for use mainly by external stakeholders, it is appropriate that 48% of topics were examined within an intra-organizational environment.

4.4 Summary of Research Focus

At a macro level, analysis of the 616 topics in 284 papers show shifts in the research traditions used across multiple conferences (1988-2011). These shifts reflect the relative importance of changes in the socio-technical environments of eTechnology project management.

The research tradition used to examine topics needs to be appropriate for the management context and the organizational and technical environments. From a technical perspective, the use of the traditions was largely appropriate for specific technologies. However, because of the social and organizational impacts of most eTechnology, the practice of project management would have benefited from more research using the Social Science Tradition would have benefited.

The organizational environment has a major affect on all aspects of project management, including the appropriateness of processes, tools and techniques. With the exception of some ICT, eTechnology is implemented across multiple and sometimes numerous organizations, impacts multiple stakeholders and/or is utilised by external users. From the analysis of the percentage of topics examined within the intra-organizational environment, research in the three traditions focused too much on the intra-organizational environment in phase 1 and especially phase 2. In phase 3, focus appropriately shifted towards research within inter-organizational environments. Even if emerging eTechnology is technically challenging, researchers need to consider topics outside the intra-organizational environment.

5 Insights & Guidance for eTechnology Project Management

Research undertaken within a particular management context and technical and organizational environment creates the possibility of new insights and suggestions for action. However, not all research satisfies those conditions and delivers useful results. Hypothetically, for example, the findings of a survey of European computer science students about the usability of a website intended for use by Australian health care recipients, although interesting, would have little relevance for most project management practitioners. Not all project management research related to projects established to implement eTechnology. Some projects, particularly those undertaken by

large corporations, aimed to integrate eTechnology with existing ICT. Some projects aimed to test and assess new uses for emerging eTechnology, but not to implement the technology.

The author judged the relevance of findings to practitioners by the appropriateness of the topic's management context at the time of publication, and its importance based on citations and support from other research. Details of the findings from each of the three periods are discussed and compared in Sections 5.1-5.3.

This section identifies the richness of the research and retains the subtlety of findings in different contexts. The citations allow readers to obtain the original papers. Detailed summaries of findings about specific topics, over selected timeframes, already exist in other Bled papers (e.g. CSFs for collaborative projects in Cameron, 2005). Key findings from this meta-analysis and the insights that they provide for eTechnology project management are summarised in tabular form in Section 5.4.

The topics are separated into the three research traditions because practitioners use the findings for different purposes. Factor Research is used to identify key CSFs that need to be addressed by project management in order to avoid project failure. The Engineering Tradition provides or evaluates processes, tools and techniques that can be used for specific technologies during the stages of a project lifecycle. And the Social Science Tradition offers guidance about appropriate management methods within specific organizational environments, and insights into the reasons for behaviours and project outcomes.

5.1 Period 1 (1988-1997)

Period 1 (149 topics in 73 papers) pioneered research into eTechnology project management. EDI and IOS technologies were innovative. In the early projects, management and ICT practitioners did not have the relevant experience or expertise. New project management methods and processes needed to be developed and assessed.

5.1.1 Factor Research

Factor Research was evenly divided into Impact Analysis (a predictive evaluation) and CSFs (the drivers and inhibitors, which were often identified from case studies or post-project evaluations). CSFs were of special interest because of concern about the failure rate of EDI projects. CSFs were divided among factors that were intra-organizational (46%), inter-organizational (31%) and external (23%).

Research found the intra-organizational impact of EDI was greater if the motive for utilising the technology was strategic rather than operational (Krcmar, et al., 1994. p217). "Strategic benefits are achieved when EDI is integrated with the organisation and business processes have been re-engineered" (Roberts & Flight, 1994, p237). IOS introduced into the banking industry was predicted to affect intra-organizational strategy, prices and costs, and have legal and security implications. Bobek forecast IOS would lead to competition from non-bank institutions, and result in changes to banking operations and services that would displace labour (Bobek, 1991, p66).

By 1990, researchers recognised the inter-organizational impacts of EDI. "EDI is not only a technical phenomenon … It can also support new types of relations between organizations, as for instance, value-added partnership" (Krueuwels, 1990, p95). Clarke

confirmed this observation and explained that "the impacts of passive implementation of EDI [on inter-organizational relationships] can be usefully categorized as evolutionary, functionally reallocative, architecturally re-structurative or industry redefinitional" (Clarke, 1991, p399).

"Large companies have usually been the first to spot the potential of EDI and have become hubs linking to their customers and suppliers, many of whom are smaller companies. These may be forced to adopt EDI" (Doukidis, 1994, p258). Few of these implementations were successful because they failed to attract a critical mass of users from within their trading chain.

Because SMEs were an essential part of the data exchange and processing within a trading chain, researchers concentrated on the intra-organizational difficulties faced by SMEs and their failure to take-up EDI. "SMEs had more problems with technical start-up, allocations of personnel and the lack of training" (van Maaren, 1992, p136). Lack of technical skills and knowledge of EDI, particularly within SMEs, and inadequate project management expertise, were significant inhibitors.

EDI was introduced to reduce the costs of data entry but data recipients received the benefits. Studies soon identified an appropriate relationship between costs and benefits as an essential factor, especially for smaller organizations with fewer resources. "For a collaborative project to succeed, all partners must benefit from it, and perceive themselves as benefiting from it: unless significant and sustained market power is available and exercised, unbalanced alliances are highly likely to fail" (Cameron & Clarke, 1996).

Initially many of the large organizations tried to impose proprietary standards of data and communications on their suppliers. External CSFs included the need for viable technical infrastructure. Agreed data and message standards (including international standards) and communications standards were essential for interoperability and cost reduction. "Message formats need to be in accordance with UN standards" (Cadez, 1991, p432).

5.1.2 Engineering Tradition

Nearly 67% of topics were examined within an intra-organizational environment. The Initiation Stage attracted 28% of topics, Development issues received most attention (56%), but the Implementation Stage was less researched.

Initiation Stage

Half the topics in the planning phase related to cost-benefit. Traditional analysis methods based on tangible economic benefits were not adequate for EDI projects because they "Present a limited view of costs and benefits of information availability within the organization … Value is a broader concept based on the effect EDI has on business performance of the enterprise" (Lesjak, 1991, p89). Ways of measuring other benefits and value, such as reduced errors and shorter processing time, were established. "The party that is benefited by, for instance, tracking and tracing information does not have the cost of collecting the information" (Janssen, 1998, p616). The importance of shared benefits for all participating organizations was recognised. "Unequal advantages can easily cause resistance from organizations which gain less benefit."

EDI came to be considered as a business strategy (Perrone, 1992). "This integration [of systems and business re-engineering] enables EDI to support a truly strategic approach to business, offering major comparative advantages to organisations, business groups, industry sectors and trading blocs" (Swatman, Paula, Swatman. Paul, et al., 1992, p360). eCommerce was seen as a strategy for reducing costs related to information handling and managing data as an 'asset' (Cameron, 1994).

Development Stage

In the design phase, about 30% of topics related to Business Process Reengineering (BPR), undertaken to achieve cost benefits from EDI. Most papers referred only to intra-organizational BPR even though changes to business and industry practice by all members of a trading chain were required before the full advantage of electronic processing (e.g. cost and time savings) could be achieved and high set-up costs recovered (McCubbrey & Imai, 1994; Ready, 1994). When SMEs were a part of the trading chain, management needed to consider their special needs, including a lack of capability and resources. "Using EDI optimally requires the redesign of internal processes and inter-organisational relationships" (Sheombar & Wagenaar, 1991, p208). Several processes and tools for undertaking BPR were proposed. "Enterprise Analysis provides a systematic approach to assist an organization in understanding the key business processes of the management of the organization through a combination of gathering background information, construction of an enterprise model for representation, re-engineering of processes, and systems development" (Vogel, 1991, p196). This process was later developed into a collaborative Groupware tool to allow inter-organizational teams to work effectively.

Reducing complexity and cost by using standards for data, message exchange and communications protocols was discussed as a part of architectural design. The challenges and complexity of integrating communications networks led architects to seek non-proprietary solutions. "Using the Internet for e-commerce can help reduce the effective traditional business disadvantages such as small size and isolated geographic location. The benefits achieved are similar to the benefits of traditional IOS but do not contain the same level of financial and implementation risk" (Golden, 1996).

In the build phase, researchers were concerned with integrating EDI with existing intra-organizational systems (Jenkins, 1990) and creating an appropriate security infrastructure including management and application controls, e.g. user authentication, confirmation of delivery etc. (Hudoklin, 1991, p121). The need for secure, auditable systems to reduce the risk associated with EDI and electronic processing was identified (Chan, S., 1991). "Use of EDI exposes an organization to a wide variety of security and internal control threats with which it must be prepared to deal ... auditors used to rely on paper trails to confirm the existence of transactions" (Kucic, 1993, p268).

Methods and tools assessed by researchers for their suitability included a form of Object-Orientated Method for requirements (Fowler & Swatman, 1996) and Total Quality Method for electronic linking (Bjorn-Andersen & Chatfield, 1996).

Implementation

Only 11 topics referred to implementation and 55% of those considered intra-organizational issues. Researchers recommended organizations carry out an internal

pilot implementation and prototyping (Bobek & Lesjak, 1992) to help reduce problems with roll-out. An inter-organizational pilot was recommended to assess the system before production roll-out (Swatman, Paula; & Swatman, Paul, 1993).

5.1.3 Social Science Tradition

Project Management Methods

The early 'hub and spoke' EDI projects were controlled by a single organization and most adopted traditional management methods. However, managers of inter-organizational projects reported that methods that assumed a single authority and co-located teams were inappropriate. "Simplicity and familiarity of the [project management] method to the participants was important. Initially these EDI projects activities were primarily co-ordinated utilising consultation, minuted meetings and reports. Some organizations reported applying conventional project management methods in-house, as a complement to the overall project management mechanisms" (Cameron & Clarke, 1996).

eTechnology project management lacks the power and authority of a manager undertaking an ICT project within a single organization. "Use of traditional intra-organisational management procedures for IOS projects created difficulties with: 1. establishing clear lines of authority and responsibility across organisational boundaries; 2. contracts for supply of services to an organisation rather than a trading chain; 3. establishing procedures which span organisational boundaries (each organization concentrates on its own internal procedures rather than taking a holistic perspective of the system); 4. holistic perspectives of systems linking participating organisations require complex information flows; 5. time delays associated with both inter and intra-organisational communication; 6. geographical dispersion" (Fowler, et al., 1993, p250).

Some inter-organizational projects were collaborations among volunteer organizations sponsored by independent bodies (e.g. industry associations). An independent project manager was normally appointed. Because this manager lacked the formal authority to direct project resources, collaborative project management required a different approach to intra-organizational project management. Activities were coordinated using:

- Consultation and communication with ICT and business staff, trading partners (Debeljak, 1991) and key external stakeholders throughout the project lifecycle. "About 30% of companies assigned an EDI manager to promote EDI internally and externally, remain in contact with EDI partners, keep in touch with standardisation issues, and solve problems" (van Maaren, 1992, p136).
- Participative decision-making and consensus building (Cameron & Clarke, 1996).
- Project teams comprising representatives from participating organizations to undertake activities and assist coordination. Inter-organizational members learn from each other, share information between the project team and their internal project team. Working groups, or an interdisciplinary team of experts (Brus, 1991), address specialist issues (e.g. business process, ICT infrastructure). "More groups create more bureaucracy … However progress is consolidated and without conflicting recommendations" (Metcalf, 1993, p379).

- Education of "executives, designers, developers" (Debeljak, 1990, p135). Time was needed for knowledge creation and to increase organizational capability (Bolisani, et al., 1998). ICT and business staff needed to understand the new technology including ICT integration and architecture and how to integrate with organizational data and processes (Krueuwels, 1990).

Guidelines established for managing collaborative eCommerce projects were:

- "Mutuality – a 'win-win' profile, participative ethos and risk management
- Learning and change orientation
- Confidence – visibility of progress, stability and staying power and trust rather than contracts
- Cohesion – commonality of culture, investment in communications and co-ordinative mechanisms" (Cameron & Clarke, 1996).

Principles observed by inter-organizational project management exhibited change:

- "From technologically focused to Integral Systems Approach
- From empirical to conceptual approach
- From individual to integrated solutions
- From cost comparison to integral efficiency analysis
- From centralised to decentralised equipment installation
- From hesitant and intensive to gradual introduction
- From single purpose to multipurpose and modular solutions
- From technocratic to participating introduction" (Jereb, et al., 1990, p70).

It was common ground that significant changes to the traditional project management methods were required to manage projects established to implement eTechnology.

Other Topics

EDI and IOS require individuals involved in or affected by eTechnology, within multiple organizations, to work together. Approximately 70% of topics in this category were examined within an inter-organizational environment. Multiple levels of analysis provided insights into inter-organizational projects (Cameron & Clarke, 1996; Clarke, 1991; Krcmar, et al., 1994). "The authors consider the characteristics of organisations at individual and organisational level. They conclude that economic realities and the competitive situation is causing organisations to avail themselves of the newest in management methodologies and applications" (Bjorn-Andersen & Chatfield, 1996, p258).

In Period 1, there was only limited application of theory to explain outcomes. Transaction Cost Theory was used to explain how IOS affects costs (Hai, et al., 1993). "Integration costs and transaction risks are important determinants of transaction costs" (p257). Theories related to alliances and business relationships, including the Political Approach, Micro-economic, Strategic Bridging, Game and Web Theory, were considered when researching a framework for managing collaborative projects (Cameron & Clarke, 1996).

Theory needs to be interpreted and 'operationalized' before it is useful for practitioners. Golden used Consumer Behaviour Theory to explain eCommerce adoption and then developed a model "based on the consumers purchasing decision … with … stages

which involve the 1. provision of information electronically, 2. facility to purchase the product online, 3. ability to deliver the product over the computer … An organisation can successfully engage in e-commerce at any of the three levels and the one chosen will depend on the characteristics of the companies, product or service" (Golden, 1996, p291).

5.2 Period 2 (1998-2001)

Period 2 was an era of consolidation, reflected in the title of the 13th Bled Electronic Commerce Conference: "The End of the Beginning" in 2000. Even though there were 46 papers and 112 topics, Figure 1 shows the Bled community's comparative interest in project management dissipated. Practitioners got on with development. Knowledge about ICT within organizations increased and experience enhanced the skills of practitioners. Some project managers learnt to work with inter-organizational initiatives and a few were successful in achieving collaboration among disparate organizations.

5.2.1 Factor Research

Figure 2 shows Factor Research was not widely used in Period 2. Only 24 topics related to impact (17%) and CSFs (83%). However, the importance of the impacts on stakeholders as a key factor in project outcomes was a significant insight for project management. An Impact Analysis of smart-cards on stakeholders (card owners such as Visa, the financial institutions and merchants) predicted affects on security, bank settlements and international transactions (Elliot, 1998, p203). Future scenarios of the way eCommerce might affect markets predicted that "Traditional intermediaries will either be driven out of the market (disintermediation) or be forced to differentiate and re-emerge in the electronic marketplace (reintermediation), while wholly new markets for intermediaries will also be created (cybermediation)" (Giaglis, et al., 1999). Stakeholder Analysis was used to assess the effect of EDI on stakeholders in general healthcare practice e.g. doctors, nurses, patients (Abu-Samaha & Wood, 1998, p.175).

Most CSFs were intra-organizational (65% of topics). When BPR significantly changed organizational processes and affected jobs, change management was a CSF. "By 2001 up to 70% of [BPR] projects failed due to the lack of understanding, human resistance to change, or inability to conduct and implement the process and inadequate information systems" (Golden & Hughes, 2001).

Lack of a critical mass of users and external CSFs inhibited take-up of eCommerce by SMEs across cultures, e.g. in Singapore, where factors were "inherently linked with the policy process" (Corbitt & Kong, 2000); and in Australia, where inhibitors included "lack of easily accessed and trustworthy information and advice ... infrastructure and technical deficiencies, problems with banking and finance and problems with physical links into export destinations" (Castleman & Cavill, 2001). For eBusiness, inhibitors included "concern about security and privacy of transactions" (Lawson, et al., 2001).

5.2.2 Engineering Tradition

In Period 2, of topics within the engineering tradition, 17% dealt with processes and tools used during the Initiation Stage, 37% with Development issues and, significantly, 46% examined Implementation.

Initiation Stage

There was little new insight into the appropriate process and techniques to be used for planning and design. Most topics discussed strategy (e.g. integration of business and ICT strategies), cost-benefit and stakeholder requirements, but all from the viewpoint of a single organization. Because the "intangible nature of most eCommerce benefits ... made developing business cases very difficult, a computer-based model was developed to simulate the business processes affected by eCommerce to gain insight on the real benefits and dangers associated with the planned business change (Giaglis & Paul, 1998).

Gradually, recognition of the need to address inter-organizational issues associated with project planning emerged. A process for Stakeholder Analysis identified those affected and their 'world view' at intra and inter-organizational levels (Abu-Samaha & Wood, 1998). This process included identifying the transformation process and defining "criteria for the Efficacy, Efficiency and Effectiveness of each stated transformation process to identify appropriate Measures of Performance" for the new system.

Development Stage

BPR continued to dominate discussion of design processes and tools during the Development Stage (81%). User Requirements Analysis was revised to take account of voluntary user participation, lack of efficient control mechanisms and modern communication architectures. Marketing research techniques were "proposed as complementary and/or substitutive methods for determining user requirements in electronic markets" (Bauer & Chong, 1999).

Importantly there was increasing acknowledgement of the importance of the organizational environment for development processes. A Business Systems Engineering Methodology was proposed that emphasised the importance of consultation, participation and achieving a 'win-win' outcome from design processes that consider the effects on multiple levels: intra-organizational, inter-organizational, and the business network (Janssen, 1998).

Some of the technical complexities were resolved as inter-operability principles were recognised, and cost effectiveness (especially for SMEs) was improved following the emergence of the Internet as a viable option for communication. Standards established for eXtensible Markup Language (XML) facilitated the transfer of electronic content as well as structured data. Nevertheless, architectural design needed processes and tools for Systems Integration that enabled "joint restructuring of intra- and inter-organizational systems" (Wassenaar & Swagerman, 1998). They developed an "integrated reengineering approach with an interactive business modelling cycle" (Wassenaar & Swagerman, 1999).As eTechnology and standards matured, organizations could buy systems rather than build them. "The effective and efficient acquisition of an IOS requires a framework that takes into account the special needs of systems that require internal and external integration" (Hunt & Swatman, 1998, p642) and comprise a technical and "relationship tier describing the business interactions of the actors" (p635).

Implementation Stage

Although implementation was a greater focus during this period, 59% of topics were still concerned with intra-organizational issues. Web implementation was discussed. An instrument "to support longitudinal monitoring of developments ... across a broad range of websites" was proposed (Elliot, et al., 2000, p71). A Web Content Management framework, based on experience from document management, customer relationship management and software configuration management, was developed to help web managers maintain content (Vidgen, et al., 2001).

Implementation of eTechnology across organizational boundaries remained difficult. "Implementation of EDI is not just a realization of a plan – it is a messy and complex process involving many factors and activities" (Chan & Swatman, 1998, p103). They suggested the use of Soft Systems Methodology, "which allows for multiple viewpoints, for the inter-connectedness of technology and organisational factors and which caters for longitudinal implications". Because of the impact of government systems on citizens and organizations, "A structured methodology for the application of electronic commerce applications in the public sector is vital in order to provide support for the adoption of new systems in a smooth and beneficial way" (Themistocleous, et al., 1998, p537). They advocated developing an experimental system, evaluating it from the viewpoint of the government and users, then a pilot system, before implementing a production system.

5.2.3 Social Science Tradition

Project Management

The challenges of inter-organizational projects led to proposals for new project management methods and skills. The quality requirements of web-enabled eCommerce needed "a new skill set for requirements engineers, particularly relating to marketing" (Carroll, et al., 1998, p654) "as well as awareness of the pressures arising from limited resources (time, lack of experienced people and immature business skills" (p643). The inter-organizational environment required the role of 'honest broker' to facilitate "negotiation and trust-building, promotion of industry standards, maintenance of a position of neutrality and possibly allocation of funds at opportune times" (Gregor & Menzies, 2000).

Other Topics

Frameworks and models were designed to explain adoption outcomes of eCommerce and IOS (Kurnia & Johnston, 2000; Wilkins, et al., 2000). Theories such as Diffusion of Innovations (Rogers, 1995) and Resource Dependency were used to explain adoption (Chong, et al., 2001). A theoretical model developed "to assess the relationship between perceived characteristics of a website and actual traffic in terms of frequency and duration of revisits" utilized the Technology Acceptance Model (TAM) and the Theory of Reasoned Action (TRA) (van der Heijden, 2000).

5.3 Period 3 (2002-2011)

Although Table 3 (in the Appendix) shows 355 topics in the 165 relevant papers were published during Period 3, the proportion of papers cited in the present paper is small.

They have been selected in order to provide examples of new or different perspectives on project management issues or insights for project managers.

During Period 3, eTechnology facilitated the emergence of new types of collaboration and even a new form of organization – the Virtual Organization (VO) (Cameron, 2005; Riemer & Vehring, 2008). Types of collaboration were diverse and ranged across a continuum from temporary, informal agreements among volunteer participants to legally binding alliances where organizations gave up some independence and authority and formed a new legal entity. Many VOs "renounce formal contractual guarantees as a coordination mechanism in order to ensure overall flexibility" (Koch, et al., 2004). The contractual status of collaborations affected the power and authority of project management and consequently the coordination methods available to project managers. The use of Web technology stimulated the creation of online communities, known as 'eCommunities' or 'Virtual Communities' (de Moor & van Erp, 2004). These were entirely self-governing groups of users supported by a website, in some cases provided or sponsored by a government organization or industry body.

The organizational and technical environments of a project together determine its lifecycle. This was a significant insight for practitioners and researchers. Collaboration changes and extends the traditional project lifecycle adopted in the Engineering Tradition of project management. Extra activities and longer timeframes are required for collaboration formation and implementation throughout a trading chain. "Collaboration formation (which incorporates selecting partners, agreeing objectives and 'rules of engagement') is added to the Initiation Stage and collaboration maintenance continues until the project is completed or dissolved. Implementation is complex and normally undertaken slowly as a series of expanding pilots to aid learning and ensure stakeholder needs are met" (Cameron, 2005). A lifecycle proposed for networks comprised:

1. "Initiation - defining an innovation that generates a common purpose, linking institutions and firms as they select partners and determine roles and linkages between network members.
2. Configuration - developing an identity, technological infrastructure, exchange relations, and governance modes complemented by social mechanisms of integration.
3. Implementation - assigning tasks and roles to network members, a process of structuring control, alignment, network identity, strategy and workplace operations.
4. Stabilisation – facilitating the social integration among organizations, groups, and individuals needs, establishing social ties, mutual understanding and trust among partner organizations as a prerequisite for effective collaboration.
5. Transformation - accepting the dynamic nature of networks as they evolve over time, the quality of their character oscillating between personal and institutional relationships.
6. Dissolution - which appreciates that networks often address a specific purpose and are wound up after this is achieved" (Frößler, et al., 2007).

Key differences from the engineering project lifecycle are the addition to the Initiation Stage of a collaboration formation phase (which includes 'configuration'), and at the

end of the Implementation Stage the addition of stabilisation, transformation and dissolution phases.

5.3.1 Factor Research

Impact Analysis was used to examine 20% of topics. Four papers considered intra and inter-organizational or industry factors. A "framework encapsulated influences on the implementation and likely uptake of mGovernment" (Carroll, 2006). A study on perspective adopters of eBusiness, used experience from EDI to reveal that … organizational preparedness, expected benefits, partnership uncertainty/trust and interaction contingencies – can provide a forecast toward the future use of a collaborative supply chain system" (McNichols & Brennan, 2004, p13). The impacts of mCommerce on risks for banking (Wolf, 2003), the influence of cost benefit on the adoption of Web and RFID, and the risks of cloud computing were analysed.

Social factors like 'mind sets' and motives of organizations and individuals gained recognition as CSFs. In 1999 the OECD had proposed a framework for classifying indicators of ebusiness impact: the readiness of technical, commercial and social infrastructures to support ecommerce; the intensity of transactions (i.e. usage, volume, value and nature of electronic transactions); and changes in the efficiency and/or the creation of new sources of wealth. The addition of "a Mindset indicator that describes the way decision-makers and/or users of ebusiness think about ebusiness" and inclusion of planning, motives and barriers was recommended (de Graaf & Muurling, 2003). "Well-managed networking and relationship-building partnering practices [create] mindsets rather than a focus purely on transactions" (McGrath & More, 2003, p11). "Key groups of stakeholders, their main interests in participating in this project and their current perception of the project direction" affected adoption of the UK National Health Service systems (Guah, et al., 2009). Project management needs to focus on four 'meta factors' motivation, capability, communication and coordination" (Cameron, 2005).

Issues of trust in relationships and systems were recognised as CSFs for eTechnology project management. eBusiness collaborative projects required a manager who "was most effective at building relationships (on-line and face-to-face), establishing a working trust among consortium members, and weaving the fine balance between conflict and consensus" (McGrath & More, 2003, p11). For telemedicine services "Judgments about system trustworthiness interact with users' technical and clinical skills and system trust and interpersonal trust are reciprocal" (Grogan, et al., 2009). In a VO, "standards in ICT, which enhance effective communication, contribute to integrity and therefore build trust in inter-organization relationships … Stakeholders need to be convinced of a partner's technical knowledge, skills and credibility before embracing eCollaboration" (Lawson, et al., 2007, p4).

Intra-organizational CSFs for Web implementations were identified as "previous organizational IT expertise, previous experience with logistics and the suitability of the product for sale on the web", management factors including "the existence of a champion, having an e-commerce strategy, and integrating the web presence into the existing business ... planning the web presence, usability of the web site, the existence of security features on the web site, outsourcing elements of the ecommerce project and marketing the web site" (Golden, et al., 2002). "Project management seemed to be a critical value delivery item in the web agency industry" but "35% of companies did not

have resources on this function" (Nemeslaki, et al., 2011, p11). These CSFs for the Web in Period 3 are similar to CSFs for EDI in Period 1.

5.3.2 Engineering Tradition

For consistency, topics in Period 3 are discussed within the engineering project lifecycle, despite differences in project lifecycles necessitated by the inter-organizational environments of collaborations and VOs. Research explored aspects of processes undertaken during the Initiation (37%), Development (43%) and Implementation (20%) Stages.

Initiation Stage

During the establishment phase, researchers found partner selection to be crucial for inter-organizational projects. All key project partners in a transaction or trading process must be included in project management processes but they must also be able to work together. "Use of Internet technology in inter-organizational cooperative relationships … indicate that trust-based governance to a large extent is dependent on the specific actors that are involved in the relationship" (Gunnar, et al., 2002). Inter-personal relationships play a significant role in stabilizing these rather fragile arrangements on the basis of trust and bonding" (Reimers, et al., 2004).

Project partners in all organizational forms need to agree to achieve common goals and share benefits (Alt, 2003). Selecting strategies and business models required special care. In peer to peer networks, "the most common factors used to analyze business models are revenue sources, potential benefits to actors, enabling technologies, security and behavioural changes" (MacInnes & Hwang, 2003). "In a B2B inter-organisational relationship, a partnership will generally be built on sharing expertise to reduce costs" (Lawson, et al., 2007, p4). "Whereas the economic dimension is concerned with economic benefits like cost efficiencies and transaction costs, the strategic dimension comprises goals, resources, technologies and ultimately all factors that contribute to achieving collaborative advantage (Reimers, et al., 2004).

The assumptions and rules incorporated into the traditional processes for evaluation and analysis (e.g. Activity-Based Costing) were inadequate due to "features of the e-business environment (like instability, unpredictability), and new behaviour elements in the attitude of the actors involved" (Iacob, et al., 2002, p17). Stakeholder Analysis needed to examine "issues by level (organization, group, individual), along the dichotomy of application … and infrastructure, and in terms of business and organizational alignment." Channel alignment became a strategic business issue due to different options for communicating (e.g. email, mobile phone). "Decisions have to be made on who should evaluate the multi channel system from the internal (company) and from the external (online customer) perspective" (Wehmeyer, et al., 2007). "The transformative power of Real Time Communication (RTC) can lead to unintended and dysfunctional effects for organizations; the fear of surveillance and control can have a negative impact on the organizational climate" (Klein, et al., 2010).

The extent of the virtuality determined the suitability of tools used to coordinate the activities of employees from disparate volunteer organizations. Web-based tools for group work helped to share project information and monitor progress. In dynamic eTechnology environments, Web-based tools that captured input from planning to

development were important. "By increasing the degree of formalization of strategy modeling, model consistency can be enhanced and specifications can be reused in subsequent business engineering phases like process (re-)design and information systems development" (Winter, 2003).

Development Stage

During Period 3, design continued to challenge practitioners and comprised 24% of topics. eTechnology was diverse and posed design and integration challenges. Despite the increasing number of extra-organizational systems, there was little research into the processes, tools and techniques required or used for this type of technology during the Development Stage.

Researchers continued to examine BPR (15% of topics about design) in various organizational and technical environments. Change management for inter-organizational projects affects many levels within an organization. Multi-level analysis of a case study illustrated management's need to consider employee reactions to RTC and manage change. The process used by management involved:

- "Conceptualizing RTC as infrastructure [for knowledge workers and a service company in the Internet age];
- Identifying distinct organizational modes of use, which will be pursued in a staged approach;
- Aligning with the organizational culture of participation and consultation;
- Defining ground rules while providing space for experimentation and appropriation
- Balancing managerial and organizational design (corporate level) and self organization and experimentation (organizational unit or group level) as well as individual appropriation (employee and group level)" (Klein, et al., 2010).

Systems integration became more complex due to the plethora of systems employed within and between organizations. eTechnology needed to interface internal systems and interoperate with partners via communications infrastructures. "If SMEs do not employ automated material management systems, there is obviously most likely no possible benefit from processes automation" (Beck, et al., 2002). Architectural issues were simplified by standardized protocols. 'Plug and play' options overcame some technical issues – but not the associated organizational issues. The dynamic nature of VO affected inter-organizational integration: "In firms that are changing through merger, acquisition and divestiture, 'integration' plans should incorporate the notion that integration must be reversible or deconstructable at critical junctures to support a common range of expected present and future inter-organizational interactions" (Lamb, 2002, p13). Concepts from the organizational change discipline "supplemented by vertical and horizontal levels of analysis explain the impact of interactions of Information Systems through a trading chain … The results from changes take place at different levels [within and among project participants] and at different times. This analysis found "complex interdependencies between changes across levels and identify interdependencies which otherwise seem unrelated" (Rukanova, et al., 2008).

Prototyping (Nemeslaki, et al., 2011) and Agile Methods (Burgess, et al., 2008) were advocated as Development approaches, but "even with the options of tailoring, there is no software development model that fits for most situations" (Wolf, 2003).

Implementation Stage

Of the 34 topics that referred to implementation, only 23% related to intra-organizational systems. Most researchers examined the adoption of eTechnology.

Benefits of eTechnology are directly linked to the take-up rates of key trading partners. Lack of critical mass continued to cause unsatisfactory project outcomes. In collaborative projects each organization separately makes its own decision about when and if to implement the initiative (Cameron, 2005). "The eBusiness environment includes external factors that drive the diffusion and adoption process. Social and economic factors push a model to success by providing needed catalysts for diffusion (venture capital, economic growth, willingness to invest, risk taking, technical competence or existence of learning network) or pull a model (computer literacy, GDP, cultural factors, competitive landscape, cost of computing)" (McGann & Lyytinen, 2002). Learning is a vital part of the adoption cycle (e.g. the stages of awareness, knowledge and acceptance, taken from models of Consumer Behaviour). Usability and meeting stakeholder requirements were important for adoption, particularly when end users were required to enter data or use self-service sites.

Few researchers tackled multi-level analysis of implementation or adoption. However, Klein, et al. (2010, p14) proposed a process for implementing RTC involving "different groups of users and also underlying distinctions between different modes of use". This comprised:

a. Pilot test in the IT department to test the infrastructure, to observe the uptake and employees' responses and to prepare the organization for a roll out.
b. Roll-out as a communication infrastructure across the core organization to allow individuals and groups to explore productive modes of use, monitored and supported by the IT Department.
c. Roll-out to the service organization as an extension into operational process.
d. Integrating chat functions into the customer portal.

Post-implementation evaluation is an important, but often neglected part of project management. One tool for web sites was based on "an evaluation grid that includes a set of criteria with which to appraise the quality and success of e-commerce applications" from the consumer viewpoint. (Leimstoll, et al., 2005).

5.3.3 Social Science Tradition

Project Management

Relationships were the most frequently discussed issue (62% of topics) for project management, even if a project was controlled by a single organization (e.g. use of mCommerce by a bank), where traditional management authority still applied.

By Period 3, management methods for coordinating multiple, independent organizations were understood. However, from a project management perspective, projects undertaken by a collaboration or VO combine the challenges of coordinating independent organizations with the complexities associated with geographically dispersed, disparate, extensive trading chains. Management is even more complex when VOs are dynamic**.** "Dynamic virtual enterprises involve rapid, on-demand, teaming of business partners in pursuit of specific business objectives defined by the customer" (Marjanovic, 2002). Collaborative projects and VOs require project management "to coordinate the three levels of participating organizations, virtual teams and representatives (Cameron, 2005).

Effective coordination of representatives from the disparate organizations who comprised the virtual teams was not well understood. Representatives "remain accountable to their own organization and continue to work as employees while supporting project activities inside their own organizations … This often resulted in role conflict and the way it was resolved affected the performance of project teams" (Cameron, 2005). Guidance was provided by research from sociology into team culture and 'effective teams' and multi-disciplinary research into 'virtuality' by other research communities (e.g. www.ejov.org).

Both formal and informal communication were used for coordinating virtual teams and VOs (Cameron, 2005). "Collaboration depends on effective communication, shared knowledge and coordinated action within a group" (Crawford & Hasan, 2006). "Knowledge brokers can help to create a tacit understanding among communities" but "need a sufficient level of knowledgeability of the practices, working culture, and discourses of each group if they are to become a trusted party and to phrase and frame the interest of one community in a way which is understood by another" (Frößler, et al., 2007, p5).

Project management needed to create appropriate social environments. "The social dimension takes into account the importance of people working in an inter-firm relationship; it comprises trust, social ties and team building issues" (Reimers, et al., 2004). "When formal coordination mechanisms vanish, informal coordination immediately gains increasing importance…Trust becomes a decisive issue for all kinds of loosely coupled organizations and especially virtual enterprises" (Koch, et al., 2004). Trust is multi-levelled: "Trust is generally focussed at the individual level; however it is often projected to the group level with cooperation, credibility, openness, benevolence, integrity, predictability, integrity and competence (Lawson, et al, 2007, p4).

Evaluating the social environment (e.g. quality of relationships, stakeholder satisfaction, tacit support for the project), and the effectiveness of the management of collaborative projects, is complex. However, "The meta factors of motivation, capability, communication and coordination at the levels of organizations, teams and representatives can be used to monitor project 'health' throughout the collaborative project lifecycle" (Cameron, 2005).

Other Topics

The search for theory to explain project outcomes and behaviours intensified during Period 3. Increasingly, multiple levels of analysis and interdisciplinary research were used to explain the interactions, complexity and outcomes of eTechnology projects.

The reasons for slow adoption of eTechnology continued to be sought. Marketing and consumer behavioral theories were used to explain adoption (Cameron, 2005). A review of theoretical perspectives for adoption of IOS concluded that the Theory of Diffusion of Innovation, in combination with Transaction Cost Theory, is the best way to incorporate organizational elements and inter-organizational relationships with environmental and implementation factors, and combine the competitive advantage and embeddedness approaches relevant to resource dependency (McNichols & Brennan, 2004). "On the micro level, an individual organisation's EDI adoption decision is considered within the tradition of the Diffusion of Innovations literature; on the meso level networks of organisations are considered, mostly with regard to mutual dependencies and power structures, and on the macro level regulatory constraints for EDI adoption decisions on the other two levels are analysed using institutional theory" (Reimers, et al., 2004).

eTechnology project management is required to coordinate multiple organizational levels. Collaborations may involve up to eight different levels that interact (Cameron, 2005): the macro or external environment (e.g. government, global markets); Industry (Clarke, 1994); the industry segment affected or involved in the project (Reimers, et al., 2004); the inter-organizational environments of the project 'owners'; intra-organizational environment – the organizations participating in a project; project teams - some of which may be virtual; and individuals representing organizations involved in the project.

Multi-disciplinary research was used to explain why organizations joined eTechnology projects. Economic concerns were a key factor, explained by Strategic Theory (the need to ensure the organization's business and ICT strategies are aligned and implemented), Micro-economic Theory (the need for cost benefit, operational efficiency and effectiveness, and reduced transaction cost), Transaction Cost Theory (the need to reduce transaction costs (Rossignoli & Lapo, 2004; Watson, et al., 2004) and Resource Dependency Theory (economic dependency on partners). Research suggested participants are motivated by self-interest. "Organizations cooperate to gain access to the power and influence required to ensure benefit from changes (Political Theory) and will regulate behaviours so that collective gains are achieved (Strategic Management Theory)" (Cameron, 2005). Social Capital Theory more altruistically proposes organizations value group membership and the benefits derived from social relationships (Riemer, 2004).

Theories from the social sciences were used to explain individual behaviour. Actor-Network Theory was used to examine how stakeholders perceive and react to changes in ICT (Guah, et al., 2009). Prospect Theory suggested risk preferences of the decision makers explain why resources continue to be committed to projects that run over-time and over-project (Benschop, et al., 2011).

5.4 Summary of Key Findings for Project Management

A generalised distillation of key findings that provide insight and guidance for project management practitioners is set out in Table 4. Most insights draw from key findings in more than one research tradition. They apply for all projects established to implement eTechnology, are substantiated by robust research within appropriate management contexts and are well supported by multiple researchers. Selected generalised guidance for practitioners is listed in the order in which it evolved. It is of the nature of a summary that some findings are not included in Table 4 and readers need to refer to the cited papers for insights associated with specific eTechnology or organizational environments.

Insights	**Guidance for Project Management**
Project management methods must be appropriate for the organizational & technical environments in which they are undertaken.	- Management methods that assume a single authority are inadequate & inappropriate for projects owned by multiple &/or volunteer organizations. - When project management lacks formal authority, consultation, communication, negotiation & participative decision-making are used to coordinate activities. - Managing inter-organizational projects requires co-ordination at the levels of organizations, teams & individuals representing disparate types of organization. - Formal & informal communication is essential to harmonize understanding among project organizations, teams representatives & other stakeholders. - Skills & roles required within project teams depend on organizational & technical environments. - Different forms of collaboration & virtual organizations & teams change the suitability & types of management methods available to project management. - Project management needs to create an appropriate social environment at organizational, team & individual levels. - Partner selection & relationships affect project outcome. - Trust in relationships & systems are important in the absence of authority. - Motives & mindsets of organizations, teams & individuals affect project outcome.
Processes, tools & techniques must be appropriate for the organizational & technical environments.	- Cost-benefit analysis for eTechnology needs to include tangible & intangible costs & benefits across trading chains. - Strategies need to consider internal & external stakeholder impacts. - Risks are increased by eTechnology so that security & audit controls need to be incorporated into the design of business & ICT systems & infrastructure. - Planning needs to include intra & inter-organizational inputs & address external stakeholder needs using appropriate techniques (e.g. from marketing). - Design needs to incorporate multiple viewpoints.

Project lifecycles must be appropriate for organizational & technical environments.	- In collaborative projects, extra activities related to coordination (e.g. consultation & communication) add to time frames. - Time is required to build relationships, shared understanding & trust. - Collaboration adds phases to the project lifecycle. A collaboration formation phase is added at the beginning of the Initiation Stage; and stabilisation, transformation & dissolution phases are added to the end of the Implementation Stage.
Business & industry processes need to be re-engineered, integrated & automated before benefits of eTechnology can be achieved.	- Benefits from eTechnology must be shared. - BPR creates & changes business relationships, activities & roles within & among organizations & other stakeholders including users of extra-organizational systems. - Change management is important as individuals & organizations may resist changes resulting from BPR. - Integration requires inter-organizational acceptance of data & ICT standards for interoperability. - eTechnology requires additional ICT capability & capacity, particularly for SMEs.
Implementation of eTechnology is complex & adoption depends on organizational & social factors.	- Implementation depends on adoption by a critical mass of trading partners. - Adoption may require assistance with ICT capability & capacity for SMEs. - Prototyping eTechnology can reduce delays in acceptance by trading partners. - Internal pilot implementation prior to roll-out can identify problems. - Evaluation needs to incorporate multiple viewpoints. - Pilot implementation of eTechnology and gradual roll-out can reduce failure. - Social & organizational factors influence adoption.

Table 4: Key Findings - Insight & Guidance for eTechnology Project Management

Examination of the themes and key findings that emerged over time shows that EDI taught project management practitioners to understand the challenges of eTechnology. The lessons learnt about the issues associated with projects established to implement eTechnology in diverse, complex organizational environments like collaborative project and VOs, still apply to current projects. These lessons apply regardless of the type of eTechnology. The key research findings imparted insight and continue to offer guidance for project management practitioners. The suitability of the management methods, processes, tools and techniques used still depends on the technical and especially the organizational environments.

Observation of the insights, from Period 1 to Period 3, show increasing importance of research into the social and organizational factors determining project outcomes. As the technical challenges were gradually resolved but projects continued to fail, the social and organizational issues gained prominence. Dynamic environments increase the need for speed but managing change resulting from the implementation of technology is not 'plug and play'. Researchers sought to understand the interactions and consequences of events and behaviours for outcomes. But there is no 'quick fix'.

Significant progress has been made in understanding project management issues and the reasons for poor outcomes. Nevertheless, practitioners and researchers find that the social and organizational aspects of the management of eTechnology projects are more difficult to identify and address. Multiple levels of analysis and interdisciplinary research, particularly in the social sciences, provided significant insights for project management practitioners. However, plenty of challenges remain to inspire future research.

6 Conclusions

Approximately 30% of the research papers published in the Bled proceedings relate to eTechnology project management. The management of eTechnology projects has always been an important topic-area for the Bled community. This research allows reflection on the challenges faced by project management as the technology changed. The Bled proceedings provide a significant resource for longitudinal studies of eTechnology project management research. The findings in these papers record the experience and research findings of both academics and practitioners. They are an important historical archive of international research during a time of rapid technological and organizational development. To ensure that all papers are preserved and readily accessible for future research, there is a need to digitise the proceedings for the period 1988-2000 using OCR technology.

The focus of research shifted over time to reflect changes in the management context due to differences in organizational and technical environments. eTechnology facilitated organizational transformation. There were significant changes in the organizational environment after the emergence of new forms of organization, like collaborations and VOs. The focus of research moved towards the inter-organizational environments of eTechnology projects. Gradual change was evident in the way researchers utilised the three research traditions (Factor Research, and the Engineering and Social Science Traditions). eTechnology is a socio-technical system and the focus of research has come to reflect the fact that the social aspects are more complex than the technical.

Key findings from the research undertaken by academics and practitioners within appropriate contexts provide insights and guidance to support effective management of projects established to implement eTechnology. Insights and reflection on practitioner experience and research that was based on early EDI projects continues to provide an excellent base from which to predict the likely impacts of emerging eTechnology and forms the backbone for the management of other eTechnology projects. The guidance from early research provided project management practitioners with the expertise and confidence to enable organizations to burst into the adoption of other eTechnologies. Progress has been made in understanding the social and organizational issues that continue to challenge project management. However, more emphasis on multiple levels of analysis and interdisciplinary research particularly in the social sciences is required to improve understanding of project outcomes.

The foresight and persistence of Joze Gricar and his teams in creating and sustaining the Bled community over 25 years has resulted in a unique record of research into the management of eTechology projects. Understanding the management of eTechnology projects requires the combined experience and expertise of practitioners from different organizational types and different roles, and academics from many disciplines, social

science as well as engineering. This was a strength of the Bled community at the beginning in 1988 and remains so in 2012.

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Appendix – Summary of Analysis of Papers and Topics

Year	Number of Papers	Management Context			Factor Research					Engineering Tradition - Lifecycle Stage											Social Science Tradition			
		Type of Technolgy	Organization Environment		Impact		Success Factors			Initiation				Development				Implementation			Project Mgt			
					Organization		Organization			Planning		Establish		Design		Build		Organization			Method		Other	
			Intra	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Exter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Exter*	*Intra*	*Inter*	*Intra*	*Inter*
1990	6	EDI	6	3	1	1			1	2	1	1		3	1	2				1	2			1
	1	ICT	1											1							1			
	1	IOS	1							1													1	
1991	18	EDI	15	9	5	1	6	1	1	2	1			7	3	2		2	1		4	2		2
	2	EFT		2	1	1	1	1	1															
1992	14	EDI	11	6	1	2	2	1		4	2			2	2	2		1			1	2		
1993	10	EDI	10	3						2				4		1		2				2		2
	2	IOS	2	2			1	1							1									1
1994	1	eCom	1	1	1	1					1				1		1					1		
	6	EDI	2	6	2	2		2	1						1				3			1		1
1996	3	eCom	3	2	1	2		1		1								1			1	1	1	2
	5	EDI	4	5	1	1			1						1									
	1	eMark		1	1	1	1	1	1															
	3	IOS	3	1			1							1	1								1	1
Total	**73**		**59**	**41**	**14**	**12**	**12**	**8**	**6**	**12**	**5**	**1**	**0**	**18**	**11**	**7**	**1**	**6**	**4**	**1**	**9**	**9**	**3**	**10**

Table 1: Summary of Analysis of Papers and Topics in Period 1

Year	Number of Papers	Management Context			Factor Research					Engineering Tradition - Lifecycle Stage											Social Science Tradition			
		Type of Technolgy	Organization Environment		Impact		Success Factors			Initiation				Development				Implementation			Project Mgt		Other	
					Organization		Organization			Planning		Establish		Design		Build		Organization			Method			
			Intra	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Exter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Exter*	*Intra*	*Inter*	*Intra*	*Inter*
1998	2	eBus	2	2										1	1			1	1				1	1
	8.5	eCom	5	5		1	1	1	2	1				2		2	1	1	1	5		5	1	3
	3	EDI	3	2	1						1			1						1			1	1
	3	ICT	2	3	1		2	1		1								1						2
	1	IOS	1	1																		1		1
	0.5	Web		1										1				1			2	2		1
1999	3	eCom		3				1						1	1				1					2
	3	eMark	1	3		1									2				1					1
	1	ICT		1				1																
	2	IOS	1	2											1						1	1		1
	1	Web	1															1					1	
2000	1	eBus	1							1														
	3	eCom	2	1			2			1								2						
	2	IOS		2															1			1		1
	2	Web	2	2										1	1								2	2
2001	0.5	B2B	1				1											1			1		1	
	0.5	B2C	1				1											1			1			
	3	eBus	1	2			2			1													1	
	3	eCom		3			2	1		2														
	2	ICT	1	1			2							1									1	
	1	Web	1															1					1	
Total	**46**		**26**	**34**	**2**	**2**	**13**	**5**	**2**	**7**	**1**	**0**	**0**	**8**	**6**	**2**	**1**	**10**	**5**	**6**	**5**	**10**	**10**	**16**

Table 2: Summary of Analysis of Papers and Topics in Period 2

Year	Number of Papers	Management Context			Factor Research					Engineering Tradition - Lifecycle Stage											Social Science Tradition			
		Type of Technolgy	Organization Environment		Impact		Success Factors			Initiation				Development				Implementation			Project Mgt		Other	
					Organization		Organization			Planning		Establish		Design		Build		Organization			Method			
			Intra	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Exter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Exter*	*Intra*	*Inter*	*Intra*	*Inter*
2002	2.5	B2B		3							1				1							1		2
	3	eBus	2	1						1				1					1		2		1	
	2	eCom		2			1		1															
	1	mCom	1	1																				1
	2.5	Web	1	2			1				1											1		
2003	4	eBus	4	1	1	1	1				1			1						1				1
	2	eCom	1	1			1	1	1											1		1		1
	1	ICT		1							1											1		
	2	mCom	1	1	1						1											1		
	4	Web	3	2							1			1	1	1				1		1		2
2004	1.5	B2B		2							1		1									2		2
	2	B2C	2	1		1				1	1				1								1	1
	1	eBus		1		1					1													1
	1	eCom		1							1											1		1
	3	eGov		3			1	2			1				1				2					1
	2.5	eMark		3		1		1			1								1			1		2
	2	ICT	2				1			1						2								
	1	IOS		1															1	1				1
	1	mCom	1							1	1			1									1	
	3	Web	1	2		1					1			1										2
2005	4	B2B		4					1		2				3		1						1	1
	4	eBus	2	3				1			1			1				1	1	1		1	1	2
	4	eCom	2	3			1	1	1								2							3
	2	eGov	1	1										1								1		1
	3	ICT	3	2			1	1								1	1							
	4	mCom	2	2			1	1							1			1	2					
	4	Web	3	3				1	1	1					1	1							1	1
2006	3	eBus	2	1						2	2			1							1			
	3	eMark		3			1	1	1		1							1						1
	7	ICT	3	5		3	1		1		2				2		3							2
	3	mCom	3	1					2		3							1	1					1
	3	Web		3			2	3	1										1					1

Table 3 – Page 1: Summary of Analysis of Papers and Topics in Period 3 – (2002-2006)

Year	Number of Papers	Management Context			Factor Research					Engineering Tradition - Lifecycle Stage											Social Science Tradition			
		Type of Technolgy	Organization Environment		Impact Organization		Success Factors Organization			Initiation				Development				Implementation			Project Mgt Method		Other	
										Planning		Establish		Design		Build		Organization						
			Intra	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Exter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Intra*	*Inter*	*Exter*	*Intra*	*Inter*	*Intra*	*Inter*
2007	7	B2B	3	4		1		1		1	2				2									1
	1	eCom	1	1			1																	
	5	ICT	5			1	1		1	2				2		2							2	
	2	IOS		2							1				1							1		
	2	mCom		2			1		1					1		1								
	5	Web	3	4			2	3	1	2			2	2		1						2		1
2008	5	B2B		5				1	1		3				1				1	1		2		2
	1	eCom	1	1											1									
	3	eGov	1	2		1				1			2											2
	2	ICT	2				1								1									1
	4	IOS	1	3			1	1	1						2		2							2
	1	mCom	1											1				1						
	1	Web	1	1					1															1
2009	8	ICT	7	2			1	3	1	1				1		1		2	1		1		2	1
	2	IOS		2		1		1												1				1
	3	mCom		3		1		1	2		2				1				1	1				1
	1	Web		1				1	1										1					
2010	1	B2B		1				1		1														
	1	eBus	1			1																		
	1	eGov		1											1		1							
	5	ICT	5	3		1	1	1	1	2				3		1			1		2			1
	1	IOS		1																		2		
	2	mCom	2	2					1	1				2		1			1					
	4	Web	4	4	1	1	1	1	1						1	1	1							1
2011	2	B2B	2	2			1			2	1				1		1							
	1	B2C	1	1			1											1						
	1	ICT	1																		1		1	
	2	IOS	1	1	1		2	1	1											2				
	5	Web	5	2						4				2		4					1			
Total	**165**		**88**	**111**	**4**	**16**	**27**	**29**	**24**	**24**	**34**	**0**	**5**	**22**	**23**	**17**	**12**	**8**	**16**	**10**	**8**	**19**	**11**	**46**

Table 3 – Page 2: Summary of Analysis of Papers and Topics in Period 3 – (2007-20011)