

# **A Preliminary Empirical Study of the Diffusion of ERP Systems in Austrian and British SMEs**

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# **A Preliminary Empirical Study of the Diffusion of ERP Systems in Austrian and British SMEs**

## **Research in Progress**

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**ABSTRACT**

This paper presents the work in progress regarding an international research project based on an empirical survey. It focuses on the early stages of making the adoption decision, thereafter evaluating and selecting an Enterprise Resource Planning (ERP) system prior to implementation in Small to Medium sized Enterprises (SMEs). The project seeks to close some of the identified gaps in ERP research. In addition, it attempts to link the results of the early stages of decision making to implementation, usage and evolution success in order to allow important conclusions to be made, for example, on the best practices in decision making or decision quality and success. This project will be restricted to the case of ERP software but will also give insights into the potential of integrating ERP and other important applications such as Customer Relationship Management (CRM) or Supply Chain Management (SCM). The proposed research seeks to identify any differences and similarities contributing to the analysed research areas between British and Austrian companies. The choice of companies originating from two different regions in Europe is an important precondition in order to formulate results that will be applicable to the European Union in general. Due to the pervasive nature of ERP systems, our research results should be of interest to a wide range of professional and scholarly communities (from software engineering to accounting), in addition to the Information Systems (IS) field. The results presented should especially help practitioners in SMEs facing the important task of introducing an ERP system into their company.

**KEY WORDS**

Enterprise Resource Planning, ERP, SME, ERP decision, ERP evaluation, ERP selecting, ERP implementation, ERP usage, empirical survey

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## INTRODUCTION

An Enterprise Resource Planning (ERP) system is a software infrastructure embedded with "best practices", thus providing the best ways to do business based on common business practices or academic theory. The aim of an ERP is to improve the co-operation and interaction between all departments in organisations (such as product planning, manufacturing, purchasing, marketing and customer service department). ERP is a fine expression of the inseparability of IT and business. As an enabling key technology, as well as being an effective managerial tool, ERP systems allow companies to integrate at all levels and to utilise important ERP applications such as supply-chain management, financial and accounting applications, human resource management and customer relationship management (Boubekri, 2001). They represent large, complex, computerised and integrated systems which can strongly influence long-term business success.

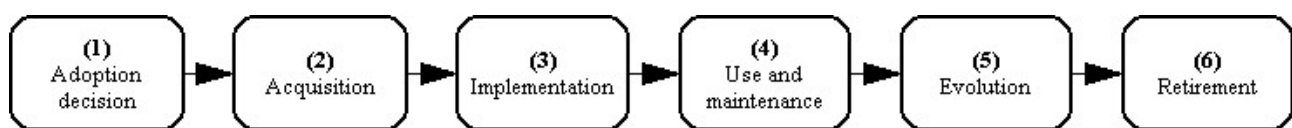
The following proposed research project will be based on an empirical survey and will focus on ERP software adoption decisions, system evaluation and selection in SMEs. It seeks to identify differences and similarities contributing to the analysed research areas, for example, in the use of evaluation methods employed in British and Austrian companies.

This proposal is presented in the following nine sections. First, ERP related literature is reviewed. The next section outlines the relevance of the proposed research to business. Goals and objectives are then set out, followed by the research methodology. Next, contacts and collaboration are described, followed by information on the workplan. A table detailing the approximate project costs is then given. The proposal concludes with the list of preliminary work and related research material already published.

## LITERATURE REVIEW

Firstly, we propose to position the adoption decision and system acquisition within a wider ERP system lifecycle, as originally proposed by J. Esteves & Pastor (1999), in order to supply a framework for the following literature review.

The lifecycle covers the six different stages that an ERP system passes through during its life within an organisation (see Fig. 1).



**Fig. 1.** An ERP Lifecycle model (J. Esteves & Pastor, 1999)

Concerning the first stage, that of adoption decision, a need for further research into the planning phase of the adoption process has been expressed by Oliver & Romm (1999). They also outlined some of the principles that should form the basis of empirical research in this area and provided a qualitative analysis of ERP adoption within universities. Other researchers have described the significance of ERP systems with case-based approaches (Hirt & Swanson, 1999). The question as to whether data quality is a reason to acquire an ERP system, together with other aspects relating to data quality, have been investigated by Xu, Nord, Brown, & Nord (2002). Based on structured interviews with ten Canadian government organisations, Kumar, Maheshwari, & Kumar (2002) analysed ERP adoption as an organisational innovation process and applied an "ERP System Experience" model. This was originally proposed by Soh & Markus (1995) and then adapted by Markus & Tanis (2000) and reflects an organisation's experience with ERP systems from adoption to success. Kumar et al. (2002) also give interesting insights into other stages of the lifecycle model. But due to the limited number of analysed units, their results are not capable of general application.

Previously published material relating to the acquisition area focused on an ERP methodological acquisition approach (Sistach & Pastor, 2000; Sistach, Pastor, & Fernandez, 1999), frameworks for the selection process (Bernroider & Koch, 2002; Stefanou, 2000), purchasing criteria (Brown, Vessey, & Powell, 2000), game-playing behaviour (D.E. O'Leary, 2000) and case studies (J. Verville & A. Halington, 2002; J. C. Verville & A. Halington, 2002).

A review of the work published in the main IS journals and conferences showed that research conducted in the area of ERP systems has concentrated on issues related to the implementation phase of the ERP lifecycle (José Esteves & Pastor, 2001). Issues attributed to the implementation

stage can be classified as implementation approaches (Hazebrouck & Frerichs, 1999; Scheer & Habermann, 2000), implementation success (Bingi, Sharma, & Godla, 1999; Dong, 2000; Hong & Kim, 2002), case studies (Galliers, Newell, Huang, & Pan, 2002; Motwani, Mirchandani, Madan, & Gunasekaran, 2002; Trimmer, Pumphrey, & Wiggins, 2002), empirical surveys (Buxmann & König, 1997) together with other issues such as the role of consultants (Westrup & Knight, 2000), information technology architecture options (Chan, 1999) and change management strategies during implementation (Aladwani, 2001; Al-Mashari, 2000).

The attention of scholars in the IS area has been directed more to the post implementation stages rather than the stages prior to implementation. Contributions to the use and maintenance stage benefits, risks, limitations and factors that affect ERP usage and organisational performance have been analysed by Beretta(2002); Poston & Grabski(2000); Pozzebon(2000)and Shang(2000). Other authors have analysed technological aspects such as architectural issues, maintenance tasks, databases performance, security and fraud prevention ((Iyer, 1996; Ng & Ip, 1998).During the evolution phase ERP applications act as a technology enabler for ERP extensions or applications and systems such as SCM (Boubekri, 2001; Knolmayer, Mertens, & Zeier, 2000).

Not all publications on ERP can be directly related to a specific ERP lifecycle phase, as in some cases, they can consider aspects attributable to the lifecycle as a whole. For example, the application of decision models during the life of ERP projects was analysed by Shakir(2000), Daniel E. O'Leary(2002) focused on knowledge management across the whole lifecycle of an ERP solution. Several researchers point to the linkages between ERP and Business Process Reengineering(BPR), where the former is considered a driving technology of BPR (Al-Mashari, 2002; Huang, Kwan, & Hung, 2001; Koch, 2001). Important research issues which can be related to any stage of the lifecycle model are proposals on how to analyse the value of ERP applications (Martin, Mauterer, & Gemünden, 2002). Although a considerable number of articles contribute towards analysing the value of information systems, packaged software solutions or Commercial Off The Shelf (COTS) products (Muschter & Österle, 1999; Ward, Taylor, & Bond, 1996), only a few have focused on the specific case of ERP systems.

Some studies investigated certain factors in the ERP context specific to smaller organisations mainly for the area of implementation (Gable & Stewart, 1999). Contributing to the acquisition stage, work has been published concerning a methodological approach to the acquisition of ERP solutions by SMEs (Sistach et al., 1999) and also on certain specific aspects of the acquisition process of Austrian SMEs (Bernroider & Koch, 2000).

In response to the widespread application of ERP systems, academic institutions introduce ERP system gradually in their IS curriculum (Al-Mashari, 2002). This also originates from the market demand for highly qualified ERP specialists. ERP vendors provided a special arrangement that encourages universities to incorporate their ERP systems and helps to integrate the teaching of these emerging technologies into their current education processes (Watson, Rosemann, & Stewart, 1999). As a consequence, researchers also focused on the processes and mechanisms that some universities implemented to introduce ERP into education (Becerra-Fernandez, Murphy, & Simon, 2000; Hawking, Ramp, & Shackleton, 2001).

Although all major IS conferences dedicate at least a track or mini-track to ERP systems, the number of publications within the information systems community on ERP systems appears small when compared to the size of the business they generated (José Esteves & Pastor, 2001). As the widespread application of ERP systems continues, research in the ERP area is still lacking and the gap in the ERP literature is huge (Al-Mashari, 2002). Considerable research effort has been directed towards the implementation and to large parts of the post-implementation phases. The lack of attention applies especially to the stages of system adoption and acquisition, as well as on how to analyse the value of ERP systems, and to the special situation faced by SMEs.

## **RELEVANCE OF THE PROPOSED RESEARCH**

ERP software solutions have become the central nervous system for almost any major large company. The effectiveness of these software applications directly relates to the effectiveness and competitiveness of the firm and its long term viability. ERP systems promise the development and sustainment of competitive advantage in the global marketplace through enhanced decision support, reduced asset bases and costs, more accurate and timely information, higher flexibility or increased customer satisfaction (T. H. Davenport, 1998; T.H. Davenport, 2000; Poston & Grabski, 2000; Rizzi & Zamboni, 1999). An empirical survey reported that two-thirds of the interviewed IT managers responsible for their organisation's ERP projects viewed the ERP systems as their organisation's most strategic computing platform (Sweat, 1998).

The acquisition and implementation of ERP systems are very effort-intensive processes. An empirical analysis of the implementation process in European companies revealed mean implementation costs of EUR 1.5 Million. and a mean implementation time of 13.5 months (Buxmann & König, 1997). In addition, high risks are also involved in every ERP project. The far-reaching structural changes following an ERP software implementation can be disastrous as



examples show (Bingi et al., 1999; Buckhout, Frey, & Nemec Jr., 1999; Scott, 1999) . A market research company reported that 70% of ERP implementations fail to achieve their corporate goals (Buckhout et al., 1999). It can be assumed that major mistakes were already made in the early stages of the ERP lifecycle prior to the implementation process.

Despite the importance of ERP systems, the high effort expended by companies to implement these systems and the high risks involved, the answers to many questions regarding different aspects (especially in the early stages of the lifecycle of ERP systems) remain unanswered. Examples include the relationship between decision approach and implementation, as well as usage success or the area of analysing the value of ERP systems (Martin et al., 2002).

The present research proposal seeks to close some of these perceived gaps in ERP research. It focuses on the early stage of evaluating and selecting an ERP system prior to implementation. In addition, it links the results of the early stages of decision making to implementation, usage and evolution success in order to allow important conclusions; for instance, on best practices in decision making or decision quality and success.

This research will focus on the decision-making situation faced by SMEs. This is of particular importance because SMEs are experiencing more and more the need for integration, (especially for inter-organisational integration), and they are expecting ERP software to fulfil these needs. The availability of relatively inexpensive hardware is fostering this situation (Gable & Stewart, 1999). In general, decision making in SMEs features much greater constraints on the ability to gather information in order to reduce uncertainty about their investment (Cobham, 2000).

On the other side of the debate, ERP vendors are searching for new challenges to generate higher revenues and have turned to the small and medium-sized market segment. In recent years ERP software packages sales have flattened. A saturation of the market occurred as most large organisations have already implemented an ERP solution and thus has decreased the annual ERP market growth (PDC, 1999). By 1998 approximately 40% of companies with annual revenues over 1 billion USD had implemented ERP systems (Caldwell & Stein, 1998). The small and medium-sized market segments, however, is far from being saturated (PDC, 1999). The total European midsize market for IT products and services surpasses US 50 billion dollars per year (Everdingen, Hillegersberg, & Waarts, 2000)

Due to the pervasive nature of ERP systems, the results of our proposed research should be of interest to a wide range of professional and scholarly communities (from software engineering to

accounting), in addition to the IS field. The results presented should especially help practitioners in SMEs facing the important task of introducing an ERP system into their company.

Another aspect of the proposed work is that results would also contribute to the development of any e-initiative (CRM, SCM, etc.) on the basis of ERP systems and to handling decision problems regarding any other type of enterprise wide standard software package.

## **OBJECTIVES AND RESEARCH HYPOTHESES**

In this section the research objectives are presented in more detail. The proposal seeks to provide findings for the following topics, which are presented corresponding to the order of the ERP lifecycle stages to which they can primarily be assigned. The last category (6) contains topics which cover more than one stage of the ERP system lifecycle.

### **(1) Adoption Decision**

**(Topic i)** Drivers for the decision to implement ERP.

The adoption initiation is strongly influenced by the expected benefits of an implemented ERP system in the organisation (Kumar, Maheshwari, & Kumar, 2002). The recognition of a need or perceived opportunity of ERP may initiate the adoption process. It is important to classify the type of need or opportunity, which can have strong implications for the further stages of the project. As Kumar et al.(2002) remark, an ERP adoption initiated for mainly technological reasons may configure ERP as a technology-driven project. Also, how and by whom the project is initiated may have important implications on ERP adoption characteristics. ERP adoption needs top management commitment and support from the initiation of the idea to its successful implementation (Bingi, Sharma, & Godla, 1999; T. H. Davenport, 1998; Xu, Nord, Brown, & Nord, 2002). An explorative study investigating ERP implementation in ten Canadian organisations showed that top management initiated ERP adoption in 70% of the responding organisations. Therefore, besides showing how, by whom, and which reasons initiated the idea for ERP, in the proposed research, we want to validate the following hypothesis which also pertains to the stages following the ERP adoption decision.

*H: The level of commitment of top management to an ERP adoption project positively influences project success*

Most large enterprises have adopted ERP. The market segment of large enterprises is largely saturated (Gable & Stewart, 1999) and this has already decreased the annual ERP market growth (PDC, 1999). Large enterprises may be increasing the pressure on their smaller business partners to adopt ERP because they demand integration functionality, e-business support and other IT related issues.

*H: Large organisations with implemented ERP systems are pushing more and more SMEs into the same direction.*

Fast growing SMEs may consider their organisational requirements on a long term basis. As they will grow up to be large enterprises, they may reach the conclusion that an investment in ERP is necessary to support their long term goals.

*H: Fast growing SMEs are likely to adopt ERP.*

## **(2) Acquisition**

**(Topic ii)** Configuration of project team.

An ERP decision produces not only large technical changes but also large organisational changes (managerial and institutional ) that affect almost all employees in an organisation. It has been indicated (Guha, Grover, Kettinger, & Teng, 1997) that not only the technical aspects play a significant role in a successful decision and implementation process. Also, the effective balancing of forces between in favour of a change over and forces of resistance is an important task; this is also a major element in change management theory (Kettinger & Grover, 1999; Stoddard & Jarvenpaa, 1995). Organisations, groups, or individuals will resist changes that are perceived as a threat (T.H. Davenport, 1993; Guha et al., 1997). The principles of change management apply especially to ERP system implementation (Aladwani, 2001). It is important that the

employees relate to the new software environment. On that basis, and with better change management practices, staff motivation will be higher. As has been argued (Appleton, 1997; T.H. Davenport, 1993; Hammer & Champy, 1993; Montazemi, Cameron, & Gupta, 1996; Willcocks & Sykes, 2000) , the participation of the people affected by the system and knowing the business processes leads to better decisions and a higher rate of acceptance later(Guha et al., 1997). Tayler(1998) suggested possible benefits arising from a participative type of team structure that included the motivational improvement of local participation and attention to individual quality of working life, as well as the necessary attention to strategic purpose and to reciprocal and coordinative social roles. On the other hand, it has to be noted that a participative form of decision making might lead to game playing behaviour if one or more parties try to influence the decision process to arrive at their preferred solution (O'Leary, 2000). Given this situation, we suggest that the majority of organisations implementing an ERP solution rely on a participative evaluation strategy and that these organisations outperform the others regarding overall ERP adoption success:

*H: Participative forms of ERP system decision making, respectively group decisions, have a positive impact on ERP adoption success criteria.*

Due to scarce resources and broader control by top management in SMEs (Gable & Stewart, 1999) it is assumed that they tend to establish centralised decision making, (characterised by a high involvement of top management and a strong focus on the IT and organizational departments) with only small participation of other internal departments and minor or no employment of consultants.

*H: SMEs engage in a more centralized form of project team configuration for the adoption of ERP than larger enterprises.*

**(Topic iii)**      Considered Evaluation Criteria for ERP

Smaller organisations tend to be more flexible than larger ones as their organisational structure is less rigid and can be changed more easily. This also applies to their business processes. Therefore, and also because they face greater environmental uncertainty due to lesser influence (Gable & Stewart, 1999), smaller organisations have the need, and also the means, to be more flexible. As the information systems in use have to be aligned with the business strategy and the current business processes, they have also to

offer more flexibility in order to fulfill this requirement. The information systems in smaller organisations should therefore offer possibilities to implement the current business processes, (which might not necessarily follow the standards which are derived from larger organizations), and be able to be changed easily in order to accommodate changes to these processes. It can be assumed that this necessary requirement for increased flexibility will also affect the evaluation and selection of ERP packages.

*H: Higher flexibility is valued more highly by smaller organizations than larger organisations.*

**(Topic iv)** Considered and chosen ERP packages.

Pertaining to the hypothesis that "higher flexibility is valued more highly by smaller organisations" the preferred ERP system needs to be flexible. Due to the lack of financial resources faced by SMEs, it also needs to meet these financial limitations. Both costs and flexibility have been perceived as being disadvantages of the ERP system offered by the market leader SAP (Xu et al., 2002). Although SAP approaches the SME market segments by offering shorter, (and therefore cheaper), implementation cycles (the ASAP implementation approach) by selling pre-customized "ready to run" solutions which can be industry focused, it seems to remain inflexible.

*H: SMEs are turning towards specialised ERP solutions from small vendors primarily due to financial and flexibility reasons.*

**(Topic v)** Applied information gathering efforts.

**(Topic vi)** The use of formal evaluation techniques

The evaluation of information systems, especially ERP solutions, is one of the more difficult problems to tackle in IT management. Nevertheless, at least one methodology from the vast set of evaluation techniques must be chosen in order to have a tool for an effective and transparent comparison of the different choices of action investigated. However, conventional financial and economic evaluation techniques alone will not suffice. Research in IT has extended the range of tools to include productivity measures and return on management and information economics (to name only a few) and various taxonomies of methods have been put forward (Bannister & Remenyi, 1999;

Jones & Hughes, 1999; Kontio, 1996; Lawlis, Mark, Thomas, & Courtheyn, 2001; Remenyi, 1991; Sedigh-Ali, Ghafoor, & Paul, 2001).

Decision makers tend to describe their decisions as being based to a greater or smaller extent on instinct or on individual experiences. The more complex the decision, the more likely this seems to be. We suggest that a such defection from the solid ground of rational decision-making should be avoided, and for every ERP software decision, formal evaluation methodologies should be applied. It has been confirmed that those IT executives who systematically collected information and analyzed it made more effective decisions than those who did not (Ranganathan & Sethi, 2000).

*H: Organisations apply formal evaluation techniques other than conventional financial methods in the ERP system selection process.*

SMEs are usually much more informal and unstructured in their management style or definition of strategy than larger companies. This allows them to compete in a very dynamic and competitive environment through high flexibility and responsiveness. This is a major premise for SMEs to be always close to their markets and customers.

Regarding IT investments, many SMEs often seem to lack an explicit IT plan or strategy, or even a defined IT budget (Dans, 2001). Dans states that decisions to adopt a particular technology are in many cases driven by personal attitudes or perceptions of the firm's owner, rather than by any formal cost-benefit or strategic analysis. Gable & Stewart(1999) proposed that a decisional specificity attributed to SMEs is less usage of formal models when evaluating SAP R/3 systems. Thus, we consider that SMEs apply less formal and less complex evaluation techniques than large organisations in the ERP system selection process.

*H: SMEs apply less formal and less complex evaluation techniques than large organisations in the ERP system selection process.*

**(Topic vii)** Situational factors, e.g. IT/IS architecture characteristics, influencing the effect of ERP software on organisational performance.

**(Topic viii)** Current needs and problems of organisations in the field of IT integration and functionality aspects.

**(3) Implementation**

**(Topic ix)** Accompanying Business Process Improvement (BPI) or Business Process Reengineering (BPR) efforts.

**(Topic x)** The implementation approach chosen.

**(4) Use and Maintenance**

**(Topic xi)** The perceived utilisation of ERP benefits.

**(5) Evolution**

**(Topic xii)** The value of ERP systems as an enabling technology especially for Supply Chain Management (SCM) and Customer Relationship Management (CRM)

After the implementation and "going live" of an ERP system, many companies perceived that their system did not meet the functionality required. Reasons are the lack of funds, expertise, or time, especially in the year 1999 where companies were struggling to achieve a Y2K compliant information system (Willis & Willis-Brown, 2002). Also many useful, but not system critical, features are often left out when implementing ERP systems (Willis & Willis-Brown, 2002). We therefore seek to establish an overview of the level of functionality which was achieved when the ERP system was going live.

Many functions needed by an organisation are currently not fully featured by ERP systems, therefore companies are turning to third-party products to meet these needs (Willis & Willis-Brown, 2002). When evaluating vendors it thus seems necessary to emphasize on the ability to integrate with other products. Important applications of ERP systems comprise SCM and CRM. Willis and Willis-Brown propose that a solid ERP foundation is the backbone of such extensions (Willis & Willis-Brown, 2002) and intend to investigate the perceived value of this enabling advantage for ERP adopters.

**(6) General Directions**

**(Topic xiii)** Decision Success and Quality.

As reported in academic literature, there is a dip in performance after going live with an ERP system (Willis & Willis-Brown, 2002). A measure of the success of the stages prior to usage is the length and depth of the performance dip encountered.

**(Topic xiv)** The influence of acquisition process characteristics and the type of implementation strategy chosen on the performance of the system in use later .

**(Topic xv)** Differences between large and small to medium sized enterprises (SMEs) in the overall acquisition process of ERP systems.

Smaller organisations face more severe restrictions on their resources, including (among others) financial and human resources than larger companies. This ‘resource poverty’ constitutes also part of the organisational specificity of smaller organisations (Gable & Stewart, 1999). Slack resources are often scarce or nil (Dans, 2001). The lack of resources refers to all human, financial and material aspects. It can therefore be assumed that this factor plays a role in the context of ERP selection. This may, for example, also include the ways in which information regarding alternatives and their respective quality is gathered, and also in the composition and size of the project team responsible for the decision making.

*H: Smaller organisations spend less effort during all stages of the decision making process than larger organisations.*

**RESEARCH METHODOLOGY**

This work will build on empirical findings from two different regions within the European Union: The United Kingdom and Austria. The choice of companies originating from these two different European regions is an important pre-condition for the formulation of results that will be applicable to the European Union in general.



The approach to this research project is two-pronged. Firstly, a research model and hypotheses will be formulated based on implications from current perceptions in the literature, from case studies under progress and from preliminary results from prior research. These preliminary results cover primarily the decision making process for ERP software systems. The research activities will be done in co-operation with the Aston Business School, Aston University in the UK and with Department of Information Business, Vienna University of Economics and Business Administration in Austria.

The methodology to be employed in the second stage for testing the research hypothesis is an empirical survey. For such an empirical study the design of a questionnaire is necessary, which will be validated in several pre-tests. Random sampling will be employed with a sample size of 1000 for each country, thus resulting in a total of 2000 enterprises. The samples will be divided into subgroups according to company size. If the number of subjects in any group falls below a certain limit then stratified and disproportional sampling will be applied. As a consequence of the disproportional sampling method, the variables of the empirical data gathered in the main step of analysis must be weighted to calculate the real distributions. Subsequently, mailings with separate, prepaid envelopes will follow. The data will then be analysed using a statistical package.

## CONTACTS AND COLLABORATION

The research project will also be supported by researchers, students and practitioners, mainly from Austria and the United Kingdom. The following list of institutions, and persons have either offered support or are interested in promoting the results to the wider public.

- *Vienna University of Economics and Business Administration, Augasse 2-6, A-1090 Vienna, Austria: Department of Information Business*

Dr. Edward Bernroider and other researchers working at the same department as well as students working on their diploma or Ph.D. theses.

- *Aston Business School, Aston University, Birmingham B4 7ET, United Kingdom: Operation and Information Management Group, Technology and Operations Management (TOM) Research Group*

Dr. Nelson Tang and the team of researchers in the TOM Research Group.

- *ADV Arbeitsgemeinschaft für Datenverarbeitung Trattnerhof 2, A-1010 Wien, Austria*

The ADV is a neutral organisation with the primary function of establishing communication links between members, the public and all other interested institutions in the field of information processing. In fulfilling this objective, the ADV establishes seminars, meetings and workshops promoting various information processing themes, and provides its members with services, information and consultation. Therefore the ADV is well suited to communicate results of the projected study to Austrian enterprises and also to support collaborative initiatives with English companies.

These contacts seem ideally suited to conduct the proposed research.

## **PROJECT STATUS**

The results achieved so far comprise a research proposal, the research framework respectively the research hypotheses, the questionnaires for the empirical survey, both the English and Austrian version, and the random samples. Random sampling was applied with a sample size of 1000 for each country, thus resulting in a total of 2000 enterprises. Due to the limited number of subjects in the groups MEs and LEs, the use of a disproportional sampling method was necessary. Due to missing telephone numbers and address information, the company data had to be completed manually. Regarding to the Austrian sample, 32 companies of the 1000 subjects were either non-existent or changed their company names.

Regarding the Austrian part of the survey, a cover letter, a supplementary sheet, the questionnaire and a self-addressed stamped return envelope were sent to managing directors of the remaining 968 companies. The cover letter explained the purpose of the study, solicited participation in the survey, assured the confidentiality of responses and introduced our incentive system, which was described in more detail on a supplementary sheet. We offered an extensive research report, future research collaboration and, in addition, for the first 50 returns a CD of the international conference proceedings on e-Manufacturing and e-Business Integration. This CD offers in particular presentations of senior executives from Boeing, General Motors, GE Medical Systems, Harley-Davidson Motor Company, Intel and Rockwell Automation.

The next step will involve follow-up telephone calls in order to increase the return quota of the survey. Thus increasing the statistical significance of the results achieved.

A few weeks after the initial mailing, another copy of the questionnaire will be sent via email to officers who had not responded. The electronic version of questionnaire is a Microsoft Word form and allows the electronic completion of the questions. The necessary email addresses, which are widely missing in the original sample will be gathered through the first series of telephone calls. After four weeks, reminder telephone calls will be made to 100 randomly selected companies that had not yet responded.

The UK study started in March 2003.

After data input, the data will be analysed using a statistical package.

## PRELIMINARY RESULTS

Currently, a case study is in progress analysing the decision making process for a CRM software solution in a large Austrian software enterprise. Preliminary work already published numbered (i-vi) concentrates primarily on general characteristics of the acquisition process for ERP software.

- (i) Bernroider, E. and Koch, S. (2001). ERP Selection Process in Midsize and Large Organisations. *Business Process Management Journal*, 7(3):251-257.
- (ii) Bernroider, E. and Koch, S. (2000). The Decision Making Process Concerning Investments in ERP Software - Results of an Empirical Study in Austrian Organisations. *WIRTSCHAFTSINFORMATIK*, 42(4):329-338, August.
- (iii) Bernroider, E. and Koch, S. (2002). A Framework for the Selection of ERP Packages for Small to Medium and Large Organisations. in: Hossain, L., Patrick, J.D. and Rashid, M.A. (eds.): *Enterprise Resource Planning: Global Opportunities and Challenges*, pp. 206-222, Idea Group Publishing, Hershey, PA.
- (iv) Bernroider, E. and Koch, S. (2001). A Process Oriented View of ERP Software Selection. *Proceedings of the Joint Meeting of the 5th World Multiconference on Systemics, Cybernetics and Informatics (SCI 2001) and the 7th International Conference on Information Systems Analysis and Synthesis (ISAS 2001), Vol. II*, pp. 310-315, Orlando, FL.
- (v) Bernroider, E. and Koch, S. (2000). Differences in Characteristics of the ERP System Selection Process between Small or Medium and Large Organisations. *Proceedings of the Sixth Americas Conference on Information Systems (AMCIS 2000)*, pp. 1022-1028, Long Beach, CA .
- (vi) Bernroider, E. and Koch, S. (1999). Decision Making for ERP-Investments from the Perspective of Organizational Impact - Preliminary Results from an Empirical Study. *Proceedings of the Fifth Americas Conference on Information Systems (AMCIS 1999)*, pp. 773-775, Milwaukee, WI.

Further publications contributing to the research objectives proposed are in preparation.

## OTHER RELEVANT PUBLICATIONS

The following list of publications, (which contribute to research areas comprising evaluation of IT technologies, performance measurements or enterprise application software issues such as SCM systems or other empirical surveys), all relate to the area of research in this proposal.

- (i) Tang, N.K.H., Yasa ,P.R., and Forrester,P. (2002).Supply Chain Excellence Through Web Based Order Management – A Case Study of a Food Ingredients Company. *The 7th International Conference on Logistics and the 2<sup>nd</sup> International Symposium on Operations Strategy*, July, Monash University, Australia .
- (ii) Chan, T. S., Tang, N.K.H., Lau, H. C. & Ip, R.W.L. (2002).A simulation approach in supply chain management, Integrated Manufacturing Systems. *The International Journal of Technology Management* 13 (2) pp 117-122 .
- (iii) Tang, N.K.H., and Tan,D. (2002).Application of QFD for E-business Planning: A Proposed Management Framework. *The 5th International Conference on Managing Innovative Manufacturing*, University of Milwaukee Wisconsin, USA.
- (iv) Tang, N.K.H., Chan,F., and Chung, S.H.(2002)Feasibility Study on a Central Coordination System for Managing Large Supply Base Through Supply Chain Collaboration. *The 5th International Conference on Managing Innovative Manufacturing*, University of Milwaukee Wisconsin, USA.
- (v) Tang, N.K.H., Yasa ,R.P., and Forrester,P.(2002) Planning Electronic-Business Roadmap by Applying a Delta Model & BPR Approach. *Conference on Logistics Research Network, September*,Institute of Logistics and Transport's, Birmingham.
- (vi) Tang, N.K.H., Burridge,M., and Ang,A.(2002) Development of an Electronic-business Planning Model for SMEs. *Conference on Logistics Research Network, September*, Institute of Logistics and Transport's, Birmingham.
- (vii) Tang, N.K.H., Zunic,A., and Forrester,P.(2002)E-Collaboration – A New Paradigm in Supply Chain Management: from theory to a practical framework. *The 7th International Conference on Logistics and the 2<sup>nd</sup> International Symposium on Operations Strategy*, July, Monash University, Australia.

- (viii) Jones, O., and Tang, N.K.H. (2001). Innovation in Product and Process: the Implications for Technology Strategy. *International Journal of Manufacturing Technology and Management* 1 (4/5) pp 464-477.
- (ix) Tang, N.K.H., and Al-Sudairy, M. (2000). Information Technology in Saudi Arabia's Supermarket Chains. *International Journal of Retail and Distribution Management* 28 (8) pp 341-356.
- (x) Tang, N.K.H., Jiang, B., and Chan, F.T.S. (2000). The Development of Intelligent Decision Support Tools to Aid the Design of Flexible Manufacturing systems. *International Journal of Production Economics* 65 (1) pp 73-84.
- (xi) Tang, N.K.H., Chan, F.T.S., Chan, M.H., and Mak, K.L. (1999). An Integrated Approach to Investment Appraisal for Advanced Manufacturing Technology. *Journal of Human Factors and Ergonomics in Manufacturing* 9 (1) pp 69-86.
- (xii) Tang, N.K.H., and Lim, P.C. (1999). Quality Function Deployment: Performance Measurement of Health Care Organisations. *Managing Service Quality Journal* 9 (6) pp 423-433.
- (xiii) Tang, N.K.H., and Bell, H. (1998). The Effectiveness of Commercial Internet Web-Sites: A User's Perspective. *Journal of Internet Research* 8 (3) pp 219-228.
- (xiv) Forrester, P.L., Tang, N.K.H., and Jones, O. (1997). Organizational Growth Demands Concurrent Engineering. *International Journal of Integrated Manufacturing Systems* 8 (1) pp 29-34.

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