THE IMPLEMENTATION OF ENTERPRISE RESOURCE PLANNING SYSTEMS IN SMALL-MEDIUM MANUFACTURING ENTERPRISES IN SOUTH-EAST QUEENSLAND: A CASE STUDY APPROACH

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ABSTRACT

This paper examines the implementation of ERP systems in small/medium-sized enterprises in South East Queensland, Australia. Nine case studies were conducted to determine factors for success or failure in the implementations. Key success factors identified included cross-functional team approaches, organisational experience of similar scale IT or organisational change projects, and 'deep' understanding of the key issues relating to ERP implementations. Failure factors identified included top-down or consultant driven implementations, IT department driven implementations, or implementations where the ERP is seen as a quick technological fix to problems within the operation of the firm, rather than as a strategic investment.

Keywords: Industrial management; Strategic planning; Organisational culture; Management information systems; Enterprise resource planning.

1. INTRODUCTION

Nine case studies were conducted, using qualitative analysis techniques to explore selection, implementation and exploitation of ERP (Enterprise Resource Planning) systems in SMEs (Small to Medium Enterprises) in South East Queensland. The case studies explored the attitudes and experiences of nine companies in terms of ERP system selection, strategies for implementation, obstacles inhibiting implementation, and experiences of ERP system benefits from a range of organisational perspectives: company background, strategic, technological and operational, human resource and organisational culture.

The research was conducted as a part of a study organised by the Queensland Manufacturing Institute to ascertain some of the key factors that influence the implementation in ERP systems in selected Australian companies in Brisbane. The Technology and Innovation Management Centre was responsible for conducting a series of case studies that provide an analytical assessment of various experiences of these companies. These case studies identify specific management issues in the selection, implementation and maintenance of ERP systems in their respective companies.

2. METHODOLOGY

The study was conducted through interviews with individuals who had been involved with the ERP implementation in each firm. The interviews were based on a structured questionnaire: however, the interviews were conducted in a semi-structured way. That is, respondents tended to talk at length covering a range of issues, with direct reference to the questionnaire by the researchers only as necessary if key points had not been covered. Information was also gathered from various company documents, and by respondents' own notes on the copy of the questionnaire provided before the interview took place. Companies and respondents were selected from a range of 50 companies that took place in an earlier quantitative survey of ERP implementation practices and attitudes.

The case studies were primarily focused on users' experiences in tackling difficult tasks in the implementation of new IT (Information Technology) systems. Accordingly, the questions were organised to identify technological, business system, IT policy, and strategic and organisational issues in the implementation of ERP systems. Based on the literature review and other research, the case studies were structured so as to explore these issues.

The types of companies selected for the study were various, ranging from food processing, to explosives manufacture, to motor vehicle assembly, to custom mining equipment manufacture. The firms fit into the small to medium enterprise

category; however, all would properly be classed as being medium in size.

3. LITERATURE REVIEW

A concise definition of ERP systems is provided by Kumar & Van Hillegersberg :

'Enterprise resource planning systems are configurable information systems packages that integrate information and information-based processes within and across functional areas in an organisation. The current generation of ERP systems also provides reference models or process templates that claim to embody the current best business practices'[1].

ERP systems are then generally described as a software/information system that seeks to centralise and rationalise information and information flows across an organisation. As implied above, this may have profound effects on the existing business processes of an company, as these may require significant BPR (Business Process Re-engineering) if the ERP is to realise its full potential – a key issue for companies implementing ERP systems is how well they understand this concept and then how they seek to act on this understanding.

Willcocks & Sykes tackle the issue of ERP implementations from the perspective of the IT managers of a company [2]. They argue that many ERP implementations are unsuccessful because of a range of factors closely related to the involvement (or non-involvement) and specific actions and strategies of the CIO (Chief Information Systems Officer) and IT function of the company. The crux of their argument is that standard IT management techniques are fully applicable to ERP implementations, but for a range of reasons these techniques are not followed in ERP implementations. They identify three archetypal scenarios typifying problematic ERP implementations.

Technological determinism: ERP is seen as a 'packaged total solution to a range of technical and business problems.' This is particularly an issue when the CIO and the IT function are very technically focused, and do not share the IT function across the other business units. The implementation is thus regarded as a new software system with only business benefit assumed to follow automatically from the implementation [3]. The IT section eagerly takes on the challenge to deliver on time and in budget, but often finds that lack of in-house skills, botched attempts to customise the ERP, and issues of linking with legacy systems soon compromise the implementation. Other business units and functions do not feel part of the implementation.

Supplier/consultant driven: In this scenario the ERP purchasing and implementation decisions are taken by senior business executives without meaningful reference to the CIO/IT function of the organisation. This is almost the complete opposite of the first scenario – because the senior management see the ERP implementation (correctly) as business-wide and so actually exclude the IT function from the implementation decision making process. This scenario is extremely likely if the IT function has been under-performing, and the management thus views the ERP as a 'replacement' for the inadequate IT function [4]. The consequences of this scenario include cost overruns in consultant time, as post-implementation training and maintenance cannot be done in-house. Again the enterprise as a whole does not feel part of the implementation, as it is a top-down (management), and outside-in (consultant) driven exercise.

Outdated relationships and capabilities: this is the most common scenario, even when implementations were perceived to be successful. In this scenario there is an understanding in the company of the need to fully involve the IT function and integrate it with the other business units in terms of the implementation, however the organisational practices and culture do not allow this to occur as the necessary trust and relationship between IT and the wider enterprise do not exist. This is compounded by inflexible and outmoded HR (human resource) policies that mean that IT departments are under-resourced and face significant skills shortages [5].

In this scenario, often the ERP is implemented reasonably successfully in contrast to the previous two; however, because the relationships between IT and the business and operational functions are weak, it is difficult for the IT function to drive and motivate cultural change and BPR in the other functions to fully capture the majority of the benefits of ERP [6]. The ERP gets implemented and has benefits for the organisation, but the IT function is never truly able to exploit and integrate all the potential of the system. A number of the cases conducted in this study fall into this category. Willcocks & Sykes' analysis would seem particularly relevant to the study in hand in terms of identifying different scenarios which can be applied to the case studies.

A common problem in adopting ERP package software has been the issue of 'misfits', which are the gaps between the functionality offered by the

package and that required by the adopting organisation, identified by Soh, Kien and Tay-Yap [7}. Few organisational users understand the functionality of ERP enough to appreciate the implications of adoption – thus there is a knowledge gap in terms of the functionality of the implemented system. Similarly, few ERP consultants or vendors understand their clients' business processes sufficiently, leading to a knowledge gap on their part in terms of their clients' business processes, a factor which became apparent in this report's case studies.

Soh, Kien and Tay-Yap's 'misfit' analysis leads them to conclude that the typical three key parties in an ERP implementation (the users, IT/IS personnel and ERP vendors/consultants) have specific knowledge sets that are difficult to transfer between them. They recommend that the problem solving process must be placed at the key user end of the equation, thus capturing the tacit knowledge relating to organisational requirements and processes [8].

Finally, Soh, Kien and Tay-Yap provide an analysis of knowledge gaps or 'misfits' between and among stakeholders (key users, IT personnel and ERP vendors/consultants) in terms of ERP system functionality and existing business processes. Based on this analysis they provide some recommendations to overcome these knowledge gaps, which basically require the early and proactive involvement of key users to aid in transfer and articulation of their tacit 'sticky' knowledge. Soh, Kien and Tay-Yap's analysis and conclusions are useful for analysis of the case studies in terms of tacit knowledge transfer and integration of all stakeholders within the ERP implementations [9].

4. RESULTS

4.1 Company Backgrounds

This section illustrates the essential nature of each of the companies, and any peculiar contextual issues relating to the implementation. For example, some of the companies required a multiple-site ERP implementation while some were single-site only. Some had already experienced either a previous ERP or MRPII (Manufacturing Resource Planning II) implementation, while others had never experienced an implementation of this type before. Only one of the companies selected for a case study had attempted to develop its own system completely in-house. One of the companies studied had an existing system, and was at the last stages of evaluation of a new system: implementation proper

had not yet commenced. Five of the case studies were identified as multi-site implementations. Five identified as having either a previous ERP or MRP II system.

The case studies clearly demonstrate that previous implementation experience greatly assists in subsequent implementations. This is demonstrated clearly in case study 1, where a previous implementation did not live up to company expectations. The general manager in this company chose to re-implement the existing system, and carefully defined the scope so that no new hardware or software could be bought for the re-implementation – the total budget for the re-implementation was spent on training, human resources, or other intangibles. This matches well with some of the key success criteria noted by Willcocks & Sykes in terms of carefully defining scope and having a time-box approach.

4.2 Implementation Drivers

The next key area of the case studies analysed was what were defined as implementation drivers: that is, what drove the company to consider an ERP implementation and what criteria were important to the company in selecting a system. Here, rapid company growth and how to manage it emerged as a key issue for several companies: the Y2K issue was also relevant for a number of companies. In one case, a proposed upgrade of an existing system to circumvent Y2K issues became a whole new system implementation after evaluation showed that an upgrade would cost around the same as a new system from a different supplier. In only two cases was consultant advice the prime driver of implementation, and one of these was in a company's first 'botched' implementation, subsequently re-implemented as described in the company background section above (Case Study 1).

One company, a joint venture, was pressured by one of its JV partners to adopt the same system that the JV partner was running, and so had no choice in their implementation criteria. Other key factors driving implementation were: general technological upgrading, desire for better customer responsiveness, desire to improve planning processes, reduce paperwork and so on. This indicates that most companies were relatively sophisticated in their reasons for wanting an ERP system: they had an understanding of the operational benefits achievable through an ERP system, rather than being driven by consultant advice or a general desire to reduce costs. Only one company, however, noted strategic issues as being an important driver, indicating that most companies did not see ERP as crucial to their strategic

direction, rather as an IT solution to a specific set of problems or issues. None of the companies really saw ERP as a business improvement change in the same category as R&D or innovation, contrary to the recommendations of Willcocks & Sykes.

4.3 Evaluation Issues

This area of the case studies covered how companies chose the systems they implemented, and is closely related to the implementation drivers section above. For those that required multi-site implementations, often their key criteria were that the ERP system chosen could handle this. In only one case (Case Study 9) was the product 'found' by a senior commercial manager with little IT department involvement, thus possibly placing the case within the realm of scenario two (supplier and consultant driven) as defined by Willcocks & Sykes. Cost was only a primary factor in one case study. Around half of the companies 'case studied' listed functionality as defined by an analysis of existing business processes as being one of the key factors. One criteria, that of speed of implementation, was not noted as a primary factor by any of the case study companies, though this was not put as a direct question or option in the questionnaire.

4.4 Implementation Issues

Many of the issues and experiences encountered by the companies while implementing the ERP systems were remarkably similar. Most of the companies bought a package with a certain amount of training and implementation assistance as part of the contract. Most were reasonably happy with the level of service provided by the vendor or consultants, but several noted that consultant budgets had a tendency to grow as unexpected problems emerged or further modifications were required.

Another shared experience was the issue of modifications and upgrades. As far as possible, most of the companies preferred to take their ERP systems in 'vanilla' flavour: that is, they did not want to customise the system to fit with the user's previous experiences of ERP or MRPII. This showed an understanding of the potential upgrade path issues if modifications were allowed. Nevertheless, those companies that mentioned this conceded that some modifications were necessary and were implemented. It should be noted that none of the companies studied matched the 6-9 month ideal implementation window suggested by Willcocks & Sykes.

This raises one of the key issues in an ERP implementation: that of either modifying the system in order to conform to the wishes of the users and the existing business practices, or conversely, re-engineering business processes and practices to conform to the ERP system installed. After all, ERP systems are often sold on the promise that they will bring best practice business processes to a company. However, all the respondents who mentioned this conceded that this was always a difficult trade-off – BPR is expensive and time-consuming as also are ERP modifications. One respondent noted that ERP systems are often sold on the basis that they can be customised to do almost anything, and they can, but often the work and maintenance required to do a particular function in this way is not worth the effort.

None of the companies case studied conform to the 'ideal' implementation as defined by Willcocks & Sykes – most actually fell into either Scenario 1 (technological determinism) where the IT department takes on the implementation and expects the company to fall into line, or Scenario 3 (outdated relationships) where IT has an understanding of the necessary change management and BPR required but does not have the capacity to communicate and promote these essential issues throughout the organisation, generally resulting in a satisfactory implementation but one that rarely fulfils the full potential of the ERP.

Nearly all companies had an awareness of the importance of training for an implementation, and most companies had some kind of training program during the implementation; however, none had ongoing training to further exploit ERP. Only around three companies had an explicit cultural change awareness or strategy, although most of the respondents conceded that cultural change and resistance was an issue in implementation. However, those companies that addressed the issue of culture indirectly by at least having cross-functional implementation teams seemed to have more positive outcomes. Most companies had a reasonable amount of sophistication with regard to their implementation, but often lacked the resources and commitment throughout the organisation to fulfil the potential benefits offered by the ERP.

4.5 Strategic Issues

This section of the analysis attempted to draw out whether ERP is seen as a strategic asset for companies, or is seen only as a cost-saving or operational tool. Only three of the companies specifically mentioned ERP in their strategic plan. This indicates that the company strategic planners see ERP as something operational: necessary to

'stay in the game' and to solve specific manufacturing or planning problems, but not really as a strategic asset. Most respondents, however, noted that ERP allowed for better operational planning on a short to medium term basis: however the potential for longer analysis and planning based on data mining from ERP seems to remain poorly understood by most of the companies in the case studies. Some of the companies did include technology and IT more generally in their strategic planning.

4.6   Obstacles

This section explored the major obstacles or inhibitors to ERP implementation. There were not many shared experiences of obstacles to ERP implementation, the exception being that most respondents could identify numerous obstacles. Those that were re-implementing ERP systems often saw disillusionment with the previous system as a significant obstacle. Resistance from various departments due to unwillingness to change business practices, or to learn to manage new interfaces, was also a significant obstacle for some companies. Inadequate knowledge of the system was also seen as an obstacle. Internal staff adequacy or competency was seen as very important but as one respondent noted, this should be a 'given': there is no point in going ahead with an implementation if this is not addressed prior to the implementation. This comment goes some way to meeting Willcocks & Sykes' notion of the nine in-house IT competencies essential prior to an ERP implementation.

Other obstacles noted were: HR 'disincentives' for staff to spend time learning new systems, departure of key staff, lack of senior management support and understanding, modification costs, BPR costs, overt dependence upon vendors/consultants, difficulty in finding a system appropriate for specific industries and companies, inadequate planning and hardware/ software problems and issues. These responses, though diverse and ambiguous, lend some support to Soh, Kien and Tay-Yap's theories of knowledge gaps or 'misfits': that is, communication of knowledge, particularly tacit knowledge between stakeholders, is a significant obstacle to successful ERP implementations. Their conclusion that users must be proactive in the implementation seems particularly appropriate for many of the companies in the case studies. User resistance to change would seem to indicate that key users have not been fully 'co-opted' into understanding and applying the ERP system in their business process area. Although most respondents did not mention culture directly in response to questions about obstacles, their answers demonstrated an implicit awareness

of many of the cultural issues connected to the ERP implementation. Also, the cross-functional team approach discussed in the implementation issue section above seemed to vitiate the knowledge gap problem somewhat.

4.7   Operational And Technological Benefits

Despite the somewhat gloomy picture painted above in terms of companies not really meeting best practice in terms of ERP implementations, it must be stated that most companies began to see real tangible benefits in terms of operations and technology reasonably quickly after implementation, sometimes in three months and usually before one year. The benefits nominated by respondents included: better inventory management, general information integration benefits, better production efficiency due to better forecasts and planning, reduction in maintenance and down-time, improved order entry, standardisation, better customer responsiveness, real-time data access across multiple sites, manufacturing flexibility information, and other benefits typically attributed to ERP systems.

These results were not surprising, given that ERP systems are specifically designed to achieve these benefits. However, only two companies really had an understanding of longer-term benefits at an organisational level. In Case Study 8 it was noted that ERP could produce a 'virtuous circle' of improvement related to ERP and beyond. Respondents for Case Study 2 also noted that the ERP implementation was really a change management issue: however, if business units properly assessed themselves in order to prepare for ERP, this was a positive benefit in itself. This then could become an ongoing improvement process, much like the 'virtuous circle' of Case study 8.

Much like the obstacles then, the perceived benefits of the ERP implementations were many and varied. For most companies, however, the benefits were those that might be expected from a typical off-the-shelf, ERP implementation. Only two of the companies really had a sophisticated understanding of other broader strategic, cultural and organisational benefits that an ERP might bring, and were acting to facilitate these benefits. Given that most of the case studies fall into Willcocks & Sykes Scenario 3 type, it may be the case that these benefits are partially or fully understood in these companies as well, but the implementers are under-resourced in terms of being able to implement and develop these wider organisational and deeper level benefits.

4.8 Cultural Issues

Finally, the analysis of the case studies was directed towards exploring important cultural issues impinging upon success or failure of ERP implementations. Of course, culture overlays or perhaps underpins almost all the categories previously discussed: that is, culture has a bearing on all the business practices of the organisation. Nearly all the companies in the case studies had some awareness of the importance of cultural issues and cultural change relating to the ERP implementation.

Cultural 'resistance' was identified as a significant obstacle in some companies as previously described: a concern for one company was to preserve the good things about the existing culture (flexible, 'can-do') while still adopting an ERP system that was perceived to limit flexibility. Again, the company in Case Study 2 appeared to have a sophisticated approach to positive change management and how culture and cultural change relates to this.

Those companies that had the benefit of a previous ERP or MRPII implementation also appeared to have an advantage culturally, in that they had a 'deep' understanding of key issues: a case of experience being the best teacher. Some organisations had no cultural preparation or strategy – sometimes the case study respondent was well aware in these cases of the dangers of this approach, but time/resource/organisational commitment issues prevented them from adequately addressing the issue. Again, the Willcocks & Sykes type 3 scenario seems to capture the key features of these cases. Top-down implementation (Case 9) also engendered some cultural resistance.

5. CONCLUSION

The key findings were as follows. Most companies had a good understanding of the issues and risks associated with an ERP implementation, and most followed reasonably comprehensive evaluation procedures when selecting an ERP system. Companies tended to base their ERP system choice on functional requirements and price; however, it is debatable whether most organisations had a good understanding of their business processes and thus required and potential functionality before ERP systems were selected and implemented.

Most ERP implementations tended to fall into the Willcocks & Sykes type 3 scenario, where the implementation is driven largely by the IT function

of the organisation with cross-functional assistance from other business functions, but the in-house capabilities of the IT function are not strong enough to carry the implementation through to its full potential. Furthermore, the relationships between the IT function and other business functions are not robust enough to allow fully adequate cooperation in terms of the implementation. Despite these issues, and an awareness in most companies that their implementations were not perfect, most companies realised real operational and technological benefits within six months-one year of the implementation.

Success factors identified include: cross-functional team approaches, organisational experience of similar scale IT or organisational change projects, and 'deep' understanding of all the key issues relating to an ERP implementation. 'Failure' factors identified include: top-down or consultant driven implementations, IT department driven implementations, and in cases where implementations are seen as a quick technological fix to problems within the operation of the firm, rather than a strategic investment.

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