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Generic Information Systems Design Strategies

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Abstract
Legacy systems are now recognised as a major problem in the design and implementation of information systems to support new business strategies and novel business processes. Information Systems (IS) research into the strategic applications of the technology typically focuses on the alignment of business and IS strategies. However it does not explicitly consider the impact of legacy information systems and their impact on new systems design strategies. Similarly the Business Process Reengineering (BPR) literature assumes a green-field site and does not prescribe strategies for overcoming problems associated with the existing systems and business practices. In this paper the Enterprise Resource Planning (ERP) approach is compared with other generic strategic options. The results suggest that although ERP projects are inherently riskier than less radical approaches the potential benefits are much higher, and the resulting systems provide a platform for longer-term development.

Introduction
Organisations are operating in a more unstable and complex environment than was the case even five years ago. The current business environment is characterised by global competition, de-regulation and rapidly changing product-markets (Moss Kanter 1988, Dicken 1992). Each of these forces, on an individual and collective basis, is driving the behaviour of organisations and industries. The strategic response to changes in the environment by firms varies by industry, size of organisation, geographic region and individual firm strategy. However there are some broad business and information technology trends emerging which are affecting all companies regardless of industry or size.

Key organisation trends include globalisation, the development of virtual organisations, team-working and the downsizing of traditional organisation structures, that is, a shrinking of organisation size measured by both the number of management levels and the number of staff (Daft 1992). There is also increased inter-connectedness between separate businesses which is forming new types of industrial structures, e.g. integrated supply chains and electronic markets (Konsynski and McFarlan 1990, Malone et al 1987). These new forms of organisations are competing using innovative strategies such as time-based competition (for example Just-In-Time, compression of the product lifecycles and order-cycles. There is also an increased emphasis on quality improvement, often measured by statistical process control techniques (Vesey 1991). What is common to all of these organisation developments is the need for excellent information systems that relate the information technology to business requirements. In the next section an outline of generic systems and business process design strategies is presented that is based on detailed case studies of twelve international companies operating in a range of industries.

Generic Information Systems Strategies
The combination of business pressures and technical issues such as year 2000 compliance mean that many organisations are being forced to change their information technology systems in parallel with developing their business processes. There appear to be a number of generic systems design strategies open to companies. These are: standard package solution based on ERP solutions; legacy systems forever; new lamps for old, i.e., re-write legacy systems onto new technology and effectively replicate the old system in its entirety before considering future changes; ring fence legacy systems and build new systems around them; and technical solutions, e.g. reverse engineering.

Standard Package Solution
Taking manufacturing companies, a common direction in the application of information systems is to use standard packages known as ERP systems or business enterprise systems. ERP systems such as SAP R/3, MOVEX and BAAN cover all of the business processes within a manufacturing company from procurement of raw materials, through production planning to marketing. A characteristic of such systems, regardless of technical platform or software supplier, is to model the company as a set of inter-connected business processes that can be described and modelled in information terms. The purpose of conceptualising an organisation in this way is to increase cohesiveness and improve the co-ordination of activities by supporting common business processes where everyone in the company, regardless of function or responsibility, is able to view and manipulate a common set of data.

There are a number of strategic issues that need to be considered when taking this approach. If all companies adopt similar software solutions where is the potential of gaining competitive advantage from IT? The statistics from surveys imply that companies are not concerned that
their competitors are using similar or even identical systems to themselves (e.g. see SAP 1996). Standard package solutions are less flexible than bespoke systems because they must necessarily be designed for the general case rather than the specific organisation. Although there is room for adapting the software through the selection of different parameters within the general model, each user of a particular package have very similar systems. Those organisations that customise the software code of the standard package may gain short-term benefits but lose out on future enhancements of the product because of specific changes that they have made to the core system that are likely to be incompatible to future general releases. If similar IT systems are being adopted then it would suggest that companies are adopting similar business processes, management control systems and approaches to marketing. This is certainly the case for SAP and BAAN organisations in the study.

**Best Of Breed**

Organisations requiring an infrastructure which meets their needs more closely than the adoption of a single standard package solution are taking a 'Best of Breed' approach. In this case the organisation makes a conscious decision to implement and manage the necessary interfaces between various software vendor 'components' and potentially other modes of information systems support such as a bespoke development or an outsourcing contract. For example, a global distribution company in the study has decided that several different vendor's solutions offer the optimum infrastructure in terms of functionality and the ability to generate a set of distinctive business processes. It is not yet clear what the long terms consequences of taking this approach may be.

**Legacy Systems Forever**

Some organisations have chosen to continue the development of their legacy systems indefinitely, e.g. the American Airlines reservations system. It is not clear whether these companies have simply chosen a different managerial approach, or whether they have superior technical resources. Similarly many European banks have taken this approach and 15-30 year old systems are common. One bank in the study has taken this approach and continued to develop systems based on assembly language. However the combined business and technical pressures for change have now forced it to completely re-write their systems to accommodate new products and associated business processes, and to become year 2000 and Euro compliant.

**New Lamps For Old**

Conservative organisations which do not perceive a radical change in their business environment have elected to implement new technology to overcome the problems of maintaining legacy systems, but which effectively mirror the old systems in their functionality and strategic alignment with the business. Banks are typical of this type of approach, for example National Westminster have implemented a strategic IT infrastructure project which was designed to overcome the problems of its legacy systems and create a platform to make future innovation easier (Clemons and Weber 1992).

**Ring Fence**

In high volume transaction processing systems, common in retailing and financial organisations, the 'core' systems are often very efficient and fast but the surrounding computer code is unwieldy and difficult to change. One option is to leave the core systems in place and build new information systems around them by ring-fencing the old core systems and interfacing the new software. This solution has the attraction of leaving tried and test software whilst also allowing the potential of using new technology to provide the management innovation and change required. An electricity company in the study has ring-fenced the existing customer database records and built client-server systems around them with the long-term view of ultimately replacing the old core systems. However the interface problems have been much more difficult than anticipated and the progress of the project is slow.

**Technical Models**

A number of technical models exist which claim to be able to decrease the entropy levels in legacy systems by reversing the programming process and effectively re-writing the computer code. The common term used to describe this approach is reverse engineering. However this approach has not been applied to large-scale systems and the success stories are all based on very small, limited problem areas.

**Discussion**

Information technology spend accounts for half of most firms' capital expenditure (Keen 1991), approximately 2% of total revenues across all industries (Price Waterhouse 1996) and over half of the non-interest costs in international banking and is now one of the largest single areas of investment for businesses. This is of particular concern when the payoff at the macro level from historical IT projects has been questioned (Hitt and Brynjolfsson 1996). Information technology is now so vital in ensuring the basic operations of an organisation that failed IT projects can risk the survival of the organisation while successful systems have been shown to reap huge economic benefits for the individual companies (Mukhopadhyay et al 1995). Most firms, now estimated at over 80%, are implementing standard package solutions to overcome the problems of legacy systems. However the projects are in most cases taking much longer to implement than was originally planned (more than 3 years compared with estimates of 1-2 years). This is particularly
true in those organisations that are attempting ambitious organisational and IT changes in one single project. The companies that have implemented ERP systems in a relatively short-time scale (1-2 years) are those that have made no changes to the standard package solutions and whose organisations were already designed around business processes. In these companies the ERP approach is now being developed further by the addition of innovative software such as knowledge systems to the core ERP system. In summary the ERP solution offers the most potential for a sustainable approach to legacy systems because the vendors take over the problems of development and maintenance. However the sheer scale of the organisational and technical changes inherent in the implementations mean that ERP is much riskier than the more conservative approaches of continuous development, ring-fence and new lamps for old.

References


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