The recursive nature of the market for enterprise applications

Fergal Carton
Frederic Adam

Business Information Systems,
University College Cork, Cork, Ireland
f.carton@ucc.ie
00 353 21 4903734
fadam@afis.ucc.ie

Introduction

The paper explores the recursive elements of the market for enterprise systems by examining the
evolution of the sales discourse from vendors of enterprise applications. Enterprise systems are
continually sold and implemented on the basis that greater integration of the modules supporting
business functions is a good thing. In this paper we question this assumption, principally based
on the redundancy of much of the information that is produced.

Following the development of computer applications from early Material Resources Planning
(MRP) days through to today’s latest offerings in the form of Enterprise Resource Planning II
(ERP II), we try to understand the circumstances which have generated the requirement (needs
discourse). In parallel, it is posited that the sales discourse is characterised by a continual
extension and re-packaging of existing solutions, responding to the business users’ evolving
requirements with ever greater integration between the operational modules. This tendency to
over-integrate exacerbates the problem of information overload that is experienced by managers
trying to monitor the organisation’s performance, efficiency and effectiveness.

MRP was once implemented to gain better visibility and control of inventory, because it was
understood that this was the most costly element of the cost of goods sold. Reducing inventory
levels is a well understood management goal in most manufacturing organisations. On the other
hand, the abundance of information that has accompanied the gradual computerisation of
business functions doesn’t seem to elicit a similarly “economical” attitude towards information.
Instead of encouraging information excess, we argue in favour of a “Just-in-Time” approach to
information provision, where appropriate information is delivered where and when it is needed,
rather than exhaustive information being available to all. Going as far back as the fundamental
design issues of enterprise applications, we question whether business value can be gained from
continually integrating business functions into a single data structure.

Background

The focus of industry in the years following the Industrial Revolution was on providing as much
output as possible, as opposed to controlling inventory (Mokyr, 2001). With this change came
the increasing need for systems to support the increasingly complex nature of mass production
facilities and activities (O’Gorman, 2004).
Research had shown however, that the main problem of managers was not a lack of relevant information, rather an overabundance of irrelevant information (Ackoff, 1967). In that era, the constraining factor on the level of computerisation was cost. The gradual commoditisation of technology has meant that storage hardware is (relatively) cheap, therefore there is no culture of economy with its use (or abuse).

This “changing cost balance” has been attributed to the original growth in the uptake of computer applications to support MRP (Miller & Sprague, 1975). Although the MRP logic was already available and widely applied, the use of systems had been hitherto prohibitively expensive for most businesses. Computation costs were falling as inventory costs were rising. The rapid update capability of computers, coupled with the MRP logic and appropriate data, made it possible for managers to cope intelligently with the thousands of changes that inevitably occur between the planning and execution of primary tasks.

The natural propensity of computer manufacturers is to sell new systems that use lots of computer time (Miller & Sprague, 1975). The same increase in price performance ratio prompted the adoption Enterprise Resource Planning (ERP) systems in the 1990’s, integrated systems capable of uniting and correlating the basic units of the business transaction (from sales order to finished goods, from demand forecast to master production schedule).

In order to achieve this integration, ERP systems rely on large central relational databases. The amount of storage and memory required to manipulate and operate these databases grew in tandem with the improvement in cost / performance of the hardware. Furthermore, software houses gradually moved away from the client / server model to the “thin client”, capable of running on any PC with a browser. For the first time it was feasible for an organisation to operate its entire transaction processing infrastructure from a remote centralised server, using the internet to deliver functionality to the desktop.

Sammon et al. (2003) describes these 2 components of ERP systems as the solution to “operational” integration problems and “informational” requirements of managers. These are the same concepts expressed by Zuboff (1988) in describing the use of technology not only to automate manual tasks, but also to “informate” management tasks, such that “events, objects and processes become visible, knowable and shareable in a new way”.

ERP systems are therefore expected to deliver the following benefits: (1) reduce costs by improving efficiencies through computerization; and (2) enhance decision-making by providing accurate and timely enterprise-wide information (Poston and Grabski, 2001).

Whether these centralized information systems really are capable of delivering both types of benefit has been a topic of debate for some time. “The notion that a company can and ought to have an expert (or a group of experts) create for it a single, completely integrated supersystem – an MIS – to help it govern every aspect of its activity is absurd”, according to Dearden (1972).
The trend towards greater integration

In a traditional manufacturing organisation, materials accounted for 75-80% of the total cost of provision of the cost or service (O’Gorman, 2004). The attitude of planners in the 70’s was therefore to develop methods that minimised inventory excess (in materials, WIP or finished goods).

Conversely, the focus of today’s ERP vendors as they strive for ever greater integration has been to provide as much information as possible (analogous to a “build to stock” model in manufacturing terms) rather than trying to control it.

ERP systems, with their focus on the integration of processes and their dependence on the integrity of data at the point of entry, can be compared to virtual assembly lines, where each stage in the business process is optimised for the throughput of high volumes of transactions.

A major downside to this level of integration of business processes is that informational “stock-outs” can occur (one small piece of relatively unimportant information missing can block a business critical transaction). A classic example would be an exchange rate missing blocking an invoice from printing.

One of the benefits of employing what ERP vendors call “best practice” is that all transactions must fit in the same system model, regardless of the relative importance of the transactions. This ignores the 80:20 rule as elaborated by Orlicky (1975), in what is probably the definitive book on MRP, according to Browne, Harhen & Shivnan (1996). If 20% of the components account for 80% of the cost, why apply the same rigour to recording transactional movements of inventory across 100% of components?

Sammon & Adam (2004) describe how businesses can succumb to the “ERP steamroller” of integration in the area of procurement. The integration of procurement into one single instance ERP system implies a rationalisation of local suppliers and purchasing patterns and the elimination of redundant suppliers. This can result in the organisation losing its ability to vary the source of supply. It can also have the effect of “steamrolling” local differences in the supply base eg. locally sourced components not having exactly the same specification as counterparts in other countries. As with all elements of master data (suppliers, parts, customers, …), integrated systems covering global operations are intolerant of local nuances in data structure.

One downside to the large scale integration of business processes as exemplified in ERP systems is the onus it puts on data capture: the more integrated the system, the more data is required at the point of entry in order that flags and triggers encountered during subsequent steps in the process are populated. Broadly speaking, ERP systems push the onus of data quality back to the point of entry, decentralising responsibility for data quality back to the rightful owners of that data.
The cyclical nature of the ERP market

The table in Figure 1, adapted from the IT planning matrix developed by Sullivan (1985), depicts the different stages in the evolution of planning requirements and corresponding management approaches. This evolution is plotted against the 2 main forces of change in IT: dependence of the business on IT (Infusion) and the degree of decentralisation of IT planning and control (Diffusion).

**Figure 1 The evolution of planning requirements and corresponding management approaches**

![Figure 1](image.png)

In simple manufacturing processes with few dependencies, material acquisition could be based on a principle of Economic Order Quantity (EOQ), whereby re-ordering of stock items was triggered automatically based on a minimum stock level. MRP originated in the early 60’s as a computerised approach for the planning of materials acquisition and production for more complex manufacturing processes where interdependencies between components existed. Orlicky (1975) realised that a computer enabled the detailed application of the technique, making it effective in managing manufacturing inventories.

Based around the Bill of Materials (BOM), early applications exploded a production plan for a top level parent item into a plan of production and purchasing for component items. These systems were implemented on large mainframe computers run in centralised material departments for large companies.

A strong influence in the promotion of MRP was the campaign of communication launched by the 11,000 member American Production & Inventory Control Society in the early 70’s. The
computer industry soon followed with a range of applications. Almost all the major computer manufacturers had developed and were pushing software applications to support MRP, and virtually every major industrial consulting firm was advising on their implementation (Miller & Sprague, 1975).

Starting, therefore, under the "traditional" influence of IT, the use of these applications became more widespread, leading to the extension of the software to support various related operational functions. In particular, the combination of the planning and execution modules, with the potential for feedback from the execution cycle to the planning cycle, was termed closed loop MRP.

So closed loop MRP, together with some financial modules, developed into an integrated approach to the management of manufacturing resources. This approach became known as Manufacturing Resource Planning or MRP II. From the 1980’s onwards MRP II applications became available at lower cost on minicomputers and then microcomputers.

The attraction of the move to MRP II in the 80's lay not only in its role as decision making support, linking as it did, the planning and execution modules of manufacturing, but more importantly, in its integrative role within the manufacturing organisation (Browne, Harhen, Shivnan, 1996). Similarly, the attraction of moving to ERP in the 90's lay not only in its integrative role within the organisation, but also in its integrative role within the corporation, forcing geographically disparate entities to toe a common line with respect to operational procedures.

**Future trends**

The growth in popularity of ERP systems can be linked to an increasing business trend towards globalization, mergers and acquisitions. To be successful, a global company must be able to control and co-ordinate their various remote operating units. Accurate, real-time information provided by an ERP system has the ability to integrate the more remote subsidiaries into corporate practice because an ERP system allows the sharing of information in standard format across departments, currencies, languages and national borders. Thus, ERP systems can be used to provide a “common language” between units (Bingi et al.).

On the other hand, many post-ERP companies are realising that despite the huge implementation expense of the project, the business is no better off in terms of having access to summarised information which might assist managers in making decisions. CIO’s might well demand, after the extravagant sales discourse and staggering budgets commanded by ERP vendors, what is the cost of having stockpiles of detailed transactional information?

As we look to the future, computation costs are still falling, while pressure on cost reduction has been growing since the worldwide economic recession in the new millennium. Vendors, desperate to make up for the dearth in large IT investments attributed to Y2K fears, never saw the purse strings loosened as IT budgets were reduced in line with all corporate spending cuts. The solution? The natural propensity of computer manufacturers is to tout new systems that use lots of computer time (Miller & Sprague, 1975).
Cue the emergence of the Enterprise Resource Planning II market, billed by some vendors as the means to realising the benefit originally planned for ERP, and by others as the continuation of the “integration” of business processes. This continuing integration is focused on the area of Product Lifecycle Management, whereby engineers and product designers are “integrated” into the sales process at one end of the cycle, to allow better translation of customer requirements, and to manufacturing at the other end of the cycle, to facilitate the development of efficient production processes.

Conclusions

In a survey of 20 US companies Lederer and Mendelow (1987) found that top managers did not view information as a business resource to be managed for long term benefit. They only appreciated its criticality when they could not get what they needed.

Business resources (eg. assets, inventory, employees) are managed carefully because managers understand that making efficient use of these resources is key to the survival of the business. Investment in these areas is always evaluated carefully with respect to what contribution they will bring to the business.

It has been notoriously difficult in the past to cost justify investments in information systems, and therefore vendors have opportunistically hitched their offerings to requirements that have an in-built business case (reducing inventory costs, for example).

A fundamental question worthy of further research is: to what extent do vendors instigate new demand for products simply by integrating application modules that share a common underlying data structure?

In their discussion of management fads and fashions in the ERP community, Sammon & Adam (2004) suggest that there is a mutually beneficial undercurrent to the constant re-packaging of the expert discourse: for every fad there will be a corresponding “panacea”. In dealing with the complex problems facing organisations today, the language promoted by vendors in the ERP community tends to help formulate old problems in new ways, such that clients can elaborate the needs discourse in a way that is new, stimulating and irrefutable.

However, with each further step into the spiders web of integration, and letting what “can” be done take precedence over what “needs” to be done, the organisation is perhaps forgetting that a) this apparent progress rarely gives tangible benefits, and b) flexibility is often more important than integration.

References


Definition of Terms

**Economic Order Quantity (EOQ)**
An approach to defining the lot size for purchasing raw materials, the EOQ is a mathematical expression of the trade-off between ordering costs (for purchased items) or set-up costs (for manufactured items) and the cost of storing material as inventory. If set-up or ordering costs are high, it may make sense to deal in larger batches, with the inherent knock-on effect of increasing inventory costs.

**Bill of Materials (BOM)**
A Bill of Materials is a hierarchical product structure, showing the sub-components and interdependencies of any given finished good. Akin to a recipe, it is the underlying link between end product demand and material requirements. It also facilitates production costing, as each component in the hierarchy can be costed.

**Material Requirements Planning (MRP)**
MRP, originating in the early 60’s, was a computerised approach to the planning of materials acquisition and production for more complex manufacturing processes where interdependencies between components exist. The application of computers to MRP was a significant initial step in the evolution of ERP systems.

**Closed loop MRP**
The combination of MRP functionality with planning and production execution modules, with the potential for feedback from the execution cycle to the planning cycle, is termed “closed loop MRP”.

**Manufacturing Resource Planning (MRP II)**
MRP II is closed loop MRP, enhanced with some financial modules for production costing and creditor management, usually running on a single integrated technical platform. MRP II was the immediate pre-cursor of Enterprise Resource Planning systems.

**Enterprise Resource Planning (ERP)**
ERP systems are integrated applications that satisfy the transaction processing requirements for a wide range of business activities, including purchasing, production planning, warehouse management, inventory control, sales order processing, distribution, finance and human resources.
Product Lifecycle Management (PLM)
Product Lifecycle Management is an approach whereby engineers and product designers are “integrated” into the sales process at one end of the cycle, to allow better translation of customer requirements, and to manufacturing at the other end of the cycle, to facilitate the development of efficient production processes. The “lifecycle” is derived from the notion of managing product design from inception through to execution and eventually retirement.

Enterprise Resource Planning II (ERP II)
Enterprise Resource Planning II (ERP II) is a term that has been coined to denote the applications aimed at satisfying organisations who have already implemented ERP. This appears to include the realisation of efficiency gains originally planned for ERP, the implementation of ERP solutions to more vertical market segments and the further integration of key business processes (for example, to include PLM).