Wynn, Martin G and Olubanjo, Oludotun (2012). Demand-supply chain management: systems implications in an SME packaging business in the UK. International Journal of Manufacturing Research, 7 (2), 198 - 212

International Journal of Manufacturing Research: Special Issue on: "Industrial Case Studies of Demand-Supply Chain Management"

Demand-supply chain management: systems implications in an SME packaging business in the UK

By Martin Wynn and Oludotun Olubanjo

(Reference: Wynn, M. and Olubanjo, O. (2012) 'Demand-supply chain management: systems implications in an SME packaging business in the UK', **International Journal of Manufacturing Research**, Volume 7 No 2.pp 198-212)

Department of Computing, University of Gloucestershire, Cheltenham, Gloucestershire, GL50 2RH, UK
E-mail: MWynn@glos.ac.uk; Olu_Olubanjo@yahoo.co.uk

Abstract: This article examines the introduction of new computer software in a small packaging company in the UK and how the need to manage demand as well as supply radically affected project scope. The company – Contrapak Ltd, Hereford – initially embarked on the introduction of new software to support packaging line scheduling and associated materials and human resources planning, as it was deemed essential to have flexibility in adapting loads and schedules at short notice in a very dynamic business. However, as the project progressed, it became clear that managing both demand and supply chains simultaneously was essential to improving efficiencies and ensuring planning could respond effectively to demand. This led to a significant redefinition of project scope and the procurement and implementation of a full Enterprise Resource Planning (ERP) system. The article analyses the evolution of the project as a case study and discusses how this furthers our understanding of demand-supply chain management and its implications for information systems strategy.

Key Words: Demand-supply chain, packaging industry, information systems, enterprise resource planning, systems strategy, case study, knowledge transfer

Biographical Notes: Martin Wynn BA, MA, PhD, PGCFHE, CMC is Reader in Business Information Systems in the Department of Computing at the University of Gloucestershire. He spent twenty years in industry as an IT professional, including 10 years as Group IT Controller at drinks company HP Bulmer plc, now part of the Heineken group. He has wide experience of information systems strategy development and implementation and has led the knowledge transfer initiative at the University of Gloucestershire in recent years. He has authored a number of articles on knowledge transfer and systems strategy, and has also published on a range of other topics, including urban planning and housing policies in Europe. He is a certified management consultant and PRINCE2 practitioner.

Oludotun Olubanjo gained his BSc in Electrical Engineering at the University of Lagos, Nigeria, and achieved an MSc in Information Systems Management at Warwick University, UK. He was KTP Associate with the University of Gloucestershire and acting IS Projects Manager at Contrapak Ltd from November 2009 until March 2011. He was project manager for the implementation of new systems in the company as well as having overall responsibility for networks, servers and technical infrastructure. He led the software package evaluation process at the company that resulted in the acquisition of the Infor ERP package. He has recently taken up a new post as Enterprise Content Management consultant with Cognizant Technology Solutions Ltd, London.

1. Introduction

Aitken (2000) sees the supply chain as 'a network of connected and interdependent organisations mutually and co-operatively working together'. Further, Christopher (2005) suggests that the concept might equally be termed the 'demand' chain 'to reflect the fact that the chain should be driven by the market, not the suppliers'. This article investigates how the interaction of demand and supply chains impacts on the scoping, selection and implementation of a supply chain systems project in a small to medium sized enterprise (SME) environment. Using a case study approach, it focuses on the requirements to automate the planning and stock management processes, and the wider supply chain implications of so doing.

The central problem that is investigated is how to automate the largely manual processes of production planning and stock control, when other major business processes already have information systems support. Questions that were formulated at the initiation of the project included the following:

- Would it feasible to computerise - at pace - the key areas of load planning, scheduling and stock control, more or less in isolation, to deliver critical benefits in the management of resources on the packaging lines?
- What interfaces would need to be built to information systems in other key process areas to ensure benefits delivery?
- Would a more holistic approach to computerisation be needed to underpin the corporate expansion visualised in the company's Business Plan?
- To what extent could packaging line efficiencies and inventory levels be improved by new systems?

These questions were postulated at the outset of the case study project, which adopted an action research methodology discussed below.

2. Theoretical framework

Ramaswamy (1996) has suggested that companies that provide services normally conceive of a process as a sequence of activities needed to perform transactions that help to provide their services. To define processes is often problematic involving a range of complexities relating to customers, human behaviour and company structure. To organize the company around business processes, it is necessary to focus on external customers because business processes usually start and end with them. Processes have a line of activities which begins with the exact understanding of what the external customer wishes and finishes with the external customer gaining what he or she needs and requests. The customer is always central within organizations structured by process and the final objective of these companies is to offer to the customer more value in less time and with less cost. In this context, supply chain management can be defined as 'the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole' (Christopher, 2005).

Van Goor (2001) points out that 'the rise of demand and supply chain management can be explained by the understanding that only combinations of companies are able to meet customer requirements in a more efficient and better way than individual companies'. This is of particular relevance to outsourced contracting companies, as they are but one cog in a complex chain, and have no end products of their own. They rely upon a range of customers and suppliers (the two often being the same entity), who are in turn, dependent upon them. Treville et al (2003) discuss the trade off between lead time reduction and transfer of demand information upstream in the chain to improve demand and supply chain performance.

The interrelationship between demand and supply chains was at the centre of the early initiatives to ensure Efficient Consumer Response (ECR) and facilitate Vendor Managed Inventory (VMI) and continuous replenishment in the 1990s, which were the forerunners of some of today's demand-supply chain concepts. Over 15 years ago, the supply chain manager at Dairy Crest noted that 'most of the major multiples are moving to shorter lead times and more frequent deliveries in an attempt to reduce stocks. This is not only putting additional pressure on manufacturers to respond more quickly, but inevitably adding more cost. Each individual retailer is making different demands which bring its own challenges' (Melville, 1994). In 2011, these pressures on suppliers are even greater. Christopher (2005) notes that 'as a result of increased outsourcing of tasks that were once performed in-house, the complexity of these webs has grown, and hence with it the need for active co-ordination of the network'.

In today's dynamic markets, organizations are using strategic management to help maximize their competitive advantage. Koopman (1999) asserts that, 'the real threat to most companies is not a strategic threat from outside. Instead it is their own failure to aligntheir organization with their strategy and thus ensure good execution'. An organization must be able to align itself with the strategic plan and turn strategy into action. Based on strategic alignment, business process improvement can be gained when organizations update their strategy; they have to analyze their current business processes and amend, modify or perhaps redefine them in order to achieve their strategic objectives and targets; and process analysis often highlights the problems of information flow, and leads to the development of a new information systems strategy. Stadtler and Kilger (2008) point out that 'during the past 15 years, progress in information technology opened up new perspectives for planning and controlling flows along a supply chain. A customer's order, demand forecasts or market trends may be re-exploded into required activities and sent to all parties in the supply chain immediately.'

The development of packaged business software tosupport all main business processes has been a major development in information systems over the past two decades. It has led to a widespread debate in the literature regarding the respective merits of procuring and implementing one integrated software package (an 'enterprise resource planning' - ERP - suite) or deploying individual stand alone software packages (often termed a 'best of breed' – BOB – strategy). Packaged software for most mainstream business processes came to market in the 1990s as the spread of the UNIX operating system as a *de facto* standard for mini computers and the increasing dominance of the Intel chipset led to a massive surge in the packaged software market. Building on the earlier materials requirements planning (MRP) packages, other packaged software provided modules for sales order processing, ledgers, payroll and personnel as well as MRP, sometimes combined into one integrated package from one vendor – the ERP software suites of Oracle and SAP, for example. The increased take-up of packaged software coincided with the spread of business process re-engineering (BPR) as a management concept employed by many companies to improve efficiencies and reduce overheads. The two became closely linked as BPR projects were frequently combined with the introduction of new software solutions.

As companies of all sizes moved from in-house bespoke systems to packaged solutions from the growing number of software vendors, so the role of the IT department in the control and integration of software deployed grew in significance. Nolan's model (Nolan, 1979) became of renewed importance in charting the status of a company as it attempted to 'Control' the IT/IS environment, then bring about systems 'Integration', and finally focus on 'Data Administration' as the organisation moves to a state of maturity in the IS/IT life cycle.

3. Research Methodology

This is a case study allied to an action-research methodology. Mansell (1991) notes that 'action-research must involve analysis of a problem situation not controlled by the researcher, the making of plans for intervention in the situation, and the attempted execution of these plans.' Mansell identifies four different methodologies for action research that can be deployed in an information systems context. One of these is operational research, which provides a general framework for the approach used here, and consists of the following activities:

- Problem definition
- Data collection and analysis (process mapping and systems profiling)
- Model building (project approach – evaluating technical options and requirements analysis – visioning the end solution)
- Solution formulation and verification (software package evaluation and selection), and
- Implementation (software installation and operation).

However, this is also a qualitative case study, which may be used to 'develop theory as a result of data analysis' (Saunders et al 2003). More realistically this case study allows a 'detailed investigation of one or more organisations, or groups within organisations, with a view to providing an analysis of the context and processes involved in the phenomenon under study' (Hartley, 1994).

When collecting qualitative data for case study research, there are various data collection methods that can be employed, including questionnaires, interviews and observation. All three were used as part of the case study documentation and analysis – but observation over an 18 month period (November 2009- April 2011) was the principle vehicle for data collection. Remenyi et al (1998) suggest that observation is one of the most valuable ways to collect evidence, whereby the researcher may observe individual behaviour, culture, and the impact of technology on the organisation.

In addition, 12 people were identified as being potential sources of information in the early stages of this research. The first batch of interviews undertaken in early 2010 involved all 12 participants and had the purpose of mapping the existing business processes and associated document flows. They involved people from all levels in the company. The second batch of interviews, which involved a carefully selected 6 of the 12 people originally identified, collected and analyzed problems related to existing information systems and/or manual transactions in key process areas. The evaluation of results was done by comparing the answers of the interview and the observations made by the authors. This was analyzed in conjunction with the findings of the literature review, and was fed back to the senior management team (who acted as a Project Board) for discussion and validation (Remenyi et al, 1998).

The Project Board played a key role in validation of research results and determining project direction. Wu et al (2003) suggest that subjects must be in a position to generalize about business behaviour - people who have a comprehensive knowledge of the business, and who would be in a position to identify the problems the organization had in changing business processes and introducing new software. Only employees at the level of manager or higher were considered for membership of the Project Board.

4. Empirical study

4.1 Research Environment

The company case study in this research is Contrapak Ltd in Herefordshire, UK. They are a specialist packaging operation, and thus occupy a particular niche in the

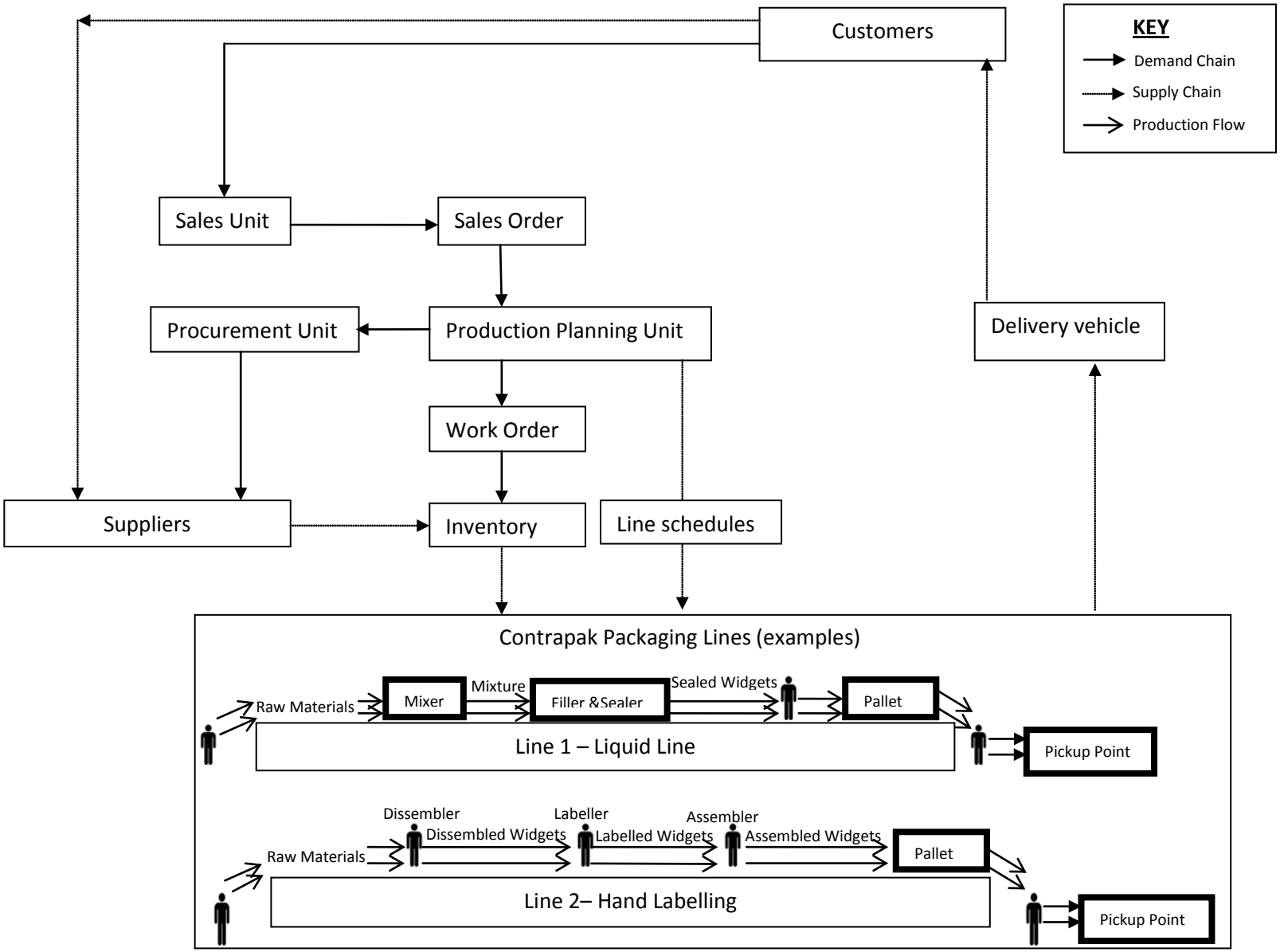

Figure 1. Supply and demand chains at Contrapak Ltd

broader supply chain (Figure 1). They are an SME, employing 63 staff, with a turnover of £2.1m in 2009/10. The company currently has two sites with their own dedicated packaging facilities based at Kingstone (which primarily progresses orders related to contract packing of chemicals) and Rotherwas (which produces liquid and hand packing solutions). In addition, it has a separate administrative building in a different part of the Rotherwas industrial estate. The company's areas of expertise are sachets and bagging, blending and formulation, shrink wrapping, labelling, pouch filling, liquid filling, high speed counting, hand assembly and repacking. The key strengths of the business are chemical powder blending and the ability to fill into virtually any container or sachet/bag available on the market. Contrapak also has the largest dedicated water soluble packing unit in the country.

To support and drive through planned growth set out in the company's 2009 business plan, new systems were urgently required to speed communication and improve information provision. The company lacked expertise in this area and without assistance could make the wrong investment. The project to replace systems started in November 2009, under the auspices of the UK Government supported Knowledge Transfer Partnership (KTP) scheme (Wynn and Jones, 2006) to implement new stock control and production planning systems in process areas where the lack of automation was particularly acute. The project was to install modern software, with one main database providing one view of corporate information in the packaging and stock areas, and a full range of online management reports. It would provide improved competitiveness and support growth in market share: the company forecasts £2.8m turnover in 2010-11, compared with £0.98m in 2008-9.

4.2 Project process

4.2.1 Problem definition

The key problem was how to automate the key processes of production planning and stock control, which were largely manual. This was causing major problems in effectively scheduling customer jobs on the various packaging lines in two different sites. The initial concern was to improve planning and stock control to reduce inventories and improve lead times. As the project progressed, however, the need to integrate planning with upstream order capture information came to the fore and led to the adoption of a more holistic view of the supply chain process

The assumption in the shaping of the original project objectives was that computerisation of the planning and stock areas of the business could deliver the required benefits. Most of the other areas of the company were already automated to some degree, and it was assumed that *ad hoc* interfaces could be built as required. However, it was recognised that there were a number of specific problems that needed addressing, either directly through this project or via parallel linked initiatives:

- There was a lack of a clear information systems strategy: the company had invested in the QuickBooks accounts package and had a number of Excel spreadsheets and Access databases supporting key business operations. The company needed a new strategy to implement new information systems to support growth.
- There was a dire lack of management information and process integration: it had proved very difficult to get accurate consistent information from existing systems; and many of the key processes were 'silo-like' and not properly integrated.

On the positive side, implementation of an effective systems strategy opened up a number of opportunities for benefits delivery:

- Improved competitiveness and market share: the company had grown revenues significantly in recent years, and new systems could provide the platform for similar growth in future years
- Greater efficiencies and increased profitability from slicker systems and improved management information
- Improved communications between the company's two main packaging sites and with the head office.

4.2.2 Data collection and analysis- process mapping and systems profiling

High-level business process mapping was carried out to develop a better understanding of Contrapak's core processes and to generate ideas for process improvement as well as profiling existing information systems in key process areas (Figure 2). Analysis of current business needs was carried out in parallel with an initial top line internet search to identify products capable of providing required functionality, focussing in particular on the planning and management of the packaging lines and related stock control. Detailed flow charts for current business processes were mapped graphically to facilitate a better understanding of the processes and current documents used, and key users from all three sites were involved in workshops to verify process flow details and establish current and future information needs. The findings were used as the basis for identifying the key improvements that new systems could deliver.

After carefully mapping the results of the IT/IS systems review (using a red-amber-green analysis) onto the company's high-level business processes, a comprehensive gap analysis was established which identified all the company's main weaknesses with regards to information management. The findings from the gap analysis indicated areas where the company could improve on its business operations. This was developed into a top-line requirements analysis for all main process areas.

4.2.3 Project approach - evaluating the options and visioning the end solution

There followed a brief evaluation of possible approaches to bringing in new software. Developing bespoke Microsoft Access systems was considered, but soon rejected, not least because none of the existing Access systems used in the company was considered robust enough to act as a basis for onward development. Using enhanced spreadsheets was also evaluated, but rejected as a mainstream solution, although it was conceded that spreadsheets may well play a part in future end-user computing activity. The functionality of the existing Quickbooks accounts package was also explored, as areas of this software remained dormant and unused. However, although the package contained a master item file and some stock control functionality, it was concluded that its lack of planning functions meant it would, at the very least, require complementing by other software.
Within 6 weeks of project initiation, and following a number of Project Board meetings, it was concluded that the approach would be to acquire packaged software to support the packaging, procurement, stock control and planning processes. Whilst the software selection process was being advanced, decisions needed to be made as to whether to pursue a hosted or on-site solution. After a pros and cons analysis, an on-site solution was judged to have a slight advantage in control, cost and flexibility which outweighed the negatives. The decision to proceed with off-the-shelf packaged software, implemented on on-premises servers, was taken. The PRISM Buy-Build methodology was used during the software package evaluation and supplier selection process. This brings a disciplined approach to the acquisition and implementation of packaged business software.

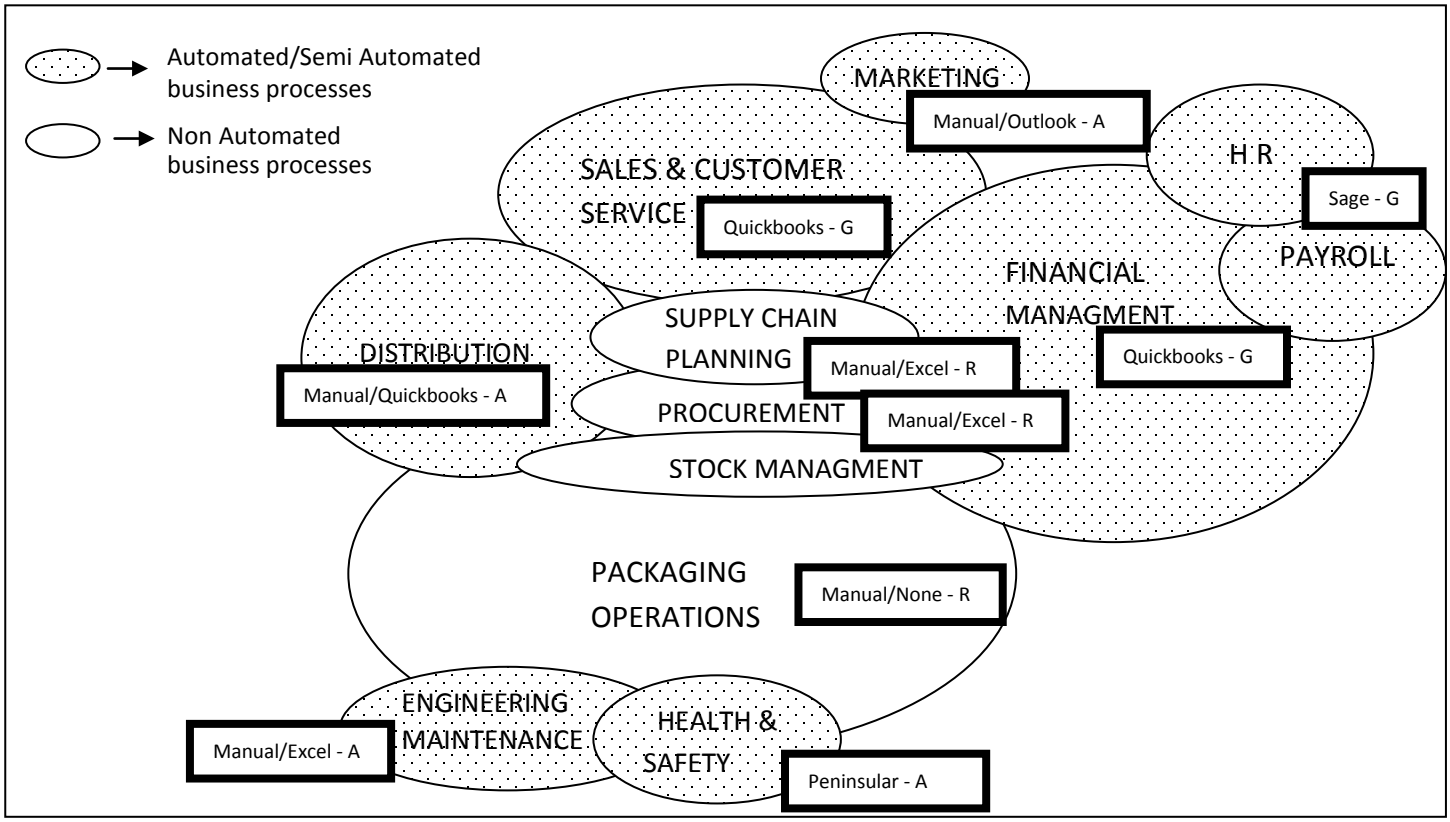

Figure 2. Process mapping and systems profiling at Contrapak 2009

Systems status 2009: R = Red – replace, A = Amber – possibly retain, G = Green – can be retained.

4.2.4 Solution formulation – package evaluation and selection

After a detailed evaluation of the options available, five suppliers were identified that could provide the required functionality at acceptable cost. Four of these software houses also offered other modules covering some of the other main business process areas – order capture and customer relationship management, finance and ledgers, plant maintenance and quality control. This was to prove instrumental in the change of scope that followed. Other factors considered in choosing the appropriate system included compliance of vendors' software solution with Contrapak's current IT infrastructure, and the assessment of all suppliers' responses to the initial system requirements and specification document sent out to all prospective vendors.

The five software companies presented their products at Contrapak over 3 separate days. The full Project Board, comprising managing director, finance director, sales and marketing manager, production manager, technical director and IS projects manager were present. The five products on the short list were Factory Master, Sage, Priority EMS, Infor and EFACS, and they were scored against 9 criteria. Out of a possible maximum of 45 points, the lowest score was 24 and the highest 36, and the Project Board concluded that 4 of the 5 solutions could 'do the job'. The company entered into commercial negotiations with the two companies scoring highest, and after considerable debate, elected to implement the Infor product. As negotiations were concluded, a draft implementation plan was drawn up, which was to be the catalyst for significant scope change in the project.

4.2.5 Project implementation and scope change

The original intention was to first address the key business areas of planning and scheduling of the packaging lines, in conjunction with the management of stock, both coming into the site from suppliers, and of finished goods. However, as the software was trialled in the test environment, it became increasingly apparent that a re-think of project scope and software implementation approach was necessary, not least because several of Contrapak's suppliers are also its customers, as they are supplying some of the basic raw materials that Contrapak packages for them, and then sells back to them as the customer, in the form of a finished, packaged product. This extra loop in the supply and demand chains led the project to focus as much on upstream demand information as on the in-house planning of supply. The new system required upstream demand information so that it could generate procurement requirements and plan and schedule packaging operations.
It was at first envisaged that *ad hoc* manual or semi-automated interfaces would have to be built to order entry and financial reconciliation functions (and then at a later date bring in new modules from the Infor package for CRM, invoicing and ledgers). However, initial piloting showed that this was unworkable for two main reasons. First, from a software integration point of view, the building of effective links to allow postings to the QuickBooks financial system was problematic. QuickBooks contained a master item file that was used mainly for financial information, but it made better sense to use the master item file contained in the Infor software. At the front-end of the demand chain, the order entry software – a bespoke Microsoft Access database – was very rudimentary and did not contain some of the data needed to kick start the production planning process. Second, the tight integration of demand and supply chain processes meant that it was problematic to improve the overall information flows by adding a further software element into what was already a fragmented set of processes.

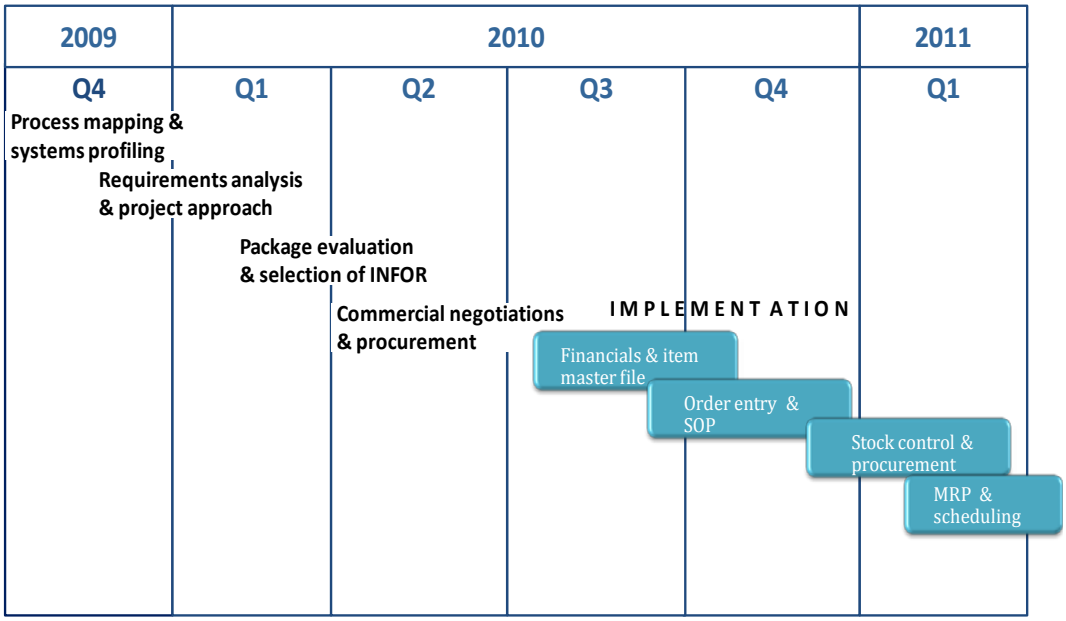

Figure 3. The revised project plan for the Contrapak systems project

After a week of in-depth testing, the Project Board agreed to expand the project scope to include new software modules for order entry and financials/ledgers from Infor to complement the production planning and stock control modules from the same supplier. This recognised the integration of supply and demand chain processes and allowed a replanning of the project, which was now to focus first of all on setting up the basic product information in the master Item file and then all the basic financial data in new Ledgers, thereby allowing the turning off the old QuickBooks finance system. With the new financials in place, a second phase ushered in new order entry functions in Infor, that initially were posted directly through to the financials system. Then, after another period of testing, the MRP and related stock functions were turned on, allowing the demand chain to kick start the planning functions which in turn produce the scheduling and control of product supply and necessary inventory movements (Figure 3).

Key users from each site were selected and sent for training on the key functional aspects of the new system and took responsibility for cascading their knowledge to the rest of the company members. The company embarked on an internal communications exercise to ensure that everyone was aware of what was coming and what was expected of them. Other activities during this period included unit testing of the main software modules and data migration of existing files from the old systems to the central server where Infor was installed. As a result of the change in the project scope, there was a great deal of project re-planning involved with the re-working of objectives, deliverables and timelines. New tests were carried out on the system, which led to some minor system reconfigurations and additional end-user training. The initial estimated project duration of 9 months (to install new planning

and stock systems) had become an 18 month project to install a full ERP system. Arrangements were made with the funding bodies and the company to allow the project manager (the KTP Associate) to continue in situ for the extended project duration.

4.3 Findings

The Infor ERP package is now up and running at Contrapak and the business functions of financials, order entry, planning, stock control and procurement are now executed via the new system. Rollout will continue for some months to come, but experience to date provides some answers to the questions noted in section 1 above.

Was it feasible to computerise at pace the key area of load planning, scheduling and stock control, and thereby deliver critical benefits in the management of resources on the packaging lines? The judgement made by the Project Board was that this was a possibility, but that it would have required the maintenance of cumbersome manual paper based interfaces with the order entry system and the existing QuickBooks financial package. This would have been unwieldy, time-consuming and open to data errors to such an extent that it was judged not to be a feasible way forward. It is interesting to note Robinson's views in this context, when considering whether a pre-existing Financials package, such as Quickbooks, could be retained in an ERP implementation. 'If a company has, for instance, a financial package they are happy with, should they dump this and use the integrated package? The answer to this question is a definite 'yes'. If a fully integrated package is right for the company, the people using stand alone systems must be trained in the use of the integrated system so that **all** the stand alone systems, databases and spreadsheets can be dumped. Not only will islands of data reduce the advantages of the integrated system but it will also undermine its integrity' (Robinson, 2003). This proved a sound decision by the Project Board as the Financials module was implemented relatively quickly and without problems, and the Finance Director played a key role in championing the project.

What interfaces would need to be built to information systems in other key process areas to ensure benefits delivery? If the old systems had been retained, some real-time interfaces would have needed to be built to allow the link between demand, as orders were received, and the MRP and scheduling modules which kick start and control packaging operations, stock control and procurement. Similar interfaces to the financial system would be needed. The cost and skill sets required to do this, for systems that would probably need replacing before long anyway, persuaded the Project Board to adopt the new strategy of full systems replacement, implemented in four main phases (Figure 3).

Would a more holistic approach to computerisation be needed to underpin the corporate expansion visualised in the company's Business Plan? Having looked at five major software packages in detail, the Project Board came to the view that a full systems replacement via an ERP package was the best strategic option, given the growth aspirations of the company. This was reinforced by the realities of the supply and demand chains where major customers were also the suppliers of some of the raw materials required for packaging operations. This added complexity required tightly knit integrated systems that could classify transactions accordingly and provide a clear audit trail at product and batch/lot levels. In addition, a holistic approach could bring consistency in the key process areas, where there had hitherto been too much *ad hoc* activity and fire fighting which can damage customer service and reduce margins. As Turban et al (2002) have argued, 'ERP forces discipline and

organisation around business processes, making the alignment of IT and business goals more likely,' and this was seen as a major benefit of adopting an ERP solution. This required organisational development in the establishment of an IT function in the company that had hitherto not existed. In terms of Nolan's model of the IT function in business (Figure 4), Contrapak has advanced from a position of 'Contagion' prior to the KTP project, to a position between 'Control' and 'Integration'.

To what extent could packaging line efficiencies and inventory levels be improved by new systems? The Infor system is now running the stock control and planning functions and one major benefit is the generation of an integrated manufacturing schedule which optimises utilisation of packaging machines and the company's multi-skilled operatives, who are capable of working on a number of different packaging operations. Li et al (2010) have pointed out the benefits of integrating planning and scheduling, and this integration in the Infor system allows the calculation of labour requirements, shift patterns and break cover in order to fulfil actual customer demand. In addition, the new software provides a control system for raw materials and free issue stock, and a system for calculating raw material planning requirements from actual demands by the customer, harnessing the interrelationships between demand and supply chains.

Lee and Ng (1998) have discussed the two key approaches to improving the competitiveness of a supply chain - closer integration of the organisations involved and improved coordination of materials, information and financial flows. Essentially, the project at Contrapak was about the latter, as a means to facilitating the former. The system and the new ways of working will take some time yet to fully 'bed-in' to company operations – as Stadler and Kilger (2008) note, 'overcoming organisational barriers, aligning strategies and speeding up flows along the supply chain are common subjects in this respect'. Once the new system is well established in internal company operations, the senior team expect to harness its potential with its main customers and suppliers, focussing more on the integration of activities and information upstream in the demand chain. As Van Goor (2001) points out, 'the integration of decisions within and between companies in a chain is the main mission. Information flows, financial flows and goods flows have to be integrated from a multi-company point of view'.

5. Concluding Remarks

This study illustrates some aspects of the interdependence of different entities in a complex supply and demand chain. The scoping and re-scoping of the systems project at Contrapak highlights the dilemma of whether to focus purely on improving product planning and supply verses the need to take cognisance of upstream demand information. By increasing the project scope and implementing a full ERP solution, Contrapak in effect addressed both aspects in an attempt to ensure production planning fully reflects upstream demand and also kick starts raw materials and components supply – in the main from the same upstream customers.

This research has attempted to unravel the complexities of these interactions and dependencies in one SME, but further research in other SMEs would help advance understanding of the options available to SMEs and the relative costs and benefits of adopting different systems solutions.

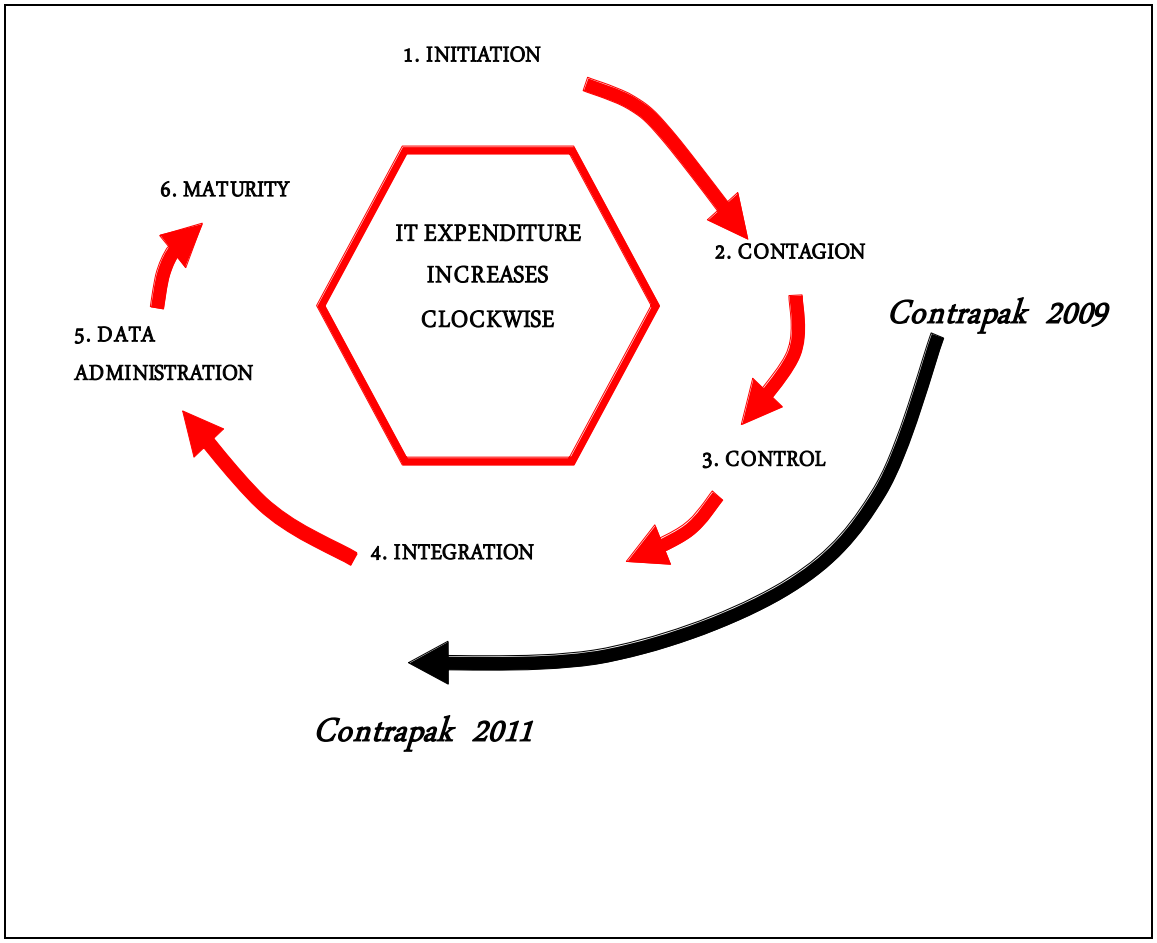

Figure 4. Contrapak progression on Nolan's model of the evolution of the IT/IS function. Source: Nolan (1979)

Key:
Initiation: The introduction of systems or technology by end-users (often, originally, the finance department).
Contagion: The spread of computing applications into other areas, in a totally uncontrolled manner. Some applications will fail, and the management of IT/IS is chaotic and largely unregulated.
Control: Senior management become concerned at the level of expenditure and lack of control. Responsibility for management is moved to a formal IT/IS department, and support responsibilities are centralised. Applications concentrate on saving money rather than making money.
Integration: Typically, this is where new significant expenditure is made in new systems in an attempt to gain the benefits of technology integration. IT/IS staff may be reorganised into functional areas to support different parts of the business, and only at this stage is there a real dialogue between IT/IS specialists and systems end-users.
Data administration: Developments are driven more by the organisation's need for information; data management and maintenance becomes a key issue in the overall management of the IT/IS function
Maturity: Planning and organisation of the IT/IS function is fully integrated into the business strategy planning and day-to-day management of the organisation. Major applications are 'owned' by end-user management, who also have responsibility for data maintenance, process change and systems upgrade decisions.

At the very least, exposure to the realities of implementing a major supply chain project has provided key staff at Contrapak with the knowledge of the ERP concept and the confidence to bed-in the system and ensure benefits are delivered. They have also had some exposure to elements of the PRINCE2® and Buy-Build methodologies employed during the project. There has been a significant building of critical mass in terms of IS/IT capability and standards that will be necessary to allow the company to pursue its growth aspirations. This has been reinforced by a broader skills enhancement and embedding - at an operational level, the project has given the company the capabilities to convert demand into sequential time phased material and human resource requirements that will be critical in delivering the key project benefits

- the right materials, the right staff in the right place, at the right time and in the right quantity.

The improved ability of Contrapak to respond to customer requirements has numerous benefits in maintaining existing relationships and securing new business. This has reduced the overhead on management in resolving operational issues and data conflicts in the packaging and customer facing areas and generally improved information quality and speeded effective decision-making. Pressure from customers – for shorter lead times, more frequent deliveries, individual customer requirements, and information sharing across the supply and demand chains – will only increase, and Contrapak's ability to run their operations via a stable, strategically sound, integrated system will help them respond effectively to these demands. The increased scope of the systems project discussed above is likely to stand Contrapak in good stead to expand its operations in demanding market conditions.

References

Aitken, J. (2000) 'Agility and Leanness – a successful and complimentary partnership in the lighting industry', *Proceedings of the Logistics Research Network 2000 Conference*, Cardiff, pp 1-7

Christopher, M. (2005) *Logistics and Supply Chain Management – creating value adding networks*, FT Prentice Hall, Pearson Education Ltd, 3rd Edition

Hartley, J. (1994) 'Case Studies in Organizational Research', in Cassell, C. and . Symon, G. (ed) *Qualitative Methods in Organizational Research: A Practical Guide.* London: Sage

Koopman, J. (1999) 'Effective alignment: strategy cannot succeed without it', *Canadian Manager*, September 22nd, pp. 14-15.

Lee H and Ng, S. (1998) 'Preface to global technology and supply chain management', in Lee, H. And Ng, S. *Global technology and supply chain management*, POMS series in technology and operations management, Vol 1, Productions and Operations Management Society, Miami, Florida, pp 1-3

Li, X., Gao, L., Zhang, C., Shao, X. (2010) 'A review on Integrated Process Planning and Scheduling', *International Journal of Manufacturing Research (IJMR)* Volume 5, Issue 2, pp 161-180

Mansell, G. (1991) 'Action research in information systems development', *Journal of Information Systems,* Volume 1, Number 1, January, Blackwell Scientific Publications, pp 29-40

Melville, M. (1994) 'Creating an integrated supply chain plan – presentation summary', paper presented at Creating Demand-Pull Continuous Replenishment in FMCG conference, May 12th-14th, Vision in Business, London

Nolan, R. L. (1979) 'Managing the crisis in data processing', *Harvard Business Review*, Vol 57 (2), Mar-April, pp 115-126

Ramaswamy, R. (1996) *Design and management of service processes*, Addison Wesley, Reading.

Remenyi, D., Williams, B., Money, A., and Swartz, E. (1998) *Doing research in business and management, an introduction to process and method,* London: Sage Publications

Robinson, P. (2003) 'Best of Breed (BOB) v Fully Integrated (FIS)', BPIC consultancy, Hove; accessed on internet at URL: http://www.bpic.co.uk April 7th, 2011

Saunders, M., Lewis, P., and Thornhill, A. (2003) R*esearch methods for business students,* Harlow: Prentice Hall

Stadtler, H., and Kilger, C. (2008) *Supply Chain Management and Advanced Planning – Concepts, Models, Software, Case Studies*, Springer, 4th Edition

Treville, S. de, Shapiro, R. and Hameri, A. (2004) 'From supply chain to demand chain: the role of lead time reduction in improving demand chain performance', *Journal of Operations Management*, 21, pp 613-627

Turban, E., King, D., Lee, J., Warkentin, M., Chung, H. M. (2002), *Electronic Commerce 2002 – A Managerial Perspective*, Prentice Hall

Van Goor, Ad R. (2001) 'Demand and supply chain management: a logistical challenge', 17th International Logistics Congress, Thessaloniki, October, pp 1-15. Accessed at www.soleurope.net/servicesupport/documents/**vangoor**-salonique.pdf, April 25th, 2011.

Wu, F., Mahajan, V. and Balasubramanian, S. (2003) 'An Analysis of E-business Adoption and its impact on business performance.' *Journal of the Academy of Marketing science*, vol 31, no 4, pp 425-447.

Wynn, M., and Jones, P. (2006) 'Delivering Business Benefits from Knowledge Transfer Partnerships', *International Journal of Entrepreneurship and Small Business,* Vol 3, Nos ¾, pp 310-320

Acknowledgements

Acknowledgement and thanks is given to Wayne Kedward, Managing Director, and the senior management team at Contrapak (the Project Board) for their support and enthusiasm for the project described in this article. This Partnership received financial support from the Knowledge Transfer Partnerships programme (KTP). KTP aims to help businesses to improve their competitiveness and productivity through the better use of knowledge, technology and skills that reside within the UK Knowledge Base. KTP is funded by the Technology Strategy Board along with the other government funding organisations.