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**SWP 12/94 SEEKING BUSINESS IMPROVEMENT:
A SYSTEMATIC APPROACH**

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SEEKING BUSINESS IMPROVEMENT: A SYSTEMATIC APPROACH

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Opportunity analysis, Business modelling, Process modelling, Information modelling, Strategic modelling, BPR, EDI.

ISRL CATEGORIES

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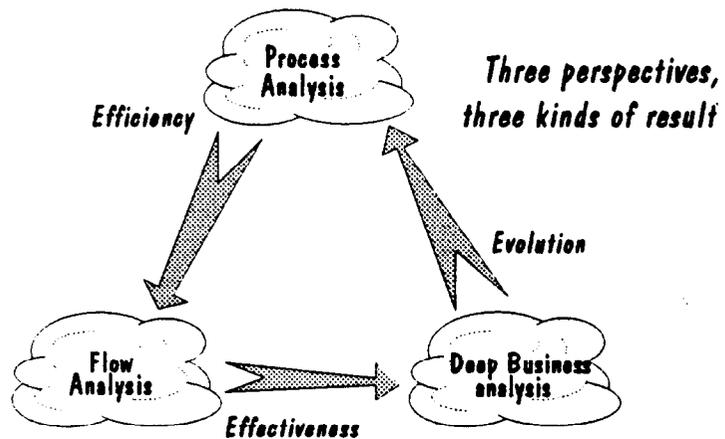
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ABSTRACT

In analysing business processes and the ways in which they might be improved, redesigned or even recreated, it is possible to use some aspects and tools of systems thinking. The methods developed over recent years by the software and systems engineering community are applicable to business process analysis and can complement the more strategic thinking of the management theorists.

An approach to the redeployment of certain systems analysis tools was developed by the Cranfield EDI research team, and includes three different analytical perspectives looking separately at processes, flows and the deeper components (high level entities) in a business. By allowing flexibility in the application of these techniques, and by allowing any one to be the starting point, a sound understanding of business operations and the potential for their improvement can be gained. Features of the analysis method include the circularity of the approach, leading to completeness in the results, and the use of the Value Chain and the Cranfield Enterprise Model as devices to check relevance and balance in the process and entity models.

Four practical studies show how this analysis method can be used to assess the potential for EDI and other business improvements in quite different business situations.



The Cranfield Analysis Method

INTRODUCTION

This is an interesting time for the information systems business, because although it is now a mature business we find that the whole industry is being called to task. Where *are* the benefits to business from all the years of work? There are certainly many failures¹.

Perhaps one of the greatest tragedies of the information systems business is the unstoppable fixation with the *next* great idea, well before we have understood the ideas that we are currently working with. Comments from experts have indicated (albeit with a hint of wry humour²) that the life cycle of a business fixation - be it total quality management, just in time, business process redesign or EDI - typically extends *for 14 years*. Those who drop out and move on after just a year or two really are missing out - history shows that very few companies persist and derive significant and enduring benefits from these sorts of ideas and that it really can take many years to achieve those benefits.

In 1994, the fixation of the moment seems to be to do with business process. The first substantial references to business process redesign ideas are to be found in the work of the "Management in the 1990s" project at the Sloan Management School in the USA³. This project identified business process redesign as an evolutionary way of exploiting the capabilities of IT beyond simple efficiency gains. The work of the Sloan Management School fell short of providing practical tools, however, and at Cranfield we have been working on this. The experience at Cranfield suggests that good tools *are* indeed available, that they *can* be used by a wider audience than the specialist systems community, and that they can be very effective. We have been using analysis tools derived from systems analysis practices developed over the last fifteen years.

The software engineering connection

The software engineering community has done some excellent work on process management as seen through the *maturity* of a business⁴. A basic starting point for this work was provided by the Software Engineering Institute at Carnegie Mellon in the USA where an early maturity model was developed, to deal with the different quality management requirements of a software business at different stages in its maturity cycle. Consider the differences involved in implementing ISO 9001 in a small two-man software company and in the IT department of a large monolithic petroleum company.

The model identifies five stages in maturing attitudes to improvement, based on the ability of the organisation to manage its processes:

- **Initial:** where the organisation may be chaotic and the processes are uncontrolled - their nature and characteristics become evident for the first time.
- **Repeatable:** where there is enough understanding about processes that they can be replicated with some degree of reliability.

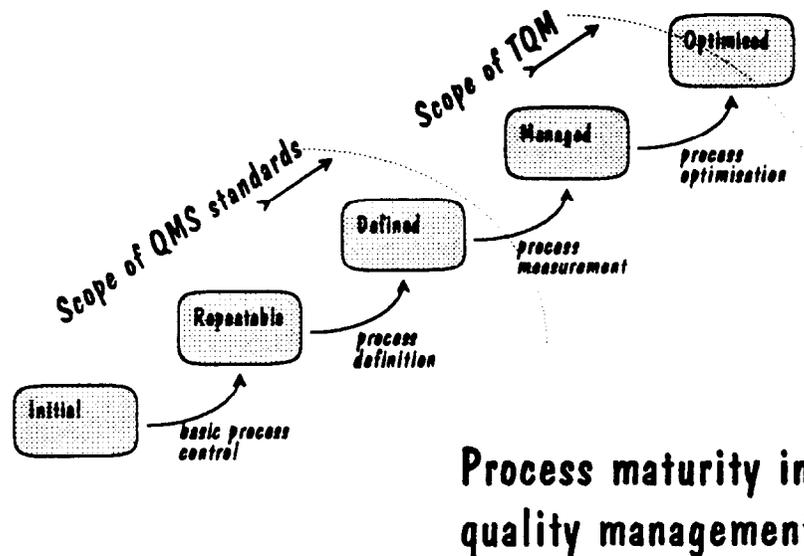
¹ For example in the UK alone: the London Ambulance Service, the Taurus Stock Exchange project, the Performing Rights Society have all hit the headlines.

² Hugh MacDonald (of ICL and the MIT Management in the '90s programme), talking at the 1993 Cranfield BPR Symposium.

³ See "The corporation of the 1990s", Michael Scott Morton, Oxford University Press, 1991.

⁴ For example, the QUANTUM project funded in the UK by the DTI, and executed by Praxis; also, the SPICE initiative which is based in the standardisation work of the international software standardisation committee: ISO/IEC JTC1.SC7.

- **Defined:** where processes are documented and there is a basis upon which to judge the degree of conformance to standards.
- **Managed:** where there is process measurement in place, in order to provide evidence of the extent of conformance the degree of improvement.
- **Optimised:** where the whole business is optimised so as to be getting the most out of its processes, and to be amongst the best in its class.



(based on a model originally from the Software Engineering Institute, Carnegie Mellon)

Figure 1: A model for process maturity

Perhaps the most interesting feature of the model is the way in which it shows the limits of application of standards such as the ISO 9000 series. In the early and late stages of maturity it is not really applicable at all: when in the early stages things are chaotic and processes are not at all formed, why force their documentation and fossilisation in written quality handbooks? Equally, at the later stages of maturity we would wish to move beyond the simple management of processes to find ways to be more flexible and responsive to ever-changing markets. This is something to do with the differences between simple standards for Quality Management Systems (ISO 9000 series) and the TQM culture (Crosby, Deming, Juran and the others), and the applicability to general business process thinking is clear.

The overview of the model raises some interesting questions:

- By what specific means will we render processes *repeatable*? We need to have ways to articulate our thoughts about processes, to control them and to communicate them to others.
- In achieving *defined* processes, what discipline will we use to define them with and how will we assess their quality and measure their performance, in order to render them *manageable*?
- Aiming ultimately for *optimised* processes sounds fine, but at the mature stage there is a danger that we will lose the ability to redefine process structures and think of completely new ways of working. If you like, who do we restart the whole cycle when the organisation is "completely" mature?

The Cranfield project

At the same time that the UK work with the Carnegie Mellon model was starting, and whilst the MIT team was concluding its work on the Management in the Nineties programme, a research project dealing with the longer term effects of EDI was starting at the Cranfield School of Management. We found that there is very little literature about the use of structured systems thinking in business beyond its mundane application to systems analysis. The research project developed new interpretations of structured business systems analysis in order to bring the best of *systems thinking* into *business process management*. The project also undertook four studies which tested the relevance and utility of the ideas.

The Cranfield EDI project was directed at the impact of EDI on business but the resulting analysis method has the ability to do far more than that. It helps to show the overall effectiveness of business and the applicability of any new technologies that might affect the handling and processing of information in business. The analysis techniques used are not necessarily new, but the overall arrangement and use of them is new. Most importantly, where we are used to using process and information analysis to drive *down* to systems specifications, we found that they are equally effective at driving *upwards* to management solutions. The way in which the techniques is used is new.

This paper presents the analysis method that was used, and illustrates it using some of the results of the four studies.

THE EVOLUTION OF THE ANALYSIS METHOD

Attitudes and expectations of management

We now know enough from the early history of EDI (and perhaps from other areas of innovation) to understand that a business might be:

- forced into EDI by a more powerful partner
- tempted into EDI by potential cost savings
- improved by finding better business practice through EDI
- expanded by finding new trading partners through EDI markets.

Each of these is a challenge for senior management to think about, but how should we help management begin to understand the issues? A passive organisation is likely to be forced into EDI, and may wish for the simplest analysis of the consequences. A more reactive organisation is likely to see others gaining benefits and be tempted by the potential savings - they will want to do more careful analysis of the costs and benefits. The proactive organisation will look at EDI for ways to improve the business and they will want a broader more strategic vision.

Clearly these different attitudes need different levels of analytical support. From the beginning, the Cranfield research project was based on three levels of analysis:

- Efficiency: "doing things right"
- Effectiveness: "doing the right thing"
- Evolution: "doing something new".

Some management attitudes are constantly focused on the need to optimise: to improve productivity, to reduce costs and to increase the margin of profit. This is all very well in stable markets which rarely change, but it can be disastrous in a market which is evolving and constantly presenting new challenges. A business which ignores a changing environment will not survive competitive threats. *Efficiency* is therefore a legitimate business strategy in mature markets where the competition is known and where most of the competitive advantage has already been worked out.

Where management are a little more outgoing and concerned with quality, excellence and image, we can see the signs of *effectiveness* thinking. Whilst a market is still maturing it is very important to pay careful attention to the way that partners (suppliers, customers and others) perceive us: we can not afford to concentrate attention solely on the inside of the organisation. Whilst a low selling price and a high level of service are visible outside and have something to do with efficiency, it is now well known that highly efficient processes actually undermine levels of service and throughput rates. A little redundancy in business resource can do wonders for service levels and renders the business much more effective.

Evolution in business is about extending markets and re-defining them, even making new markets. This is just not possible where managers are preoccupied with efficiency and effectiveness matters. A more adventurous approach is necessary which accepts the need to explore and invest in new business (and wait for the financial return at a later date!).

So, we see that if we can understand the nature of our business and the nature of the markets that we are operating within, we can make a judgement about the quality and appropriateness of our business strategy and the benefits that it seeks. As markets come and go, those of us who support the business

have to deploy our resources to support evolution, effectiveness and efficiency depending upon the maturity of the market. To do this successfully we need the right tools.

By and large it took 30 years - from the early '60s to the late '80s - for business to work out how to apply information systems in a competitive and strategic way (although many businesses are still struggling to understand the basics, of course!). The question we must ask is: *how can we accelerate the rate at which we mature our thinking about new opportunities*, in order to gain and maintain some level of competitive advantage? We can not afford to wait another 30 years.

To further enhance the chance that we gain true advantage we must consider the *scope* of what we are trying to do. It is no longer sufficient to work within the confines of our own company. Systems stretch beyond corporate boundaries and their management needs to understand this. Equally, the approach to business analysis needs to reflect this. Anyone who has worked on the implementation of wide scale EDI projects will know the additional problems and complexities of working with many companies at the same time. How are we to come to terms with the different operational practices of different organisations, quickly and effectively?

The need for a business modelling and analysis method

We are all familiar with the organisation chart as an "entry point" to understanding an unfamiliar organisation. "*Here's a copy of the organisation chart - that will tell you what goes on around here ...*" is a familiar phrase that must have tripped off thousands of tongues since the organisation chart was first invented.

The truth is that the organisation chart often tells us nothing about what actually goes on in a business. Seeing a "Marketing Department" in the chart may raise a vision of marketing activity in the mind of the reader, but are they really marketing people, and are they really doing marketing? Perhaps they get involved with other activities such as design and administration. Perhaps they are involved with corporate management. These are all legitimate activities within the business and we can no longer assume that business processes are wholly contained within a single department.

Making any assumptions at all from the organisation chart is a trap for the unwary, and those of us who have spent time helping organisations to sort out business and technology problems know the importance of studying actual business activities and visiting the parts of the organisation where the critical work is done. We know intuitively that understanding business processes is important, but without systems thinking we have no tools to work with.

During the first year of the research at Cranfield it became clear that business modelling was an essential prerequisite if organisations interested in EDI are to be able to analyse and anticipate the effects of EDI upon business. The systems approach (traditional systems analysis, data flow diagramming, data analysis) is not the only one, however. There are different ways in which can choose to set about the modelling task, for example traditional numerical analysis (from simple financial models to complex operational research techniques) and more conceptual approaches such as soft systems methods and strategic modelling. The table below comments on the relative contribution of each kind of modelling technique to the need for efficiency, effectiveness and evolution in business.

	Mathematical Modelling	Structured Business Modelling	Concept Modelling
Analysis of efficiency	Because efficiency is intimately concerned with cost and time, mathematical techniques will be essential here.	Structured business models show the potential to eliminate and optimise business procedures and practices.	Concept modelling has little to do with efficiency.
Analysis of effectiveness	Effectiveness has something to do with the probability that things will improve if an action is taken. Probabilistic techniques for estimating the chance that a business becomes more effective may be useful.	Structured techniques are essential if we are to optimise the business at a structural level. The potential here is known to be important. This is an area for exploitation.	Analysis of effectiveness might lead to ideas about new concepts. Linking to concept models is full of potential this is an area for further exploration.
Analysis of evolutionary potential	Numerical techniques have little relevance here.	Structured business models help to detail new business ideas, but their potential for the conception of new ideas is limited. The entity model is probably the most useful.	This is an area for research. There seems to be limited actual experience but a great deal of potential.

Table 1: A comparison of modelling techniques

The table shows how structured analysis has the potential to contribute to all levels of need. Mathematical techniques have a bias to the analysis of efficiency and conceptual techniques have a bias to new evolutionary thinking; we therefore find a top-left to bottom-right relationship between our need and the analysis opportunity.

Structured analysis gives us a way to think about information and processes *in the abstract* and to structure our thoughts without regard to human and geographical constraints⁵. There is also a potentially useful circularity in systems analysis: from the analysis of *processes* and *information flows* comes a catalogue of all the *data* that is extant in a business; from the analysis of this data comes a catalogue of all the *entities* - things that are important to the business and about which we keep information; from the analysis of these entities comes an understanding of the very foundations upon which the enterprise is based and a catalogue of the activities needed to support those things ... we thus come back to thoughts about *processes*.

This circular arrangement of thinking (see the box below) is one of the most powerful notions to have come out of the systems and business analysis techniques of the 1980s and yet it is not well understood. Few proprietary methods achieve this completeness⁶. It is a main feature of the Cranfield approach.

⁵ There is clearly a need to deal with these other concerns, but one might argue that we should deal with one thing at a time.

⁶ The UK public sector method known as SSADM is perhaps the most complete, but it is very detailed.

A simple illustration of circularity in business analysis:

"Why don't you tell me what goes on here, then?"

"Sure, but its not very exciting! We have to deal with incoming sales orders (process). Mostly there are no problems - they come in in the post (data flow) and we enter them in batches. The problems arise when orders are not on one of our own forms (data structure). For example, overseas customers (entity) often use their own purchase orders and sometimes they're not even in English! When an overseas order comes in (event) we give it to the boss! He goes over it and prepares a dummy order on our own forms (back to process) which we then process in the usual way"

(and so on!)

Figure 2: Circularity in systems thinking

Structured business analysis

Conventional structured analysis techniques (such as SADT, SSADM and Information Engineering) employ the following kinds of techniques⁷.

- FUNCTION ANALYSIS typically produces a hierarchical view of the activity within a system, subsequently detailed on data flow diagrams which show the flow through a business, or a part of a business.
- DATA ANALYSIS which produces normalised data structures in a data model, by the application of "first normal form", "second normal form" and "third normal form" rules to the somewhat chaotic data structures that are usually evident in the forms and reports to be found in a business. The component data elements will be tabulated, with information about their data type and length.
- ENTITY ANALYSIS which produces entity models and (sometimes) entity life history models. The entity life history diagrams provide information about sequence, iteration and choice in the life of the entity, such as in the case of a *customer* or a *product*.

An analysis (and the resulting model) may not employ all of these notions but only use one or two of the "views" (function, data or entity). In this case the analysis might not be complete. Where there is more than one view derived from two or more analysis techniques, it adds considerably to the completeness and coherency of the resulting specification. Again, the ability to develop more than one view is a key feature of the Cranfield approach, but this was done with a light touch and more flexibility that might be usual in systems analysis.

⁷ Regrettably, terminology varies from one proprietary method to another, but this is not the place for an exhaustive discussion of the variations.

INTRODUCTION TO THE ANALYSIS METHOD

The three perspectives chosen for the Cranfield analysis method are:

- **Process analysis:** a simple analysis of all the relevant processes in the business, at a higher rather than lower level.
- **Flow analysis:** a more careful analysis of the movement of information between the principle processes of a business.
- **Deep business analysis:** a conceptual "stand right back from the detail" viewpoint, based on the key business entities as seen by senior and operational management.

Process analysis

Analyse the function of the business quickly, using process decomposition techniques. At the lowest relevant level, assess the opportunity for efficiency improvements in terms of the processes which take a lot of time or resource, and which might benefit from technology-based improvement. Quantify the potential reduction in time and cost.

The example below is based upon work done in a manufacturing company (Heenan Drives) as it was some years ago when it was involved with the production of variable speed electrical drives, and the control systems that go with them⁸.

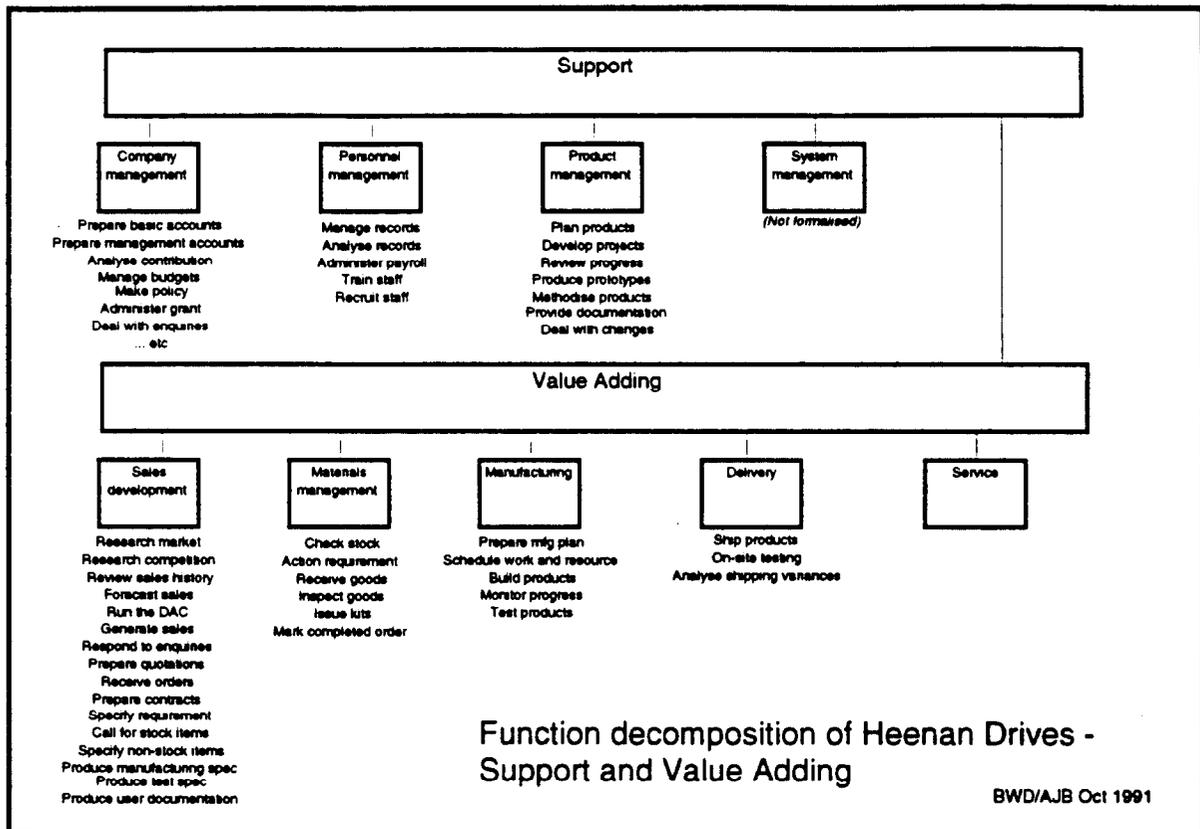


Figure 3: The function decomposition model

⁸ Although based on Heenan Drives, note that this is not intended to represent the company as it is today. The model is based on the arrangements that were in place some years ago.

At this level process analysis is quick and gives a rough but useful overview of what is going in the organisation. It helps to indicate who should be interviewed for more detailed information, and it gives a first indication of the quality of the current business process arrangements. For example, Figure 3 shows that:

- There is an over-riding emphasis on sales development (not unexpected in a company which is developing a complete new range of products).
- There is little vision of service (no doubt that will come later?)
- In the supporting area there is no vision of systems management processes (a critical issue, when the company strategy is entirely based upon new manufacturing systems)

In this way we can find out about the balance and completeness of what is being done, and do something to redress any difficulties (as was done in the case in question, of course).

Flow analysis

Extend the process analysis by adding an analysis of flows - both information and material flows. Use the flow model to assess the delays and costs at each stage in the overall process, and to find redundancy and duplication of operations. Assess the relative cost of error and exception handling activities and make a judgement about the potential for business process redesign, thereby identifying effectiveness benefits.

This is a more substantial and time consuming task than simple process analysis. The work needs to be focused of course. In the case of EDI opportunity analysis, one would look at the *interfaces* with external business partners (suppliers, customers, agents, distributors, etc) rather than *internal* operations.

There are four distinct features to be found in a data flow diagram: processes, external entities, stores and flows. Each of these is discussed briefly below (alternative terms that may be found in particular proprietary methods are given in parentheses).

- **Processes** (functions, activities, actions)

The things that people or machines do may be referred to as processes. They can be identified by a name that is usually a verb-object construct: "Receive goods", "Assemble orders".

- **External entities** (outsiders, real world entities)

A person, organisation or process outside the boundary of the system, but with whom (or which) the system must interact: "Supplier", "Accounts department".

- **Stores** (for information and for goods; files, buffers)

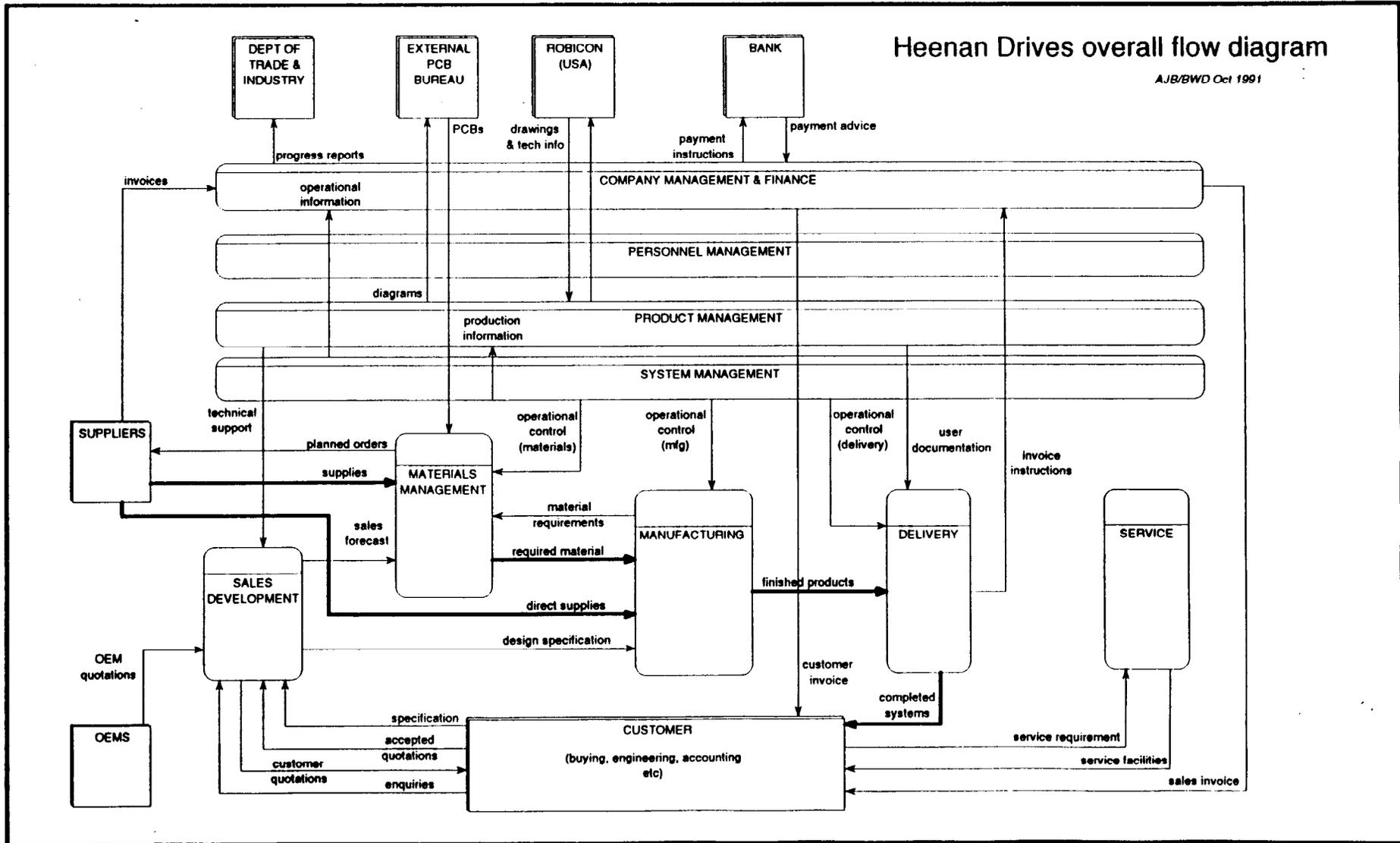
A place where goods or information is kept, pending its use by a process which needs it: "Stock master file", "Warehouse".

- **Flows** (information flow, data stream, material transportation)

The movement of data or goods between processes, stores and external entities: "Unchecked shipment", "Completed packing slip".

The example below gives another perspective on Heenan Drives, based upon the high level processes that are evident in the business.

Figure 4: A high level flow model



Flow analysis is a powerful and almost universally acceptable way to analyse the detail of a business, taking into account processes *and* the flow of information and materials. It provides a rigorous way of analysing the speed of flow of goods and information and a basis for a resource loading analysis (although it is not traditionally used for this purpose). However, flow analysis takes time and it needs to be done with the close involvement of the business. It also tends to reinforce attitudes about the current way of running the business, rather than helping us to find new ways to run the business.

It is therefore not really appropriate to use this technique for radical business redesign. A significant investment of time and effort is needed in the construction of a good flow model and it sometimes leads to an unwillingness to change the current arrangements. In some way, a beautifully presented flow model reinforces the notion that all that happens at present is good and that there is no need to change it.

Deep business analysis

Step back completely from the process perspective and undertake a deeper analysis of the business, by identifying its essential components (or entities) at a deeper, more fundamental level. Follow through with an analysis of the lifecycles of the key entities, and derive a statement of "idealised" process requirements. Review how the scope of the business might be extended by the addition of new entities - the evolutionary opportunity.

This is akin to brainstorming, but uses a controlling discipline derived from entity modelling. Brainstorming is appropriate where evolutionary thinking is required or where it is proposed to develop completely new business ideas (or completely new ways of operating existing business).

Entity modelling⁹ is a difficult discipline to learn and internalise, but when it is understood there are great benefits. Some positive aspects of the technique are:

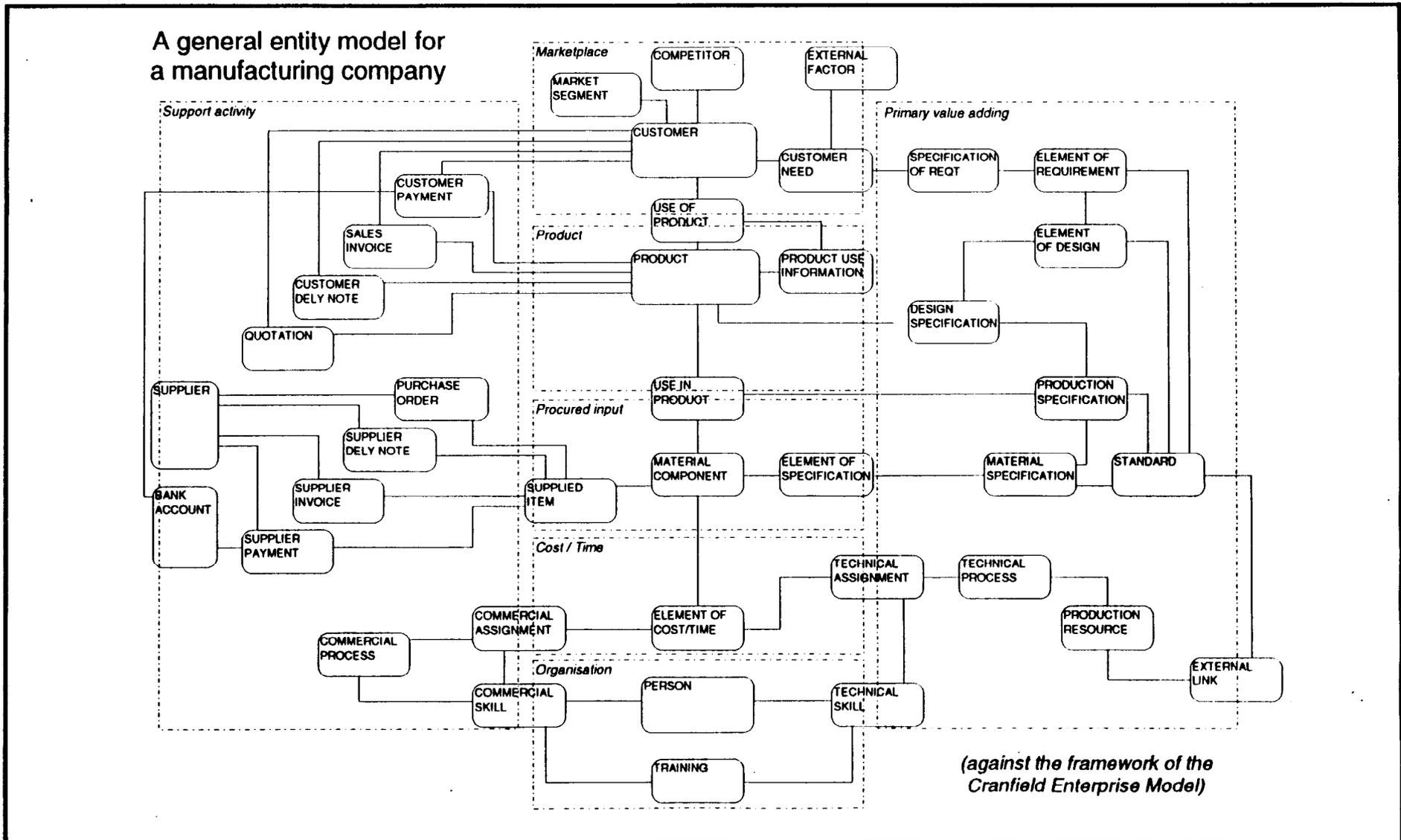
- There is probably only one high-level entity model for a business; there is an infinity of process models that would support a business in actual practice.
- The entity model is probably the only model of a business that would fit on a single sheet of paper, albeit A3 or A2 rather than A4.
- The entity model lays down an overall structure for the information required by a business and is critical to understanding the scope of a business and the way in which it can be extended or redefined.

In this way the idea that it is useful at the management level is formed. Our belief is that this kind of approach is the only one which will achieve sufficient depth in business analysis in order to achieve *radical* business process redesign.

The example below shows a manufacturing business, and is typical of companies like Heenan Drives.

⁹ For some people the term "Entity" is a loaded word: that is, it raises preconceived ideas which are sometimes not helpful. This is in part because Entity Modelling is a difficult discipline to learn and internalise when one has been working for a lifetime with simpler paradigms based on process, organisational and even geographic principles. It is also because in typical proprietary methods (such as SSADM) entity modelling is the last thing that is done in the cycle (specifically, SSADM Entity Life History analysis). Surveys have shown clearly that this stage is often not done or it is just skimmed over, and this has set attitudes. As long as entity analysis is the last thing that we do and as long as we have difficulty understanding it will continue to present problems. This research project has helped to demonstrate that it does not have to be the last thing that you do - it can be the first. Also, that when this is done it can be a very rapid technique indeed.

Figure 5: A high level entity model, the "deep view" of a business



The life cycle analysis step is crucial. For each of the entities, in a review meeting for example, the events in the lifecycle of the entity can be examined for key requirements of the business processes. In the case of CUSTOMER this would be akin to Customer Resource Life Cycle Analysis where each stage in the relationship with a customer is examined for the processes and facilities that need to be provided. The same is true for EMPLOYEES, PRODUCTS, and any other key concepts within the business.

Not everyone in an organisation can articulate this deeper understanding of what the business is all about - the communication of ideas through this vehicle might be best done selectively. However, at the management level - with close teams of managers - we *have* demonstrated that this technique can be dramatically quick, and that it can sweep away perceptions of what has to be done which are based only on history and substitute fresh visions of what could be done.

Summary of the analysis method

We started with a discussion of traditional systems analysis and explored how it might work in a different context - the search for management solutions rather than systems specifications. We also noted that it has the potential to be circular in nature, leading to a much more complete and coherent understanding of a business *and its potential for improvement*. The Figure 6 below summarises this circularity and shows how we can derive efficiency, effectiveness and evolutionary benefits from process, flow and deep business analysis. It also shows how we can use two high level (conceptual frameworks to further check for completeness: the Value Chain¹⁰ and the Cranfield Enterprise Model¹¹. This is discussed in the following paragraphs.

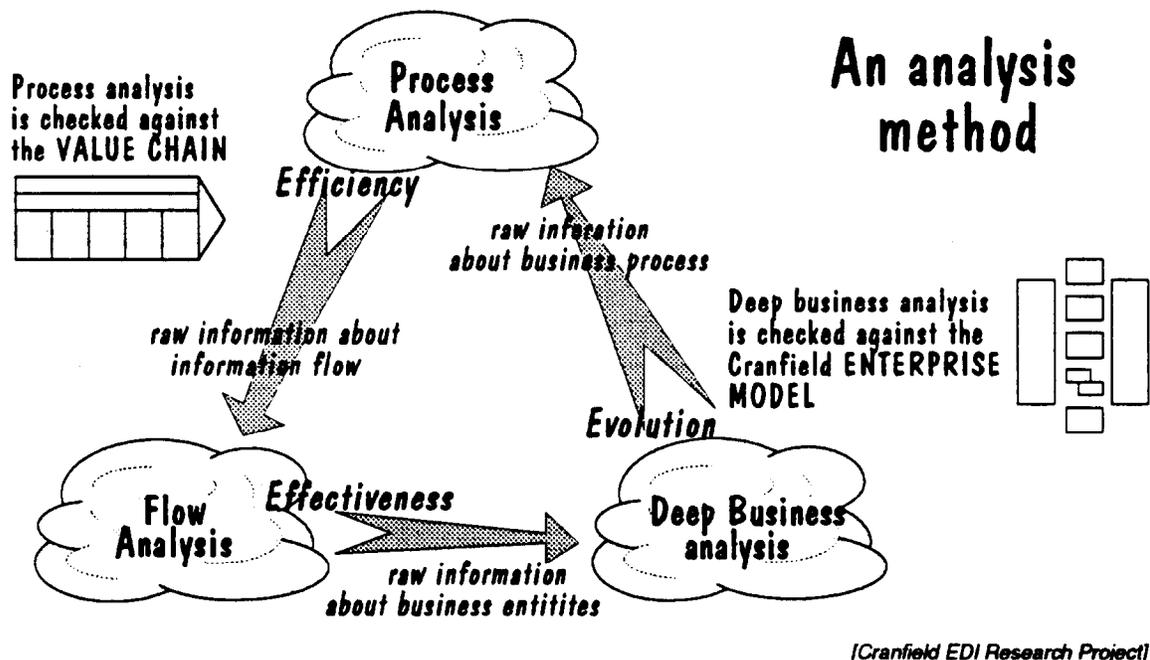


Figure 6: Overview of the analysis method

¹⁰ See the extensive and widely quoted literature by Michael Porter, of Harvard University.

¹¹ See the Cranfield Working Paper entitled "Beyond the Value Chain: a new framework for business modelling", by Andy Bytheway, Bernard Dyer and Ashley Braganza.

Checking against the Value Chain

In order to take a check on the completeness and balance of a process analysis, it is helpful to take the results of a process decomposition and map the low level processes into the Value Chain, the general form of which is shown below:

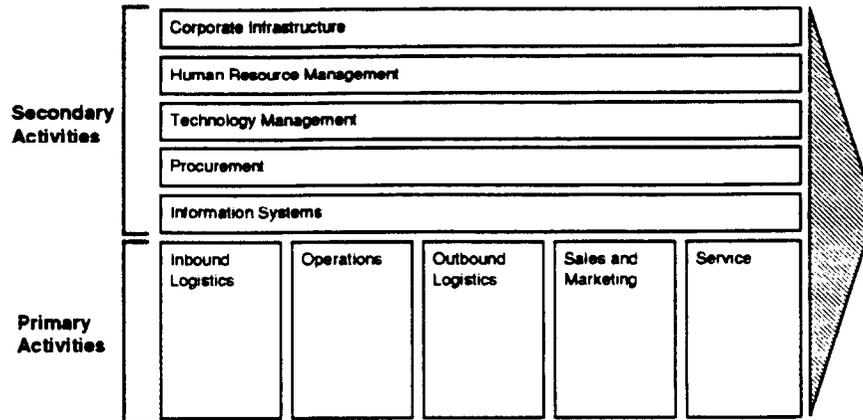


Figure 7: The value chain

In its original conception the value chain was intended as a framework for modelling manufacturing businesses but it is possible - with very good effect - to use it as a framework for service companies such as building societies and banks, and even for generic life processes such as running committees (looked as a business operation, with a critical eye for value adding, this can be very informative).

In this context, the value chain works at two levels:

- First, it allows us to classify and organise the processes that are identified in the first stage of analysis (look again at the model of Heenan Drives processes in Figure 3). We can then be sure that all the generic functional areas have been thought about, and that they are dealt with an appropriate balance and attention to detail.
- Second, it gives an initial framework for the flow analysis, whereby material product generally goes from the left to the right; money goes from the right to the left, as does information about market demand.

Checking against the Cranfield Enterprise Model

In the same way, we need a high level framework to help us achieve entity modelling without confusion and in a way that renders different businesses comparable. In the course of the Cranfield research project we looked for such a model but failed to find one. We therefore developed the "Cranfield Enterprise Model" as a basis for doing this high level modelling of entities¹². It provides a generic framework against which a high-level entity model can be tested in the same way as the value chain. Although it is still in the early stages of its testing it has served well, and it is reproduced below.

¹² See the Cranfield working paper "Beyond the Value Chain: a new framework for business modelling", by Andy Bytheway, Bernard Dyer and Ashley Braganza.

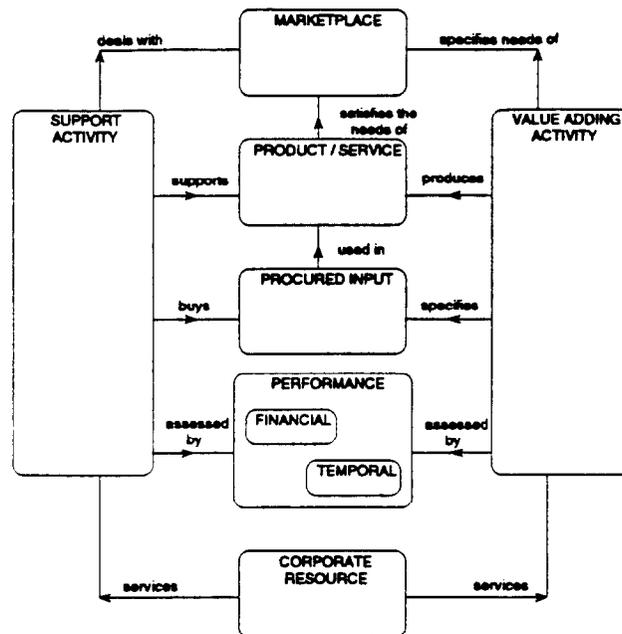


Figure 8: The Cranfield Enterprise Model

A full discussion of this model is given elsewhere¹³ but the following summary introduces the ideas underlying the seven main domains within which detailed entity modelling can be fitted:

- **Marketplace:** Information about the marketplace typically includes details of customers, people and organisations that want to have benefit of the product. Also, about competitors and the way that their presence impacts on success.
- **Product:** Information about the material product, service or other "deliverable" that an enterprise offers to the market; its specification, capability, configuration and operational needs. In the case of service operations, the nature of the service and its speed of response; its information content and the timeliness of the information provided.
- **Procured input:** Information about the raw materials and inputs that are required to manufacture or formulate the product or service; their sources and the suppliers offering them. Their characteristics, such as availability, lead time and cost. In the case of service operations, much of the procured input might be external data, taken into the organisation and used to deliver service of some kind to the customer.
- **Corporate Resource:** The available standing corporate resource in terms of people, capital equipment and other assets. Also, buildings and property, but not unused inventory (that is better seen as procured input).
- **Corporate performance:** Management information. Probably (as indicated in Figure 8) information about the financial performance of the business and also information about the temporal performance - how quickly and how productively product and service is delivered. Here we would find the raw input to an executive information system.

¹³ Again, see the Cranfield working paper "Beyond the Value Chain: a new framework for business modelling", by Andy Bytheway, Bernard Dyer and Ashley Braganza.

- **Supporting processes:** Information about the supportive tasks whereby the operation of an enterprise is sustained: management, financial and contractual information; also information about the selling and other ancillary processes.
- **Value adding processes:** Information about the tasks whereby a product (or service) is conceived, designed, engineered, manufactured and maintained. Information about any aspect of operations which is perceived by the customer as useful.

In the same way as the value chain, the new enterprise model operates at two levels:

- First, it allows us to classify and organise the entities that are identified in the third stage of analysis (look again at the model of manufacturing entities in Figure 5). We can then be sure that all the generic information domains have been thought about, and that they are balanced and dealt with at an appropriate level of detail.
- Second, it gives a "clean sheet" to work with, at a higher level than usually adopted for information analysis. Conventional areas for database design can be positioned within it; customer database, product database, personnel database, asset register all down the centre, and additional critical information about how the business works (the information about value adding and supporting processes such as might be found in procedure and commercial manuals, and quality handbooks) to the left and the right.

Using the Cranfield analysis method

The analysis method does not have to begin with process analysis, proceed with flow analysis and then conclude with deep business analysis. It can be started at any one of the three stages and each would be appropriate in different circumstances (see Figure 6).

- Where an organisation simply wants to look at the current operation for *efficiency* benefits, it is not helpful or useful to undertake deep business analysis. A simple process analysis will get a grip on things and may itself be sufficient where there is no wish to change current arrangements.
- Where an organisation wants to seek out the benefits of *business process redesign*, then flow analysis is the natural place to start. It will reveal opportunities for real improvement in effectiveness by showing the route through the business for high-level processes such as "customer order fulfilment" and "product design". Unnecessary delays can be tracked down, and whole parts of the business which might be better transferred to business partners can be examined.
- Finally, where an organisation wants to find a completely new starting point, it is best to start with deep business analysis. Any current thinking about processes is put largely to one side and an entirely new process model can be developed from first principles (this is done in one of the examples which follow).

The following section of this paper presents an overview of each of the four studies that were undertaken to test the analysis method, and indicates how the analysis method works in each case.



TESTING THE ANALYSIS METHOD: THE FOUR STUDIES

Billing for telecommunications services

The first study using the analysis method was aimed at identifying improvement opportunities within BP's procurement and payment of telecommunications services and the associated BT activities in the supply and billing of those services. It was thought that EDI might be useful in reducing the cost of administering telephone bills and payments.

The study identified the low level processes which each organisation was using to service information exchanges with the other. Invoices and payments are the traditional examples of these exchanges, but here we have also have requests for engineering services.

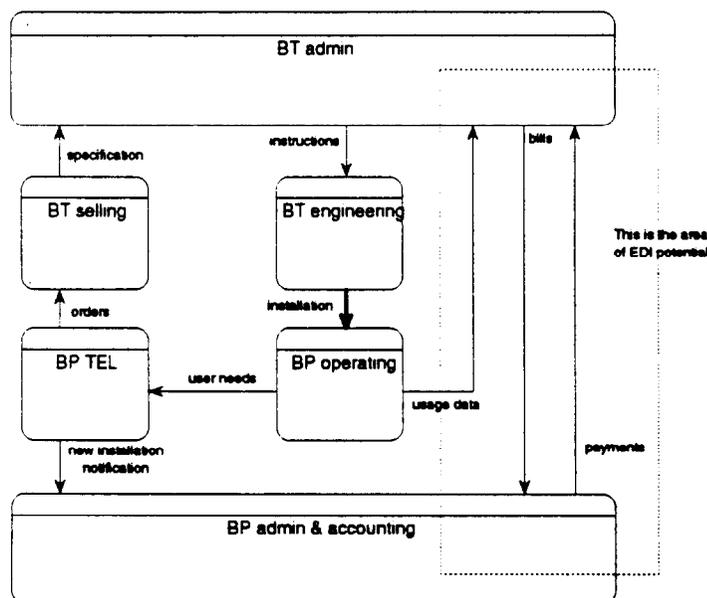
The study achieved its aims through the application of the first and second phases of the Cranfield opportunity analysis method. It included testing against the Value Chain. By this means the study identified a wide range of possible developments based upon the application of EDI and related technologies and classified them into:

- benefits of improved efficiency (saving money and time) and
- benefits of improved effectiveness (making the business better and providing a higher level of service).

The study successfully developed business models for BP and BT which provided a basis for analysis of both organisations and the information exchange and sharing opportunities between them. As a consequence of the study both organisations set up action teams to further develop and act upon the findings.

The key objective of the study was to show how EDI could simplify and standardise the business processes associated with the procurement of routine business supplies and services, such as telephone services, from both the buyer and supplier view point.

Figure 9: An overview of the BT-BP interface



Although the model of the interface (see the figure) is simplified, it shows at a high level the exchange of information and service between the two companies.

To the right is the area where it was thought that EDI could usefully be applied - in order to reduce the cost of billing and payments. To the left is where the "real work" is done - the negotiation of major new systems and the routine use of the service.

The high level process areas identified (apart from administration at the top and bottom) are:

- BP TEL projects: a special team in the BP head office providing support and advice to operating divisions, and the primary interface with BT for major projects.
- BP operating: all parts of BP's global operations which use BT services.
- BT selling: The BT sales office dealing with all sales.
- BT engineering: the BT teams who do the installation and maintenance work.

A more detailed process decomposition which underpins this model is given in the table following:

BP Value adding activities	BT Value adding activities
BP TEL Projects	BT Selling
Design and develop	Consulting
Tendering	Receiving orders
Ordering	BT Engineering
Gaining approval	Receiving instructions
BP Installing	Carry out instructions
Determine service info	Give feedback response
BP Operating	BT Support activities
Specifying user needs	BT Administration
Using installation	Enter orders
BP Support activities	Computer system process
BP Administration & Accounting	Issue bills
Receiving bills	Handling queries using BT databases
Checking bills	Receive payments
Gain authorisation	
Pay bills	
Save billing data	

Table 2: Process decomposition at the BP-BT interface

In the final detailed models that were reviewed with the companies, the information exchanges between these lower level processes were all identified and analysed. One of the features of the study was the marked differences in attitude to these processes. To BT, much of the activity that we have here is *primary* and therefore seen as value adding; to BP telecommunications services are just a *supporting* activity, and this was reflected in the different levels of investment in information systems to support the business activity on both sides. BT has a massive investment in mainframe systems; the BP administrator had a single personal computer.

The principle results of the study were:

- There is little overall cash saving to be achieved from the use of EDI in the present arrangements. The saving is insignificant when set against the cost of administration and the value of the business being transacted.
- If billing information were to be presented more frequently and with more supporting information EDI would provide an economical way to achieve the exchange. For example itemised billing involves greater volumes of data, and the economics of EDI start to look more interesting when this is taken into account.
- In the extreme case, the cost of each call could be automatically transferred upon completion of the call; this would allow BP real time control over its expenditure. But, does it really want that level of control?

- BP could benefit significantly from additional billing information, for example to allow costs to be more easily allocated their own cost headings and budgets.

The analysis also stimulated more wide ranging discussions about longer term opportunities.

- For example, the use of telephone numbers is presently very primitive and could be developed. A telephone number could be allocated not to a line, nor even an individual instrument, but to a *business process*. To an extent this already happens in a small way where (for example) telesales companies use different numbers for sales, technical support, customer services, and so on.
- Equally, it became obvious that BT have extensive and generally very accurate information about *installed equipment* in organisations like BP. Where it might take BP staff several days to clarify the actual existence of an unknown line, BT can deal with such questions promptly and quickly. Better perhaps that BT should simply make this information directly available to large corporate customers?
- At another level still, small transactions (for minor items of equipment) cost a great deal to administer and could be dealt with on a completely different basis if BT were to offer an electronic ordering facility, perhaps within agreed limits of spend.

These sorts of ideas are typical of any project which takes a fresh look at the way things are done, and it was gratifying that the discussions led to new ideas. This was intended to be a short study to check out the analysis method ahead of the other more substantial studies, but in some respects it proved to be the most interesting. The ideas that came from it were unconstrained and quite substantial in themselves. Perhaps most usefully of all, it showed that the simple application of EDI would provide little useful return on the investment.

Retail supply chain administration

This study of a three-stage supply chain analysed business development opportunities within the overall chain of supply involving BP Chemicals, Procter & Gamble and ASDA. It looked at the activities associated with the manufacture of domestic cleaning products. Most of the analysis was achieved using process and flow analysis. The resulting flow model was complex and included about 240 components: individual processes, flows, stores and external entities.

The study made extensive use of modelling to achieve its objectives and much of the work was done using a CASE (Computer aided systems engineering) tool and a spreadsheet package. It involved a considerable number of days working with staff within the involved organisations, in order to elicit and document the details of the model, which are too extensive to be included in this paper.

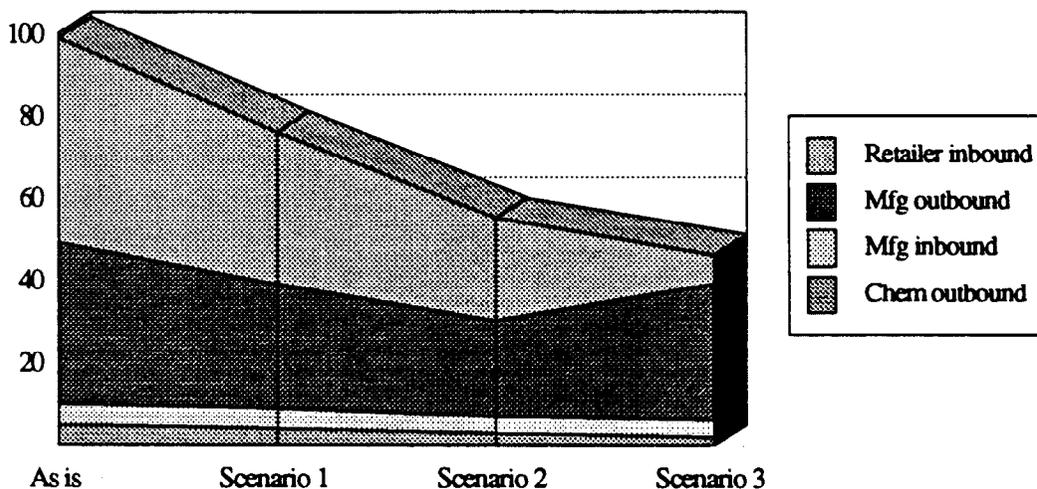
The study proceeded as follows:

- The prevailing business arrangements were analysed and documented in a decomposition model for *each of the two business interfaces*. This differs from typical in-company analysis, and involved a reconciliation of the differing viewpoints of the departments involved.
- The flow of information and goods was then analysed and modelled, and progressively refined and stabilised by means of three separate review meetings with key staff involved. The resulting "as-is" model was agreed and frozen.
- Current costs were surveyed and incorporated into a spread sheet version of the model, which allowed the automatic recalculation of costs consequent upon process improvement or change.

- Three scenarios were defined, basically relating to the three different goals of efficiency, effectiveness and evolutionary benefits:
 - *Scenario one:* Applying EDI to existing processes without any significant changes, thereby reducing transaction-level costs, improving timescales and reducing errors.
 - *Scenario two:* Redesigning the business interfaces to achieve improved effectiveness, for example by means of self billing and automatic replenishment, thereby simplifying the interface and significantly changing the way business is done.
 - *Scenario three:* Going for major supply chain restructuring based upon the redefinition of each player's role, principally the reduction of the retailer role to that of a "shelf renter", and allowing the manufacturer to maintain ownership of the goods through to end-customer purchase.
- The cost model was re-computed based on these three scenarios, in order to assess the financial benefits of each level of progressive change.

The analysis indicates that there is potential in the application of EDI, in the form of an overall progressive reduction in operational costs, and this reduction was quantified. It also showed how the balance of cost between partners can be moved between them, and that the sharing of net benefits at the manufacturer-retailer interface is both negotiable and potentially beneficial to both parties.

The illustrative analysis (below) shows the progressive reduction in overall cost¹⁴.



Note: The costs included in the analysis are only partial; specifically, haulier costs and internal costs such as production, internal inventory and work in progress were not included

Figure 10: Illustration of reducing cost of supply

¹⁴ The detailed results from the model showed separately the variation in people costs, computer costs and material handling costs.

The following observations interpret and summarise the results of this study.

- The overall value of the business transacted between the partners is very much greater than the costs and savings identified.
- In the general case, where profit margins of only a few percentage points are being considered the potential savings are significant, but where margins are high the saving would become insignificant.
- In the detail of the model (not provided here) it is clear that material handling costs are very significant and less tractable than the people costs. Only Scenario 3 showed any real impact upon them.
- The cost of operating the manufacturer-retailer interface is significantly greater than that of the raw materials-manufacturing interface.
- The reduction in people costs is progressive throughout the three scenarios, although most marked in scenarios 1 and 2.
- There is more slightly more potential advantage to the retailer in the first two stages; significant further potential in the third stage is negotiable but probably to the manufacturer's cost.

We believe that this is the first time that a multi-stage supply chain has been modelled at this level of detail in order to show the balance of costs between multiple partners, and the ways in which costs might be affected by the application of new technologies. This study has led to a new research project at Cranfield looking more carefully at information management in the supply chain.

A new systems services operation

A completely different study looked at the way in which systems thinking could help to define new process models in a case where the business was undergoing radical change. Within the Norwich Area Health Authority in the East Anglian region of the UK, the computer department was planning to launch itself as a free trading company, to be known as *Norwich Systems and Accounting* (NSA). After a long history of successful operations within the National Health Service, they needed to find a new commercial model for the future operation of the new company.

The overall objective of the study was to identify and analyse the core components of the new business using deep business analysis, to use entity life cycle analysis as the key analysis tool, and to prepare a model of the new "ideal" business operation.

It achieved this using deep business analysis in conjunction with the Cranfield Enterprise Model and the Value Chain. By this means the study achieved a statement of the business functions that are required by the new company, from the concepts and principles evident in the enterprise model. By avoiding analysis of existing business processes the analysis has shown how an idealised model for business can be derived from a basic statement of the entities upon which it is founded.

The first brainstormed enterprise model was mapped to the Cranfield Enterprise model and extended where there were obvious gaps. The key entities were then put through a life cycle analysis in order to create a statement of process requirement, and this was mapped to the value chain. The result was interesting, because it revealed gaps in the process model, especially in outbound logistics, service, and technology management (see the Figure 11 below which illustrates this intermediate stage in the analysis). This illustrates yet again the importance of taking more than one perspective on the business.

International payments

The fourth study is different yet again. Given the apparent failure of the market to take up EDI and electronic payments services offered in recent years by the Banks, it was agreed to mount a study of the current situation in international payments and the prospects for future developments, but based upon the needs of corporate banking customers rather than the aspirations of the banks. This was done with a *concept model* for payments, which provided an insight into the current situation and sound foundations for further work.

The concept model was developed using deep business analysis, and the heart of the model is reproduced below. It shows a simpler view than the full version of the model, and yet one of the key findings is clear: there is little direct connection between the *trade* that takes place between buying and selling business partners, and the *banking services* that support that trade. This gives a strong indication of what is required: more sophisticated segmentation of their corporate markets by the banks, and closer gearing of the banking service to trade and other conditions.

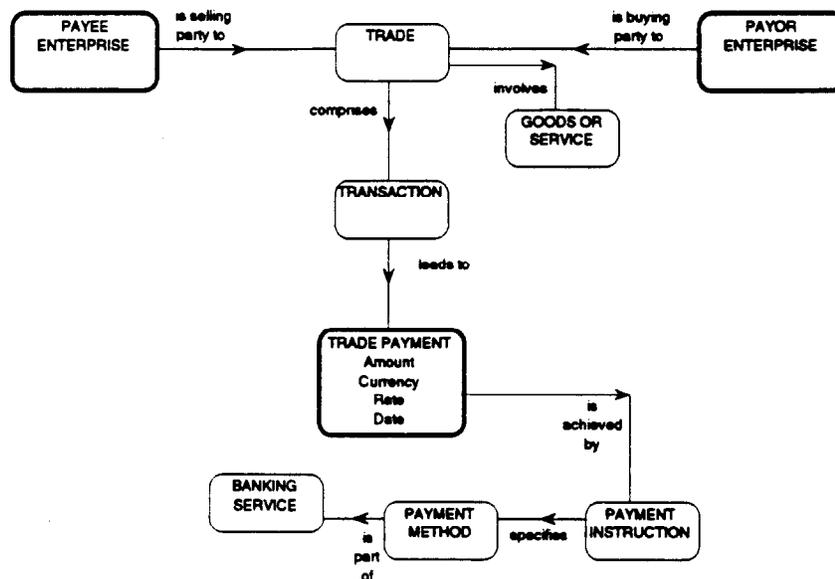


Figure 12: The heart of the payments concepts model

Following development and refinement of the concept model, a questionnaire was circulated to selected corporate banking customers, and further review sessions with the research sponsors were undertaken. This all helped to indicate what could and should be done.

The key findings of this study were:

- Arrangements for achieving payments are perceived as complex and they *are* complex. There is a wish to have simpler arrangements.
- The cost of payment services is a critical issue. It is unlikely that there will be any significant take up of financial EDI until the cost is demonstrably less than traditional payment services.

- There is a range of opportunity for new services, from further automation of existing activities through to completely new services based in more adventurous use of information relating to payments, which *would* be seen as valuable by corporate banking customers.
- The potential for value adding services is there, but the banks are not seen as an appropriate source of such services. The wider third party role is critical to the future of the banks and needs to be properly understood.
- Rightly or wrongly, it is perceived that the banks have an "attitude problem" in the provision of new services. It may be easier to provide new services through the creation of new banks, with a new image and new ways of working. This has already demonstrated at the level of personal banking services¹⁵.
- There is more evidence of success with EDI on the *supply* (payments) side where benefits are largely limited to cost saving and marginal performance improvement. Corporate customers would appreciate more help on the *customer* (collections) side, where there is greater business advantage to be had, and much greater long term business benefit in terms of expanded markets and higher volumes of business. For the average business it is *not* all about payments to suppliers, it is about service to customers. When the banks can find a way of helping their customers provide service to *their* customers, then there will be a way forward.

A series of recommendations were made to the sponsoring bank, based on the detail of this analysis.

¹⁵ Specifically: Firstdirect in the UK, where in 1993 1300 banking employees serviced 400,000 accounts, 24 hours a day, 365 days per year - through the use of completely new telephone banking procedures *and* with value adding services thrown in.

CONCLUSION

The four studies have each exercised the analysis method in a different way, and although none of them demonstrate a complete iteration of the method to a "final" conclusion, this would not actually be a proper reflection of real life. Nothing stands still, and at the level that these studies were pitched we were not trying to find a fixed basis for a single solution, but stimulation for new thinking about the business.

Benefits of the analysis method

It has been shown that the analysis method is particularly helpful in achieving:

- Completeness in the analysis of business opportunity, combined with a degree of relaxation in the application of the "traditional" rules for structured business analysis.
- Ideas for *business process improvement*, based on rapid analysis of processes by decomposition.
- Ideas for *business process redesign*, based on flow analysis of both information and materials.
- Ideas for *business process invention*, based on entity analysis as a rapid management brainstorming technique.

The four studies exercised these concepts, ideas and analysis techniques in different combinations, and with this practical experience behind us we now have a tried and tested business analysis method which is already being deployed in further studies.

The last of the benefits listed above is perhaps the most interesting. Many people talk about business process redesign (or re-engineering) but few have a thought for the special case when an *entirely new* vision of the business is required. In these times of constant change, when the most promising strategies are aimed at survival and success comes from rapid response to change, we might expect that this kind of approach to the problem of business process management by *invention* will be particularly useful.

Directions for future work

At the start of this paper it was shown that structured analysis techniques were likely to assist in seeking efficiency, effectiveness and evolutionary benefits. It was further shown that numerical analysis techniques would supplement analysis at the efficiency end of the scale, and conceptual models at the evolutionary end of the scale. Current work with the method is aimed at further developing these extensions to the idea. In a new research project dealing with information management in the supply chain, new ideas are being explored to examine the way in which information can be used for business advantage.

Also at the start of this paper was a model for maturity, drawn from the relatively tight confines of the software engineering community. The analysis techniques described here have applicability at all levels of the maturity model, as has been shown. Whether it is a small start up operation like NSA, or a pairing of mature companies like BP and BT, it is possible to make a contribution to new thinking about how these businesses might be systematically improved.



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Finally, we must acknowledge the help given by Brian Morgan, who during the early development of the method allowed us to re-analyse material originally prepared when he was managing director of Heenan Drives, and helped us by reviewing the results from a senior management viewpoint¹⁶.

¹⁶ The reader should note that the illustrations based on Heenan Drives are not in any way intended to show the business as it is today. They are based in a period of significant change during the 1980s, when Brian Morgan was overseeing the introduction of radical new product developments and manufacturing processes.

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