A STUDY OF BUSINESS INTEGRATION METHODS

by

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PULLOUTS

DECLARATION OF AUTHORS RIGHTS

To my wife Margaret

and

daughters Yasemin and Melissa

for their invaluable support.

CONTENTS

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ABSTRACT

Business-wide integration is a key strategic objective for survival in a global market place. The objective of the work presented in this thesis was to conduct a detailed study of business integration methods with a view to identifying development areas and developing the necessary methods, procedures and tools to address these gaps.

Following a literature review the following development needs were identified:-

- A Reference Model
- An Audit Method
- A Methodology

The latter part of this thesis presents, in detail, the Reference Model, the Audit Method and the Methodology which has been developed to fulfil the gaps identified.

The Reference Model identifies six performance areas and criteria which an organisation would need to fulfil to achieve business-wide integration.

The Methodology provides necessary framework, tools and techniques to achieve the performance criteria specified within the Reference Model. The Methodology consists of six main phases which ensures that the business vision, objectives and strategy are deployed through various functions down to operational processes. This is achieved through the use of an integrated set of performance measures.

The Audit Method provides a set of procedures to measure an organisations performance against the criteria identified within the Reference Model. It is also used to measure the effectiveness of the methodology towards the achievement of the Reference Model.

The application of the Methodology is illustrated through three different case studies. All three case studies, through the Audit Method, demonstrate that the application of the Methodology has resulted in considerable and measurable improvements in the levels of integration.

Throughout the thesis emphasis has been placed on the research methods employed. The thesis concludes with a review of the work done and the research methods employed.

CHAPTER ONE

INTRODUCTION

1. INTRODUCTION

1.1 GENERAL INTRODUCTION

Today worldwide competition between manufacturing enterprises is increasing significantly. To survive, grow and maintain margins of profit, companies have to compete on product, price, quality and service. Facing these challenges a business can improve its competitive position through better integration. Within the total business context, the integration of individual business functions is now being regarded as a competitive weapon in the market place. Many organisations, large and small, are including within their strategic objectives specific goals focusing on achieving business excellence through integration.

The need for business integration has been recognised for some time. Research focusing on systems integration has resulted in a number of methodologies. These methodologies may be categorised as follows:

- Hard systems methodologies
- Soft systems methodologies
- Hybrid methodologies

Hard systems methodologies places emphasis on the mechanistic aspects of businesses. Although they are rigorous they fail to take account of the human aspects which is a vital integrating factor of any business. On the other hand the soft systems methodologies, which place greater emphasis on the human and fuzzy aspects of a business, lack the rigour of hard systems methodologies. Hybrid methodologies attempt to

combine the rigour of hard systems approach with the human and fuzzy features of the soft systems approaches.

Although, at present there are a number of systems integration methodologies available, they were developed primarily to aid integration of computer systems within a business, rather then integration of all aspects of a business. An added complexity is that some of these methodologies require the use of complex tools and techniques not easily accessible to industrialists operating in the small to medium sized enterprises due to lack of specialist skills and extended learning curves.

Many organisations attempted to achieve integration and regain lost competitiveness through application of rapidly developing computing technology for design, planning and control of business. However, to date, the reality has been disappointing. Although the technology has shown remarkable advances, often producing significant benefits for individual company functions, in many cases overall company benefits have been limited. The main reason behind this is that technology in itself failed to achieve total business integration.

The main objective of the work presented in this thesis has been to conduct a study of methods, tools and techniques for business integration. In conducting this study a number of development gaps were identified and appropriate tools and techniques were developed to address these gaps. The appropriateness and the validity of the

newly developed tools and techniques have been tested through their application in case study organisations.

In the context of this thesis the word "integration" is used in its broadest sense. It is not specific as in Computer Integration, which aims to integrate computerised islands of automation. Integration, within a total business context, is defined as follows:

> *"All functions of a business working together to achieve a common goal, using clearly defined objectives, benchmarks, disciplines, controls and systems in a flexible, efficient and effective way to maximise value added and to minimise waste."*

1.2 THESIS STRUCTURE

This thesis presents the work done to develop a methodology for total business integration. The thesis is structured in the following fashion:

- Chapter 2, titled "Background", outlines the historical development of the concepts behind business integration and details the broad aims of the work presented in this thesis.

- Chapter 3, titled "Literature Survey", provides detailed survey of work related to integration and from this survey develops a requirements specification for a methodology which would facilitate total business integration.

- Chapter 4, titled "Existing Methods for Business Integration", critically reviews the existing methodologies for business integration with reference to the requirements specification compiled in chapter 3. The concluding section of this chapter presents the final objectives of the work presented in this thesis.

- Chapter 5, titled "Review of Management Research Techniques", reviews the management research techniques in relation to the objectives and nature of the work presented in this thesis. This section concludes with the specification of a research plan which would ensure that subject area is researched and developed with appropriate rigour.

- Chapter 6, titled "Reference Model" based on the findings from the literature review and research conducted develops a reference model for business integration. This section concludes with a discussion on how the reference model reflects the key issues identified during the literature reviews and interviews.

- Chapter 7, titled "The Audit Method" outlines the procedures developed to measure the level of integration within a company. Emphasis is placed on discussing the specific limitations of the technique in the concluding section of this chapter.

- Chapter 8, titled "A Methodology for Business Integration" details the methodology developed. In this chapter emphasis is

placed on providing an insight to the detailed functionality of the methodology. This chapter concludes with an evaluation of the methodology with respect to the Requirements Specification and the Reference Model.

- Chapter 9, titled "Evolution of the Methodology" provides an insight in to the logical thinking behind the development of the methodology.

- Chapter 10, titled "Case Studies" discusses the application of the methodology in three different organisations. The practical considerations and the resulting benefits and limitations are also outlined in this section.

- Chapter 11, titled "Discussion" provides a critical review and discussion of the work presented in this thesis. Emphasis is placed on the research methods employed, the research results and the contribution of this work to the field.

Chapter 12, titled "Conclusions", presents the final conclusions of the work and makes recommendations for future work. This chapter concludes with the authors closing comments.

CHAPTER TWO

BACKGROUND

2.0 BACKGROUND

2.1 WHY INTEGRATION ?

Over the recent years phrases such as:- "manufacturing integration", "business integration", "computer integrated manufacturing" and so on, have been commonly used within the strategic objectives of a variety of organisations operating in either the manufacturing or the service sector. The critical question is "Why do we want integration?"

Integration for the sake of integration is obviously not a valid goal. Therefore integration must be seen as a means of improvement. When an organisation takes a positive step towards integration it must be able to demonstrate some level of improvement. This improvement should contribute towards the bottom line business performance. For example, an improvement in product quality or staff morale will have a direct effect on business performance but an improvement in sales without having the production capability to meet the increased sales may have, in the long term, an adverse effect on business performance.

Therefore the objective for business integration must be to achieve total business improvement and to avoid sub-optimisation. In achieving this improvement the integration process should also install the necessary disciplines and controls to ensure that the improvement is sustained and opportunities for further improvements are exploited.

2.2 BACKGROUND TO BUSINESS INTEGRATION

The concept of integration was born approximately three decades ago. The study conducted by Lawrence and Lorsch (1967) concluded that sucessful organisations would demonstrate superior levels of integration. Throughout the seventies and eightees the importance of this concept grew with the increasing use of computers in the industry. For manufacturing industry, initially, the focus was on isolated automation of repetitive manufacturing activities. Simultaneously, the same technology was utilised in the development of the management and support activities.

Figure 2.1 illustrates the parallel development of various computerised business modules leading to the concept of Total Business Integration.

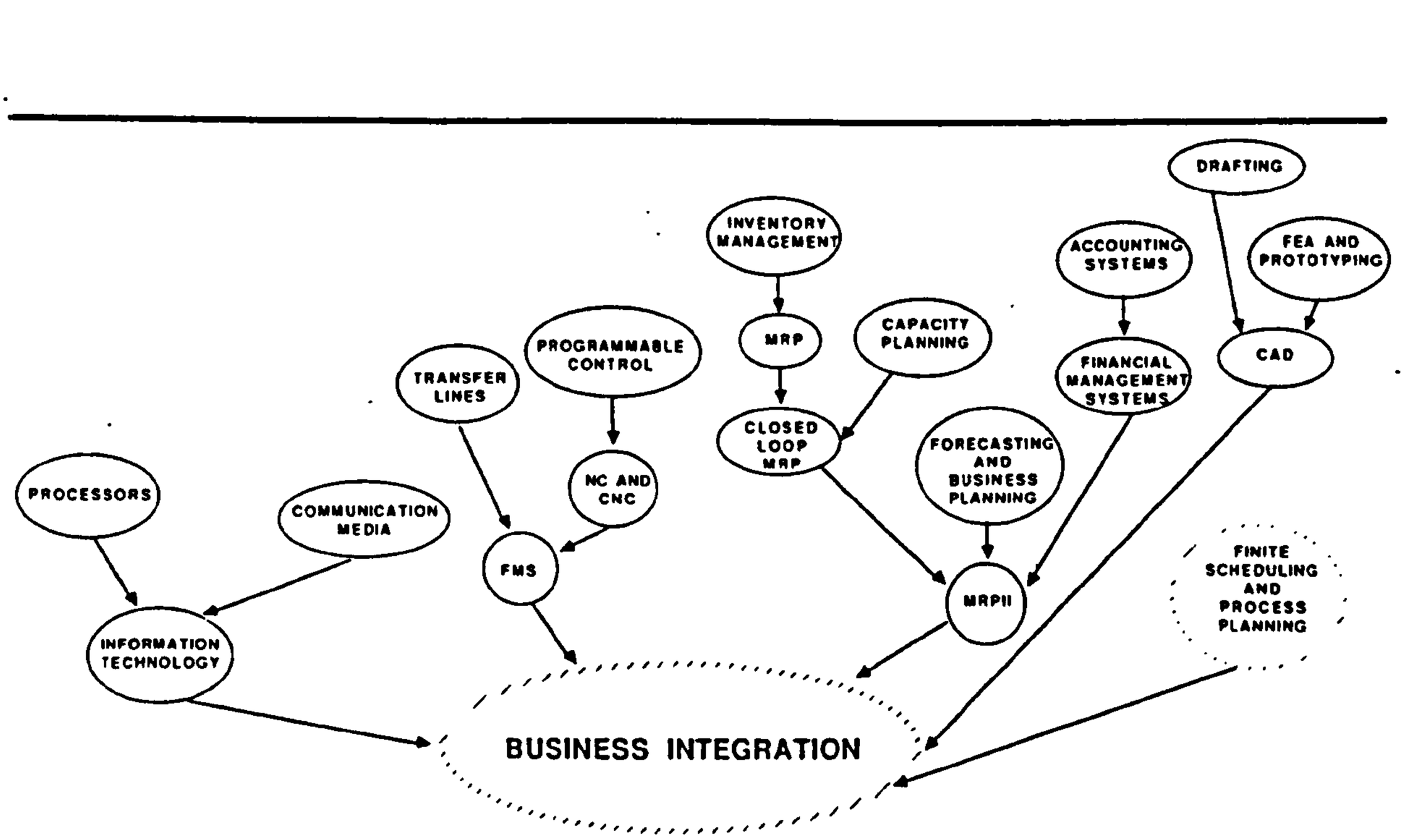


Figure 2.1 Development of Business Integration Concepts.

During the early seventies the rapid developments in programmable technology for real-time control resulted in the development of sophisticated production equipment such as Numerical Control (NC), then Computer Numerical Control (CNC) machines, Robotics and Automated Guided vehicles (AGV). By the late seventies and early eighties this technology was widely available off-the-shelf and was in common use. Further developments eventually resulted in Flexible Manufacturing Systems (FMS).

FMS involved a number of computer controlled machines, robots, conveyors, etc, operating under the command of a host computer to produce specified range of products. During the early days, FMS was the state of the art as far as manufacturing systems integration was concerned. It represented the ultimate level of integration between computer controlled equipment. However this status was short lived as companies who took the bold steps to invest in such systems found that FMS alone failed to deliver the expected benefits. It rapidly became clear that there were fundamental issues of much greater importance which needed to be addressed before one could justify investment in FMS.

The main reason behind the initial failure of FMS was due to its isolation from the rest of the organisation. It was purely an island of automation. In many cases it did not integrate with its upstream and downstream operations. It also failed to integrate with the higher level planning and control systems. In many cases it was a sub-optimised element of the total business.

Whilst the development of production systems was continuing, considerable progress was also being made in the integration of management and support systems through computerisation, such as materials management, factory planning, design (CAD), financial management and personnel management. Initially these systems were developed and implemented in isolation as islands of automation. Again this led to sub-optimisation of discrete business processes.

As the technology developed, opportunities for integration of these islands of automation were identified and implemented. The approach employed for materials management, for example Materials Requirement Planning (MRP), provided a powerful platform for further development. The integration of production scheduling and capacity planning with MRP resulted in the Closed-loop MRP. The integration of business planning and financial management elements with the Closed-loop MRP systems led to the development of Manufacturing Resource Planning (MRP II) systems.

Throughout the eighties MRP II systems developed at a phenomenal rate. With the rapid improvements in the computing hardware and software technologies and the relative decrease in costs, MRP II systems were and are still being implemented by companies of all sizes, as a means of achieving business wide integration.

However, MRP II also had its problems. A large number of applications failed to return their expected benefits. Some implementations actually resulted in serious business problems. A survey published by Fisher

(1989) show that those implementations which adopted a structured approach and treated the project as a business project rather than a mere systems project were the most successful implementations.

Above discussion shows that the principles and concepts of integration developed in a modular fashion, and were led primarily by the technology where each module created an island of automation. Figure 2.2 illustrates the relationship between various business modules. The current levels of technological integration between these modules is also illustrated. Those interfaces where there is a proven level of integration, are joined together with solid lines. Those interfaces which require further development are joined together with broken lines. Figure 2.2 shows that there is a high level of technological integration between modules which fall under the umbrella of MRP II technology. Similarly, the various components of FMS technology are also well integrated (Bititci et al, 1989).

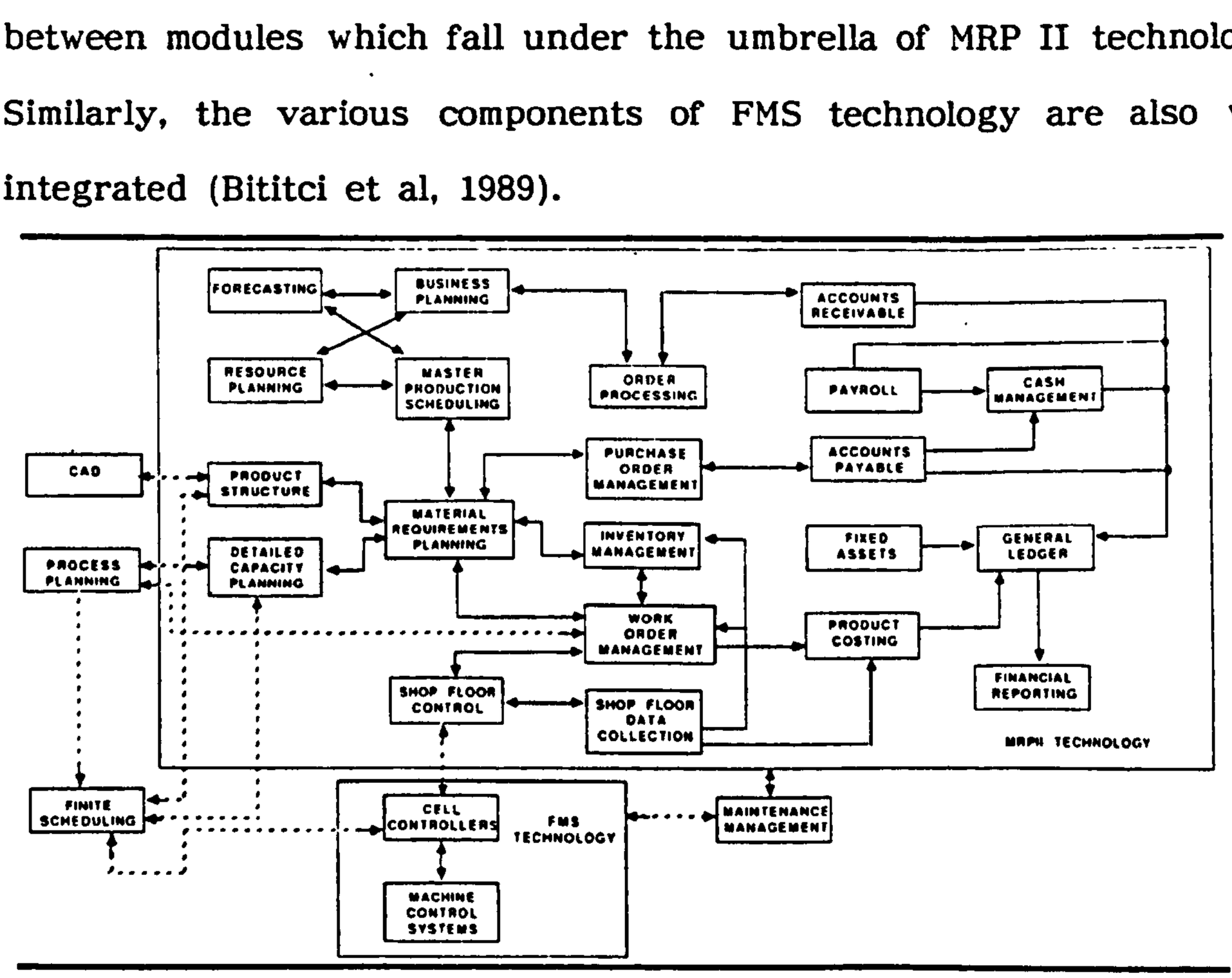


Figure 2.2 Integration between business modules.

The modules which fall within the MRP II technology area as shown in figure 2.2 cover a wide range of business activities, such as strategic planning, production planning, production control, financial management, inventory and procurement control.

The question is: "If these technologies are available and proven, why did their application fail to achieve the expected improvements?"

2.3 THE NEED FOR AN INTEGRATED BUSINESS PLATFORM

The reasons behind the failure of these systems in achieving the originally planned benefits are not due to technological deficiencies, but are due to lack of structures, frameworks, reference models, standards, techniques and methods to facilitate project management and control. Both the academic and industrial communities now recognise that technologically a plateau has been reached where the technology is no longer the constraint, but methodologies are required to define the route to integration.

To expand on this argument the case of MRP II may be taken for an example. MRP II technology which is available off the shelf today has developed over a number of years. At present there are over 200 MRP II systems available in the market place. Through the years MRP II has proven itself to be a technologically integrated business wide information system. However it must be stressed that implementation of MRP II technology does not necessarily lead to an integrated business.

The successful applications of MRP II where the expected business benefits were achieved, were implementations based upon an integrated business foundation. In contrast, those implementations expecting to achieve business integration as a result of implementing MRP II without first integrating the main business processes resulted in failures (Fisher 1989).

The conclusion to be drawn from this section is that, although the available technologies may be reasonably well integrated, they do not provide the solutions to achieve total business integration. ***Therefore the research and development effort on integrating methodologies must be directed towards achieving business integration independently of the available technology.*** Figure 2.3 illustrates this concept, where the integrating methodology is applied to create a sound integrated business platform, considering only the needs of the business. Only then should the relevant computerised modules be consciously applied focusing to maximise business benefits.

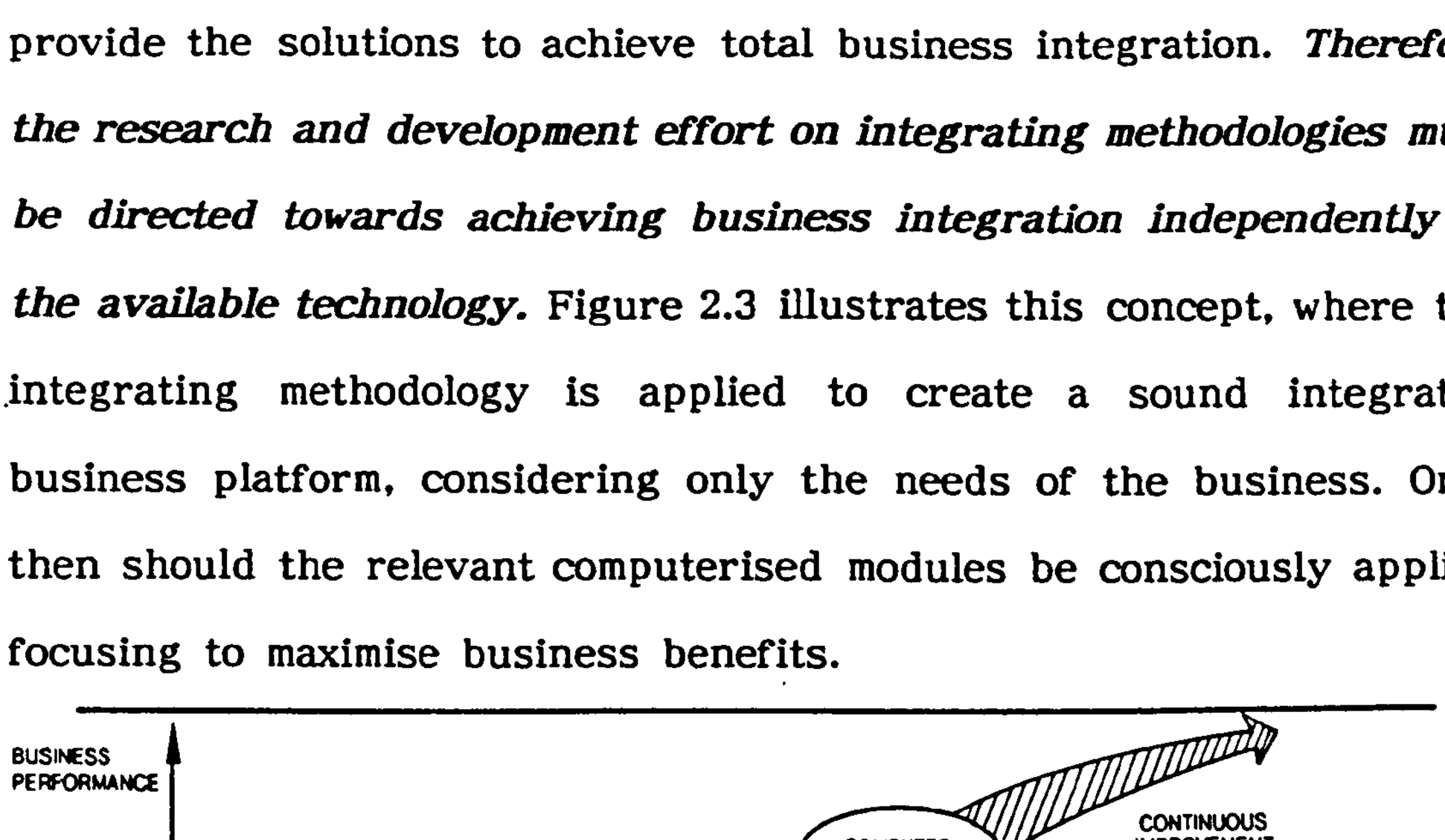


Figure 2.3 The route to CIM through an Integrated Business Platform.

This conclusion is supported by Self (1992) and Hodson & Waterlow (1992) which make it clear that the business modules outlined earlier in figure 2.2 should be seen as techniques which may be used if appropriate and justifiable, not as philosophies or goals in their own right.

2.4 CONCLUSION

Although the original concepts of business integration have developed from information technology roots. Today integration is seen as a concept which is independent of the technology and which extends across all aspects of business encompassing business objectives, people, systems and technology.

Therefore the definition of integration introduced in chapter one of this thesis remains valid. That is:-

> *"All functions of a business working together to achieve a common goal, using clearly defined objectives, benchmarks, disciplines, controls and systems in a flexible, efficient and effective way to maximise value added and to minimise waste."*

To this end the general aim of the research work presented here was to conduct a study of business integration methods to identify development needs and go on to develop methods, tools and techniques to address these needs and facilitate the achievement of an integrated business platform as described earlier in this chapter.

CHAPTER THREE

LITERATURE SURVEY

3.0 BUSINESS INTEGRATION LITERATURE SURVEY

The objective of this chapter is to survey relevant work relating to business integration and compile a comprehensive requirements specification for a methodology which would facilitate business wide integration.

The vast majority of the recent research focuses on the development of effective methods, practices, tools and techniques to facilitate improvements in various aspects of a business. These range from tools and techniques for specification and design of integrated computer systems to methods and techniques for organisational modelling and business performance improvement. This chapter provides a broad but shallow review of all these tools, techniques, practices and methods. There are a number of methods available specifically focusing on business integration, These are:-

- Manufacturing Business Redesign Methodology
- The Arthur Andersen Method
- The Gemini Approach
- Bozz Allen and Hamilton Approach
- The PRTM Method
- The Strathclyde Institute Method
- Strathclyde Integration Method

A more detailed review of the above methods is provided in the following chapter.

3.1 AN OVERVIEW

At the very early stages, research into business integration recognised that correct analysis and definition of the supporting information system is of critical importance to realisation of business wide integration. The information system is analogous to the nervous system of a human being, since it controls the behaviour of the business it is supporting, ie "INFORMATION INTEGRATED ENTERPRISE".

Having recognised the importance of the information systems to create an integrated business environment, the majority of the current work on integrating methodologies is based on information systems analysis and definition. In many cases, these methodologies make use of systems analysis techniques, such as data flow diagrams, entity relationship diagrams, and activity cycle diagrams. The methodologies themselves define the appropriate application of these techniques in order to analyze and design an effective and efficient business system. A review conducted by the GRAI Laboratory (Chen et al, 1990) provides a summary of these techniques.

On the other hand, with the increasing competition on a worldwide scale and due to the recent world recession, there has been considerable emphasis placed on streamlining of business activities for improvement of business performance. Work in this area focuses on the

business needs and order winning criteria to develop techniques and methodologies for business performance improvement through better integration. In the context of business integration, developments on the Total Quality Management concepts and principles also provide some guidelines, methodologies and frameworks for business improvement and integration. These TQM oriented methodologies also take account of the softer aspects of business.

In summary, over the recent years research into business integration has been developing in two directions:

- Information Systems Oriented Methods
- Business Oriented Methods

The literature review presented in the following sections provides an insight into the current research, tools, techniques, methods and practices which relate to business integration.

3.2 INFORMATION SYSTEMS ORIENTED METHODS

Information technology oriented methodologies may be categorised as follows:

- Frameworks and standards
- Hard systems methodologies
- Soft systems methodologies
- Hybrid methodologies

The following subsections provide further detail on each of the above categories.

3.2.1 Frameworks and Standards

The European Programme on Research and Development for Information Technology (ESPRIT) was launched in 1984 with the objective of improving the competitiveness of the European industry through cooperative research and development. Open Systems Architecture for CIM (CIM-OSA) is a major ESPRIT programme with the objective of defining an architecture for the building of a computer supported and integrated manufacturing enterprise (ESPRIT Consortium AMICE, 1991). This architecture is subdivided into three models to provide the basic building blocks for the design and implementation of CIM systems. The three models are:

- Requirements definition model
- Design specification model
- Implementation description model

During the early stages of development this project recognised that, to address the many problems of the manufacturing industry, integration had to be achieved at three levels. These are shown in figure 3.1

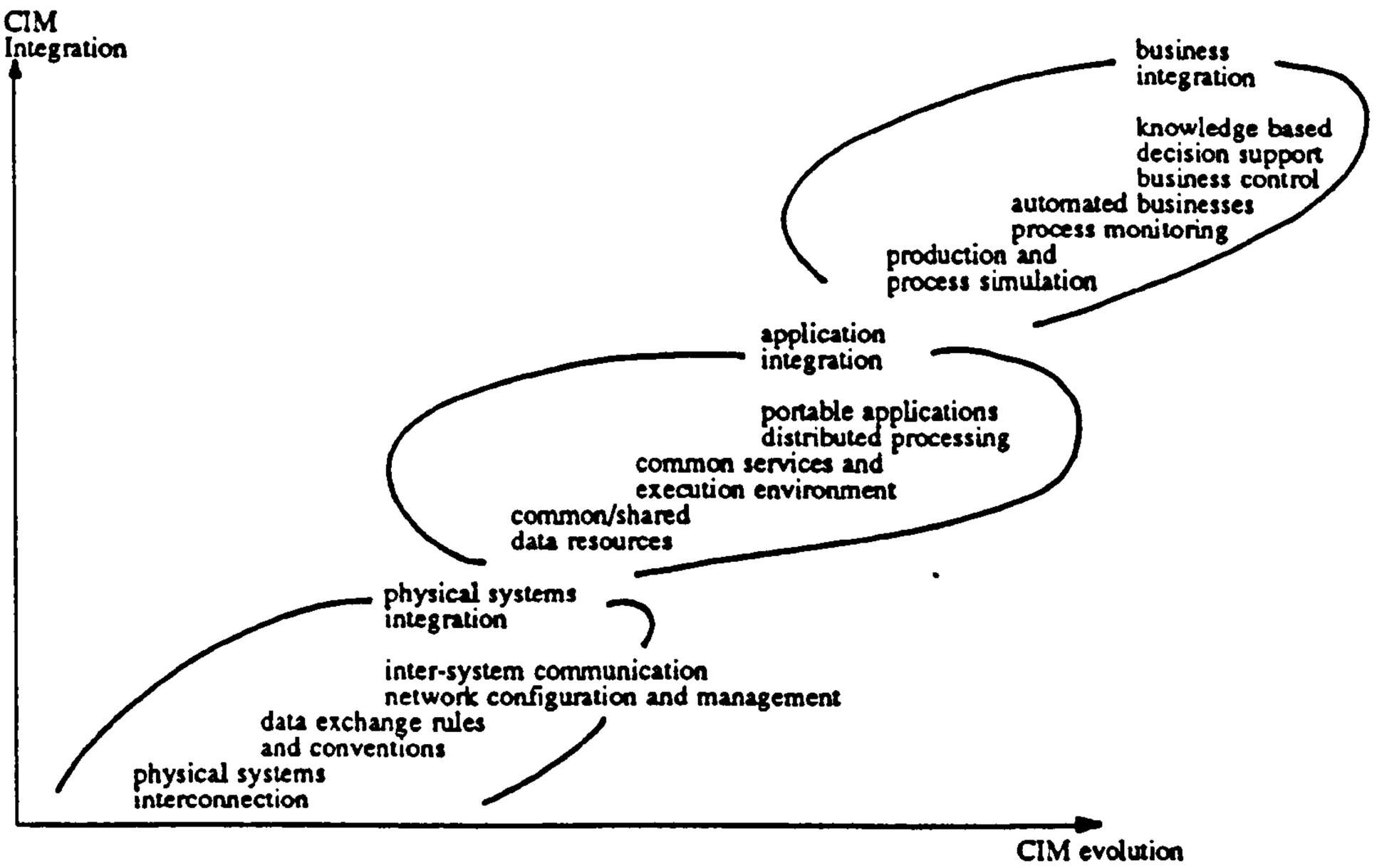


Figure 3.1 The ESPRIT - AMICE integration concept

Physical system integration is mainly concerned with communication between physical systems. Integration at this level falls within the brief of current concepts and standards (Stacy A H, 1988 and DTI 1987), such as Open Systems Interconnection (OSI), Manufacturing Automation Protocol (MAP) and Technical Office Protocol (TOP). Kosanke (1991), with reference to this framework, clearly states that further concepts and methodologies are required for application integration and business integration levels.

The current status of the AMICE project is that it has developed an overall concept for the modelling framework (Russell, 1991) and the integrating infrastructure

(Querenet, 1991). These concepts have now gained worldwide recognition and provide the basis for international standardisation activities.

The report titled Technical Issues of Enterprise Integration (MCC, 1991) provides an overview of the current work relating to business integration. This report recognises that in many cases better integration is achieved through purely cultural changes, but also makes it clear that computing technology plays an important role in business integration. The emphasis of the report is on the application of computing technology for enterprise integration. The study presented in this report outlines various research and development efforts, including the CALS Programme, CAD Framework Initiative, CIM-OSA Project, DAPRA Initiative on Concurrent Engineering, Engineering Information Systems Programme, IDEF User Group, Integrated Information and Support Systems Project, MCC Enterprise Integration Project, Portable Common Interface Set Programme, Product Data Exchange Initiative, USAF Enterprise Integration Framework.

The MCC report summarises that a number of the above consortia and standards bodies are working towards harmonisation of the integration related standards. The objective of this work is on the creation of a computing

infrastructure to sustain preliminary business integration solutions.

3.2.2 Hard Systems Methodologies

These methodologies make extensive use of the techniques described earlier in this section. Therefore they provide a rigorous and structured approach. During business analysis and development phases they focus on the mechanistic elements of the business and generally fail to understand and account for the human aspects of a business. Because they are mainly analyst oriented, the application of hard systems methodologies on their own fail to pull together all aspects of a business. In particular, they fail to achieve user ownership. Therefore their use should be limited to analysis and development of mechanistic processes.

Commonly used methodologies which fall into the hard systems category are:

- I.CAM methodology (CAM.I Architects Manual) using the IDEF0, IDEF1, IDEF2, IDEF3 and IDEF4 techniques

- Stardis methodology (Gane and Sarson, 1977)

- Information engineering methodology (Inmon, 1988)

- DeMarco, Ward and Mellor and Yourdon methodologies (Page-Jones, 1988)

- GRAI methodology, comprising the GRAI Grid and GRAI Net techniques (Doumeingts, 1989).

- D2S2 methodology (McDonald and Palmer, 1982)

3.2.3 Soft Systems Methodologies

Methodologies which fall into the soft systems category do not assume that the development of a computer system is necessarily the solution to the problem. Therefore they do not rely on the information systems techniques discussed. These methodologies tend to be more people oriented and they take account of the socio-technical view. These methodologies address the fuzzy, ill-structured issues within a business. However in achieving this they lack the structure and rigour of the Hard Systems methodologies.

A significant difference between the hard and soft systems thinking is that hard systems approach assumes a goal and is concerned with "how" to achieve this goal. The soft systems approach considers the business objective as a whole, which may consist of a number of conflicting goals.

The soft systems approach focuses on the "what" as well as the "how" of a system.

The most commonly applied soft systems methodologies are Soft Systems Methodology (Checkland, 1981) and ETHICS (Effective Technical and Human Implementation of Computer-based Systems) (Mumford, 1979).

Checkland and Scholes (1990) in their book titled Soft Systems Methodology in Action, point out that SSM accommodates individuals' perceptions of the world and translates these into processes. In principle SSM combines the logical based stream of analysis which is inherent in many hard systems techniques with the stream of cultural analysis which is deemed to be very important for accurate analysis and modelling of practical systems.

Trought (1993) argues that hard systems or soft systems methods alone are not sufficient for accurate analysis and modelling of organisations. He states that:-

- Soft systems techniques more readily address messy organisational issues which tend to be strategic and long term.

- On the other hand hard systems techniques more readily address operational issues which are shorter term.

- Therefore there is a need for hybrid techniques which combine the relative merits of hard and soft systems techniques.

3.2.4 Hybrid Methodologies

MULTIVIEW (Wood-Harper et al, 1985) is a methodology developed by the integration of soft systems and hard systems concepts. However it again concentrates on computer integration rather than total integration. Unlike other methodologies its use is specific to small scale computing projects, where off-the-shelf software packages are used rather than specifying and developing tailored systems.

The MULTIVIEW methodology relies on the involvement of the end user throughout the project. This obviously maximises the ownership. Its authors claim that MULTIVIEW incorporates all views - ie organisational, technical, human and economic - to achieve maximum integration and optimum fit between the users and the implemented system. It achieves this through the following phases:

- Analysis of human activity system
- Information modelling
- Analysis and design of the socio-technical system
- Design of the Human-Computer interface
- Design of the technical sub-system.

Similar to MULTIVIEW, the SERC-ACME funded research programme in Manufacturing Integration (Carrie and Bititci, 1990 and Carrie and MacIntosh, 1992) focuses on the problem of manufacturing integration from three viewpoints. These are:

- Organisational viewpoint
- Material flow viewpoint
- Information systems viewpoint

When the three views are fully developed, defined and consolidated they provide a complete and integrated description of a system. This programme has made considerable progress towards achieving its objective. Individual methodologies for organisational, material flow and information systems views as well as an all-embracing methodology have now been developed. Details of this method together with other methods and techniques are discussed in further detail in chapter four of this thesis.

3.3 Business Oriented Methods

Many of the total quality oriented methodologies for business integration are primarily based on TQM concepts developed by quality gurus, such as Crosby (1980), Deming (Neave, 1987), Juran (1988), Feigenbaum (1991). Key ingredients of these concepts are:

- Management commitment
- Total participation through multi-functional teams
- Identification of current and potential quality problems
- Evaluation cost of quality
- Education and training
- Establishment of quality goals
- Communication of problems and obstacles
- Recognition of contributors

In this category, although there are a number of complete methodologies, the majority of the published work concentrates on specific aspects of business improvement and integration. The following paragraphs provide a brief overview of some of these current methodologies and work-in-progress.

The Production Engineering Research Association report (PERA, 1991) describes a three phased approach to TQM implementation. The three phases adopted by PERA are:

- Understanding six key concepts, which are:
    - Internal and external customers
    - Never ending improvement
    - Control of business processes
    - Upstream preventative management
    - Ongoing preventative action
    - Leadership and teamwork
- Addressing six managerial elements, which are:
    - Communication of the mission aims and objectives
    - Collection of external intelligence
    - Measurement of internal performance
    - Identification of improvement areas
    - Implementation of changes
    - Steering and coordination of the total quality programme
- Launching a total quality programme based on a six stage plan, which is:
    - Statement of intent
    - Provision of awareness
    - Diagnosis of problems
    - Initial strategy
    - Management consensus
    - Launch of improvement programmes

The methodology for the implementation of TQM proposed by Cullen and Hollingum (1987) is based on the following concepts:

- Elimination of waste by making things right the first time
- Improving customer satisfaction
- Continuous improvement of products and services
- Involvement of all people

This methodology proposes a six phase approach. These phases are:

- Understanding
- Top management commitment
- Company wide awareness
- Planning
- Implementation
- Review

One limitation of Cullen's methodology is that it takes a 'Hard' approach to TQM implementation by focusing attention only on business processes. It fails to address the softer issues surrounding business integration and improvement.

Whittle et al (1992) propose a framework for understanding and improving the implementation of the soft aspects of TQM in manufacturing companies. Three models are described, these are:

- The visionary model
- The learning model
- The planning model

The framework enables transition between the three models, allowing change programmes to meet the needs of the company.

All the methodologies for TQM outlined in the above fail to address the key issues identified in a recent survey conducted by AT Kearney (1992). This study reveals that 80% of the TQM programmes fail to return the initially expected benefits because they lack:

- An integrated approach to ensuring that the improvement actions are in-line and complimentary to the business objectives and direction.
- Integrated performance measures to focus improvement actions.
- An emphasis on tangible results.
- Top management understanding and commitment.

The framework proposed by Mann (1993) for implementation of TQM contains 15 elements. Within this framework there is a seven step methodology which includes:-

- TQM education and training of management board
- Management Board review of the TQM implementation framework

- Appointment of an assessment team
- General plan of TQM implementation and appointment of a planning team
- Detailed plan of TQM implementation
- The implementation of TQM
- Monitoring of TQM

Within this framework, Mann addresses some of the issues identified by AT Kearney (1992). In particular, it recognises the criticality and need for the integration of performance measures to achieve business integration. However he does not specify how to establish this integrated set of performance measures.

Pimbolt (1992) and Allen (1992) emphasise the need for planning and use of trained and educated people through Quality Improvement teams to achieve business improvement. Shaskin and Kiser (1992) stress that the key to successful implementation of TQM to achieve business improvement is effective leadership and commitment at all levels. Sheehy (1992) emphasises the importance of focusing on early success in order to ensure that the improvement momentum is maintained. Emphasis is also placed on the importance of planning and education. Schranot (1992) and Goehring & Smith (1992) identify that recognition of the internal and external customer/supplier relationship is the key step towards continuous business improvement.

Tolstoy (1992), Johnstone & Daniel (1992) and Klausland (1992) state that company vision and values, human resource development, customer focus, performance measurement and quick response to change are key elements of successful TQM programmes. Bajpai and Willey (1992) emphasise the importance of cost of quality, types of performance measures and the relevance of BS6142 "Guide to the determination of quality related costs" for business improvement.

Nigel Slack in his presentation at the Operations Strategy and Performance Measurement Workshop held at Cambridge University during May 1993 demonstrated the importance of employee's business awareness, ie an employee's ability to understand his or her role and contribution towards the overall business vision and objectives.

Oliver (1992) stresses the importance of commitment for the success of any type of company improvement programme and outlines a model for ensuring commitment. This model includes explicitness, revocability, measurability and publicity. Similarly, Tyrrell (1991) identifies lack of management commitment as the prime reason for the failure of most TQM programmes.

Ovretvat (1992) proposes an approach for measuring customer perceptions of service quality. This is a market-

focused approach, analyzing the behaviour of customers and relating these to customers' and suppliers' perceptions. Emphasis is placed on the importance of measures of customer satisfaction to facilitate business improvement. The approach focuses largely on external customers and pays little attention to the internal customers of a business.

Hartlen (1992) identifies management of information systems and communication as of critical importance in achieving TQM through integrated information systems. In this context information systems refer to all types of communications within companies, whether manual and computerised.

Wilkinson et al (1991) finds a strong tie between soft aspects of TQM and its success. The paper demonstrates, through case studies, the impact of effective human resource management through communication of business objectives and employee participation on business performance improvement. Harber et al (1991) emphasises the importance of participation by employees at all levels on business performance. The paper clearly identifies the need for ensuring ownership of all changes at all levels within the organisation.

Memmott (1992) and Decieri (1992) identify employee commitment and involvement, team oriented multi-functional problem solving groups and use of performance measures as key requirements for successful management of change and business improvement. Sowards (1992), Atkinson (1991) and Jones (1988) stress the importance of well planned and well structured programmes for successful management of change and installation of a TQM culture.

Reicheld and Sasser (1990) describe the effect of the quality revolution in the services industry. The discussion concludes that as the number of service defects reduce the profits increase. This is related to the maintenance of customers over long periods by becoming customer focused. A company wide awareness of customer requirements, and incentive schemes to encourage individuals to ensure that all services satisfy these requirements, are seen as the critical factors in reduction of service related defects.

Kinchin (1992) emphasises the process oriented approach and considers each department as a process. The paper states that clarification of departmental accountability and definition of formal interfaces are the critical factors in business integration.

Eccles (1991) identifies the movement towards increasing use of non-financial performance measures in order to develop measurement systems which accurately relate to the firms' business strategies. Sink (1986) also discusses the importance of performance measurement with respect to business improvement. In this paper a five step approach to business improvement is described. The five stages are:

- Strategic planning process
- Input/output analysis to understand the current systems and evaluate the existing performance criteria
- Road block identification, analysis and removal
- Development of personalised scoreboards
- Creation of visibility

Lunio (1991) states that performance measurement and benchmarking is going to be recognised as one of the most powerful and important management tools of this century. Further, CBI (1992) who state that the establishment of performance measures and benchmarks in terms of quality, service and cost has to be a priority for the UK industry. Similarly, Young (1993) emphasises the importance of performance measurement and benchmarking for continuing business improvement. Young's paper outlines a four stage approach to benchmarking. The four stages are:

- Planning
- Analysis

- Integration
- Action.

Kochhar (1992) in his application for a SERC-ACME research grant on "Performance Indicators and Benchmarking in Manufacturing Control Systems" identifies the need for an integrated set of financial and non-financial performance measures for manufacturing control systems. Kochhar's proposed research aims to create a framework which shows the relationship between various performance measures and identifies realistic and comparative benchmarks.

Wisner and Fawcett (1991) state that one of the most important areas for international industrial competitiveness is performance measurement. The paper presents a review of the performance measurement literature and concludes that apart from "trimming the fat" to increase productivity, performance measures must be developed which are consistent with the long term competitive business strategy.

Vora (1992) identifies a definite need for integration of performance measures used at various levels of an organisation. Vora's study specifically shows that the emphasis and focus of various measures of performance varies considerably from senior level of management to operational levels.

Seemann (1991) emphasises the importance of a common vision together with process orientation and the use of performance measures for the development of a rigorous manufacturing strategy.

Gardiner (1993) stresses the importance of process orientation and the criticality of relating these processes to the overall systems objectives and goals to the achievement of a globally ideal manufacturing system.

Clemons (1991) states that many CIM implementations have failed because the projects did not relate to clear business and functional strategies. The paper identifies the importance of process definition and having a clear understanding of the relationship between the business processes and the business and functional strategies for successful implementation of CIM.

Parnaby (1991) describes an approach to business integration. The approach described, being based on systems engineering principles, relies on the analysis of business processes. The approach described in this paper considers the hard aspects of the business and does not attempt to integrate the business processes with the business and functional strategies.

Jones and McIlroy (1991) and Turnipseed (1992) stress the importance of clearly defined and documented business processes and associated procedures for successful implementation of CIM modules. Similarly, James an Kaeli (1990) states that CIM tools alone cannot provide corporate success and highlights the importance of the procedural and cultural elements. These papers clearly identify the importance of the formalisation of the business processes and the definition of the interfaces between these processes.

Gibson et al (1991) investigated the use of Computer Aided Software Engineering (CASE) tools for analysis and definition of business processes. This investigation concludes that CASE tools provide valuable techniques for analyzing, defining and communicating the mechanistic aspects of a business.

A DTI publication (DTI, 1991) specifically states that, instead of looking for the technological fix, companies need to adopt a broader approach and address organisation, people and technology. The meaning of total integration is identified as follows: Technological integration, People integration, Human-computer integration. This DTI publication categorically states that industry has recently begun to show interest in the broader approach to business integration.

Lawrence and Lorsch (1967) in their research provided evidence that high-performing organisations were demonstrating higher levels of differentiation consistent with sub-environmental requirements and a high degree of integration consistent with the requirements of total environment.

Miller, Friesen and Mintzberg (1984) have conducted a study into the classification of organisations according to their success and failure. The classification focuses on the organisations':-

- Environment
- Strategy
- Structure
- Information processing systems
- Location of power
- Decision making abilities

Based on analysis of a large sample base a classification system consisting of four failure models and five success models have been developed. Furthermore, nine transition models were developed which define the transition routes from one model to another. The most significant portion of this work is that the success models share the following common features:

- Clear demonstration of environmental awareness
- A clear and forward looking strategy
- A flexible and functional structure
- Formal or informal but open internal communication at all levels
- Power at the apex but shared throughout the organisation
- Analytical and planned decision making

Beer (1984) describes a cybernetic model for a viable system which has five necessary subsystems interactively involved in any organisation which is capable of maintaining its identity independently of other similar organisations. He applies these five subsystems to an organism such as a human being as well as organisations consisting of human beings such as a company or a state. The five subsystems of Beer's Viable Systems Model are:-

- <u>System 1 - Operating Units</u>

  These are processes within an organisation which are capable of independent operation. In a practical sense, these could be the various functions of a business or they could be various internal organs of a human being. Their main concern is carrying out the task.

- System 2 - Coordination and Regulation

  This system represents the local management function of the operational units. It coordinates and regulates the activities of each operating unit by interpreting the higher management decisions into operational instructions to ensure that each operational unit functions as part of a whole organisation.

- System 3 - Communications and Control

  This system receives and interprets the policy decisions of higher management and undertakes decisions for day to day running of the total enterprise. In achieving this, it communicates with the Coordination and Regulation systems (system 2) and the policy making systems, ie systems 4 and 5.

- System 4 - Planning and Development

  This system interfaces with the external environment of the organisation and passes this information to higher and lower systems. It also interfaces with systems 1, 2 and 3 providing a central information hub containing both internal and external information allowing senior management to make decisions based on realistic and accurate data.

- System 5 - Policy

  This is the policy making system which defines the direction and the strategy of the whole organisation based on data received through lower level systems.

In their SERC-ACME funded research Burns and Blenkinsop (1992) compared Miller's classifications with Beer's Viable Systems Model and found that the firms in the success categories were viable systems and the firms in failure categories were not.

3.4 CONCLUSIONS

Discussion so far demonstrates that business integration has two facets. These are information systems oriented and business oriented. However, these can be further subdivided. Whiston (1992) identifies six facets to integration. The Table 3.1 shows the relationship between Whiston's six facets and the authors two facets.

Whiston's Six Facets	Authors Two Facets	
	Information Systems	Business
Strategic		*
Information	*	*
Material flow	*	*
Organisational		*
Managerial		*
Technological	*	

Table 3.1 Varying views of integration.

This table illustrates how and under what categories authors two facets of integration recognises Whiston's six facets. Information integration and material flow integration as defined by Whistle corresponds to both information systems and business oriented facets as described by the author. Author's definition of business integration includes process integration, therefore it also includes the information and material flows between these processes, however it excludes the technological aspects of information systems integration, such as communication standards, protocols, networks, etc.

This section attempts to summarise the key messages from the literature survey presented in this chapter under facets as identified by the author. The following subsections present the author's conclusion for each category, followed by general conclusions.

3.4.1 Key Messages: Information Systems Oriented Methods

The key messages extracted from the review of information systems oriented methods are as follows.

- Information systems oriented methods see business integration as a function of correctly and rigorously defined information and support systems.

- The correct definition of information and supporting systems is approached from two angles. These are:
    1. Development of frameworks and standards to model and represent information integrated enterprises.
    2. Development of methodologies based on business and systems analysis techniques.

- A large majority of the work, on the development of frameworks and standards, focuses on integration from a computing technology viewpoint. Thus efforts in this area produce complex, information technology oriented, conceptual frameworks and standards.

- The majority of the methodologies, whether hard, soft or hybrid, make use of analysis techniques to identify weak links in a company's operational environment. The concept is that once these weak links are addressed the level of integration will be improved.

- The majority of integration methodologies are based on systems analysis techniques. These tend to be complex techniques requiring the involvement of an analyst to identify the weak links and make suggestions. This approach understandably results in ownership problems.

3.4.2 Key Messages: Business Oriented Methods

Based on the literature survey presented on the business oriented methods the following have been identified as being critical to successful business integration and improvement.

- Shared vision and business values
- Common understanding of business objectives
- Commitment at all levels
- Leadership
- Differentiation and awareness of responsibilities
- Customer (internal and external) focus
- Human resource development
- Education and training
- Participation and involvement by employees at all levels
- Ownership
- Structured and planned approach
- Focusing on early success
- Performance measurement and benchmarking
- Communications
- Process oriented approach

All of the points identified above are in line with the latest concepts and principles presented in most recent text books such as Shores (1990), Teboul (1991), Zeithaml et al (1990), Johnson (1989) and Oakland (1989). These

points are also consistent with the conclusions of the report by the Strathclyde Institute (1992) which identified the critical factors for successful management of change.

3.4.3 General Conclusions

Based on the literature review presented in this chapter new initiatives in business integration techniques and methodologies must take a more practical viewpoint by taking into account the business oriented methods. This has to be achieved by taking a step back from integration of computerised islands of automation and focusing on the integration of the main business processes with regard to the business objectives and the people who work within the business. This approach would be very much in line with the Total Quality Management (TQM) concepts, and it would focus on improving an organisation's competitive edge.

The bottom line is that, the factory of the future - ie the fully automated factory - is still a distant dream. For the foreseeable future these small to medium size businesses will continue to operate a mixture of manual and computerised systems. This view is supported by Nabuo Kanoi (1992), Deputy President of Sony Corporation, by the following quotation:

"The successful modern factory does not have to be new, beautiful, fully automated or contain a proliferation of robots and computers. The crucial element is how a company manages its processes effectively to develop and manufacture innovative and order winning products and services."

Self (1992) and Hodgson & Waterlow (1992) make it clear that the CIM modules outlined in chapter two are techniques which may be used if appropriate and justifiable, not as philosophies or goals in their own right. These papers call for the development of methodologies which provide a simple and stepwise approach towards business integration, which is equally applicable to small, medium and large organisations.

It is evident that increasing attention is now being paid to the business integration aspects, rather than just the technology aspects of CIM. Major research initiatives, such as CIM-OSA, are developing frameworks, architectures and standards for CIM which represent idealistic solutions to theoretical technological problems and do not effectively address the total business integration aspects. Clearly there is a need for methodologies which result in an integrated business platform upon which further improvements can be based.

3.5 REQUIREMENTS SPECIFICATION

The objective of this section is to compile a requirements specification for a methodology which would facilitate business wide integration. The specification compiled is based on the literature review presented, interviews carried out with a number of industrialists and the results of the SERC-ACME research recently completed.

The requirements specification has been categorised under the following three headings:-

- Scope
- Functional Requirements
- Application Requirements

The following sub-sections detail the requirements under these headings.

3.5.1 Scope

Requirements specified under this heading define the scope of application for a methodology to facilitate business-wide integration. These requirements are:-

* Incremental Approach

In many companies it may not be realistic or feasible to take the whole business through a major change programme. Therefore the methodology as well as being applicable across the entirety of a business should also facilitate integration of specific parts of the

business within the business wide framework provided.

* Independency from CIM Technology

  The methodology should not be associated or tied to the use of a particular set of CIM modules or software packages as described in chapter two. It should facilitate the achievement of an integrated business platform which is independent of the CIM technology and modules.

* Subsystem for CIM Implementation

  Where the use of CIM technology and modules are seen to be beneficial, the methodology should provide the necessary tools and techniques to ensure that this technology is effectively and efficiently implemented.

* Hard and Soft Systems Orientation

  In order to account for all aspects of business activity the methodology should include elements of hard and soft systems approaches.

3.5.2 Functional Requirements

Requirements specified under this heading refer issues the methodology should address through out its application. Therefore, the methodology should provide appropriate,

tools, techniques, procedures and guidelines to facilitate the achievement of the requirements specified below:-

* Commitment and Education

  It is recognised that it is the people which make or break any initiative. Therefore the methodology must facilitate commitment of all personnel to business improvement through improved integration.

* Shared Vision

  In order to avoid sub-optimisation and conflicting objectives the methodology should facilitate the development and communication of a vision for the business which would be understood and shared by personnel at all levels.

* Common Objectives

  Also, to avoid sub-optimisation and conflicting objectives the methodology must ensure that the strategy for achieving the business vision is defined in terms of clearly expressed business objectives. These objectives should be clearly understood by staff at all levels.

* Accountability and Contribution

  In order to maximise business awareness personnel at all levels must understand their own and each others'

roles and responsibilities with respect to the business vision and objectives.

* Process Orientation

  To maintain the rigour of information systems oriented methods the methodology must focus on the business processes and ensure that these are streamlined to complement the business objectives. The methodology should also ensure that the role and objective of each of these processes is clearly understood within the total business.

* Information Systems Orientation

  The information system represents the nervous system of an organisation. An efficient and effective information system will maximise flexibility and ensure that business reacts to internal and external changes rapidly. Therefore it is critical that all key communication lines are understood and formalised.

* Integrated Approach

  To ensure optimisation of business activities priorities must be coordinated, and various functions and levels of the organisation must be integrated with each other as well as with the business vision and objectives.

* Ownership

  The methodology must ensure that maximum ownership is achieved through the involvement and participation of personnel at all levels.

* Continuous Improvement

  Since organisations are dynamic, the state of integration will be transitory unless it is continually reviewed and updated. Therefore the methodology must install a culture of continuous review and improvement through the provision of appropriate tools and techniques.

* Performance Measurement

  The methodology should ensure that the right performance measures are implemented to measure the true performance of the business at various levels. It should also ensure that the relationship (ie complementary and conflicting nature of measures) of performance measures are understood.

3.5.3 Application Requirements

The requirements stated under this heading refer to the degree of complexity and ease of application of the methodology. These requirements are:-

* Low Cost

  The methodology should be supported by low cost tools and techniques to ensure that it is within the reach of small to medium sized companies.

* Simplicity

  The tools and techniques used by the methodology should be simple to learn and use to minimise learning curves and accelerate implementation.

* Early Benefits

  The methodology should ensure that benefits are seen as early as possible to maintain momentum and commitment.

* Structured and Planned Approach

  One of the main reasons for the failure of early TQM programmes was the lack of a structured and planned approach. Therefore the methodology should ensure that it provides a structured implementation plan which clearly identifies what needs to be done and how it is going to be done. In other words a complete methodology which would facilitate business integration should provide a structured framework and the necessary tools and techniques which would facilitate the achievement of the functional requirements.

* Viable Systems

In addition to the requirements stated above a methodology which would facilitate business integration should ensure the installation of various elements of the viable systems (Beer,1984) at appropriate levels of an organisation.

3.5.4 Summary of Requirements

A methodology which has been designed to facilitate business wide integration should provide:-

a. A structured framework

b. The necessary tools and techniques

which would facilitate the achievement of the requirements stated in Table 3.2. The layout of Table 3.2 also provides a useful checklist to evaluate existing methodologies for business evaluation against the requirements identified in this chapter.

REQUIREMENTS	PROVISION WITHIN A FRAMEWORK	PROVISION OF TOOLS AND TECHNIQUES
SCOPE		
Incremental Approach		
Independency from CIM technology		
Subsystem for CIM implementation		
Hard and soft systems orientation		
FUNCTIONAL		
Commitment and education		
Shared vision		
Common objectives		
Accountability and Contribution		
Process Orientation		
Information systems orientation		
Integrated approach		
Ownership		
Continuous improvement		
Performance measurement		
APPLICATION		
Low cost		
Simplicity		
Early benefits		
Structured and planned approach		
Viable Systems		

Table 3.2 Summary of Requirements Specification.

CHAPTER FOUR

EXISTING METHODS FOR BUSINESS INTEGRATION

4.0 EXISTING METHODS FOR BUSINESS INTEGRATION

The objective of this chapter is to review the existing methods, approaches and techniques for business integration against the requirements specified in the previous chapter. The methods and approaches reviewed in this chapter were identified during the literature review. The details of these methods and approaches were gathered from various publications as referred to throughout the text. The details for methods offered by some of the consultancy organisations were collected as a result of interviews with representatives of the organisations concerned. In some of these cases, for commercial reasons it was not possible to collect detailed information on the current tools and techniques used. However, where specific sets of tools and techniques are employed, in many cases a clear indication was obtained from the organisation.

The following methodologies are reviewed in this chapter:-

- Manufacturing Business Redesign Methodology
- The Arthur Andersen Method
- The Gemini Approach
- Booz Allen and Hamilton Approach
- The PRTM Method
- The Strathclyde Institute Method
- Strathclyde Integration Method
- Whiston's ten-by-three matrix

4.1 MANUFACTURING BUSINESS REDESIGN METHODOLOGY

4.1.1 Methodology Overview

The Manufacturing Business Redesign (MBR) methodology has been developed by Lucas Engineering Systems (Lucas 1992) initially for the redesign of various manufacturing businesses within the Lucas group. It is based on the systems approach to manufacturing systems engineering developed by Parnaby (1991).

The MBR methodology consists of five key steps which are shown in figure 4.1. The five steps are:-

- Business Target Setting

  This step is primarily concerned with the definitions of the business sectors and setting of the strategic objectives for the business in terms of quantifiable targets for reductions and increases of high level performance indicators, such as work in progress, stock, producibility, flexibility, etc.

- Market and Financial Analysis

  The purpose of this step is to position the business within its current operating environment with respect to its competitors and financial performance. At this stage various product groupings are recognised and the performance targets established in the previous step is translated into product group and functional targets.

- Engineering Analysis

  This step is concerned with collection and analysis of product/engineering related data in order to simplify and rationalise the complexities associated at this level. The concepts applied at this stage are based on the concepts and principles of Just-in-time manufacturing and should lead to simplification of the manufacturing business.

- Synthesis

  This step is concerned with the redesign of the manufacturing system using a bottom up approach starting with the design of processes and their interfaces, through the design of organisational aspects, such as job design, personnel policy, etc, to design of the dynamic aspects such as work mix, volume and process performance. Considerable emphasis is also placed on the design of a suitable management and control system. This step results in the definition of a complete manufacturing business with a supporting implementation plan.

- Consolidation

  This step is mainly concerned with the packaging of the redesigned manufacturing business in the form of a proposal together with the associated cost/benefit study.

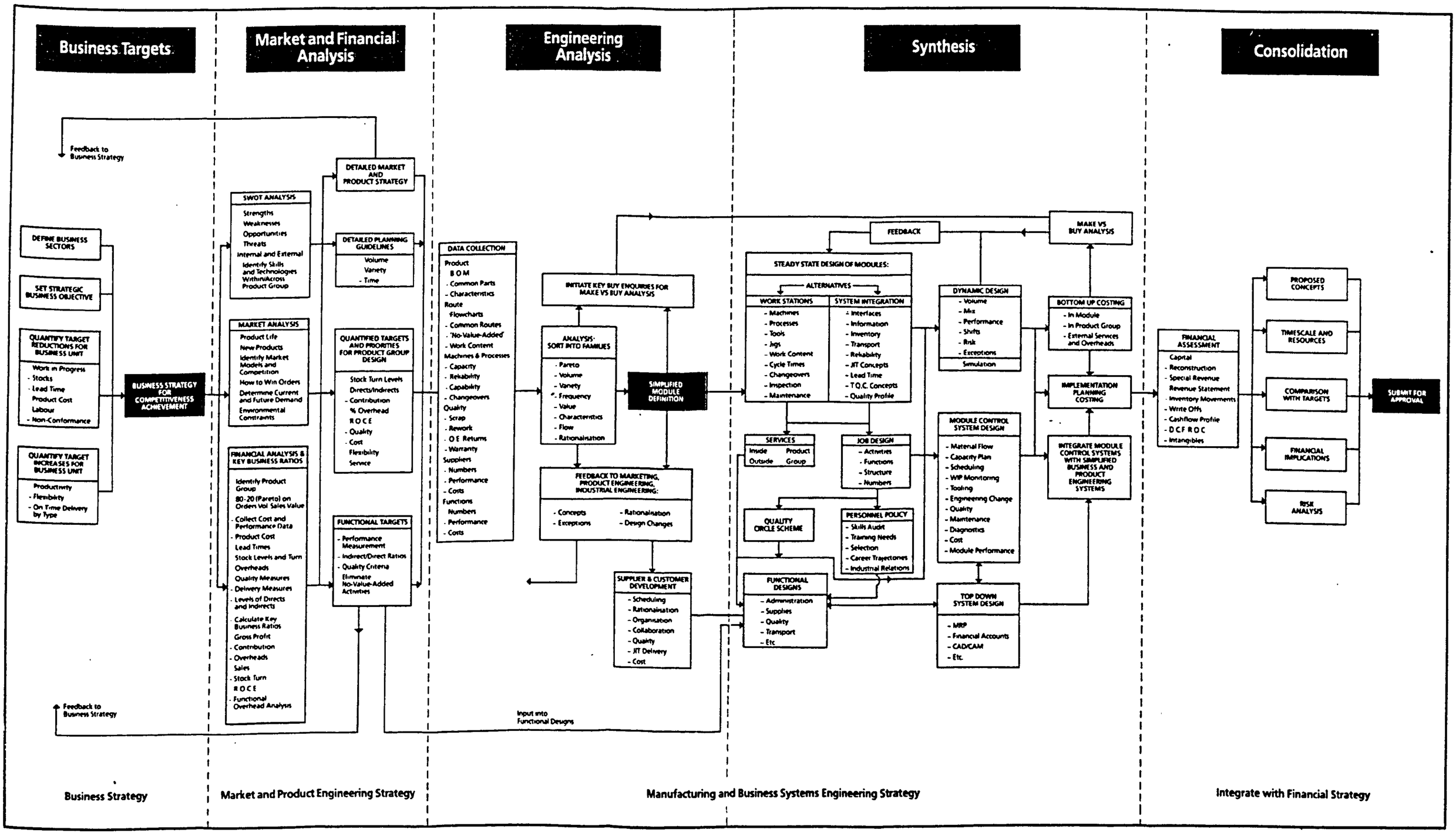


Figure 4.1 Manufacturing Business Redesign; The framework

4.1.2 Discussion

The MBR methodology was evaluated against the requirements specified in the previous chapter. The results of this evaluation are presented in a tabular format in table 4.1.

In summary MBR provides a detailed framework for analysis and design of manufacturing businesses. Its basic concepts are based on the principles of cellular and just-in-time manufacturing and it emphasises a matrix-oriented organisation structure. MBR is design oriented and it is not implementation oriented therefore it does not provide detailed tools, techniques or procedures for achievement of each one of its elements, ie it specifies what needs to be done but it does not specify how it should or could be achieved. One further point is that MBR is manufacturing oriented and it will require considerable interpretation for application in other sectors.

The main limitations of the MBR methodology are:-

* The incremental approach is not inherent within the methodology.
* There is a limited provision of tools, techniques and procedures for redesign.
* It lacks in soft systems orientation.
* It is not implementation oriented.
* It is project team focused thus may not gain complete ownership.
* There is no provision for continuous review and improvement, although implied.
* The framework is too complex.
* Too much focus on manufacturing processes.

REQUIREMENTS	PROVISION WITHIN A FRAMEWORK	PROVISION OF TOOLS AND TECHNIQUES
SCOPE		
Incremental Approach	Not inherent but possible	
Independency from CIM technology	Totally independent	
Subsystem for CIM implementation	Limited provision through process flow analysis and input-output analysis	Process flow analysis Input-output analysis
Hard and soft systems orientation	Being engineering oriented it presents a harder approach	Process flow analysis Input-Output analysis
FUNCTIONAL		
Commitment and education	Not catered for	
Shared vision	Business targets are set but not in the form of a shared vision	
Common objectives	Quantifiable business objectives are set and translated in to functional objectives	SWOT analysis
Accountability and Contribution	Clearly defined as part of redesign of the manufacturing system	
Process Orientation	Process oriented	Process flow analysis Input-Output analysis
Information systems orientation	The criticality of information flow between processes is recognised	Input-output analysis
Integrated approach	Through a hierarchical approach to business and functional target setting	
Ownership	It is not implementation oriented. Project team focused	It makes reference to cross-functional teams to support new schemes
Continuous improvement	Recognised but not catered for	
Performance measurement	At business and functional levels	
APPLICATION		
Low cost	No need for expensive, computerised tools,	
Simplicity	Complex framework	Process flow analysis and I/O analysis are simple
Early benefits	Implied	
Structured and planned approach	Provides a detailed but complex framework	Limited in its provision of tools and techniques
Viable Systems	Does not recognise VSM	

Table 4.1 Review of the Manufacturing Business Redesign Methodology

4.2 THE ARTHUR ANDERSEN METHOD

4.2.1 The Methodology Overview

Details of this method was obtained as a result of a interview with one of the partners of the company. The Arthur Andersen method takes a total business view and ignores the need for incremental approaches to business improvement. The method is project team oriented and contains the following stages:-

- Understanding

  This involves the communication of the scope and objective of the programme across the organisation.

- Current reality

  The project team first establishes the current position of the organisation.

- Vision and Targets

  Based on the positioning exercise above a corporate vision and the operational targets are established.

- Project Definition

  The team identifies the long term "redesign" and short term "quick-hit" projects. These projects are then prioritised.

- Redesign

  The team synthesises solutions both from a bottom-up (ie understanding the current processes) and top-down (ie global

best practices) view to ensure that processes meet the operating vision identified.

4.2.2 Discussion

It is implied that the Arthur Anderson method optimises the amount of analysis required and moves rapidly to implementation to achieve early benefits. Although claim is made that effort is focused on areas which are critical to business success, how this is achieved is not specified. It is also implied that the broad constituency of employees are involved in the analysis and redesign processes.

Table 4.2 presents a review of the Arthur Andersen method to the requirements specified in the previous chapter. One criticism of this approach is that it is project oriented and conducted through a project team, preferably full time. The net effect of this type of approach is that once the project is completed and the project team is dissolved there is a danger that working practices and policies may deteriorate due to changes in the business environment and due to reduced focus on business integration (ie Hawthorne Effect). Although, the need for continuous review and improvement is recognised, due to the project oriented nature of this approach the methodology does not facilitate continuous incremental change to ensure optimisation of business processes.

This effect is analogous to a dynamic system under open loop control. That is, once the control parameters are set it assumes a steady state operation and would fail to detect changes in the operating

environment. On the other hand, a formal closed loop control system will monitor the critical parameters in the operating environment and provide feedback to the control logic which would automatically adjust the control parameters to ensure optimum operation. Thus it is the author's conclusion that the Arthur Andersen approach provides an open loop control mechanism and fails to install the necessary formal feedback mechanisms and practices.

One other failure of the Arthur Andersen method is that it does not make use of any particular set of tools and techniques. Although, it was stated during the interview that certain tools and techniques are used to facilitate each phase of the programme, it was also stated that the use of these tools were left very much to the discretion of the particular company and the consultant responsible for that project.

REQUIREMENTS	PROVISION WITHIN A FRAMEWORK	PROVISION OF TOOLS AND TECHNIQUES
SCOPE		
Incremental Approach	Not catered for	
Independency from CIM technology	Completely independent	
Subsystem for CIM implementation	Not catered for	
Hard and soft systems orientation	Emphasis on employee involvement and participation	
FUNCTIONAL		
Commitment and education	Through communication of the objectives of the project	
Shared vision	Yes	
Common objectives	Yes	
Accountability and Contribution	No reference	
Process Orientation	Inherent in the process oriented approach to redesign	
Information systems orientation	No reference	
Integrated approach	Implied	
Ownership	Implied	
Continuous improvement	Implied, but project oriented	
Performance measurement	No reference	
APPLICATION		
Low cost	Consultancy is likely to be costly	
Simplicity	Looks simple but no provision of tools, techniques or procedures	
Early benefits	Catered for in "quick hit" projects	
Structured and planned approach	Simple but very broad framework. No provision of tools and techniques	
Viable Systems	Not recognised	

Table 4.2 Review of the Arthur Andersen Method

4.3 THE GEMINI APPROACH

4.3.1 The Methodology Overview

Details of this approach was also compiled as a result of an interview with the managing director of the company. The philosophy behind the Gemini approach is that, it no longer considers the traditional hierarchical organisation as a viable option and places emphasis on more lateral, more networked and more self managed organisations which are managed and operated by people who can perform their own functions well as well as connecting effectively and efficiently with other functions.

The approached used by Gemini consists of the following phases:-

- Definition of scope

  Here the scope of the programme is agreed with the senior management within the organisation, ie whether they are dealing with the entire business or one particular piece of it.

- Analysis

  At the analysis stage the consultants teams work for 8 to 10 weeks in the company to define processes, their behaviour and marketplace realities. This is essentially an analysis of the current situation of the business. At this stage the team also identifies the critical success factors for the business.

- Design

  Having completed the analysis, the team identifies areas for potential improvement based on the critical success factors and assesses where the barriers to an effective interface between functions exist. The team then prepares and presents a plan for change which identifies how these areas of potential improvement are going to be exploited and how the barriers are going to be overcome during the change process.

- Implementation

  This phase focuses on the involvement of employees in the form of large teams to ensure that the changes introduced are accepted and owned. The exact activities undertaken during the implementation phase are defined by the plan for change created in the previous phase by the consultancy team. During the implementation phase considerable attention is paid to the use of the critical success factors to ensure that the change process is integrated with the requirements of the market place.

4.3.2 Discussion

The detailed analysis of the Gemini approach to business integration is illustrated in table 4.3. This approach caters for both business wide and incremental approaches to business integration. However, its initial phases, being analyst-oriented, could cause long term problems with ownership. Essentially, a team of consultants are used to carry out an analysis to identify the required actions and develop an implementation plan. People are involved only during the implementation phase. The

main reasons behind this is that, any attempt to involve people during the analysis and design phases would considerably prolong these phases. The author's view of this is that failure to maximise involvement right from the start will result in the key people having ownership problems with the problems and issues identified by the consultancy team. In short, the Gemini approach uses analysts to identify problems and employees to find and implement the solutions.

Another failure of this approach is that it does not recognise the need for a long term vision for the company. The approach ensures that the improvement actions are integrated with the business objectives through the high level, marketplace oriented critical success factors, but fails to take a longer term view by creating a long term vision for the business.

The performance measures used are market oriented and are applied at a high level. For example, during the interview the following performance measures were quoted:-

- Cost saving
- Revenue enhancement
- Capital cost reduction
- Faults per 1000 products
- Number of complaints

Although, this provides some overall direction to the business, it fails to provide specific direction at functional levels. The approach used

here does not in any way ensure that a individual working in any specific part of the organisation could relate his/her job responsibilities to the overall business objectives in a measurable and structured way.

Like the Arthur Andersen method, the Gemini approach does not specify tools and techniques. However it is implied that a process oriented approach is used and the function, input and output of each process is analyzed during the analysis phase.

Although, this approach appears simple in the first instance, it provides a vague and loose framework with a lot of room for misinterpretation. This is particularly so for the analysis and design phases. The implementation phase is controlled through the detailed implementation plan created during the design phase.

REQUIREMENTS	PROVISION WITHIN A FRAMEWORK	PROVISION OF TOOLS AND TECHNIQUES
SCOPE		
Incremental Approach	Yes	
Independency from CIM technology	Completely independent	
Subsystem for CIM implementation	No specific reference, but emphasis is placed on the use of modern communications technology	
Hard and soft systems orientation	Analysis & design phases being analyst oriented are hard. Implementation phase takes a much softer approach by involving people.	
FUNCTIONAL		
Commitment and education	No specific reference	
Shared vision	No specific reference	
Common objectives	Market place oriented	
Accountability and Contribution	No specific reference	
Process Orientation	Process oriented approach - see analysis phase.	
Information systems orientation	No specific reference	
Integrated approach	Through high level market oriented critical success factors.	
Ownership	Non during analysis and design, but heavily focuses on ownership during implementation.	
Continuous improvement	No specific reference	
Performance measurement	At high level (ie Strategic)	
APPLICATION		
Low cost	No hard/software requirements. But heavily analyst/consultancy oriented which could be costly	
Simplicity	Over simple framework with no guidance on tools and techniques to be used	
Early benefits	Implied but project dependent	
Structured and planned approach	A very loose structure during the analysis and design phases. A rigid implementation plan is followed there on.	
Viable Systems	Not recognised	

Table 4.3 Review of the Gemini Approach

4.4 BOOZ ALLEN & HAMILTON APPROACH

4.4.1 Methodology Overview

This is another method where the details were collected as a result of an interview with a managing consultant from the company. The Booz Allen and Hamilton (BAH) approach takes a strategic view to business integration. In that it has identified long term planning as the entry point into the business integration process. This view is expressed by the following quotation by John Houlihan, Vice President of BAH.

> *"A company's current success is usually based on changes made over the previous five years, so success today does not guarantee success tomorrow unless the company is already thinking ahead"*

The BAH approach to business integration consists of a three stage approach, these are:-

- Stage 1

  The company's strategy is reviewed and the desired competitive targets are considered for two to three years hence. These targets are set with intermediate goals.

- Stage 2

  The business processes are analyzed with a view to identifying those processes which will be critical to the achievement of these goals and targets. In identifying these processes the organisation, systems and control requirements are also assessed

and identified. At this stage the middle management is involved in the analysis process to ensure their commitment to support the top-down goals of stage one.

- Phase 3

  This phase is concerned with implementation planning and implementation. The implementation heavily focuses on the use of performance measures by correlating the existing measures to personal/individual measures.

4.4.2 Discussion

A detailed analysis of the BAH approach is provided in table 4.4. The BAH approach to business integration does not recognise the incremental need towards integration. The main reason behind this is that it operates at a high level by concentrating on the current situation of the business, identifying the appropriate business strategies and linking personal objectives and targets to these strategies. In failing to consider the detailed operational processes, it focuses attention on high level processes, such as strategy formulation and review, performance measurement and progress review.

The BAH approach considers involvement and ownership at senior and middle management level an essential element of success. But does not encourage involvement and participation of operational personnel. This is to be expected because the approach addresses only the high level strategic issues as described in the previous paragraph.

The structure of the approach used looks simple at first sight, however when studied in detail it is vague. The fact that there is no evidence of supporting tools, techniques and procedures to achieve the objectives of the approach it is likely that it will require considerable consultancy support.

In summary the BAH approach is a very loosely structured method which addresses the high level issues without using specific tools and procedures. Its effectiveness will depend on the consultant's skills and on the match between the consultant and the client company.

REQUIREMENTS	PROVISION WITHIN A FRAMEWORK	PROVISION OF TOOLS AND TECHNIQUES
SCOPE		
Incremental Approach	Not recognised	
Independency from CIM technology	Completely independent	
Subsystem for CIM implementation	No reference	
Hard and soft systems orientation	Not specific enough to make a judgement	
FUNCTIONAL		
Commitment and education	Emphasis on senior and middle management commitment but does not specify how.	
Shared vision	Yes, entry point is long term objectives of the business	
Common objectives	Correlation of long term objectives with personal goals	
Accountability and Contribution	Implied but not specifically stated	
Process Orientation	Focuses on high level processes to meet the overall objectives	
Information systems orientation	Not specified	
Integrated approach	Through long term goals and their correlation to individual goals.	
Ownership	At senior and middle management levels	
Continuous improvement	Not specifically referred, lack of tools	
Performance measurement	As strategic targets with intermediate goals and through correlation of these goals to personal performance	
APPLICATION		
Low cost	Not specific enough therefore it will require considerable consultancy support	
Simplicity	Too simple and vague	
Early benefits	Not specified	
Structured and planned approach	Structure is very vague until the implementation plan is in place	
Viable Systems	No reference	

Figure 4.4 Review of the Booz Allen & Hamilton Approach

4.5 THE PRTM METHOD

4.5.1 Methodology Overview

The PRTM method has been developed in conjunction with the Scottish Enterprise (1991) to facilitate small to medium sized companies to achieve business improvement through better integration of business functions and operations. The method is administered as a twelve month programme with considerable consultancy support. The twelve month programme involves the following stages.

- Senior Management Seminar

  The objectives of this seminar is to create an awareness and understanding of the programme with the senior management of the company and gain their initial commitment.

- The Questionnaire

  This is the stage where the company is provided with a detailed self evaluation questionnaire. This questionnaire forms the basis of this method. The areas covered by the questionnaire include:-

  * Company Background
  * Finance
  * Product Development
  * Materials Management
  * Marketing
  * Customer Service
  * Manufacturing
  * Quality Management
  * Distribution

  This questionnaire, in analyzing the performance and current status of the company with respect to the above areas also

identifies the current strengths and weaknesses of the business. The questionnaire is supported with a detailed procedure which insists that the relevant sections of the questionnaire is completed by the senior managers responsible for that area of the business and that on completion each manager presents his/her section to the management team. This obviously leads to certain amount of discussion and helps to create a common understanding of the current position of the business, its strengths and weaknesses.

- Business Review

  This is an on site review of the business activities by the consultant. It is not a detailed analysis, but the consultant leads the management team to the next stage of the process by discussing the results of the questionnaire and facilitating the identification of weaknesses, priorities and short and long term actions. This stage results in an action plan.

- Education and Training

  Education and training is provided to support and facilitate the action plan created in the previous stage. At this stage the education and training is aimed at the senior management and is primarily in the form of books, videos and where necessary in-house seminars. The range of education and training provided varies from TQM, JIT to Business Planning to SMED (Single Minute Exchange of Die) techniques.

- International Benchmarking Study

  In parallel with the education and training of the senior management the consultants are engaged in an benchmarking study to compare the company's current performance, based on the performance indicators identified during the questionnaire, with the best practice in the world.

- Goal Setting

  At this stage the consultant works with the management team to identify long and short term goals against the performance indicators identified through the questionnaire. The results of the benchmarking study is used to set long term goals and shorter term goals are set to encourage and monitor the business performance towards the world class objectives.

- Project Management and Training

  This is an optional stage where the consultants provide a project management and training service for implementation of the action plan.

4.5.2 Discussion

A detailed analysis of the PRTM approach is shown in table 4.5. The approach adopted by PRTM is more of an approach for business improvement where a questionnaire is used to structure a self conducted SWOT analysis. It would not necessarily improve the integration between various parts of the business because it is not process oriented, it does not cement various business activities

together towards its common objectives through an integrated set of performance measures. It is applied at the senior management level to decide necessary actions to improve business performance. Although the literature claims that it facilitates business integration, the framework presented would not facilitate this. However it could lead to improved integration as a result of facilitating improved awareness of issues and current difficulties but it does not provide a rigorous methodology towards integration therefore it has soft systems characteristics.

In summary, the PRTM approach is designed to facilitate self analysis and action planning for business improvement rather then integration.

REQUIREMENTS	PROVISION WITHIN A FRAMEWORK	PROVISION OF TOOLS AND TECHNIQUES
SCOPE		
Incremental Approach	Yes	
Independency from CIM technology	Independent	
Subsystem for CIM implementation	None	
Hard and soft systems orientation	Closer to soft systems	
FUNCTIONAL		
Commitment and education	Targeted at senior management level	Briefing seminar
Shared vision	no reference	
Common objectives	yes	Questionnaire Benchmarking
Accountability and Contribution	no reference	
Process Orientation	Not process oriented	
Information systems orientation	Does not go down to that level of detail	
Integrated approach	Yes, action plan is derived from business objectives	
Ownership	At senior management level	
Continuous improvement	Implied	
Performance measurement	Using existing measures, some standard measures are implied in the questionnaire	Questionnaire Benchmarking
APPLICATION		
Low cost	Initially minimal use of consultants and no hardware/software requirements	
Simplicity	Questionnaire is straight forward	
Early benefits	Implied	
Structured and planned approach	Self analysis and action planning oriented.	Questionnaire
Viable Systems	No reference	

Table 4.5 Review of the PRTM Method

4.6 THE STRATHCLYDE INSTITUTE METHOD

4.6.1 Methodology Overview

The Strathclyde Institute (Si) (1991) method consist of a five stage process. The five stages are:-

- Top Level Situation Analysis

  This is a one day workshop aimed at senior management to introduce the programme and set the scene. The main objective of this workshop is to conduct a SWOT analysis taking into account of internal (ie. communications systems, cost structure, products/services offered, labour profile, process technology, customer service, etc.) and external (ie. suppliers, customers, economy, legislation, competition, etc) factors. This stage results in the identification of key issues for the business (eg skills shortage, ageing product, high operating costs, etc).

- Identify Business Potential

  Following on from the top level business situation analysis the consultant assists the steering group to form a vision for the company through identification of an agreed set of business objectives against key performance indicators.

- Detailed Business Operations Review

  Each key functional activity is examined. Key functional activities are defined as processes which handle material or information critical to business performance. In reviewing these activities the inputs, outputs, performance standards, resources and

personnel aspects of each activity is examined to conduct a SWOT analysis at the level of each activity. This SWOT analysis is conducted in conjunction with the operational staff responsible for that activity. This stage results in the identification of strengths and weaknesses for each key functional activity.

- Human Resources Audit

  The view taken here is that a business ability to work as an integrated unit is heavily dependent on the skills, abilities, education, attitudes and culture. The human resources audit is based upon the recently introduced national standard for human resource management 'Investors In People' (1991). In conducting this review the consultant constantly refers to the areas of weakness identified. This results in identification of issues which could be resolved through training and education.

- Action Planning

  Based on the business and functional level strengths and weaknesses as well as the training and education needs, an action plan is compiled and agreed with the organisation.

4.6.2 Discussion

A detailed analysis of the Si method is shown in table 4.6. The Si method, rather like the PRTM approach focuses on business performance improvement rather then integration. However, because it focuses selectively on key processes it could be argued that it would

lead to improved integration of these key processes within the business. However the method does not address the interfaces between individual processes and the criteria used to identify the key processes is not specific which can be misleading.

This method places emphasis on analysis and action planning. It provides little assistance, tools and techniques to facilitate continuous improvement of business processes. To facilitate analysis it makes use of the following tools and techniques:-

- Input/Output analysis for key activities
- SWOT analysis at two levels (ie Business and Functional)
- Investors In People audit checklist.

Use of performance measures is limited to the business level and is not propagated to functional levels. The method does not provide a mechanism to allow auditing of existing performance measures, ie it assumes that the performance measures used by the company are the correct measures.

In summary the Si method provides a well structured approach to analysis and action planning. The analysis is made rigorous through the provision of the above tools. However, it is limited in its scope because it focuses on processes selectively and fails to recognise their interaction. Therefore, it is more suitable for identifying short term business improvement actions then facilitating business wide integration.

REQUIREMENTS	PROVISION WITHIN A FRAMEWORK	PROVISION OF TOOLS AND TECHNIQUES
SCOPE		
Incremental Approach	Yes	
Independency from CIM technology	Independent	
Subsystem for CIM implementation	None	
Hard and soft systems orientation	I/O and SWOT analysis provides elements of hard systems. H audit deals with the softer issues	
FUNCTIONAL		
Commitment and education	At senior management level only	Top level SWOT analysis
Shared vision	None	
Common objectives	Business objectives defined as part of the top level swot analysis	SWOT
Accountability and Contribution	Implied	
Process Orientation	Selective processes	Input/output analysis
Information systems orientation	Not referred	
Integrated approach	Action plan is focused on achieving the business objectives	
Ownership	Ownership of problems are at all levels	Through top level and functional SWOT analysis
Continuous improvement	not supported	
Performance measurement	At business level, does not attempt to propagate to functional or personal levels	
APPLICATION		
Low cost	Consultancy oriented, therefore may be costly.	
Simplicity	Requires consultancy support	
Early benefits	Implied	
Structured and planned approach	Structured up to action planning	I/O and SWOT analysis IIP audit
Viable Systems	Not recognised	

Table 4.6 Review of the Strathclyde Institute Method

4.7 THE STRATHCLYDE INTEGRATION METHOD

4.7.1 Methodology Overview

The Strathclyde Integration Method (SIM) (Carrie and MacIntosh, 1992) was developed through an SERC-ACME research grant to facilitate improved integration of physical and management systems within a manufacturing organisation. The method, being process oriented, establishes the information and material flow through key decision points through top-down and bottom-up analysis of operations. The method, through a workbook, provides comprehensive set of tools and techniques which facilitate rigorous operations analysis. The method consists of the following steps:

- Definition of Scope

  The study is initiated by definition of it's scope which defines the boundaries of the study. It may be applied to the complete organisation or to a smaller subset of the organisation such as a particular function.

- Conceptual Modelling

  This is the stage which is mostly applicable to external analysts/consultants as its main purpose it to familiarise the analyst with the organisation which is being studied.

- System Modelling

  During this stage a detailed top-down and bottom-up analysis of the operations is carried out. The top-down study attempts to represent the management's view of how the system operates. At

this stage the Data Flow Diagramming technique is used to illustrate the operations from a management perspective. The bottom-up study is conducted using the same tools and techniques, but in this case the system is analyzed from the operational staff's viewpoint. The results of these analysis is transposed in to GRAI Grids which essentially condense the DFD's into a single diagram.

- Analysis

  The GRAI Grids produced from the two viewpoints are analyzed for inconsistencies and mismatches. In analyzing these discrepancies attention is also paid to identification of decision responsibilities and their appropriateness.

- Proposed Modifications

  This stage involves the prioritisation of the results of the analysis (ie discrepancies). The GRID's and DFD's are modified to show a system with reduced discrepancies, duplication and wasted effort. These new grids and diagrams are used for gaining agreement and prioritisation of improvement actions.

4.7.2 Discussion

A detailed analysis if the SIM is shown in table 4.7. The method is an analysis oriented approach which is designed to identify opportunities for improvement through rigorous analysis. It does not attempt to install good practice, ie key requirements and elements of integration, such as common objectives, shared vision, etc . Although, the analysis

process may identify lack of these key elements as areas for improvement, there is no guarantee that this may happen.

The method is process oriented and makes use of rigorous tools and techniques to facilitate analysis, this results in a hard systems oriented approach and may miss some of the softer issues. The SIM, being analyst oriented, is rather weak in people involvement and therefore may result in ownership problems at the analysis stage.

In summary, the SIM, like some of the other methods and approaches examined, is analysis oriented and results in the identification of the improvement actions necessary for improving integration. However, unlike other techniques it provides a comprehensive set of tools and techniques to facilitate its implementation.

REQUIREMENTS	PROVISION WITHIN A FRAMEWORK	PROVISION OF TOOLS AND TECHNIQUES
SCOPE		
Incremental Approach	Yes	
Independency from CIM technology	Completely independent	
Subsystem for CIM implementation	Not referred	DFD's provide a good method of information flow modelling
Hard and soft systems orientation	Hard systems oriented	
FUNCTIONAL		
Commitment and education	Referred as a requirement	
Shared vision	Not specified	
Common objectives	Not specified	
Accountability and Contribution	Documented as part of the top-down analysis process	Functional task analysis
Process Orientation	At process I/O level	DFD's
Information systems orientation	DFD's model information flows between key decision points	DFD's
Integrated approach	Not a function of the method	
Ownership	Analyst oriented	
Continuous improvement	Not referred	
Performance measurement	Not specified	
APPLICATION		
Low cost	Yes	
Simplicity	Analyst oriented. May not be a practical proposition for self analysis	
Early benefits	Implied	
Structured and planned approach	Specific framework	Supported buy specific tools, techniques and guidelines (workbook)
Viable Systems	Not referred	

Table 4.7 Review of the Strathclyde Integration Method

4.8 WHISTON'S TEN-BY-THREE MATRIX

4.8.1 Methodology Overview

Whiston (1992) outlines mechanisms for Managerial and Organisational integration. This mechanisms are presented in the form of a matrix. Within the matrix Whiston identifies ten principles of integration. These are:

- Maximise involvement
- Minimise hierarchies
- Encourage multidisciplinarity
- Design improvement
- Use technology well
- Maximise quality
- Maximise external awareness
- Encourage academic-industrial linkage
- Overcome apathy
- Aim at job meaningfulness

For each one of the above ten principles he provides further actions against three levels. The three levels are:-

- Educational level
- Organisational level
- Industrial policy level

The actions provided in this ten-by-three matrix is illustrated in table 4.8.

	Principle Aims	Level: Educational	Level: Organisational	Level: Industrial Policy
1	Maximise Involvement	Greatly increase FE and HE participation rate	Encourage industrial participation. Aim at organic organisation structures	Reduce all forms of barriers; Increase all forms of managerial, work-force mixing
2	Minimise hierarchies	Team work at schools; FE and HE interdisciplinary syllabus	Aim to flatten organisational pyramid.	Reduce all forms of higher level privilege. Allocate greater responsibility to lower levels.
3	Encourage multidisciplinarity	Minimise early over-specialisation through multi disciplinary training programmes.	Cross functional task teams. Matrix management approaches. Project teams	Constant MD retraining and strategic analysis. Reduce demarcation rules.
4	Design improvement	Develop applicative skills. Encourage study of bionics and natural systems.	Link design to all aspects of production.	More closely relate design to wider societal needs.
5	Use technology well	Emphasise ergonomic, cognitive, psychology and information in training of engineers.	Recognition that FMS, CIM, CIE, CAD-CAM etc require ancillary organisational changes.	Aim at socio-ergonomic principles. Automate where desirable.
6	Maximise quality	Encourage personal and team responsibility for performance at all levels of education.	Increase shop-floor responsibility. Personal responsibility for product. Management to shop-floor	Policies geared to total quality JIT schemes related to supply sector
7	Maximise external awareness	More general, wider education programme.	Greater enterprise and customer linkage in defining production schedule.	Manufacturing output agenda more closely related to societal need.
8	Encourage academic-industrial linkage.	Greater societal component and practical skills at all levels.	Much greater mutual design of linkage programmes.	Expand joint collaborative research and exchange programmes.
9	Overcome apathy	More challenging syllabus. Better integration academic and applicative areas. Increase societal relevance.	Fuller shopfloor responsibilities. Reduced "boxed-in" status of many managerial functions.	Policies to reduce polarisation of management and workforce
10	Aim at job meaningfulness	Increase educational input	Much greater job enrichment at lower levels. Set greater organisational and integrative challenges for management.	Automate where automation is highly desirable. Products that society needs and value.

Table 4.8 Whiston's ten-by-three matrix for Organisational and Managerial Integration

4.8.2 Discussion

The ten principles proposed by Whiston together with the actions provided against the three levels provide a useful do-list. However, it does not provide an overall framework for structuring this do-list and is rather weak in the provision of tools and guidelines to facilitate the achievement of these actions.

Table 4.9 provides a detailed review of Whiston's ten-by-three matrix against the requirements identified in chapter three of this thesis. Because this approach focuses mainly on Managerial and Organisational Integration it looks mainly at softer aspects of integration. As a result emphasis is placed on participation, motivation, empowerment, organisational structures, job enrichment, societal issues, education and training. Therefore, it does not take in to account the harder aspects of integration such as process orientation, information systems orientation, the need for common objectives and so on.

It is evident that Whiston's ten-by-three matrix is not a methodology, but it defines what must be done to achieve Managerial and Organisational integration as defined by Whiston in his book. This conclusion is supported by Whiston. In effect, if progress towards integration is defined as a journey. Whiston, in defining the ten-by-three matrix defines the destination and actions necessary to get there. However, he does not provide a framework, tools and techniques on how to achieve these actions in order to get to the destination.

In summary, the ten-by-three matrix provides a useful check-list for organisational and managerial integration, but it does not provide a structured, rigorous methodology for business-wide integration.

REQUIREMENTS	PROVISION WITHIN A FRAMEWORK	PROVISION OF TOOLS AND TECHNIQUES
SCOPE		
Incremental Approach	Not Referred	
Independency from CIM technology	Independent	
Subsystem for CIM implementation	Not catered for	
Hard and soft systems orientation	Soft systems oriented	
FUNCTIONAL		
Commitment and education	Yes	
Shared vision	Not referred	
Common objectives	Inferred	
Accountability and Contribution	Yes	
Process Orientation	No	
Information systems orientation	Not referred	
Integrated approach	Not integrated	
Ownership	Yes - Through involvement	
Continuous improvement	Inferred	
Performance measurement	Not referred	
APPLICATION		
Low cost	Cost = time	
Simplicity	Simple matrix	
Early benefits	Not referred	
Structured and planned approach	No framework therefore no structure	
Viable Systems	Not recognised	

Table 4.9 Review of Whiston's ten-by-three matrix.

4.9 DISCUSSION AND CONCLUSIONS

4.9.1 General Discussion

In this chapter eight existing methods and approaches to business integration has been reviewed. These range from methods developed as a result of research from academic institutions to approaches developed and practised by some of the leading management consultancies. The author is certain that this list of eight does not provide a exhaustive list of the methodologies available for business integration. However, these were the methods and approaches identified as a result of comprehensive literature survey carried out. The author is confident that, all the approaches and methods with academic origins are included in this chapter. However, the author is in no doubt that other unpublished methods are available which have been developed and employed by other management consultancy organisations. The methods and approaches outlined here which originate from the worlds leading management consultancy organisations provide a fair representative sample to allow assessment of the state of the art in this field.

The general conclusion of this review is that various methods and approaches to business integration are available and each approaches business integration from a different viewpoint. For example;-

- from a rigour viewpoint the methods with academic origins (MBR and SIM) demonstrate greater rigour and more specific frameworks than the methods originating from management consultancies.

- from the concepts viewpoint some methods encourage adoption of certain concepts and others do not. On one hand MBR strongly supports matrix type of organisations. Similarly the Gemini approach encourages the development of self-managed-network type organisation. On the other hand methods such as SIM, BAH, etc, do not indicate a preference. In other words, those methods which support certain concepts lead the business towards implementation of these concepts, other methods conduct an analysis to identify issues and problems and result in specific action plans.

- from the application viewpoint, methods such as BAH operate only at strategic levels, MBR is applied at strategic and operational levels and the SIM is applied primarily at the operational levels.

Whatever the view point all methods attempt to improve business performance through better integration, however some of the methods, such as the SI and the PRTM methods, emphasise more on improvement than integration. In trying to improve integration some recognise the need for certain practices to be adopted, such as defining a long term vision and setting measurable objectives whereas others focus only on operational analysis (eg the SIM).

Based on the review and discussion in the previous sections, it has become clear that different methods take different viewpoints and emphasis on different aspects of integration. Of course this may be

expected as the subject area is very broad and covers all aspects of a business. However, the main reason behind this level of variety is the lack of a reference model or a standard which defines aspects of business integration.

4.9.2 Specific Conclusions

Based on the specific and general discussions resulting from the review of existing methods for business integration the following conclusions have been reached:-

- None of the existing methods completely satisfies the requirements specified. Some address higher level issues, some focus only on operational detail, while some take prescribed solutions and attempt to implement these and so on.

- Existing methods are either analysis-oriented or design-oriented. The analysis-oriented methods attempt to analyze the current situation of an organisation with a view to identifying improvement opportunities. These usually result in action plans which would lead to improved integration. The design-oriented methods take the analysis process one step further and attempt to design or define a more integrated system on paper prior to improvement. An example of analysis oriented method is the SIM. MBR provides a good example of design oriented method.

- None of the methods are implementation oriented. That is they provide support up to the specification/design or action planning stage but they fail to facilitate the implementation process.

- None of the methods provide a reference model or a standard for integration. Therefore, the analysis is conducted without reference to a model or a standard.

- All models provide a framework (eg a structured action list) of some description. Some methods, such as MBR and SIM are very specific. Others, such as BAH and Arthur Anderson methods, are very vague.

- Few of the methods prescribe specific tools and techniques to facilitate the analysis and re-engineering process. With the exception of SWOT analysis all of the tools and techniques provided are analysis oriented and will require support from a analysis/consultant.

4.10 RESEARCH ISSUES

The first chapter of this thesis identified business integration as a key competitive requirement in order to compete in a world economy. At this stage the broad objective for the work presented in this thesis was defined as:-

"to develop and test a methodology providing a stepwise approach to total business integration using simple readily available tools and techniques"

Chapter two, in reviewing the background to business wide integration identified the need for an integrated business platform which would be independent from the technology but which focuses on all aspects of a business. To this end business wide integration was defined as:-

"All functions of a business working together to achieve a common goal, using clearly defined objectives, benchmarks, disciplines, controls and systems in a flexible, efficient and effective way to maximise value added and minimise waste"

Chapter three conducted a shallow but broad literature survey of the subject area to identify factors which contributed towards the integratedness of a business. This literature survey concluded with a requirements specification for a methodology which would facilitate business wide integration.

Chapter four set out to review some of the existing methods against this requirements specification. In conducting the review two major issues came to the surface. These are:-

- There is no clear reference model or standard for business integration.

- There is no methodology which would facilitate business wide integration which satisfies the requirements specified.

In the context of this work, reference model is best explained through an example. TQM is a very broad concept, rather like Business Integration. The field of quality, more specifically TQM contains a number of reference models which outlines the performance areas a business must satisfy to be a Total Quality business. The two most widely use reference models are the Malcolm Baldridge Model (1994) and the EFQM (European Foundation for Quality Management) Model (European Quality Award, 1993).

As there is no specific reference model, there is no specific methodology which would facilitate the achievement of this model. In the context of this work a methodology is a combination of a framework, ie a structured action list, supported with specific tools, techniques and procedures to facilitate business wide integration.

With these points in mind the specific objectives of this research work was realigned as follows:-

- To develop a reference model for business integration
- To develop a methodology to facilitate the achievement of this reference model.

In summary the reference model provides the objective and the methodology will provide the means of achieving the objective.

CHAPTER FIVE

RESEARCH METHODS

5. RESEARCH METHODS

5.1 INTRODUCTION

Having completed a literature review and identified the key research issues, the purpose of this chapter is to review the existing management research methods and design a research plan which would ensure that the remainder of the research is conducted with rigour.

The chapter first discusses the current thinking with respect to management research and draws some generic conclusions from this research. It then goes on to relate the particular research area of business integration to these conclusions and outlines a clear research plan.

However prior to reviewing the research methods, it was considered important to restate the specific research objectives. This would allow the pros and cons of various research methods and techniques to be examined and consequently would result in a rigorous research design.

The specific objectives of the research presented in this thesis are:-

- to develop a reference model for business integration based on the requirements specified.
- to develop a methodology which would facilitate business integration to the specified reference model.

- to demonstrate the application of the methodology through a number of experiments (ie. case studies).

- to analyze and discuss the success and failure of the methodology

5.2 A REVIEW OF MANAGEMENT RESEARCH METHODS

In management research there are a number of schools of thought. In order to review a fair share of these a number of texts were consulted. Easterby-Smith et at (1991) focuses on discussing the two research paradigms, ie. qualitative v quantitative. Gummesson (1991) focus on the qualitative research methods and imply that qualitative research results in more realistic and practical results. On the other hand, Gay and Diehl (1992) describe the quantitative research methods and imply that qualitative methods lack rigour. Therefore in order to reach to sound generic conclusions quantitative techniques are appropriate. Proceedings of the seminar on Management Research Techniques held at Cambridge University, June 1993 implied that both paradigms have their advantages and limitations and therefore it is the researcher's responsibility to examine and relate these to the specific area of research, to construct a research plan which ensures that necessary level of rigour is exercised and the results are practical and realistic.

Having studied the references quoted above the following sections present the author's own interpretation and conclusions with respect

to the research types and the two paradigms which represent two extremes of a spectrum.

5.2.1 Research Types

According to the references reviewed, based on the outcome of research, research types may be categorised as follows:

- Pure research
- Applied Research
- Action research

Following sub-sections provide further discussion on each one of the research types identified above.

5.2.1.1 Pure Research

Key feature of pure research is that it leads to theoretical developments with or without practical implications. Pure research may be further sub-divided into a number of categories, these are Discovery, Invention and Reflection.

Discovery:-

This type of research refers to the emergence of a totally new idea/concept. It is generally unintentional. The researcher does not start the research seeking solution for a specific problem, but he or she stumbles across a new idea or concept. A good example of this is Penicillin which was discovered by Alexander Fleming. The purpose of Fleming's research was to study the

growth of bacterial cultures, after he noticed that the cultures which were accidentally contaminated with mould "Penicillium Notatum" failed to grow. Here the research was being conducted for another purpose and the researcher accidentally discovered penicillin by noticing its characteristics.

Invention:-

This type of research refers to the development of new concepts, techniques or products based on direct experiences of their inventors. It is conducted intentionally where there is a clear hypothesis or problem. The research is carried out to prove the hypothesis or seek a solution to the problem. A good example of this is Edison's invention of the phonograph, where he specifically set out to design a machine which was capable of reproducing sound. Another good example of invention is TQM which was developed to address a specific problem (Easterby-Smith et al, 1991).

Reflections:-

This type of research refers to the examination of a group of existing ideas and techniques in a different environment. For example the original application of Data Flow Diagrams, which were developed to aid specification and design of software, to model organisations could be considered a reflection.

5.2.1.2 Applied Research

Here the starting point is to address a specific problem which may be common to more than one organisation. The objective is to develop a solution and prove that the solution works through a specific application. This is a typical consultancy assignment. In applied research the solution is rarely specific to the application and is expected to be generalisable.

5.2.1.3 Action Research

This is more of a learning process than research. The thinking behind action research is that if you want to understand something, you should try changing it. The objective is to tackle specific problems using known methods to learn and understand the application of these methods. The main difference between action research and reflection is that in reflection a method developed for one environment may be applied in another environment to reflect on its applicability. In action research however, the method will be applied to a specific problem where the results of the application is already known. The purpose of the application is to develop a hands-on understanding of how the method is applied rather than reflecting on the applicability of the method.

In the context of the above description of research types the Business Integration Research falls in to the pure research category because it is concerned with the invention of new techniques, tools, procedures and concepts (ie. methodology) to facilitate more effective business integration.

5.2.2 Management Research: Two Conflicting Paradigms

Management research spans a spectrum. At one end lies the Positivist (Quantitative) Paradigm and at the other the Phenomenological (Qualitative) Paradigm. The characteristics and basic concepts, benefits and limitations of each paradigm are summarised in table 5.1.

On one hand, the quantitative paradigm assumes that the world is external and the researcher must remain independent of the subject which is being researched by focusing on facts, using mechanistic techniques to generate measurable results based on data gathered from numerous samples. On the other hand, the qualitative paradigm assumes that the world is socially constructed and subjective, therefore the researcher must be immersed in the subject which is being researched by studying the totality of the situation, assimilating data from various views in a few samples.

Having studied the details of each paradigm the author concludes that the quantitative paradigm supports a hard systems approach to research whereas the qualitative paradigm supports a soft systems approach each with its own limitations and benefits. In reality, in order to study the subject area in totality the research method must take both hard and soft systems viewpoints in to account by ensuring that the potential benefits are maximized and limitations are minimized. In order to achieve this research methods must be designed as a hybrid of the two paradigms.

QUALITATIVE PARADIGM	QUANTITATIVE PARADIGM
BASIC CONCEPTS	
The world is socially constructed and is subjective.	The world is external and objective.
The researcher must be part of what is researched. It is impossible to discount the effects of the researcher.	The researcher is independent of what is being researched.
The research should focus on the meaning of data.	The research should focus on facts.
The research should look at the totality of the situation and try to understand what is happening.	The research should reduce phenomena to simplest elements and focus on fundamental laws.
The research should develop ideas through the induction an assimilation of data. this is possible as the researcher is involved in what is researched.	The research should formulate an hypothesis and then set out to test this hypothesis.
The researcher should use methods to establish different views of the subject area.	The research techniques should be mechanistic and should generate measurable results to support conclusions.
The research methods should focus on few samples and investigate the subject in depth.	The research should be based on data gathered from numerous samples, ie data should be statistically viable to support findings and conclusions.
BENEFITS	
More suitable for the study of change processes over a period of time	Wide coverage of a range of situations.
Takes in to account of people aspects of the subject area	Data gathering is fast and economical.
Better contribution towards the development of new theories, concepts, etc	Conclusions based on accurate statistics from large samples.
Provides a natural way of providing data.	
LIMITATIONS	
Data collection is time consuming as the researcher needs to become part of the process which is being researched.	Not very good at taking in to account of the human factors.
Data is more subjective therefore analysis and interpretation becomes more difficult.	Not very helpful in generating theories.
Untidy because the beginning and end points are not too clear.	Focuses on recent events.

Table 5.1 Basic concepts, benefits and limitations of Qualitative and Quantitative management research paradigms.

5.3 THE RESEARCH METHOD ADOPTED IN THIS THESIS

Having studied the types of research and the research paradigms the following conclusions have been reached:

- Research in Business Integration clearly falls in to the Invention type research category.

- Research must be designed to take into account the subject area, the characteristics, benefits and limitations of the two extreme paradigms.

However, bearing the objectives of the research in mind and taking account of the conclusions stated above, it was considered prudent, before designing the research plan, to forecast some of the potential pitfalls and difficulties which may be encountered in trying to achieve the stated objectives.

5.3.1 Potential Pitfalls and Issues

The potential pitfalls and issues were identified as a result of consultation with other research colleagues and experienced researchers, and the following research method or plan oriented issues were identified as being potentially critical:-

* Comparative nature of research
* Sample sizes
* The Hawthorne effect
* Measurement of Change

In the following paragraphs each of the above potentially critical issues is discussed in further detail.

5.3.1.1 Comparative Research

This is a facet of the quantitative paradigm. An example of comparative research may be; two identical organisations are found, with identical problems, in identical environments (ie. market forces, economics, objectives, strategies, technology, etc). In one organisation the methodology is applied and in the other it is not applied. In both cases the conclusions of the research will be based upon a comparative analysis of the results of each experiment (ie. case study). Another example of comparative research may be; a number of identical organisations are found The methodology developed through the research presented in this thesis is applied to one organisation and other methods which were reviewed in chapter four are applied to other organisations.

The difficulty associated with this scenario is that comparative experiments provide meaningful results only if conducted under controlled conditions (Gummesson, 1991, Gay & Diehl 1992). It is therefore more suited to types of experiments where all variables are under the control of the researcher. Therefore the researcher is able to study the effect of one single variable on the system by ensuring that all other variables remain unchanged. Although this is possible under laboratory conditions it becomes less practical in environments where the researcher has no control over the variables (ie market forces, economics, staff, policy, strategy, technology etc). It is

therefore virtually impossible to conduct realistic and meaningful comparative research in an industrial organisation where the researcher has no control over the organisations environment.

5.3.1.2 Sample Size

The sample size, ie the number of experiments (or case studies), was considered to be potentially critical due to the nature of this particular research. It was recognised that any methodology which would be developed will take in the region of six to twelve months for implementation in a particular organisation. Each experiment could take approximately one year to complete, therefore selection of a large sample size (eg ten experiments) would not be a practical proposition.

However, this only becomes an issue if the research method is approached purely from the quantitative paradigm which requires the research to be based on data gathered from numerous samples or experiments. The qualitative paradigm emphasises that the research should focus on a few experiments but study the subject in depth. In this research the intention is to demonstrate the application of the methodology through case studies where the subject was studied in detail.

5.3.1.3 The Hawthorne effect

One of the problems associated with the researcher or the research being so closely associated with the subject being studied is that their presence may cause the subject to behave differently. For example in testing a methodology which has been designed to facilitate

integration the researchers presence by itself result in improved performance rather than as a direct result of the application of the methodology. This is commonly known as the Hawthorne effect.

The objective of this work is to develop a methodology which would cause change in the case study organisation. Therefore, it is important for the research method to identify or differentiate the change caused purely by the application of the methodology from the change caused due to the Hawthorne effect.

5.3.1.4 Measurement of Change

Earlier in the thesis it has been stated that Business Integration should lead to improvements in business performance. However, it is expected that each experiment would take in the region of six to twelve month and the researcher cannot exercise complete control over other variables. Therefore it would not be credible to argue that; "the methodology alone resulted in improvements in business performance therefore the methodology must work". Because the improvement in business performance may be due to other external influences which are not controlled, it is critical that the research method attempts to measure the change caused directly as a result of application of the methodology.

5.3.2 Research Design

Based on the research objectives, the review of research methods and the discussion on potential pitfalls and issues following conclusions were reached with respect to designing the research method for the research presented in this thesis:-

- Comparative research was not considered to be a practical proposition because it would not be possible to control the experiments, therefore any comparison would be meaningless.

- In order to demonstrate the application of the methodology the research and the researcher would be involved in detail with the case study organisations looking at the totality of the situation. In this respect the research falls in to the qualitative paradigm where a large sample size is not a critical requirement.

- Due to in depth involvement with the case study organisations, the isolation of the Hawthorne effect would be critical.

- It would be critical to measure the effect caused by the application of the methodology by developing a audit method which would measure the level of integration within a business.

Based on the reasons specified above the research method for this subject area will be a hybrid of qualitative and quantitative research techniques. In order to maintain a certain degree of objectivity in to the research some of the techniques usually associated with the

Quantitative paradigm will be included mainly to account for the Hawthorne effect and to measure the level of integration attained. In this respect the quantitative approach will provide the skeleton and the qualitative approach will provide the flesh to ensure that the subject area is adequately researched both in terms of rigour and depth.

With the above discussion in mind the following research plan was agreed:

- Develop the reference model based on the requirements specification.

- Develop a methodology which would facilitate the achievement of business integration with respect to the reference model and the gaps identified in chapter 4.

- Develop an audit method for measuring the level of integration of a business. Assess the limitations of the audit method with respect to its effectiveness, reliability and repeatability.

- Conduct three experiments (ie case studies) to demonstrate the application of the methodology. For each case study, present the application of the audit method to illustrate the direct effect of the methodology on the case study organisation. The audit method would be applied to measure the state of integration in

each company before, at the end and one year after the completion of the integration programme.

- Analyze the results of the experiments and provide a critical review of the reference model, the methodology and the audit method. Also compare the methodology developed as a result of this research to the existing methodologies presented in chapter four by reference to the Requirements specification defined in chapter three.

5.4 POTENTIAL PITFALLS AND ISSUES ADDRESSED

The objective of this section is to illustrate the thinking behind the research plan by tying the plan to the potential pitfalls and issues identified earlier.

5.4.1 Comparative Research

From practical viewpoint, due to the reasons discussed earlier in this chapter, comparative research against other methodologies is not feasible. However discussion in chapter 9 does include a comparison of the methodology developed through this research to other methods.

5.4.2 Sample Size

Due to the length of each experiment (approximately one year) the sample size is limited to three, ie three case studies are provided. However, this limitation is recognised and discussed in greater detail in chapter 9.

5.4.3 The Hawthorne Effect

The proposed integration audit method by measuring the level of integration before, after and a year after the implementation of the methodology will ensure that the hawthorn effect is accounted for.

5.4.4 Measurement of Change

The audit method ensures that the level of integration in a business is measured. The improvements in these measures will be absolute and will be due to application of the methodology rather then uncontrolled external factors.

5.5 SUMMARY

Having studied the existing research methods the research plan has been decided. This research plan leads to the development and application of:

- A reference model for business integration.
- A methodology for improving business integration.
- An audit method for measuring the level of integration in a business.

The reference model would specify the requirements a business should satisfy in order to demonstrate business wide integration. The methodology would provide the framework, tools, techniques, procedures and guidelines which could be used to achieve the requirements of the reference model. The audit method will provide the means to measure the level of conformance to the reference model.

In other words the reference model specifies "WHAT" must be done. the methodology specifies "HOW" it could be done and the audit method provides the means of establishing "WHERE" an organisation is with respect to the reference model. Figure 5.1 illustrates this relationship.

Chapter 6 specifies the reference model together with the thinking behind the development of the reference model. Chapter 7 describes the development of the audit method. Chapter 8 discusses the reference model developed and details the tools and techniques used

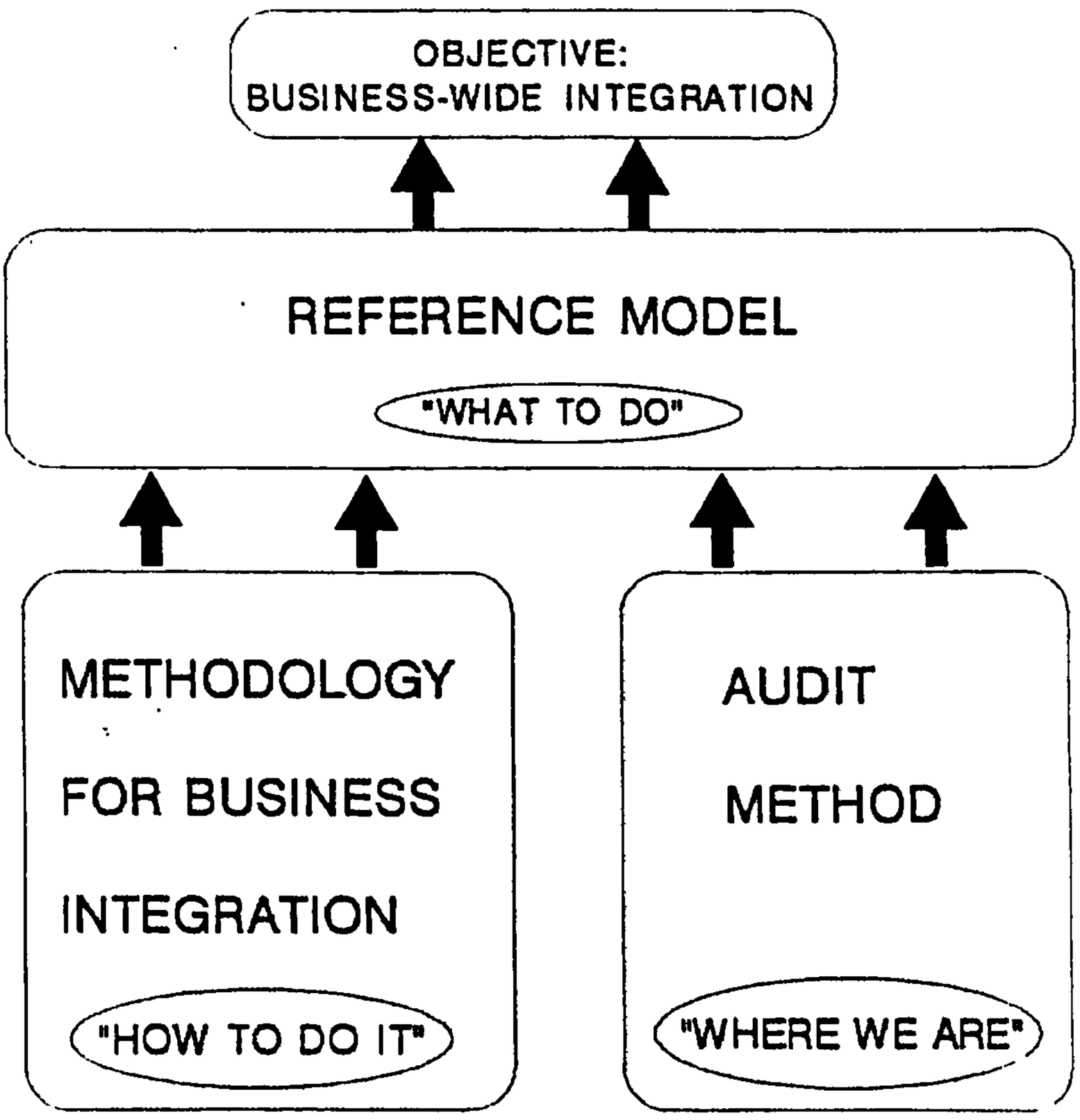


Figure 5.1. The Reference Model, the Audit Method and the Methodology.

CHAPTER SIX

REFERENCE MODEL

6. REFERENCE MODEL

6.1 INTRODUCTION

The previous chapters, having conducted a literature survey, compiled a requirements specification for business integration methodologies. Further investigation into existing methods revealed various approaches to business integration vary considerably in approach, emphasis and purpose. At this point it became clear that the reason for this variety in approach, emphasis and purpose was the absence of any generic reference model for business integration.

In this context, a reference model for business integration should specify the behaviour an organisation should demonstrate, or in other words the reference model should give guidance on the requirements an organisation should satisfy to become an integrated business. The thinking behind this reference model was initiated by examples which can be seen in the TQM arena.

The objective of this chapter is to review the current thinking on reference models, and then go on to develop a reference model for business integration based on the literature review conducted and the requirements specified in chapters three and four.

6.2 REFERENCE MODELS FOR TQM

Today, a number of reference models are available which provide guidelines and specify requirements an organisation should satisfy to become a Total Quality organisation. The three most common reference models for TQM are:

- The Malcolm Baldrige Model
- The EFQM (European Foundation for Quality Management) Model
- BS7850 for TQM

The Malcolm Baldrige Model for TQM was developed during the mid 80's by the United States Department of Commerce to create an awareness of quality, to encourage understanding of the requirements for quality excellence and sharing of information on successful quality strategies and practices. It takes the form of an annual award based on a rigorous examination process by a panel of trained assessors (Malcolm Baldrige National Quality Award, 1994).

The EFQM Model for TQM was developed by the European Foundation for Quality Management in response to the Malcolm Baldridge Award and identical objectives and it is also administered in the form of an annual award (European Quality Award, 1993). The EFQM Model was announced during 1992, its requirements are very similar to that of the Malcolm Baldrige Model, however being a more modern model it places greater emphasis on business results and customer satisfaction.

BS7850 was announced during 1993. It is not an award but provides guidelines for organisations who wish to progress toward TQM. Its structure different from the Malcolm Baldrige and EFQM Models.

In the context of this thesis the structure of these models is more significant than their content. All three models, in particular the Malcolm Baldrige and EFQM Models, define several performance areas

and for each area the performance criteria which should be fulfilled. Table shown in Figure 6.1 illustrates the performance areas for each of the three models.

The reference models are structured such that the performance criteria associated with each performance area are then specified. This is best illustrated through the following example.

The EFQM Model under the Processes Performance Area specifies the following performance criteria:-

Evidence is needed of how:-

a. processes critical to the success of the business are identified

b. the company systematically manages its processes

c. feedback is used to review processes and set targets

d. the company stimulates innovation in process improvement

e. the process changes are implemented and benefits evaluated

Malcolm Baldrige Model	EFQM Model	BS7850
Leadership	Leadership	Commitment
Information and Analysis	Resources	Customer Satisfaction
Strategic Quality Planning	Policy and Strategy	Quality Losses
Human Resource Development	People Management	Participation by All
Management of Process Quality	Processes	Process Measurement
Quality and Operational Results	Customer Satisfaction	Continuous Improvement
Customer Focus and Satisfaction	People Satisfaction	Problem Identification
	Impact on Society	Alignment of corporate objectives and individual attitudes
	Business Results	Personal Accountability
		Personal Development

Figure 6.1 Reference Models for TQM - Performance Areas

6.3 REFERENCE MODELS FOR BUSINESS INTEGRATION

In the general area of business integration there is a clear absence of a generally accepted reference model. This was demonstrated during the review of existing methods for business integration.

On the other hand, work carried out as part of the ESPRIT programme (ESPRIT Consortium AMICE, 1991) has developed a reference model for a computer supported and integrated manufacturing enterprise. The details of this model was discussed in chapter three of this thesis. As the name of this model suggests, it has been developed purely from an information technology/systems point of view and it focuses on the various types of CIM modules which should be employed at specified

levels within the organisation and the information which needs to be transmitted between these modules. Therefore it provides a reference model for integration of computer based systems within a manufacturing enterprise rather than for business integration as defined in this thesis.

Similarly Kehoe et al (1993) have developed a reference model for Integrated Manufacturing Systems, which also specifies the types of systems which should be used for planning and controlling manufacturing activities and goes on to specify the information systems requirements to support these systems. This work also takes an information systems view of integration. Although valid in its own right, it also does not provide a reference model for business-wide integration.

6.4 A REFERENCE MODEL FOR BUSINESS INTEGRATION

6.4.1 Introduction

The purpose of this section is to specify a reference model based on the literature survey and the requirements specification compiled. The reference model is structured in a similar fashion to the Malcolm Baldrige and EFQM Models, in that it identifies a number of performance areas for business integration. It then goes on to specify the objective, performance criteria and audit points for each performance area.

6.4.2 Reference Model Overview

In the context of this reference model "Business Integration" is defined as:

> *"All functions of a business working together to achieve a common goal, using clearly defined objectives, benchmarks, disciplines, controls and systems in a flexible, efficient and effective way to maximise value added and to minimise waste."*

To achieve the above objectives the following have been identified as the critical performance areas:

- Shared Vision
- Shared Strategy and Common Goals
- Awareness of Roles and Responsibilities
- Integrated Processes
- Conforming Working Practices
- Integrated Performance Measures

The following section specifies the performance criteria for each one of the performance areas identified above. Section 6.5 provides a detailed discussion on the relative merits of each performance area and its contribution towards business integration.

6.4.2 Reference Model Performance Criteria

6.4.2.1 Shared Vision

The objective is to ensure that the business direction is defined and this direction is known and understood by employees at all levels of the organisation. To achieve this the management should ensure that:-

a. The current position of the company is defined with respect to competitors and customers, financial performance, internal strengths and weaknesses, external threats and opportunities.

b. A long term, realistic, vision is defined.

c. The key competitive criteria which would enable the company to achieve its vision are defined.

d. Employees can relate their own job functions to the achievement of this vision and items a-c above is understood by employees at all levels.

6.4.2.2 Shared Strategy and Common Goals

The objective is to ensure that the company has defined a plan which details how it is going to progress from its current position towards its vision in terms of both long and short term goals, and that employees at all levels understand this plan. To achieve this the management should ensure that:-

a. The vision is expressed in terms of measurable short and long term goals.

b. A strategy for achieving the vision has been formulated and expressed in measurable terms in the form of short and long term targets and priorities.

c. Employees can relate their own job functions to the long and short term strategic targets and items a and b above are understood by employees at all levels.

6.4.2.3 Awareness of Roles and Responsibilities

The objective is to ensure that all roles and responsibilities are defined and that there is a general awareness of all roles and responsibilities across the business. To achieve this the management should ensure that:-

a. All strategic and operational processes within the business are identified.

b. All process responsibilities are allocated to business functions.

c. All functions clearly understand their process responsibilities.

d. All functions demonstrate an awareness of other functions' roles and responsibilities.

6.4.2.4 Integrated Processes

The objective is to ensure that the objectives, interfaces and the procedures for each process are clearly understood by the personnel responsible for those processes and that these objectives, procedures and interfaces are agreed with the customers and suppliers of those processes. To achieve this the management should ensure that:-

a. The objective of each process is defined.

b. The inputs, outputs and controls (ie. policies, constraints, etc) of each process is clearly defined.

c. The customers (ie the destination of outputs) and suppliers (ie the source of inputs) for each process are defined.

d. The procedure (ie. the actions necessary for converting the inputs into the outputs) for successful execution of each process is defined.

e. The customers and suppliers agree with the objectives, inputs, outputs and the procedures for each process.

f. All personnel responsible for the process understand a-d above.

g. Regular reviews are conducted to ensure that the processes remain integrated.

6.4.2.5 Conforming Working Practices

The objective is to ensure that the working practice conforms to the processes as described in the previous paragraph. In other words the Integrated Processes provide a static picture of how the processes should interrelate. In this section the objective is to ensure that the defined procedures are followed as described. To ensure this the management should:-

a. Conduct regular audits

b. Take corrective actions as necessary (eg training, retraining, redeployment, revision of the processes, etc)

6.4.2.6 Integrated Performance Measures

The objective is to ensure that the goals and targets set at the strategic levels are deployed to individual functions and processes within the organisation through an integrated set of performance measures. To ensure this the management should:-

a. Define the performance criteria of each process.

b. Identify indicators which objectively measure the ability of these processes to fulfil the performance criteria.

c. Establish an understanding of the relationships between the process level performance measures and the strategic measures and goals.

d. Establish the relative priorities at process levels with respect to strategic priorities.

e. Encourage the use of the integrated performance measures as a management tool.

6.5 DISCUSSION

The objective of this section is to discuss the thinking behind the reference model by cross referencing the individual performance areas to the key messages extracted from the literature survey (sections 3.4.1 and 3.4.2). This cross reference is illustrated in Figure 6.2.

REQUIREMENTS	REFERENCE MODEL PERFORMANCE AREAS					
	SHARED VISION	SHARED STRATEGY	ROLES AND RESPONSIB	INTEGRATED PROCESSES	WORKING PRACTICES	PERFORMANCE MEASURES
SHARED VISION	*					
COMMON BUSINESS OBJECTIVES	*	*				*
COMMITMENT AT ALL LEVELS	*		*			
LEADERSHIP	*	*	*	*	*	*
CUSTOMER FOCUS (INT & EXT)				*		
INFORMATION SYSTEMS				*		
EDUCATION AND TRAINING	*	*	*	*	*	
PARTICIPATION BY ALL	*	*	*	*	*	*
OWNERSHIP	*	*	*	*	*	*
PERFORMANCE MEASUREMENT		*				*
PROCESS ORIENTATION			*	*		*

Figure 6.2 Reference model - literature survey cross reference.

The cross reference table presented in figure 6.5 shows that the reference model addresses all of the key functional requirements identified through the literature survey. There are a number of areas where the coverage appears to be broad, such as leadership where the reference model requires the management to ensure that the performance criteria specified is implemented. Similarly, for the areas of Participation and Ownership, each performance area requires involvement of the responsible or related personnel, therefore they are also addressed by each one of the performance areas specified.

More specific discussion on each one of the performance areas is included in the following sections.

6.5.1 Shared Vision

The definition for business integration requires all aspects of an organisation to work towards common goals and objectives. The objective of Shared Vision is to ensure that the business has a clear direction and this direction is clearly understood by all personnel within the business. However, prior to establishing a direction for the business, it is essential for the organisation to understand the starting point, external and internal influences and developments so that the objectives and goals are realistic. In other words "if you don't know where you are, you cannot know where you are going". The four audit points, "a-d", specified in the reference model ensures that the business has established its current status, identified its internal end external influences, defined an overall goal, identified the key competitive criteria to achieve its objective, communicated these to all

personnel and ensured that all personnel could relate their individual job function to the overall objective.

In fulfilling the performance criteria specified here, the business would contribute towards the following requirements:-

* A **Shared Vision** would be established.

* A high level **Common Objective** would be established.

* The contribution of individual employees to the overall objective would be established. Consequently individual employees will have greater understanding **(Education) and Ownership** of their job responsibilities.

* Consequently the level of each employees **Commitment** will also increase.

6.5.2 Shared Strategy and Common Goals

The performance criteria specified under this heading ensures that the vision is quantified in terms of measurable goals and a strategy (expressed in terms of short and long term targets and priorities) is formulated to achieve this goal. Again emphasis is placed on common understanding **(Education and Training)** of the strategy and goals by all personnel in the organisation.

In fulfilling the performance criteria specified here, the business would contribute towards the following requirements:-

* Common Business Objectives
* Performance Measurement at a high level
* Education and Training

6.5.3 Awareness of Roles and Responsibilities

The objective of this performance area is two fold. One is to ensure that all functions and employees understand the processes for which they are accountable **(Education and Training)**. Another is to ensure that all functions have a broad awareness of business by demonstrating an awareness of other functions accountability. This is a key aspect of business integration as defined in this thesis. In that disciplines and controls cannot be effective unless processes and accountability **(Ownership)** are clearly defined and understood. The performance criteria specified under this area ensures that all processes are identified, for each function the functional process responsibilities are established and the functional roles and responsibilities are understood across the business.

In fulfilling the performance criteria specified here, the business would contribute towards the following requirements:-

* The **Processes** within the business will be identified (ie Process Orientation)

* The accountability and contribution of each function and individual will be specified in terms of processes. Consequently the **Commitment and Ownership** will be improved.

* The individual working in the company will have an increased and broader awareness (**Education**) of business activities.

6.5.4 Integrated Processes

In order to instill the best practices, disciplines and controls the interfaces between each process and the contents of these processes must be understood and specified. This will result in systems which are flexible, efficient and effective as specified in the definition of business integration.

In fulfilling the performance criteria specified under the heading of business processes, the business would contribute towards the following requirements:-

* Focusing on integration of processes, ie **Process Orientation.**

* Focusing on interfaces between processes, ie **Information Systems Orientation.**

* Agreeing the contents and outputs of each process with the customers of that process resulting in greater **Ownership.**

* Clearer communication links, information systems and increased ownership resulting in increased **Commitment and Education.**

6.5.5. Conforming Working Practices

Through conducting regular audits of the working practices, the management demonstrates **Commitment and Leadership.** Furthermore, as the audits require the **Participation** of employees at various levels, audits lead to increased **Ownership.**

In fulfilling the performance criteria specified under the heading of business processes, the business would contribute towards the following requirements:-

* Commitment
* Leadership
* Participation by all
* Ownership

6.5.6. Integrated Performance Measures

The criteria specified in this performance area ensures that all aspects of the business is streamlined towards the **Common Business Objectives** by identifying the **Performance Measures** associated with each **Process** and relating these to the business objectives.

In fulfilling the performance criteria specified under the heading of integrated performance measures, the business would contribute towards the following requirements:-

* Common Business Objectives
* Performance Measurement
* Process Orientation

6.6 CONCLUSIONS

The reference model presented in this chapter, based on the above discussion, encompasses all the key issues identified during the literature survey with respect to business integration. The Reference Model, against each performance area specifies the ideal criteria. This criteria is said to be ideal as it may not be possible or practical to achieve 100% of each criteria. The performance areas specified within the model may be grouped under two headings. These are illustrated in Figure 6.3 as "Drivers" and "Enablers".

"Drivers" are those performance areas which provide strategic direction to the integration process. These are:-

- Shared Vision
- Shared Strategy and Common Objectives

"Enablers" are those performance areas which improve the ability of the business to progress towards its business objectives in the most efficient, effective and flexible manner. These are:-

- Awareness of Roles and Responsibilities
- Integrated Processes
- Conforming Working Practices
- Integrated Performance Measures

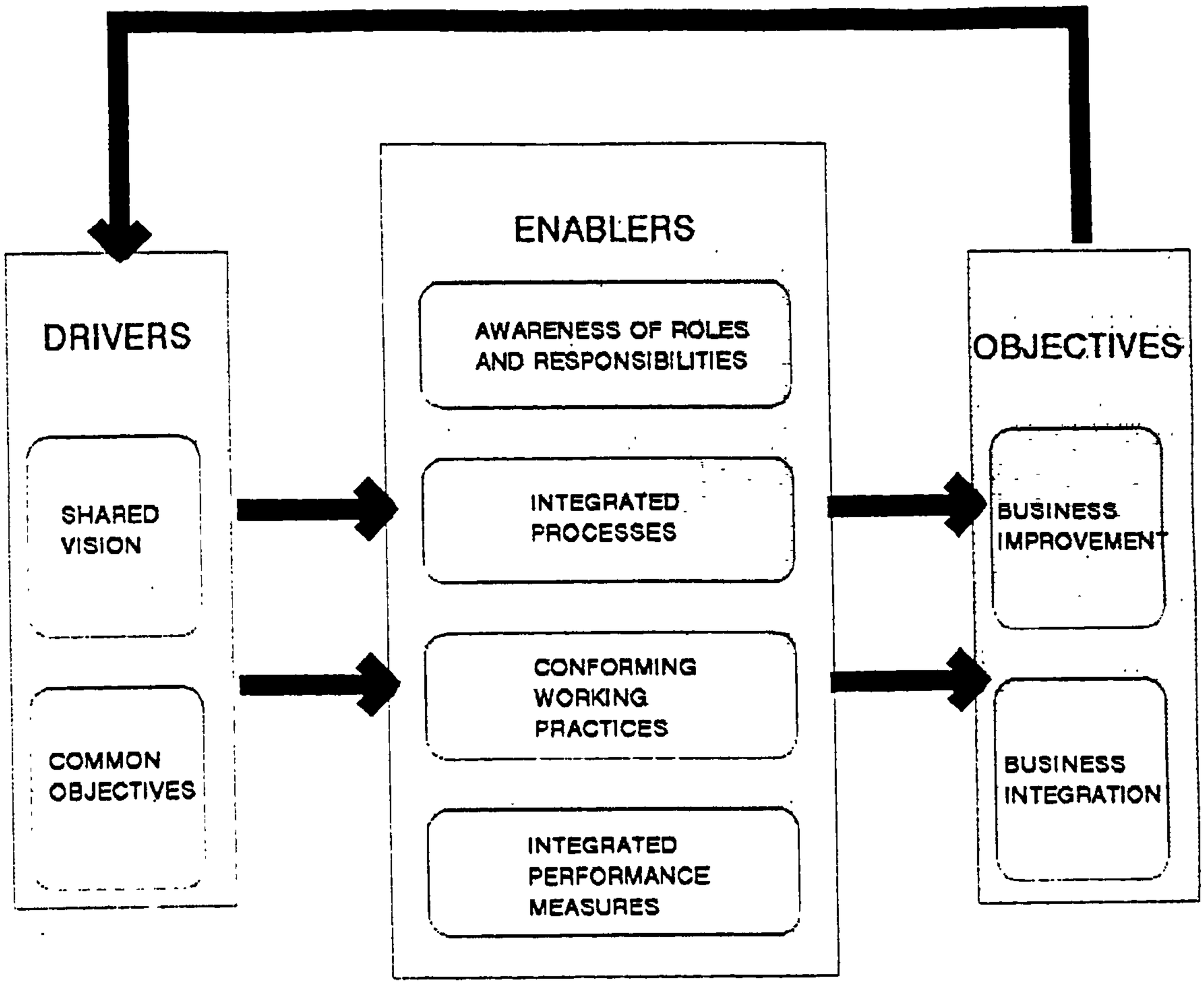


Figure 6.3 A Reference Model for Business Integration

CHAPTER SEVEN

THE AUDIT METHOD

7.0 THE AUDIT METHOD

7.1 INTRODUCTION

The objective of this chapter is to briefly describe the development of the audit method to measure an organisation's level of integration. As discussed in the previous chapters, before one can measure the level of integration there must be some form of standard, ie the reference model. Therefore, the audit method developed focuses on the performance areas and criteria specified within the reference model and measures the level of attainment against each performance area.

Prior to detailed description of the audit method, the chapter provides a critical review of other audit methods and then goes on to discuss the rationale behind the audit method developed.

7.2 REVIEW OF AUDIT METHODS

7.2.1 Audit Methods for TQM

The Malcolm Baldrige and the EFQM quality awards discussed in the previous chapter has assessment/audit methods associated with them. The purpose of these audits is to establish some form of a measure of how much an organisation meets the performance criteria specified in the reference models. These audits are designed to measure the conformance of an organisation to the reference model in absolute terms to allow inter-company comparisons.

In both cases an identical system for auditing is used. To illustrate the mechanism of auditing the Malcolm Baldrige auditing process provides a good example. For auditing purposes each of the

performance areas is subdivided into more specific areas, and each performance area and the sub-area is allocated a maximum point value based on the importance/weighting of the particular area. The maximum point values associated with the Malcolm Baldrige audit system is illustrated in Table 7.1.

EXAMINATION CATEGORIES	MAX. POINT VALUE
1.0 Leadership	95
1.1 Senior Executive Leadership	45
1.2 Management for Quality	25
1.3 Public Responsibility	25
2.0 Information and Analysis	75
2.1 Scope and Management of Data	15
2.2 Competitive Comparisons	20
2.3 Analysis and Use of Data	40
3.0 Strategic Quality Planning	60
3.1 Company Performance Planning	35
3.2 Quality and Performance Plans	25
4.0 Human Resource Management	150
4.1 Human Resource Planning	20
4.2 Employee Involvement	40
4.3 Employee Education and Training	40
4.4 Employee Performance Recognition	25
4.5 Employee Satisfaction	25
5.0 Management of Process Quality	140
5.1 Design of Products	40
5.2 Process Management: Production	35
5.3 Process Management: Business	30
5.4 Supplier Quality	20
5.5 Quality Assessment	15
6.0 Quality and Operational Results	180
6.1 Product and Service Quality	70
6.2 Company Operational Results	50
6.3 Business Process Results	25
6.4 Supplier Quality Results	35
7.0 Customer Focus and Satisfaction	300
7.1 Customer Expectations	35
7.2 Customer Relationship Management	65
7.3 Commitment to Customers	15
7.4 Customer Satisfaction Determination	30
7.5 Customer Satisfaction Results	85
7.6 Customer satisfaction Comparison	70
TOTAL POINTS	1000

Table 7.1. Baldrige Scoring System

The audit itself is an assessment of a company's performance against the performance criteria specified in the reference model. The audit is conducted by a panel of trained auditors who analyse the company's policies, processes, procedures and performance against the performance criteria and allocate points based on deployment of each performance criteria and the results achieved. At this stage the audit process becomes rather subjective and is largely dependent on the company's ability in presenting and selling itself and on the judgment of the audit panel. The subjectivity of the audit process is minimised through the following mechanisms:

- Detailed training of all auditors
- Use of a panel of auditors rather then one auditor
- Scoring guidelines (Table 7.2)

The EFQM model uses a very similar audit method for measuring the quality of an organisation, the only difference is the slight variation in the weighting system used in the scoring systems.

Although, in practice these methods seem to be working satisfactorily, from the management research point of view as discussed in chapter 5 they tend to be phenomenological (ie qualitative) and are therefore to certain extend subjective.

SCORE	APPROACH/DEPLOYMENT
0%	• anecdotal information; no system evident in information presented
10% to 30%	• beginning of a systematic approach to addressing the primary purposes of the item • significant gaps still exist in deployment that would inhibit progress in achieving the major purposes of the item • early stages of a transition from reacting to problems to preventing problems
40% to 60%	• a sound, systematic approach responsive to the primary purposes of the item • a fact-based improvement process in place in key areas addressed by the item • no major gaps in deployment, though some areas may be in early stages of deployment • approach places more emphasis on problem prevention than on reaction to problems
70%	• a sound systematic approach responsive to the overall purposes of the item • a fact-based improvement process is a key management tool; clear evidence of refinement and improved integration as a result of improvement cycles and analysis • approach is well-deployed; with no significant gaps, although refinement, deployment, and integration may vary among work units or system activities
100%	• a sound, systematic approach, fully responsive to all the requirements of the item • approach is fully deployed without weaknesses or gaps in any areas • very strong refinement and integration—backed by excellent analysis

SCORE	RESULTS
0%	• no data reported or anecdotal data only • data not responsive to major requirements of the item
10% to 30%	• early stages of developing trend data • some improvement trend data *or* early good performance reported • data are not reported for many to most areas of importance to the item requirements and to the company's key performance-related business factors
40% to 60%	• improvement or good performance trends reported in key areas of importance to the item requirements and to the company's key performance-related business factors • some trends and/or current performance can be evaluated against relevant comparisons, benchmarks, or levels • no significant adverse trends or poor current performance in key areas of importance to the item requirements and to the company's key performance-related business factors
70%	• good to excellent improvement trends in most key areas of importance to the item requirements and to the company's key performance-related business factors *or* sustained good to excellent performance in those areas • many to most trends and current performance can be evaluated against relevant comparisons, benchmarks, or levels • current performance is good to excellent in most areas of importance to the item requirements and to the company's key performance-related business factors
100%	• excellent improvement trends in most to all key areas of importance to the item requirements and to the company's key performance-related business factors *or* sustained excellent performance in those areas • most to all trends and current performance can be evaluated against relevant comparisons, benchmarks, or levels • current performance is excellent in most areas of importance to the item requirements and to the company's key performance-related business factors • strong evidence of industry and benchmark leadership demonstrated

Table 7.2 Baldridge scoring guidelines.

7.2.2 Audit Methods for Business Integration

An extensive literature survey was conducted on audit/measurement methods for business integration. However, amount of work carried out in this area seems to be limited.

Lawrence and Lorsch (1967) in their research to study differentiation and integration in organisations measured the effectiveness of integration by asking respondents for their evaluation of the state of interdepartmental relations. The evaluation being based on a seven point scale ranged from "full unity (1)" to "couldn't be worst (7)". Although, for the purposes of their research this method of measurement may have been adequate, but for the purpose of this research, this method is considered to be inadequate as it does not relate to the performance criteria specified within the reference model.

Kehoe et al (1990) discusses the measurement of integration and focuses on the information systems. The work described considers the quality of information systems as a key aspect of integration. Indeed this is also recognised as a critical aspect of integration in this work. In discussing the measurement of integration Kehoe et al deals with the measurement of information quality of a company and outlines a method for quantifying the effectiveness of information flow. It is suggested that this method could be used in the planning phase for an information systems development methodology. They identify six attributes which may be associated with information quality and try to convert all the detailed characteristics of information systems in to single overall index using these six attributes.

Ahituv (1886) and Ives (1983) conducted research to measure the value of information systems using several approaches. The objective in both cases was to understand the limitations and benefits associated with different approaches to measuring the value of information systems, mainly to aid the cost-benefit type decision process rather then to aid integration of the information system.

7.2.3 Audit Method: Requirements

Having reviewed the currently available audit methods both for TQM and Business Integration the following conclusions have been reached:

- Audit methods in the TQM area are well developed.

- Audit methods for TQM rely to a certain extent on subjective processes which have been well accepted in practice, but are open to criticisms due to lack of objectivity.

- There are no audit methods in existence to satisfactorily measure Business-wide integration. Any attempt to measure integration focuses on the integrity, ie quality, of the information systems.

Based on the review conducted in this chapter and discussions in previous chapters, the objective of the audit method was identified. The objective is:-

- to systematise the measurement of integration within a company so that opportunities for improvements can be identified and progress towards business-wide integration can be monitored.

To achieve this objective, the audit method could be designed to provide an absolute measurement or a relative measurement. An absolute measure would achieve the objective stated above, it will also allow for intercompany comparisons. However, a relative measure would only allow an organisation to audit itself over a period of time and monitor any trends. However it will not allow inter company comparisons. The audit methods for TQM are designed to be absolute to allow intercompany comparisons.

In order to achieve the objective stated above the audit method would need to fulfil the following requirements:

- The audit method should measure an organisations performance against each one of the performance areas and criteria specified in the reference model.

- The measurement should be objective.

- The audit method need only provide a relative measure.

- In order to maintain objectivity a measure against each performance area would suffice. Attempts to arrive at a single combined measure would require a certain degree of subjectivity and therefore should be avoided.

7.3 AUDIT METHOD

The audit method was developed to provide an objective measure against each one of the performance areas specified in the reference model. The following sections discuss the operation of the audit method with specific reference to the reference model.

7.3.1 Shared Vision

The criteria specified in this performance area of the reference model is summarised in Table 7.3.

The objective is to ensure that the business direction is defined and this direction is known and understood by employees at all levels of the organisation. To achieve this the management should ensure that:-
a. The current position of the company is defined with respect to competitors and customers, financial performance, internal strengths and weaknesses, external threats and opportunities.
b. A long term, realistic, vision is defined.
c. The key competitive criteria which would enable the company to achieve its vision are defined.
d. Employees can relate their own job functions to the achievement of this vision and items a-c above is understood by employees at all levels.

Table 7.3 Performance criteria for Shared Vision

In order to objectively measure a company's performance against this criteria the following procedure has been adopted:

- Identify the company's current position, vision and key competitive criteria. In some companies this may be formally documented in the form of a business plan, vision statement etc. In other cases it may be necessary to establish these through interviews with the Managing Director/CEO and the senior managers within the company.

- If the company can not demonstrate an understanding of their current position, vision and key competitive criteria at the senior management level a score of "0%" is allocated against this performance area.

- Having established the company's current position, vision and the key competitive criteria the following questions are asked to various staff at each level in the organisation.

  * What is the company's current position, vision and the key competitive criteria?

  * What does it mean to you and how does your job relate to this vision?

For the sake of practicality where a large number of employees are involved a representative sample may be taken at random from each department.

- The response received from each employee is evaluated as High, Medium or Low according to their response to the above questions. High score means that the employee demonstrated a good awareness of the company's vision and was able to relate his/her job function to this vision. On the other hand a "Low" score is awarded to those employees who demonstrate a poor or no awareness. A "Medium" score is awarded to those employees who demonstrate some awareness of the vision and their job function with respect to this vision.

- The following formula is applied to establish an overall score.

$$\% \text{ Score} = \frac{\text{(No of high sores) + 0.5(no of medium scores)}}{\text{Number of Interviews}} * 100$$

7.3.2 Shared Strategy and Common Goals

The criteria specified in this performance area of the reference model is summarised in Table 7.4.

The objective is to ensure that the company has defined a plan which details how it is going to progress from its current position towards its vision in terms of both long and short term goals, and that employees at all levels understand this plan. To achieve this the management should ensure that:-
a. The vision is expressed in terms of measurable short and long term goals.
b. A strategy for achieving the vision has been formulated and expressed in measurable terms in the form of short and long term targets and priorities.
c. Employees can relate their own job functions to the long and short term strategic targets and items a and b above are understood by employees at all levels.

Table 7.4 Performance criteria for Shared Strategy and Common Goals

In order to objectively measure a company's performance against this criteria the following procedure has been adopted:

- Identify the company's current strategy to achieve its vision. If this strategy is expressed in terms of measurable targets these should also be identified. In some companies this may be formally documented in the form of a business plan, strategy plan etc. In other cases it may be necessary to establish these through interviews with the Managing Director/CEO and the senior managers within the company.

- If the company can not demonstrate the existence of a strategy and objectives at the senior management level a score of "0%" is allocated against this performance area.

- Having established the company's current strategy and goals the following questions are asked to various staff at each level in the organisation.

  * What is the company's current strategy and goals to achieve the stated vision?

  * What does it mean to you and how does your job relate to this strategy and goals?

  For the sake of practicality where a large number of employees are involved a representative sample may be taken at random from each department.

- The response received from each employee is evaluated as High, Medium or Low according to their response to the above questions. High score means that the employee demonstrated a good awareness of the company's strategy and goals and was able to relate his/her job function to this strategy. On the other hand a "Low" score is awarded to those employees who demonstrate a poor or no awareness. A "Medium" score is awarded to those employees who demonstrate some awareness of

the strategy and their job function with respect to this strategy and goals.

- The following formula is applied to establish an overall score.

$$\% \text{ Score} = \frac{\text{(No of high sores) + 0.5(no of medium scores)}}{\text{Number of Interviews}} * 100$$

7.3.3 Awareness of Roles and Responsibilities

The criteria specified in this performance area of the reference model is summarised in table 7.5.

The objective is to ensure that all roles and responsibilities are defined and that there is a general awareness of all roles and responsibilities across the business. To achieve this the management should ensure that:-
a. All strategic and operational processes within the business are identified.
b. All process responsibilities are allocated to business functions.
c. All functions clearly understand their process responsibilities.
d. All functions demonstrate an awareness of other functions' roles and responsibilities.

Table 7.5 Performance criteria for Awareness of Roles and Responsibilities.

In order to objectively measure a company's performance against this criteria the following procedure has been adopted:

- Establish the roles and responsibilities of each function through consultation with the functional representatives and allocate a score for each function using the following guidelines:

0% - The functional representatives cannot demonstrate a clear understanding of their own functions roles and responsibilities.

10%- Each function demonstrates an awareness of their roles and responsibilities.

20%- Each function demonstrates an awareness of their roles and responsibilities and the roles and responsibilities are clearly identified in the form of business processes.

- Calculate score 'X' by averaging the scores allocated above.

X = Sum of Scores / Number of Functions

- Establish the understanding of all functions understanding of each others roles and responsibilities by asking representatives of each function of their understanding of the other functions roles and responsibilities. In selecting the functional representatives care should be taken to ensure that a representative number of representatives are consulted as a group.

- Identify any mismatches, conflicts and differences and query these to ensure that these were not merely due to oversight and establish the real differences and mismatches.

- Allocate score by comparing the total number of processes (responsibilities) by function to the awareness demonstrated by function. For example when function 'A' is questioned on the roles and responsibilities of all other functions they may demonstrate an awareness of 30 processes out of 50 for 5 functions. In this case the score would be 60%, ie function 'A' demonstrated an awareness of 60% with respect to other functions roles and responsibilities. This exercise is repeated for all functions and the scores demonstrated by each function are averaged to calculate the final score for this performance area. The following formula is used:

$$\text{Score} = \left\{\frac{\text{Sum of scores demonstrated by each function}}{\text{Number of functions}} * 0.8\right\} + X$$

7.3.4 Integrated Processes

The criteria specified in this performance area of the reference model is summarised in Table 7.6.

The objective is to ensure that the objectives, interfaces and the procedures for each process are clearly understood by the personnel responsible for those processes and that these objectives, procedures and interfaces are agreed with the customers and suppliers of those processes. To achieve this the management should ensure that:-
a. The objective of each process is defined.
b. The inputs, outputs and controls (ie. policies, constraints, etc) of each process is clearly defined.
c. The customers (ie the destination of outputs) and suppliers (ie the source of inputs) for each process are defined.
d. The procedure (ie. the actions necessary for converting the inputs into the outputs) for successful execution of each process is defined.
e. The customers and suppliers agree with the objectives, inputs, outputs and the procedures for each process.
f. All personnel responsible for the process understand a-d above.
g. Regular reviews are conducted to ensure that the processes remain integrated.

Table 7.6 Performance criteria for Integrated Processes.

In order to objectively measure a company's performance against this criteria the following procedure has been adopted:

- Through workshops with each function (or representatives of each function) the inputs and outputs of each process is identified together with the sources of the inputs and the destinations of the outputs. This represents the information flow between business processes as well as the information flow between functions.

- The results are collated at functional level by mapping all processes which fall under the responsibility of that function. This results in a functional level data flow diagram which also identifies the information flows in and out of that function together with the source and destination of the information.

- The results from above are used to construct inter-functional data flow diagrams which illustrate the flow of information within functions.

- In constructing both the functional and inter-functional diagrams attention is paid to ensure that information output from source matches to the information input at destination. If the output fails to match the input then it is identified as a discrepancy. For example, if the sales function having processed an order then passes the order details to the finance function for credit clearance, then we would expect the sales function to specify "processed order" as an output from the "order processing" process to the "credit control" process, we would also expect the finance function to specify "processed order" as an input from the sales function into the "credit control" process. If either of the functions fail to specify this flow it would be identified as a discrepancy.

- Create a list of discrepancies and consult the relevant functions to ensure that these discrepancies were not merely due to

oversight and eliminate those discrepancies which are resolved as a result of the consultation with the relevant functions.

- Calculate the score for this performance area using the following formula:

$$\% \text{ Score} = \frac{\text{Total Number of Discrepancies}}{\text{Total Number of Interfaces}} * 100$$

7.3.5 Conforming Working Practices

The criteria specified in this performance area of the reference model is summarised in Table 7.7.

The objective is to ensure that the working practice conforms to the processes as described in the previous paragraph. In other words the Integrated Processes provide a static picture of how the processes should interrelate. In this section the objective is to ensure that the defined procedures are followed as described. To ensure this the management should:- a. Conduct regular audits b. Take corrective actions as necessary (eg training, retraining, redeployment, revision of the processes, etc)

Table 7.7 Performance criteria for Conforming Working Practices.

In order to objectively measure a company's performance against this criteria the following procedure has been adopted:

- Conduct a workshop with the representatives of each function and identify their internal customers and suppliers.

- For each supplier identify the function's requirements and the current problems with respect to these requirements.

- For each customer, identify the suppliers requirements and the problems the function faces in meeting the customers requirements.

- Establish the score by simply adding up the number of problems raised by each function.

7.3.6 Integrated Performance Measures

The criteria specified in this performance area of the reference model is summarised in Table 7.8.

The objective is to ensure that the goals and targets set at the strategic levels are deployed to individual functions and processes within the organisation through an integrated set of performance measures. To ensure this the management should:-
a. Define the performance criteria of each process.
b. Identify indicators which objectively measure the ability of these processes to fulfil the performance criteria.
c. Establish an understanding of the relationships between the process level performance measures and the strategic measures and goals.
d. Establish the relative priorities at process levels with respect to strategic priorities.
e. Encourage the use of the integrated performance measures as a management tool.

Table 7.8. Performance criteria for Integrated Performance Measures.

In order to objectively measure a company's performance against this criteria the following scoring guidelines have been adopted:

For each function allocate:-

- 10% for clearly defined objectives and performance criteria for each process within their responsibility.

- 20% for clearly established performance indicators for each process.

- 10% for having the performance measures clearly prioritised.
- 40% for demonstrating that the functional priorities are linked to the strategic priorities.

- 20% for use of performance measures as a management tool through regular reviews and improvement actions.

- the total score by adding up the scores allocated based on the above criterion.

Calculate the final score for this area by averaging the total scores for each function.

$$\% \text{ Score} = \frac{\text{Sum of functional totals}}{\text{Number of functions}}$$

7.4 APPLICATION OF THE AUDIT METHOD

The objective of this section is to discuss the application techniques for the audit method developed in conjunction with a case study to test the application of the audit method.

7.4.1 Representation of Score

The first decision was on the representation of the results of the audit. For this a graphical method was selected in the form of a dart board as shown in Figure 7.1. Each axis of the dart board represents one of the performance areas specified in the reference model with the exception of the "Bulls-eye" which represents the Conforming Working Practices performance area. The reason behind this is that Conforming Working Practices was the only performance area where difficulties were encountered to convert the score in to a % score.

Concentric circles from the bulls-eye outwards represent 0 to 100% in increments of 20%. The score achieved by a company against each performance criteria is then plotted on this diagram. In Figure 7.1 the two diagrams 'a' and 'b' shows how over six months the improvements in a company's level of integration could be represented.

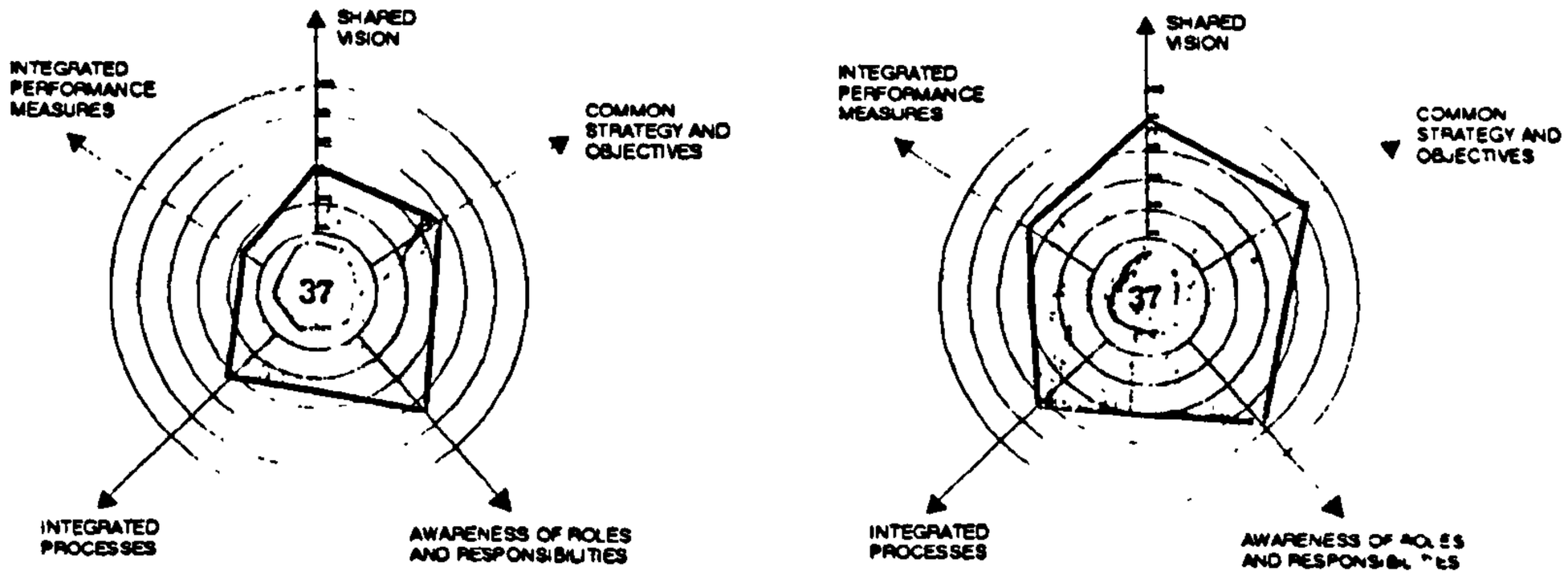


Figure 7.1 - Representation of the audit results

7.4.2 Application Techniques

Having developed an audit method to measure the level of integration of a business with respect to the reference model specified in chapter six, fair amount of consideration was given to its application.

Initially two alternative techniques were identified. These being:-

- Face to face interviews with the researcher
- Use of Questionnaires

Prior to making a decision on the technique to be adopted the pros and cons of each alternative was identified. These are represented in Table 7.9. On considering these it was initially decided that the questionnaire method would be most useful mainly because it would provide a audit mechanism which is faster, requires less time and minimises Hawthorne effects.

Following this decision the audit method was tested on a case study company. The company is Ritchie (UK) Ltd, a medium sized printing operation based in Kilmarnock, Scotland. A set of questionnaires and work-sheets were prepared and distributed to the appropriate people within the company for completion. The exact details of this case study is subject of another report, Quinn (1994). However, through internal sources within the company it became evident that the questionnaire was not being completed by individuals in isolation. But prior to the completion of the questionnaire considerable amount of informal discussion was taking place between individuals.

INTERVIEWS	QUESTIONNAIRE
ADVANTAGES	
The researcher would ensure that correct information is received by interpreting the question. The questioning structure could be adopted to ensure that the required information is received. Any vague statements can be questioned. Respondents could be briefed before the interview in order to relax them Any queries by the respondents could be clarified.	Easier to implement and requires less time then interviews. Free from Howthorne Effect Management and employees would be more receptive to questionnaires because they are quick and easy to conduct Questionnaires could be completed away from working hours.
LIMITATIONS	
Requires considerable investment in time to conduct all interviews. Interviewer will have an influence on the success of the interview. The respondents attitude towards being interviewed could effect the success of the interview. Ensuring access and availability of people may represent difficulties	Any confusion and misinterpretation could lead to misleading information or delays. The information gathered through the questionnaires may not be as detailed as the information gathered through interviews. The questionnaires may not be completed with the respondents full attention.

Table 7.9 - Advantages and limitations of interviews and questionnaires.

In practice this is not a bad thing, one could argue that the audit method itself is helping to improve the level of integration within the company. However, the objective of the audit is to measure the level of integration without influencing it. Based on the results of this experience it was thought appropriate to employ interviewing techniques where the researcher conducts face to face interviews with individuals within the company but uses the questionnaires and work-sheets already developed to give structure to the interview.

7.5 DISCUSSION

Previous sections of this chapter discussed the development of a method for auditing an organisations level of integration and provided some guidelines for its application. The full application of the audit method is illustrated in chapter 9 "Case Studies". The objective of this section is to discuss the rationale behind the development of the audit method together with its perceived weaknesses and alternatives.

The audit method, although not ideal, goes a long way towards measuring the level of integration within a business. In applying the method the following aspects of integration are measured:-

- Whether the company had a vision and to the extent this vision was understood and shared through out the organisation.

- Whether the company had a clear strategy to achieve this vision and the extent this strategy was understood and translated to specific objectives and responsibilities within the organisation.

- The extent to which functions and individuals awareness of each others roles and responsibilities.

- The extent to which the individual business processes integrated with each other, ie the integration of the formal systems.

- The extent to which conformance is achieved to working practices, this includes the integration of informal systems.

- The extent to which integrated performance measures are used.

Having summarised what the audit method is capable of measuring it is equally important to discuss its perceived limitations. In the opinion of the author its limitations are:-

- Measures obtained are relative rather than absolute.
- Lack of weighting mechanisms to establish relative priorities.
- Time scales and requirements.

The method developed provides only a relative measure and therefore it can only be used by an organisation to measure the changes in its level of integration over a period of time. But it will not allow for one organisation to compare its level of integration to another organisation, therefore it cannot be used for intercompany benchmarking purposes.

The audit method as presented in this section does not attempt to differentiate between what may be considered more and less important factors which may effect the level of integration. For example, in auditing the first two performance areas, ie Shared Vision and Common Strategy, one may argue that it is more critical for the management staff to demonstrate a good awareness of the company's vision and strategy and therefore a higher weighting should be given to the responses received from staff at this level. In trying to address this type of problem, the researcher was faced with two specific problems. The first one of these problems was that there is no common view. For example, in the case study companies, between the senior managers

there were differences in opinion whether the awareness of senior management was more or less important then the awareness of operational staff. The second one of these problems was that, even if agreement was reached that the management awareness was more important, the question remained "by how much?". Attempts to identify a weighting system proved to be subjective and it was felt that it would be more objective to quantify the results without a weighting system.

With reference to the timescales and requirements the audit process requires considerable input from the employees of the company which is being audited. The experiment carried out with Ritchie (UK) Ltd proved that the audit process if fairly simple and quick for the first two performance areas, ie Shared Vision and Common Strategy. However, the process of auditing the Awareness of Roles and Responsibilities and in particular the Integrated Processes performance areas required considerable amount of time from the functional representatives.

Based on the discussion presented above the researchers conclusion is that the audit method provides an effective mechanism for measuring the level of a companies integration. However, it must be applied in recognition of its limitations. In applying the audit method, in order to obtain useful and realistic results it should be applied with commitment from the senior management within the organisation.

In the opinion of the researcher the method would provide most of its value if it is applied as an integral part of a methodology to improve business-wide integration. The application of this audit method in this manner becomes clearer as the details of the methodology is discussed in chapter 8 and its applications are detailed in chapter 9 of this thesis.

CHAPTER EIGHT

A METHODOLOGY FOR BUSINESS INTEGRATION

8.0 A METHODOLOGY FOR TOTAL BUSINESS INTEGRATION

8.1 INTRODUCTION

The objective of this chapter is to discuss the development of a methodology which would facilitate business-wide integration. In discussing the development of this methodology the details of the tools and techniques used is also explained. Prior to discussing the development of the methodology, it is deemed essential to discuss, briefly, what a methodology is.

8.2 WHAT IS A METHODOLOGY?

In the context of this thesis a methodology is defined as "a systematic approach which provides a structured framework and a set of tools and techniques to facilitate business-wide integration".

Within the scope of a methodology, the framework provides a structured action list. The tools, techniques, procedures and guidelines facilitate the achievement of these actions by providing explicit mechanisms.

The objective of the methodology developed during this work is therefore to provide:-

- A structured framework
- A set of tools and techniques

to facilitate business-wide integration as specified in the reference model discussed earlier in chapter 6.

8.3 THE FRAMEWORK

The framework for the methodology consists of six major phases which provide the underlying structure. These are:

- The Awareness Phase
- The Strategic Phase
- The Analysis Phase
- The Integration Phase
- The Continuous Improvement Phase
- The CIM Implementation Phase

Figure 8.1 illustrates the constituents and interaction of these phases. The objectives of each phase are as follows:

- The AWARENESS phase is designed to provide a focus at the start of the programme for application of the methodology. As the methodology requires the involvement of people at all levels of an organisation. This phase ensures awareness of the programme and methodology as well as establishing a structure for project management and setting out the critical mile stones for the programme.

- The STRATEGIC phase is designed to facilitate the review of the current status of the business and the definition of a vision. This phase is also used to review the business strategy and establish the critical performance factors applicable at business level.

- The ANALYSIS phase provides the structured and a rigorous approach to the analysis and documentation of the current practice at operational levels. Although this is a separate phase from the Strategic phase the interface points are clearly defined to ensure that the Strategic objectives and the operational objectives are common and complimentary. Mechanisms for identifying conflicts are also part of this phase.

- The INTEGRATION phase provides a structured environment and techniques to ensure that the business activities are integrated and streamlined at all levels. This phase is driven by the strategic objectives of the business and the results of the analysis phase. On completion of this phase an integrated business platform is achieved.

- The CONTINUOUS IMPROVEMENT phase takes account of the organisational dynamics, ie the state of integration can be fragile unless it is maintained. The purpose of this phase is to install necessary mechanisms and disciplines to avoid disintegration over time and to effect further business improvements.

- The CIM IMPLEMENTATION phase provides a sub-system for identification and implementation of appropriate computer based software modules.

The application of the methodology should is seen as a continuous process rather than a stand alone project with a definite beginning

and ending. It is regarded as the start of a process of change and improvement which will extend beyond the period of the project, ie the continuous improvement phase. The purpose and the role of each phase becomes clearer as the reader becomes more familiar with the detailed activities within each phase. The following sections provide further details on each one of the six phases.

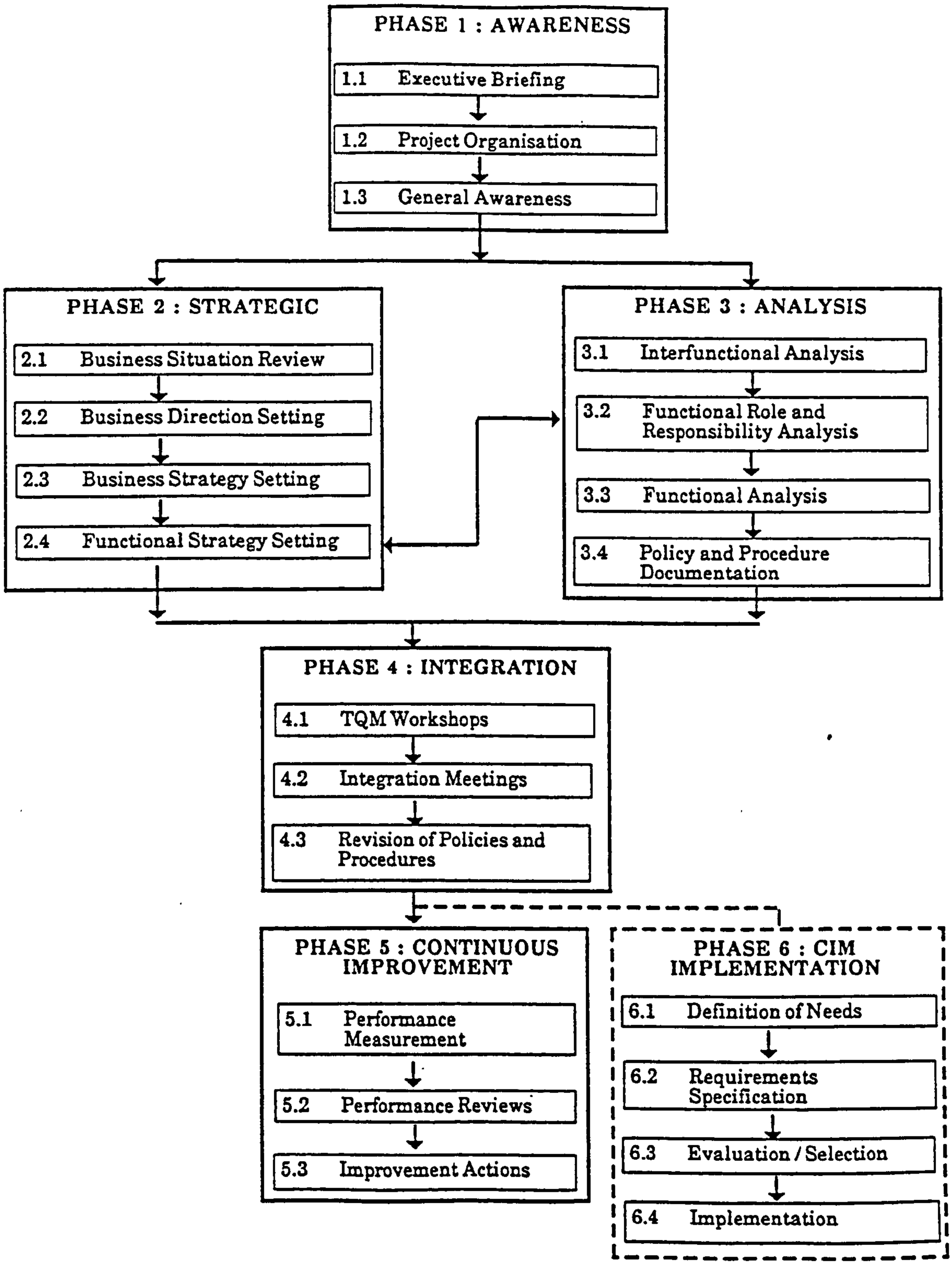


Figure 8.1 The methodology framework.

8.4 AWARENESS PHASE

The purpose of this phase is to create a general awareness of the initiative and the methodology across the organisation. In order to achieve this it is also important to communicate the project management structure and relevant responsibilities. Therefore this phase consists of the following activities:

- Executive Briefing
- Project Organisation
- General Awareness

8.4.1 Executive Briefing

Any project of this scale will require total commitment and ownership by the senior management of the company. Thus the first task is to ensure full understanding of the project and its phases by senior management. This may be achieved by taking the management team through the thought process behind the methodology and letting them see for themselves the potential benefits. The executive briefing ensures initial commitment of the senior management team to the programme.

The executive briefing should also include the recommended project organisation which is further discussed in the next section (8.4.2). This will facilitate discussion on responsibilities and personalities with respect to the programme.

8.4.2 Project Organisation

The purpose behind this activity is to create an organisation for the management of the initiative both for the short term and through out the continuous improvement phase. Because of the long term nature of this management infrastructure it is recommended to create an initial structure which is compatible with the current organisational structure. This allows for the necessary project ownership to propagate through out the entire organisation. The project team approach, as in MRP II projects, is not recommended because they tend to localise ownership.

The main reason behind the creation of this infrastructure is to clearly define the associated roles and responsibilities for efficient and effective management of the project. This activity should be carried out by the senior management following the executive briefing.

The recommended organisation to manage a project of this scale consist of four levels as shown in Figure 8.2. This structure, with the exception of a short term project co-ordinator, is identical to the widely recognised structure for TQM Programmes.

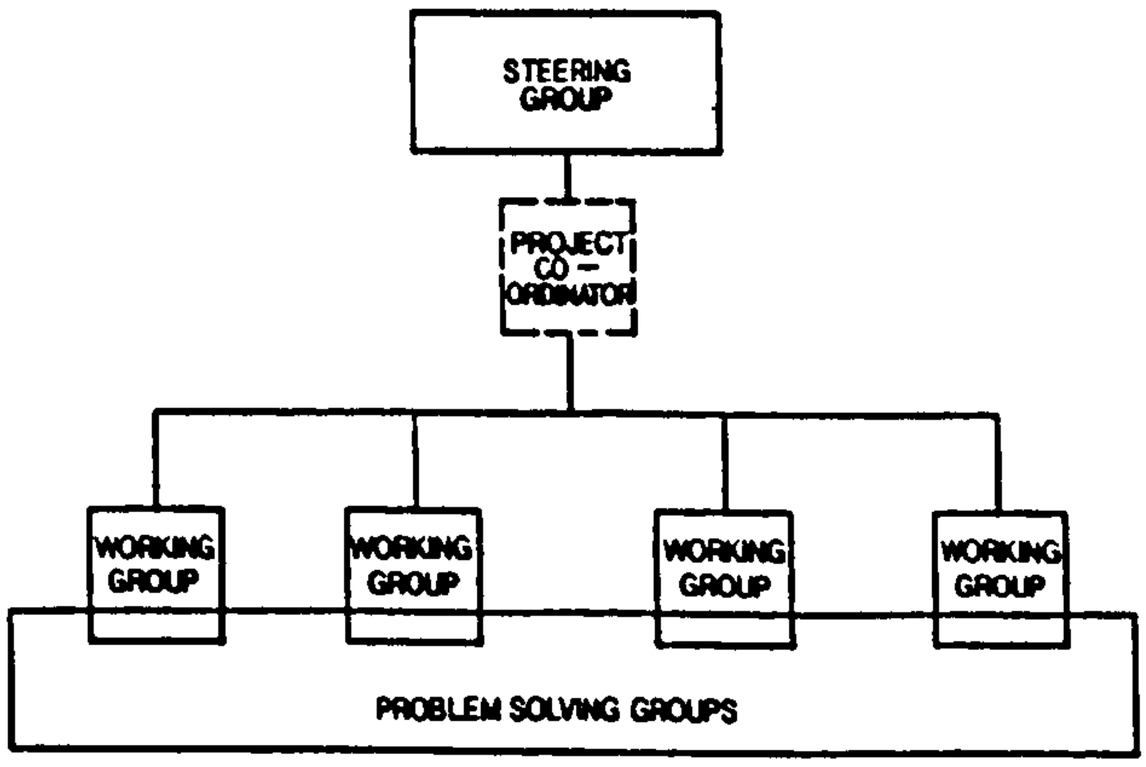


Figure 8.2 Recommended Project Organisation

8.4.2.1 Steering Group

This involves setting up a steering group comprising directors or senior decision makers within the company. Members of the steering group should be able to contribute to the programme by providing knowledge on the high level issues which may influence the performance and growth of the company, such as:

- Financial performance
- Current and opportunity markets
- Products and or services
- Competitive position
- Organisation
- Strategy
- Business objectives

Depending on the complexity of the company and the time scales adopted the steering group will be expected to meet on a fortnightly or monthly basis through out the life of the programme and beyond. The exception to this meeting schedule will be the strategic phase during which the steering group will be expected to meet more frequently for the senior management workshops.

The steering group approach is an effective, efficient and powerful means of securing top level management ownership and commitment to the process. In the application of the Total-I methodology the author's experience shows that the steering group also provides a mechanism to break down existing communication barriers within the management

team and bring about improvements in the senior management awareness and understanding of the total business.

8.4.2.2 Project Co-ordinator

The project co-ordinator is an individual who is responsible for co-ordinating the project activities within the given time scales. The role of the project co-ordinator should not be confused with project management. The main responsibility of the project co-ordinator is to ensure that each activity has been conducted properly and the desired objectives have been achieved and relay this information to the steering group. In summary the project co-ordinator acts as the bridge between the working groups and the steering group. Ideally the project coordinator should be a director or senior manager, ie member of the steering group, however the methodology has been implemented with equal success in companies where the role of the project co-ordinator was assumed by a functional manager.

It is important to note that for this programme the role of the project co-ordinator is temporary. If the methodology is implemented correctly the need for a co-ordinator will gradually disappear, thus in figure 8.2 the project co-ordinator is shown in broken lines.

8.4.2.3 Working Group

The working groups will have the main responsibility for conducting the Analysis Phase of the methodology. Essentially each function is treated as a working group involving all personnel within a function. Each working group is lead by the functional manager. The leaders

responsibility is to review and supervise the working group activity as well as ensuring that the tasks specified by the project co-ordinator are completed in time. Commonly in small companies comprising of a single management level the members of the steering group are required participate and lead the working groups.

The ideal size of a working group should be maintained around four to eight people. It is recognised that in functions comprising large number of members it will be difficult to form a practical working group. In these cases it is recommended that initially a core team is extracted to conduct the analysis. This is acceptable providing it is ensured that the remainder of the personnel is kept informed and consulted through out the programme. One point of critical importance is that nothing is put forward as a formal output from a working group without first ensuring that all functional personnel has been given a fair chance to review its contents and discuss his or her worries and queries. This process is extremely critical to the success of the programme by ensuring ownership thus commitment.

8.4.2.4 Problem Solving Groups

These groups are specific to the integration and continuous improvement phases. The problem solving groups are inter-functional and are created to address specific problems and issues as these are identified. The factors which determine the members of a problem solving group are task specific and may involve members of the management team, functional managers and operational staff.

8.4.3 General Awareness

Having briefed the senior management team, gained their commitment towards the project and established a project management structure the next task is to create a general level of awareness across the organisation, ie all other levels of management and operational staff. The objective here is not to gain total ownership and commitment to the programme by all employees. The methodology is structured such that at operational level ownership and commitment to the programme is gained through involvement. The purpose of this activity is merely to achieve a general level of awareness across the company.

The author's experience is that the most effective mechanism for the delivery of general awareness is through the management hierarchy. Attention must be paid to ensure that the general awareness is delivered not through a big bang presentation by the managing director but through informal chats with small groups of operatives by their functional managers. However it is also important to ensure that senior management commitment is demonstrated in all meetings.

8.5 STRATEGIC PHASE

The objective of this phase is to identify a common vision and identify the strategic issues for the business. In doing this further commitment of the senior management is also gained. Throughout this phase the company's current position is reviewed with respect to its long term objectives and current strengths and weaknesses. In this process critical performance indicators, financial and non-financial, are identified for overall business and for individual functions based on

functional roles and responsibilities. The current measures and targets based on long term objectives are identified.

The purpose of this phase is to define and integrate the business objectives, business strategy and functional strategies through the use of structured performance measures. Figure 8.3 illustrates this philosophy from a total business level to individual job level. This is a requirement which was clearly identified earlier in this thesis. The philosophy being;- the business strategy must be driven by the business objectives and the business strategy in turn drives the functional strategies. The functional strategies must be expressed in terms of roles and responsibilities of each function with associated performance measures and targets. These performance measures must be driven by the business objectives and should include appropriate measures at the business strategy and functional strategy levels. This will ensure that the whole business is progressing towards its common vision and objectives.

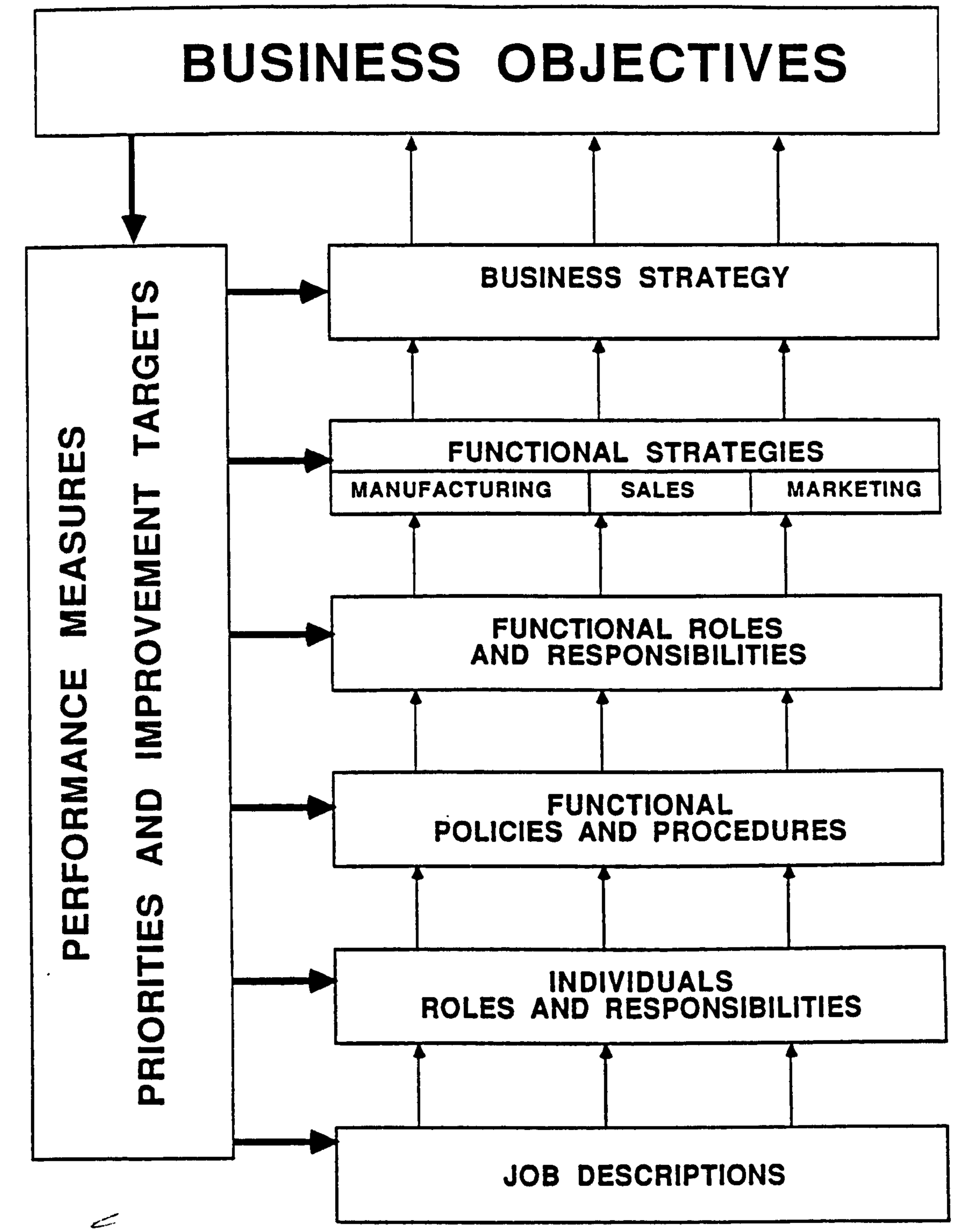


Figure 8.3 A structure for business integration and application of performance measures.

The scope of this phase is to establish the structure shown in Figure 8.3 from business objectives to functional roles and responsibilities.

This phase consists of four key activities which are discussed in the following sections. These are:

- Business situation review
- Business direction setting
- Business strategy setting
- Functional strategy setting

8.5.1 Business Situation Review

The purpose of this activity is for the steering group to use a structured agenda and analyse the top level strengths and weaknesses of the company through a series of workshops. The number of workshops required may vary according to the availability of information.

Throughout this activity both the internal and external business pressures are examined. These include the effects of economy, environmental pressures and constraints, changes in markets for products or services offered, new developments in technology, competitor strengths and weaknesses. Essentially these constitute some of the threats to and opportunities for the business.

During this activity the steering group will be expected to develop their responses to these internal and external factors by analysing and

understanding the various functions of the business that they can determine and control. The mechanism developed to achieve this level of understanding is based upon a SWOT analysis which focuses on the following areas:

- Financial performance
- Marketing and sales activity
- Competitive position of products and services
- Effectiveness of operations
- Application of technology and information
- Effectiveness of organisation
- Human resources

This analysis is best conducted using a workshop type of structure. The outcome of this workshop forms a solid base upon which to address key issues and build a strategic plan for business growth.

8.5.2 Business Direction Setting

'Knowing where you are' is an important step in determining 'where you want to go' with the business. The previous activity, ie Business situation review, establishes the current situation for the business. Business direction setting follows immediately on from the business situation review with a purpose of defining where the business wants to be in three to five years time.

Business direction setting is again the responsibility of the steering group and it is best conducted through a workshop structure.

Essentially the outcome of this activity answers the following questions:

- What is the vision for the business? - ie where does the business want to be in three to five years time?

- What are the key areas of focus (ie the competitive criteria) which would allow the business to achieve the above vision?

In carrying out this process the starting point is the vision for the business. That is knowing where the business is at present, the objective is to establish where it would wish to be in three to five years time. At this stage it is recommended that the steering committee considers high level issues such as operating profit, market share, return on investment, return on net assets, etc. By focusing on these it will be possible to identify targets for the business, for example "increase of profit by 40% in three years" or "increase of market share to 45%". The authors experience is that usually a combination of up to four such high level targets provides an overall top level focus for the business. It is equally important to identify with this target through a corporate vision statement, such as:-

"The mission of XYX Ltd is to become the world's leading head-set suppliers by the year 1995 by increasing its market-share to 60% and its profits by 40%"

The next step from this is to identify the key areas of focus to achieve this vision. This is achieved through workshops with the senior management where each one of the high level objectives are decomposed to identify those factors which have an impact on the objectives. Figure 8.4 provides a sample of these types of factors, ie areas of focus.

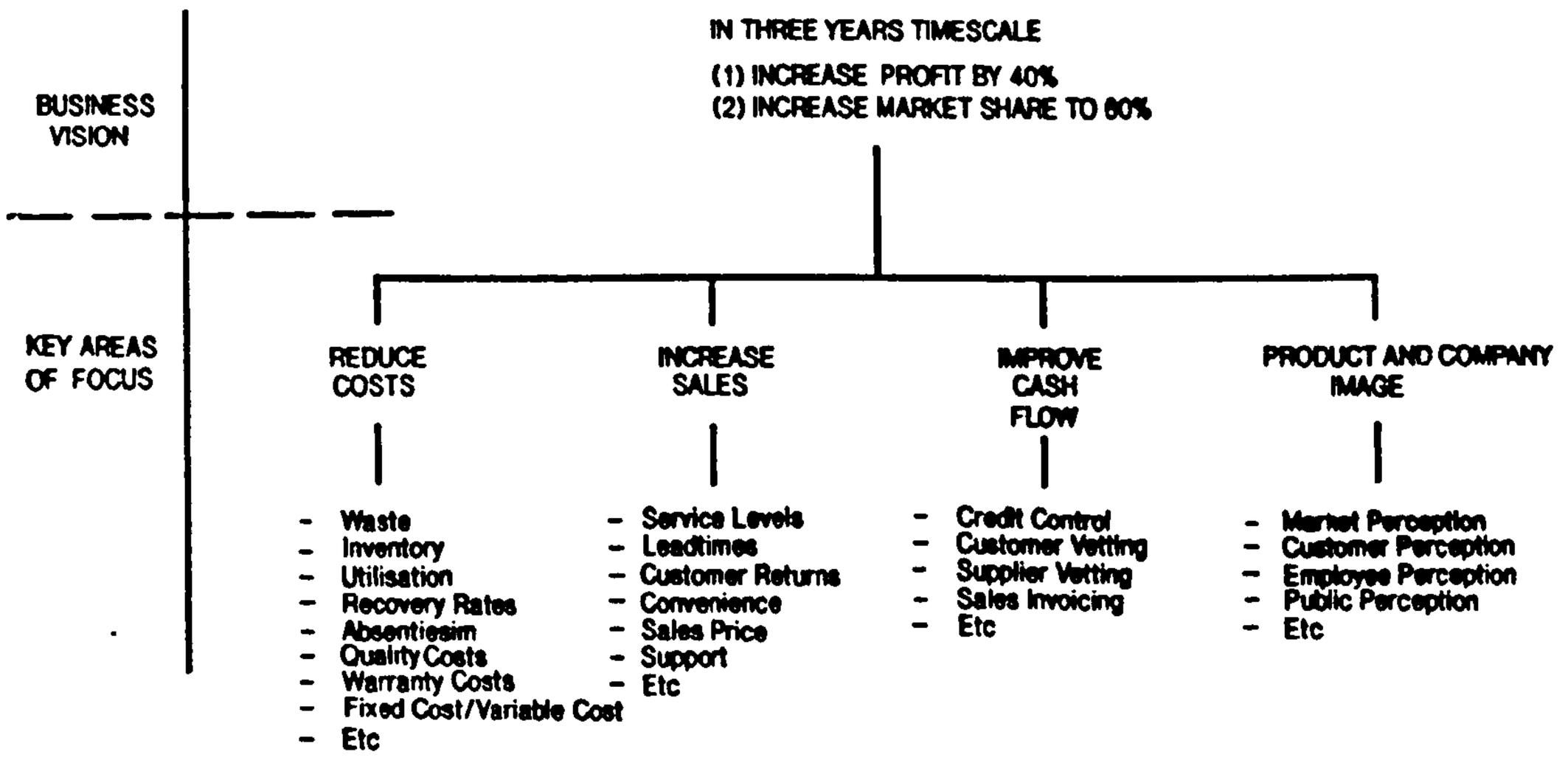


Figure 8.4 Business vision and key areas of focus through the decomposition technique.

It must be noted that the results should be arrived at as a result of collective brainstorming by the steering group rather than suggested and presented by an outside party. The process of discussion between the steering group members reinforces common objectives.

8.5.3 Business Strategy Setting

Having established a vision for the business and identified the key areas of focus to achieve this vision the next stage is setting targets and priorities. The purpose of business strategy setting is to set measurable targets against each key area of focus and analyse the importance of each area to define strategic priorities. A key element of this activity is the definition and installation of strategic performance measures. The objective of strategic performance measures are:

- To establish the common performance objectives for the business.

- To measure the present performance of the business against these objectives.

- To provide a tool for senior managers to prioritise and initiate actions, on a continuous basis.

In order to set targets against key areas of focus it is essential to understand the current performance. Therefore at this stage use of strategic performance measures are highly important. The steering group will be required to identify those performance measures which objectively measure the current performance for each area. In order to achieve this it is not unusual to introduce two or more measures for each area. For example the following measures may be introduced to assess the effectiveness of customer service:

- Customers required delivery date v promised delivery date
- Promised delivery date v actual delivery date
- % of orders delivered on time (by value and volume)
- % of orders delivered 1 week late

It is also not unusual to encounter areas where an objective measure cannot be identified and implemented. An example of such an area is "Convenience" as shown in Figure 4.4. The question is 'How does one measure the convenience factor?'. For example, for a customer based in the USA it may be more convenient to buy from a USA base supplier than a UK based supplier. Although intangible areas such as "Convenience" are not measurable they must play a critical role in the process of developing a strategy. In cases where intangible areas are identified it may be necessary to provide an textual/descriptive explanation of the area to put it in to context.

One key component of performance measures is the unit of measure and the data gathering procedure. These will ensure the elimination of any possible ambiguity in the measures when presented. One example of the importance of units and procedures was experienced when the measure 'Order hit rate' was introduced. The production department's interpretation of this measure was: All orders shipped on or before the planned shipping date. The sales department's interpretation was: All orders delivered on or before the promised delivery date. This conflict was further complicated when it became evident that the measures presented by both the production and sales departments were based on goods leaving the factory and they did not take account of quality.

In one specific case goods were dispatched to customer with one critical component missing but because the order was dispatched and delivered according to planned and promised dates it was counted as a successful delivery, the fact that it was returned within a few weeks was ignored.

Having established the strategic performance measures for the key areas of focus and their units of measure and the supporting procedures the next step is to monitor current performance over a period of time. The length of this monitoring period varies considerably from company to company. In some businesses with accurate historical records it may be possible to extract these measures from historical data therefore saving valuable time. These measures should be presented on a matrix as shown in Figure 8.5. The benefits of this mode of presentation is that all of the measures becomes visible on a single sheet of paper with the appropriate columns identifying responsibilities, targets (when set), the trends and timescales.

The process from here on is for the steering group to review the performance achieved against these strategic measures on a regular basis. Through this review an understanding of the current trends is established, which will allow prioritisation and target setting against each measure. The authors experience is that prioritisation through discussions within the steering group works effectively, however if deemed necessary more structured techniques such as Pareto Analysis or Failure-Mode-Effect-Analysis may be used.

MEA	FREQ	OWNER	MONTHLY Q4 RATE	FY OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TARGET	ACTION LIMIT
On time deliveries (%) Export	M	CN	38	34	32	69	61	53	43							-	
Actual v Plan volume %							106	104	98							-	
Actual v Latest agreed forecast %	M	RS	102	89	111	121	99	102	109							100	
Hit rates (%)	M	RS	89	89	95	95	92	94	94							95	
Total line downtime (hours) BH I	M	IH / JC	-	N / A	245	211	154	179	196								
BH III					144	162	139	177	161								
Non-conforming cases (%) Total				0.7	1	0.7	1.4	0.7	0.4								
Category 9	M	GO'H	1	0	0	0	0	0								0.5	
Actual v Budget spend (%)	M	GO'H	-	92	114	103	99	100	86							100	
Actual v Latest QF (%)			-	92	114	103	98	100	86							100	
Turns / Annum - Finished goods	M	CN	12.4	17.4	20.2	15.7	13.5	18.4	12.1							14	
Turns / Annum - Raw materials	M	ET	10	10.8	10.0	10.0	10.6	10.9	12.1							12	
Value of all material waste (£K)	M	AS	20.3	50.8		88	43	68	76							-	
Waste relative to material cost (%)	M	AS	1.0	1.7		2.2	1.6	2.0	2.1							1.0	
Obsolescence/Write off Dry Goods (£K)	M	ET	25	28	NIL	43	1	12.6	17							-	
Case Goods (£K)	M	CN	35	2	NIL	8	6	0	1								
Number of stock outs BH I	M	IH/	N/A	N/A	31	30	12	18	19								
BH III		JC			0	0	5		4								
Cost/Case produced YTD (% of LQF)	M	GOH	-	106	101	94	102	100	96							100	
Good cases/Man hour	M	GOH	20.8	22.4	26.8	26.5	25.8	24.3	25.7							23.6	
Cases handled/Man hour	M	CN	105	129	148	151	122	120	121							127	

Figure 8.5 Matrix presenting strategic performance measures

A critical issue is the relationship between measures. It must be recognised that the measures are not mutually independent but they are closely related. For example in some companies the finished stock levels may have an impact on the customer service performance. Therefore it is important to identify this relationship between the measures including the positive and negative effect of the measures on one another. Figure 8.6 illustrates a matrix which defines the relationships between measures identified. This matrix should, at all times, be attached to the matrix illustrating the performance achieved. This allows the steering group to conduct an efficient review of the current performance resulting in effective decisions and realistic targets.

The targets set against each of the strategic measures, to be realistic the following factors should be considered:

- Competitors performance
- Best practice
- Current performance
- Priorities
- The relationship between individual measures
- Timescales

PERFORMANCE MEASURE	On time deliveries (%) Export	Actual v Plan volume % Actual v Latest agreed forecast %	Hit rates (%)	Total line downtime (hours) BH I BH III	Non-conforming cases (%) Total Category 9	Actual v Budget spend (%) Actual v Latest QF (%)	Turns / Annum - Finished goods	Turns / Annum - Raw materials	Value of all material waste (£K)	Waste relative to material cost (%)	Obsolescence/Write off Dry Goods (£K) Case Goods (£K)	Number of stock outs BH I BH III	Cost/Case produced YTD (% of LQF)	Good cases/Man hour	Cases handled/Man hour
On time deliveries (%) Export			+			+/-	+	+							
Actual v Plan volume % Actual v Latest agreed forecast %	+		+			+	?	?			+		+		
Hit rates (%)	+	+				+/-	?	?							
Total line downtime (hours) BH I BH III	-	-	-			-	-	-				-	-	-	-
Non-conforming cases (%) Total Category 9	-	-	-			-			-	-	-	-	-	-	-
Actual v Budget spend (%) Actual v Latest QF (%)													+		
Turns / Annum - Finished goods								+			+	- ?			
Turns / Annum - Raw materials											+	- ?			
Value of all material waste (£K)	-	-	-		-	-				-		-	-	-	
Waste relative to material cost (%)															
Obsolescence/Write off Dry Goods (£K) Case Goods (£K)	-	-	-	-					-	-		-	-	-	
Number of stock outs BH I BH III	-	-	-	-		-							-	-	-
Cost/Case produced YTD (% of LQF)															
Good cases/Man hour													+		
Cases handled/Man hour													+/-		

Figure 8.6 Matrix representing relationships between strategic measures of performance.

8.5.4 Functional Strategy Setting

Having established a strategy at business level the next stage is to establish strategies for each function. However this needs to be done in conjunction with the functional managers and working groups therefore there is a natural interface between this activity and the activity titled 'Functional Roles and Responsibilities' which is part of the analysis phase. The objective of this phase is not to finalise a strategy for each function but to provide a forum for the steering group to draft out the roles and responsibilities of each function based on the current activities of each function and on the business strategy and targets established.

One other output from this activity is the impact of each function on the business strategy. This is done by studying each role and responsibility of that individual function, assessing its impact on the strategic performance measures and establishment of a functional performance measure which specifically measures that functions contribution towards the business level strategic measure. For example one specific role and responsibility of a production planning and control function may be creation of accurate weekly production schedules which obviously impact the delivery performance. In this case a measure to establish the accuracy of weekly productions plans may be appropriate.

Again the intension of this activity is merely to make the steering group think about each of the functions. The functional strategies are finalised through interfacing with the working groups throughout the

analysis, integration and continuous improvement phases. The development of the functional strategies will become evident in the following sections.

8.6 ANALYSIS PHASE

The objective of this phase is to conduct a detailed analysis of the current business practices, disciplines and procedures. The responsibility for executing this phase lies primarily with the working group. In order to achieve this objective, this phase focuses on key business processes, their interfaces and procedures. A modified version of the IDEF0 techniques is used to aid with the initial documentation. The detailed procedures are documented using a combination of structured english and flow-charting.

The philosophy behind this phase is that all business may be analysed as a series of processes and these processes interface with each other in real-time. In TQM terms this process network represents the internal and external customer/supplier relationship as illustrated in Figure 8.7. Therefore each process must have an output otherwise it will be an redundant process. To generate this output it must have a number of inputs. The process, generates its output from the given inputs under certain controls, disciplines and/or constraints using given resources. In this case a resource may be personnel, equipment, computer systems etc. Figure 8.8 provides a simple example of the internal customer/supplier concept based on the process of "planning production".

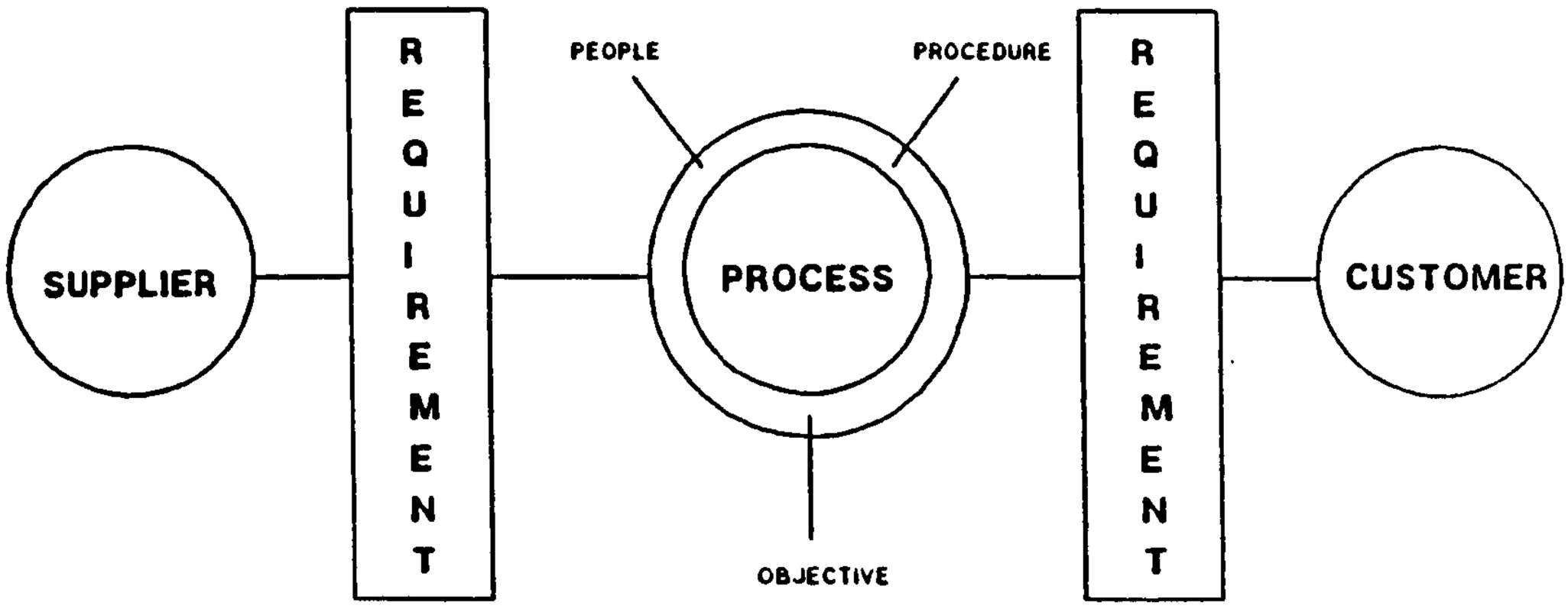


Figure 8.7 The process network concept

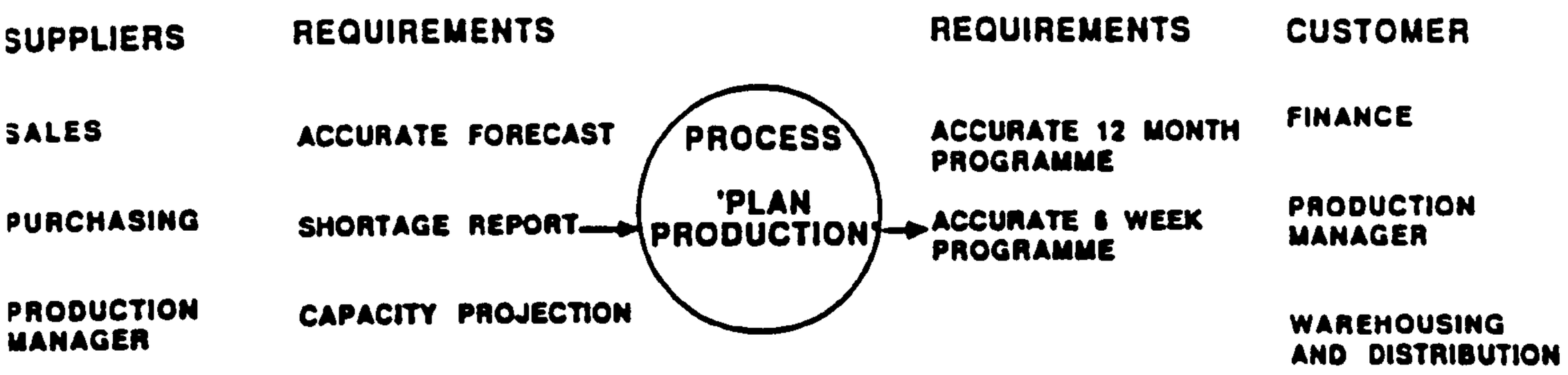


Figure 8.8 An example of the internal customer/supplier concept

The analysis phase being a mechanistic phase consists of four activities. These are:

- Inter-functional analysis
- Functional role and responsibility analysis
- Functional analysis
- Policy and procedure analysis

8.6.1 Interfunctional Analysis

The purpose of this activity is to analyse the present state of the documentation and information flow between individual functions of the organisation using the modified IDEF0 technique. The organisation chart provides a good starting point for this activity as it represents all departments and functions. To achieve this the following procedure has been designed.

Step 1 - Provision of modified IDEF0 training to all working groups.

Step 2 - Involving all working groups through a workshop to identify individual functions within the organisation. Examples of typical functions are; Marketing, Sales, Design and Development, Finance and Accounting, Manufacturing, Planning, Shipping, Stores, Personnel, Purchasing etc.

Step 3 - Prepare and issue working documents which include each function identified in step 2 as well as external functions such as customers, suppliers and sub-contractors. The

purpose of issuing working documents is to achieve some level of standardisation across the work of a number of working groups. These working documents form the basis of the inter-functional analysis. Example of a working document is provided in Figure 8.9.

Step 4 - Each working group carries out an exercise to identify the document and information flow between its own functions and all other functions. The IDEF0 configuration is used throughout this analysis identifying inputs, outputs, controls, policies, constraints, resources etc. Figure 8.10 illustrates a completed working document for the planning function of one of the case study companies.

Step 5 - The working groups through a series of workshops compare each others interpretation of the interfaces, identify and resolve differences. Finally where required it may be possible to consolidate all the completed documents in to a single document. The limiting factor here is the practicality of consolidating the amount of detail presented in a number of documents. Based on the experiences gained through the case studies presented in the following chapter it is recommended that this consolidation is carried out for reasons of good practice.

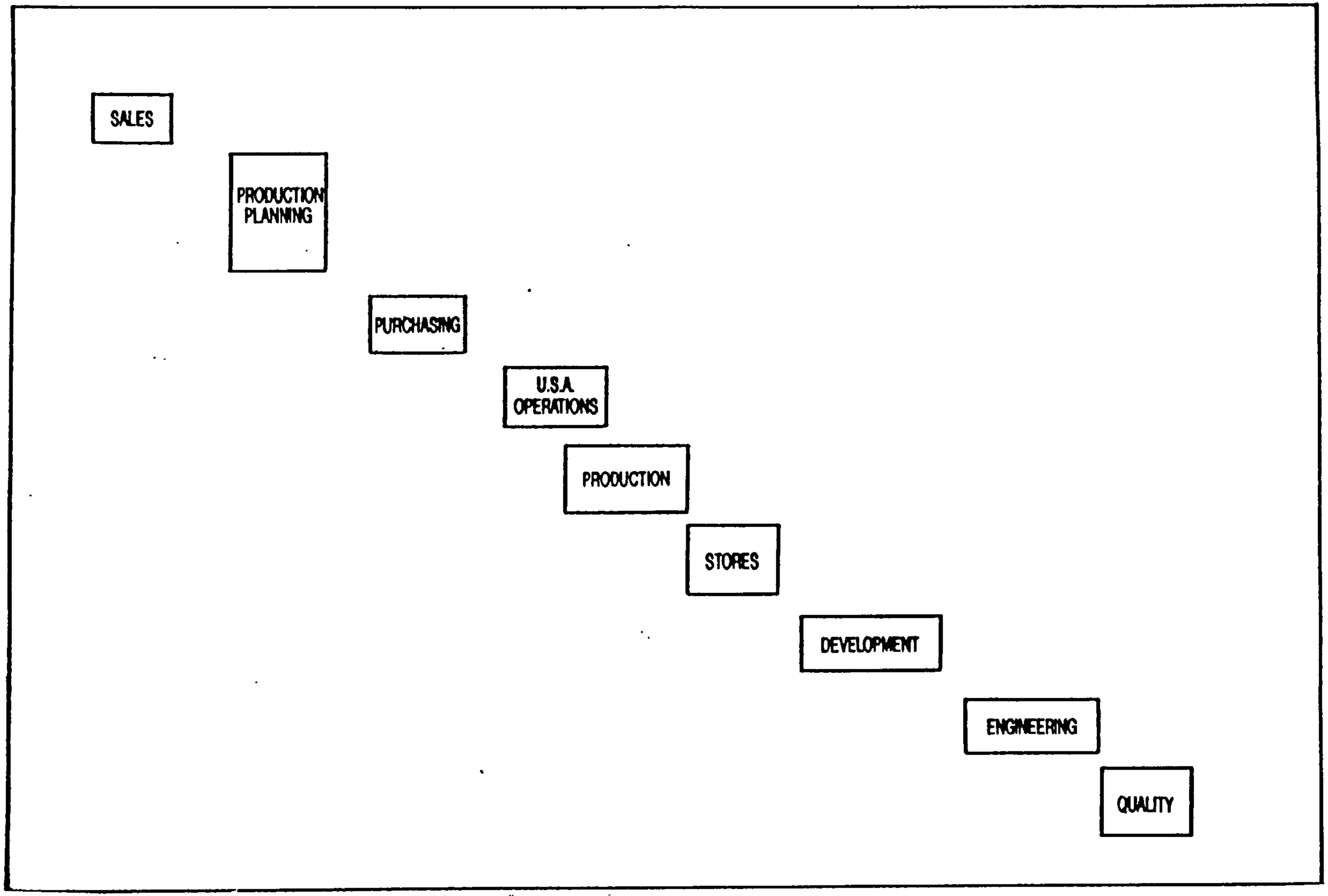


Figure 8.9 Sample working document for Inter-functional analysis.

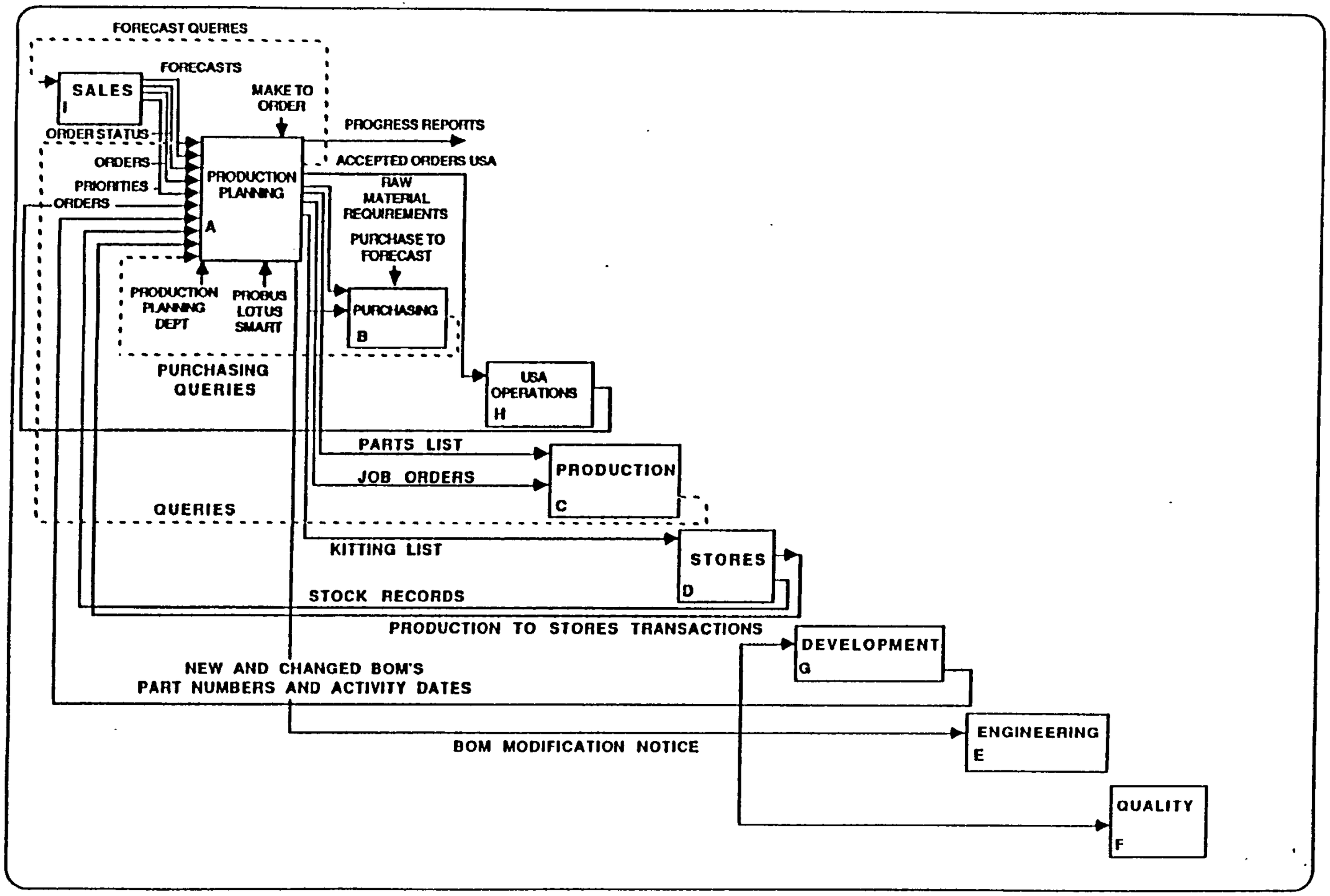


Figure 8.10 Completed inter-functional analysis.

8.6.2 Functional Role and Responsibility Analysis

Having defined the flow of key documentation and information between individual functions, the purpose of this activity is to identify and agree the key processes within each function. This is done through the working groups. The concept employed here is that each function is responsible for a number of processes therefore by identifying each functions role and responsibility within the organisation it is possible to identify the processes which lie within a functions boundary. One area of complexity which may arise during analysis is that, in practice one may encounter a process which is the responsibility of a number of functions, for example the process of business planning is usually the responsibility of Marketing, Finance and Production functions. In such cases it is necessary to identify exact nature of each functions role and document this as a process specific to that function with appropriate interfaces to the processes of other functions.

As stated above the purpose of this activity is not limited to identification of each functions role and responsibility. One key activity is to agree each functions role and responsibility with its internal customers and suppliers. One other key activity is to compare the roles and responsibilities agreed with those generated by the steering group during the strategic phase. It is important that any differences are resolved through discussions before proceeding further.

The procedure for this activity is as follows:

Step 1 - Each working group identifies and agrees their functions roles and responsibilities through workshops. Although there is no strict rule on format or wording of these roles and responsibilities it is recommended that short phrases are used in a bullet point format. For example the roles and responsibilities identified by the working group within one of the case study companies (ie G N Netcom Ltd) were as follows:

- Forecast management
- Order Management
- Rough-cut capacity planning
- Master production scheduling
- Materials requirements planning
- Stock allocation
- Issuing job orders
- Capacity planning
- Progress monitoring
- Bill of materials maintenance

In identifying these roles and responsibilities it is also important to document a single paragraph purpose and scope statement which summarises the activity. This is particularly important to ensure that each role and

responsibility is defined and interpreted in the same context by everybody involved.

Step 2 - Discuss and agree the roles and responsibilities of each function through workshops between working groups representing customer and supplier functions

Step 3 - Compare the agreed roles and responsibilities with those identified by the management team during the strategic phase and resolve differences

Step 4 - Finalise and publish functional roles and responsibilities.

8.6.3 Functional Analysis

The roles and responsibilities identified for each function represents the processes within that function. The purpose of this activity is to identify all inputs, outputs, constraints, policies, mechanisms and resources for each one of these processes. In doing this the source and destination of each one of these inputs, outputs and policies are identified. The procedure for this activity is as follows:

Step 1 - Through working groups using the work-sheet (see Figure 8.11) provided identify the inputs, outputs, constraints, controls, policies, resources and mechanisms associated with each process. Also identify the source and destination of each one of these parameters. Figure 8.11 illustrates a

completed work-sheet for the order management process within the planning function of G N Netcom Ltd.

Step 2 - Ensure that all personnel involved with the process agrees to the analysis.

Step 3 - For each function consolidate the individual diagrams in to a single diagram and resolve any differences through discussions within the working group. Figure 8.12 illustrates a consolidated diagram for the Planning function of G N Netcom Ltd.

Step 4 - Compare those parameters extending beyond the functional boundary to the results of the inter-functional analysis and resolve differences.

Throughout this activity it may be necessary to revisit the functional roles and responsibilities and their original purpose and scope statements. Although it is unusual for a significant change to be necessary to the roles and responsibilities identified changes to their purpose and scope are common, as through this activity greater detail is explored.

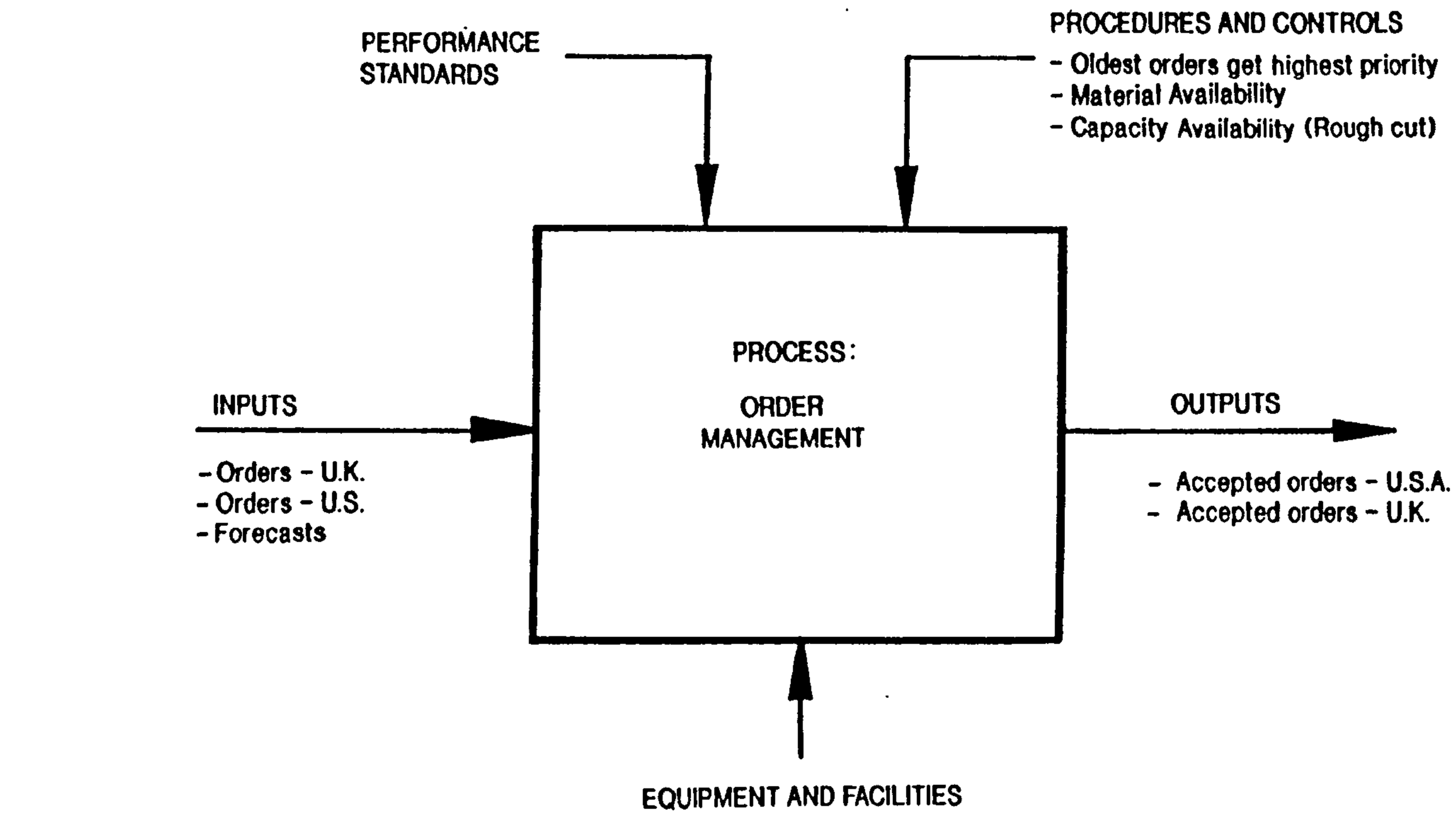


Figure 8.11 Sample completed work-sheet for the order management process.

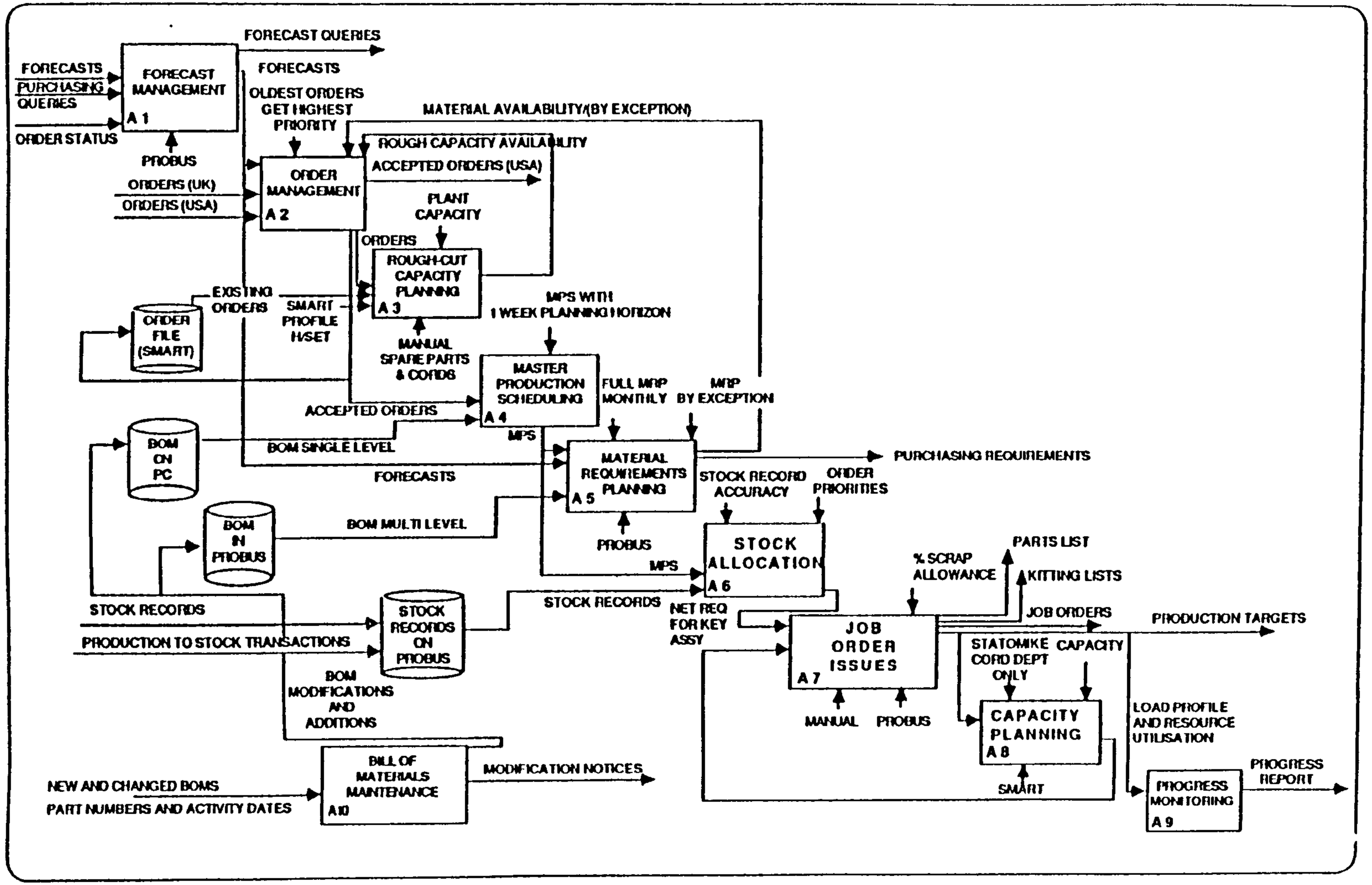


Figure 8.12 Consolidated analysis for the planning function of G N Netcom Ltd.

8.6.4 Policy and Procedure Documentation

As outlined earlier in this section each process consists of a procedure. The purpose of this activity is to document this procedure as accurately as possible through a structured approach. The format used to document the actual procedures does not need to be strictly controlled however it is recommended that this format is standardised for each application. In some cases flow charting has been the preferred route, however in majority of the cases use of plain English or structured English was preferred. Again the responsibility for documenting the procedures lies with the working groups. It is important to note that input is sought from all individuals involved in the particular process to ensure that the procedure reflects the current practice.

Throughout this activity the functional analysis is used to guide the procedure writing. In effect the procedure of a process outlines the key steps necessary to convert the given inputs to the outputs within the specified constraints, controls and policies using the resources and mechanisms identified in the functional analysis.

In the documentation of these procedures it is recommended that the following structure is adopted:

Purpose/Scope:

To define the purpose and the application boundaries of a procedure by stating its starting and finishing points. For example a procedure on order processing may be applicable only to a certain type of order

and the procedure starts with the receipt of an order and finishes with the entry of the order into the planned orders file.

Responsibility:

It is evident that the responsibility for a procedure lies with the function which owns it. However, where possible it is recommended that the job title of the responsible personnel is specified. In addition associated responsibilities should also be specified. For example order processing may the responsibility of the order processing clerk but the credit control element of each order may be carried out by the credit controller as part of another process.

Inputs/Outputs:

In this section all inputs and their source (ie function or process), outputs and their destination (ie function or process) is specified.

Procedure:

Outlines the key steps required to execute the process. An example of a completed procedure is provided in Figure 8.13.

On completion of all procedures, those procedures specific to each function will be combined in to a single operational procedures document for each function. It is recommended that these procedures are issued to all key users as controlled documents in a similar manner to ISO9000 documents. For those organisations already operating to ISO9000 or a similar standard, majority of these procedures will already exist, however their format and structure may be different.

J&B SCOTLAND LTD

SUBJECT	DESPATCH CONTROL	PROC NO PAGE 2 OF 5 ISSUE NO
SITE	DUMBARTON	DATE
DEPT	DESPATCH ORDER PROCESSING	COMPLIED APPROVED

Scope

This process defined the procedure to be followed for day to day management of planned despatches from J&B Scotland Ltd.

Responsibility

The ultimate responsibility for this process lies with the Shipping and Operations Manager. This responsibility is delegated to the personnel working within the Despatch Order Processing function.

Inputs	Source	Reference
Weekly Despatch Plan	(Despatch Planning)	
Un-allocated orders Report	Stock Control	

Outputs	Destination	Reference
Picking List	Cased Goods Stock Control (Internal)	
Planning Board Tickets	(Internal)	
Daily Despatch Programme	Haulier Cased Goods	

J&B SCOTLAND LTD

SUBJECT	DESPATCH CONTROL	PROC NO PAGE 3 OF 5 ISSUE NO
SITE	DUMBARTON	DATE
DEPT	DESPATCH ORDER PROCESSING	COMPLIED APPROVED

Procedure

- ☐ On a daily basis receive the un-allocated orders report from stock control.
- ☐ Identify orders which can be despatched. The criteria used here is the availability of stock.
- ☐ If there is a stock shortage consult shipping, decide whether it can be replaced by other existing stock. Inform cased goods and stock control of decision.
- ☐ Check for accuracy of orders on the un-allocated orders report. Amend if necessary eg hauliers details, customs procedure code etc.
- ☐ Release orders for despatch.
- ☐ For USA and Spanish Orders
  - ☐ Pass un-allocated orders report to stock control who will allocate the relevant stock and print the picking list
- ☐ For Row orders
  - ☐ Allocated stock to order
  - ☐ Print Picking List
- ☐ Book haulage (re Transport Management Procedures)
- ☐ Change shipping/booking details if necessary and inform shipping.

Figure 8.13 Sample procedure

8.7 INTEGRATION PHASE

The purpose behind this phase is to allow the functions to exchange their respective policy and procedure documents and review them with a view to resolving the current problems and differences. To facilitate this, TQM workshops are held between individual departments to promote the internal customer and supplier concept and identify the current problems specific to the interfaces of the participating functions.

Integration meetings are held between the functions to prioritise and resolve problems and other differences identified through the TQM workshops. This consequently leads to revision of the policies and procedures to reflect the changes necessary. These integration meetings tends to be iterative sometimes having to involve more then two functions to resolve a specific problem. On conclusion of this phase, once the revised policies and procedures have been implemented, it may be argued that the organisational integration has been achieved.

The key constituents of this phase are:

- TQM Workshops
- Integration Meetings
- Revision of Policies and Procedures

Following sub-sections provide further details on these activities.

8.7.1 TQM Workshops

The purpose of the TQM workshops are to install the internal customer/supplier concept into each function and in doing this to focus the attention of working groups at the process interfaces and identify problems. The structure of these workshops is that a number of working groups are brought together in a seminar room. A brief presentation is given to the participants to reinforce the internal customer/supplier concept. At the end of the presentation each working group is provided with the work-sheets illustrated in Figure 8.14. Each group is asked to discuss within themselves and complete the work-sheets provided. In completing one of the work-sheets the groups are asked to identify their internal suppliers and against each supplier to define their requirements. Finally against each requirement, they are asked to list typical problems which leads to difficulties and inefficiencies within their own processes. Similarly, in completing the other work-sheet the groups are asked to identify their internal customers, their understanding of the customers requirements and their problems in meeting the customers requirements. Figure 8.15 illustrates samples of completed internal customer/supplier work-sheets.

For the TQM workshops to be successful complete honesty, objectivity and openness is required, therefore it is recommended that the importance of this is stressed at the start of each session. Also experience shows that to ensure best results from these sessions the provision of the results of the Analysis Phase, ie the IDEF0 diagrams and the policy and procedure documents are essential for reference purposes.

Department:		
Suppliers	Your Requirements	Problems

Department:		
Customers	Their Requirements	Problems

Figure 8.14 Internal customer/supplier work-sheets.

Department: Production		
Customers	Their Requirements	Problems
Prod. Planning Finance Senior Management Canteen	Daily ops. info. Accurate hours worked Performance info. Prior o/time warning	Informal feedback Not consistent Inaccurate No communications

Department: Management Accounts		
Suppliers	Your Requirements	Problems
Sales & Marketing	Accurate forecast	Timeliness/accuracy
Purchasing	processing of PO's	Delays and accuracy
Departmental Mangrs	Coding of invoices	Inaccurate coding

Figure 8.15 Completed internal customer/supplier work-sheets.

8.7.2 Integration Meetings

The purpose of the integration meetings are to provide a structured forum to allow the individual working groups to discuss and resolve the problems identified in the previous stage. To achieve this a two staged approach is employed.

Stage 1 - Review of policy and procedure documents

This is designed to be the preparatory stage where each function distributes its policy and procedure document to other functions. Each working group then reviews other functions policies and procedures paying particular attention to the interface between its own procedures and the reviewed procedures with a view to identifying discrepancies and sources for the problems discussed during the TQM workshops. This process is best explained through an example.

If we focus on two functions of an organisation such as Customer Services and Shipping the two working groups would have prepared their functional policy and procedure documents through out the Analysis Phase. During this stage the working group representing the Customer Services function will receive a copy of the policy and procedure document for the Shipping function and similarly the working group representing the Shipping function will receive a policy and procedure document for

the Customer Services function. The working group representing the Shipping function will be expected to review the policy and procedures of the Customer Services function with a view to identifying discrepancies, ie Does the inputs and outputs match?; Are the policies and procedures compatible?.

In other words the procedure documents form pieces of a jig saw and to achieve integration their interfaces must be compatible. The purpose of this stage is to identify these incompatibilities.

Stage 2 - Integration Meetings

The purpose of the integration meetings is to prioritise the problems identified during the TQM workshops, attribute the discrepancies identified during the review of each others policy and procedure documents to these problems and identify and agree possible solutions. Normally an integration meeting is specific to two functions which allows attention to be focused to a single interface. However, where more than two functions are closely coupled it may be necessary to hold integration meetings between three functions which is the maximum recommended number for practical purposes. Experience shows that the process is most effective when it is focused to a single interface between two functions.

The key steps throughout the meeting are:

- Prioritise problems
- For each problem;
    - (i) Identify and agree cause
    - (ii) Agree corrective action
    - (iii) Agree necessary policy and procedural amendment
- Move on to the next problem

8.7.3 Revision of Policies and Procedures

The purpose of this activity is to ensure that the functional policies and procedures are amended to fall in line with the agreed modifications, working practices etc. It is the responsibility of each working group to ensure that all modifications are included and implemented effectively and efficiently. It is recommended that the revised policy and procedure documents are reviewed by the key customer and supplier functions before being authorised by the functional managers.

Experience shows that throughout the integration phase the key players are the working groups. However support from the functional managers and senior managers may be required to answer questions, resolve difficulties and approve proposals for policy level changes. For example proposed change to order processing forms may be approved and implemented at the working group level, but a proposed change

to the company's invoicing policy must be approved by the steering group.

8.8 CONTINUOUS IMPROVEMENT PHASE

Phases from Awareness through to Integration ensure that an organisation achieves a state of integration at all levels. The Strategic phase ensures that the business direction and strategies are well defined and the roles and responsibilities of each function is clearly understood. The Analysis phase ensures that various functions of an organisation is analysed in detail with respect to the direction and objectives defined through out the strategic phase. The Integration phase ensures that differences and problems of integration are identified and resolved with a view to fulfilling the business objectives and strategies.

The purpose of the continuous improvement phase is to ensure that the state of integration is maintained and improved upon. This is achieved through the introduction of a set of integrated performance measures across all levels of the organisation. Monitoring of these performance measures and carrying out of improvement actions. Therefore this phase consists of the following activities:

- Operational performance measures
- Performance reviews
- Improvement actions

8.8.1 Operational Performance Measures

The purpose of this activity is to establish operational performance measures for each function. Throughout this activity the functional manager plays an instrumental role in ensuring that the functional performance measures outlined during the strategic phase are in agreement with those identified during this activity by the working group.

First step within this activity is for the working groups to review their roles and responsibilities, ie key processes, and the associated procedures with a view to defining a performance criteria for each one of the processes. For example the performance criteria for the process of order processing may be prompt processing of orders. The measures used to monitor this criteria may be:-

- Time taken to process an order from receipt to completion

- Number or % of orders incorrectly processes

Similarly the performance criteria for sales invoicing may be to invoice all sales on the day of dispatch. The measure applicable here may be:-

- Number or % of invoices processed within 3, 5, 10 days of dispatch.

Having established the performance criteria for each process and the appropriate performance measures the task for each working group is

to compare and map these measures to the criteria and measures defined by the steering group. It is the authors experience that usually there are minimal differences which arise due to misinterpretation or misunderstanding of roles and responsibilities. It would be the responsibility of the functional manager to liaise with the steering group and the working group to resolve the differences. Figure 8.16 illustrates a sample matrix containing performance measures for a shipping function.

The next step within this activity is to define the relationship between lower level, operational, performance measures and the higher level, strategic, measures defined by the steering group. This is again carried out by the working group under the leadership of the functional manager. This relationship between the higher and lower level measures are best illustrated through a matrix as shown in Figure 8.17. This allows some level of traceability between higher and lower level measures and serves as a useful management tool for problem and cause identification.

OWNER	MEASURE	PERIOD												YEAR AVERAGE	TARGET
		1	2	3	4	5	6	7	8	9	10	11	12		
	% of orders 'booked' or 'third partied' within two working days of order being made bookable														
	% of orders 're-booked' on a period basis														
	% of orders 'closed' within 5 working days of the sailing date														
	% of orders closed within 10 working days of the sailing date														
	% of orders 'closed' within 15 working days of the sailing date														
	Number of orders not 'closed' within the period of sailing														
	Number of debits and credits issued														
	% of orders not meeting requirements														
	Number of customer complaints and associated costs														

Figure 8.16 Performance measures for the shipping function.

STRATEGIC PERFORMANCE MEASURES / OPERATIONAL PERFORMANCE MEASURES	On time deliveries (%)	Actual v Plan volume Actual v Latest agreed forecast %	Hit rates (%)	Total line downtime (hours) BH I BH III	Non-conforming cases (%) Total Category 9	Actual v Budget spend (%) Actual v Latest QF (%)	Turns / Annum - Finished goods	Turns / Annum - Raw materials	Value of all material waste (£K)	Waste relative to material cost (%)	Dry Goods (£K) Obsolescence/Write off Case Goods (£K)	Number of stock outs BH I BH III	Cost/Case produced YTD (% of LQF)	Good cases/Man hour	Cases handled/Man hour
% of orders 'booked' or 'third partied' within two working days of order being made bookable	+		+												
% of orders 're-booked' on a period basis	-		-												
% of orders 'closed' within 5 working days of the sailing date															
% of orders closed within 10 working days of the sailing date															
% of orders 'closed' within 15 working days of the sailing date															
Number of orders not 'closed' within the period of sailing	-	+										+			
Number of debits and credits issued									-						
% of orders not meeting requirements	-				-										
Number of customer complaints and associated costs					-										

Figure 8.17 Matrix illustrating relationship between higher and lower level performance measures (+/- indicates the negative or positive effect of the lower level measure on the higher level measure).

8.8.2 Performance Reviews

The objectives of this activity are two fold. These are regular reviews of the:-

- strategic measures by the steering group.
- operational measures by functional managers and staff.

Strategic measures of performance are reviewed with respect to the corresponding targets (eg monthly basis) to re-prioritise and identify areas for attention. During this phase the role of Benchmarking becomes critical. A benchmarking task team should be initiated to continually review and assess the applicability of the benchmarks/long term targets against the best practice. These strategic performance reviews will also serve to focus attention on to particular operational measures of performance through the relationship matrix.

Operational measures of performance are reviewed (eg weekly basis) by the functional managers and operational staff to discuss recent problems, attribute problems to measures and identify necessary corrective action. The nature of the problems identified at this level will determine the nature of the necessary corrective action. It will be expected that those problems limited to a particular function are resolved within the function. Problems or corrective actions involving a number of functions should be resolved through a multi-functional task team.

The operational performance reviews should also be used as form for prioritisation of measures and target setting. It should be the responsibility of the functional manager to lead this activity based on priorities defined at the strategic level and the current performance at the operational level. The operational performance review may be used as a forum to discuss and agree targets against specific measures.

The operation of this phase is best described through an example. In a collaborating company the strategic performance measures showed a drop in the customer service achieved, ie number of orders delivered to customer on or before the due date. Through the relationship matrix the main reason for this appeared to be attributed to the shipping functions failure to book orders on time. This was reflected in the operational performance measures for the shipping function. However, during a operational performance review meeting within the shipping function it was established that delays in booking of orders were due to incomplete or incorrect letters of credit which needed to be reprocessed by the customer services function. This matter was allocated to a task team consisting of key (ie effected) personnel from both functions with a target to achieve 80% hit rate in bookings. The problem was resolved by the introduction of procedures and slight re-alignment of responsibilities between the two functions. A new performance measure was introduced to monitor the process of receiving and processing letters of credit. The new roles and responsibilities were defined and the functional procedure documents were updated for each function. All functional personnel were informed

of the change. This particular example resulted in an immediate 8% improvement in the customer service levels.

In summary the purpose of the performance reviews are to install the discipline and the mechanism for on going review of performance at strategic and operational levels, prioritise, set targets and initiate corrective action through functional or inter-functional task teams with specific briefs.

8.8.3 Improvement Actions

The performance reviews at both strategic and operational levels will identify areas for improvement. The objective of this activity is to ensure that the corrective action is valid and permanent. In the above section it has been suggested that problems local to a function are resolved by that particular function and those inter-functional problems are resolved through inter-functional task teams. Whichever the case, it is essential that the solutions are generated at the operational level, here the functional managers are responsible for facilitating and where necessary approving the proposed corrective actions

One other key ingredient for success is to involve the owners of a particular problem in the task teams. At the same time the functional manager must ensure that all personnel involved had an opportunity to review and comment on the problem and suggested actions before signing off and implementation. Attention must be given by the functional manager to ensure that all operational staff is asked to

contribute as a member of a task team or as an individual, this will ensure that motivation and momentum is maintained until continuous improvement becomes a way of life within the organisation. To facilitate this it may be necessary to provide the operational staff with some level of awareness training on problem solving tools and techniques. However, this is not a formal requirement of the methodology, the case studies presented demonstrates successfully application of the methodology with or without training on problem solving tools and techniques.

The discipline of updating the policy and procedure manuals is also a key requirement to ensure that organisational integrity is maintained through time and changes. Periodically it may be necessary to conduct reviews and audits to ensure that an integrated business platform is maintained.

8.9 CIM IMPLEMENTATION PHASE

This phase has been designed to allow rapid specification selection and implementation of computerized business modules such as Forecasting, Business Planning, Sales Order Processing, Purchasing, Stock Control, Maintenance Management, Production Planning, Finance and Accounts, Estimating, Tool Management etc. The purpose of the phase is to guide the user of the methodology through a structured process for the specification and selection of appropriate software meeting the requirements of the business. The approach described in this phase is suitable for specification of both tailored or off-the-shelf software packages.

This phase is not an essential part of the methodology and is only applicable when on completion of the Integration phase a need for computerised modules is identified. Application of this phase is illustrated in one case study presented later in this thesis.

This phase consists of four activities. These are:

- Definition of needs
- Requirements specification
- Evaluation and Selection
- Implementation

Following sections discuss the contents of each activity in detail.

8.9.1 Definition of Needs

The purpose of this activity is to define those areas within the business where computerised modules or systems may be implemented with certain benefits. The emphasis here is to identify areas which on computerisation will result in definite benefits. The types of benefits may be:

- Improved accuracy of information
- Improved frequency of accurate information
- Improved reliability of information
- Accessability to common data
- Reduction in workload resulting in redeployment of resources

The starting point for the definition of needs is the business problems identified in the previous phases. The working groups in discussing these problems may have already come up with proposals for the implementation of computerised modules. These proposals should clearly indicate the new procedures, ie the proposed way of working to resolve a particular difficulty. For this new procedure to work in the desired manner with maximum effect it may be necessary to introduce a computerised solution.

One other reason for identifying a need for a computerised module may be that the management or the working group, in reviewing the current policies and procedures identified an opportunity for improvement by the introduction of a computerised module. These types

of needs are not derived from current problems but are put forward as opportunities for improvement.

Whether the source of need for computerisation is a business problem or an opportunity it is important that the necessary new procedures are clearly documented and integrated within the total business. It is also important at this stage to identify the clear benefit to be gained from the implementation of such procedures.

8.9.2 Requirements Specification

The new procedures proposed form the basis of the requirements specification. These procedures detail the activities necessary to achieve certain business objectives and therefore reflect the business needs. Therefore it is important, at the process of defining these procedures to be totally objective and non software/system specific. The prime consideration is to ensure that the new procedures meet the requirements of the business and deliver maximum business benefits.

The objective of this activity is to create a requirements specification using the procedures defined and agreed. This is a relatively simple task providing that the procedures are well structured clearly defining the interfaces between the user and the required system in terms of inputs, outputs, screen and report formats.

The main task here is to format the information contained in the procedures in to a structured specification document which aids

evaluation and selection process. The recommended approach here is that the relevant procedures are reformatted to reflect and emphasise the desired operation of the system.

The requirements specification should be presented in a similar format to that shown in Figure 8.18. This allows for the systems suppliers to respond in an accurate and precise manner against each requirement. This in turn aids system evaluation and selection.

MANUFACTURING RESOURCES PLANNING II SYSTEM REQUIREMENTS

No.	MANUFACTURING	YES STANDARD	YES CUSTOMISE	NO ALTERNATIVE	COMMENTS
2.1	IS IT POSSIBLE FOR SHOPFLOOR OPERATORS TO DIRECTLY ENTER (THROUGH TERMINALS OR BAR CODES) APPROPRIATE INFORMATION INTO THE SYSTEM.				
2.2	DOES THE SYSTEM HAVE (OR HAVE THE ABILITY TO INTERFACE WITH) A GENERAL PURPOSE TIME AND ATTENDANCE RECORDING SYSTEM AND CAN IT REPORT ON ABSENTEEISM, LATENESS, ACTUAL HOURS WORKED, OVERTIME ETC.				
2.3	DOES THE SYSTEM PRODUCE PRIORITISED "WORK-TO" LISTS FOR THE SHOPFLOOR OVER VARIABLE TIME PERIODS AND BY INDIVIDUAL WORK CENTRE.				
2.4	CAN THE SYSTEM LIST ALL CURRENT PROCESS OPERATIONS AND ROUTINGS FOR EACH PRODUCT.				
2.5	CAN THE SYSTEM INCORPORATE SOME TIME FOR PLANNED MAINTENANCE IN THE FORWARD LOAD OR MPS.				
2.6	CAN THE SYSTEM LIST STANDARD AGAINST ACTUAL OPERATING TIMES SO THAT WE MAY MONITOR THROUGHPUT RATES.				
2.7	CAN THE SYSTEM LIST AVAILABLE CAPACITY BY WORK CENTRE.				
2.8	CAN THE SYSTEM REPORT ON MACHINE VARIANCES, ANALYSED INTO DOWNTIME, SCRAP, REWORK ETC AND DOES IT PERMIT THE EXPLANATION OF THESE VARIANCES BY PRODUCT EG PRODUCTION PERSONNEL SHOULD BE ABLE TO ENTER DELAY CODES.				
2.9	CAN THE SYSTEM REPORT ON WORK COMPLETED BY WORK CENTRE AND REPORT THE FINANCIAL PERFORMANCE OF ALL WORK CENTRES.				
2.10	CAN THE SYSTEM PRINT LABELS (FOR STICKING ON FINISHED PRODUCT) AND CAN THE REQUIRED INFORMATION COME FROM THE SALES ORDER ENTRY SYSTEM.				
2.11	CAN MATERIAL BE ISSUED BY KIT WITH EXCEPTION REPORTING OF SHORTAGES.				
2.12	DOES THE KITTING LIST ADVISE OF POSSIBLE SHORTAGES.				
2.13	DOES THE SYSTEM SUPPORT THE PRINTING OF KITTING LABELS.				

Figure 8.18 Sample page from a requirements specification document.

8.9.3 Evaluation and Selection

The requirements document as presented in the previous section is designed so that the system suppliers complete the columns at the right hand side of the document. This presents the key to system evaluation. In effect at a glance one could assess whether a feature is standard or special and the cost and timescale associated with any modifications which may be necessary to a standard system. Similarly it works equally well for the tailor-made systems, in fact it aids the suppliers thinking process by itemising each transaction which may be costed.

Based on this cost and time scale information presented by the suppliers system selection may be carried out. Through out evaluation it is important to justify each cost against the expected benefit. In some cases one single option may not be justifiable. An example of this is that one of the case study companies who specified a requirement to maintain the actual weight of finished goods by lot rather than average weight found that the cost of modification to a standard package outweighed the expected benefits and decided to drop that particular requirement.

It must be made clear that the approach outlined above for system evaluation and selection is focused on evaluation of functionality costs against expected benefits. It is recognised that other factors such as user friendliness, speed of processing etc are also important considerations and are well established elements of the present system selection processes.

8.9.4 Implementation

Having followed the activities outlined in this phase, the implementation of the selected system tends to be a relatively minor process, that is minor in complexity not in time scale or data preparation effort. Because the system was specified based on procedures created by the working groups, ie the eventual users of the system, and the fact that the working groups were involved in the evaluation and selection phase, the selected system will be owned by the users. The authors experience is that the key tasks here are data preparation and loading and the training of the users on the system.

Case studies presented later in this thesis show that following a Total-I project systems implementations have been relatively painless and rapid with minor and negligible teething problems.

8.10 DISCUSSION

This chapter presented the concepts and procedures behind the methodology for business integration. In summary the methodology consists of five core phases which if implemented correctly will result in fulfilment of the requirements specified in the reference model. The sixth phase, ie the CIM Implementation Phase, is optional and is only applicable when a need for computerised modules is identified through the core phases of the methodology. Table 8.1 summarises each step of the methodology together with associated responsibilities and expected outcomes.

PHASE		ACTIVITY/ACTION	RESPONSIBILITY	OUTCOME
1.0	AWARENESS PHASE			
1.1	Executive Briefing	Executive workshop	Steering Group	General understanding and commitment to the programme
1.2	Project Organisation	Executive workshop	Steering Group	Definition of roles and responsibilities for the Total-I programme
1.3	General Awareness	General awareness sessions in small groups by function	Steering Group and Management hierarchy	An awareness of the Total-I programme by all employees.
2.0	STRATEGIC PHASE			
2.1	Business Situation Review	Identify key business issues including economy, environmental issues, competitors and business performance through SWOT workshops	Steering Group	Summary of the high level business situation, SWOT analysis.
2.2	Business Direction Setting	Identify business vision based where the company wants to be in three to five years.	Steering Group	Agreed vision statement.
		Identify key areas of focus.	Steering Group	Agreed performance areas.
2.3	Business Strategy Setting	Identify strategic performance measures for each performance area. Agree on units of measure and on the data collection procedure. Monitor current performance against the strategic performance measures.	Steering Group	An Agreed business strategy based on performance measures, current performance external forces, etc.
2.4	Functional Strategy Setting	Draft out functional roles and responsibilities. Assess the impact of each function on the business strategy.	Steering Group and the functional managers	Draft functional roles and responsibilities and appropriate functional performance objectives. To be finalized with the working groups through the analysis and continuous improvement phases.
3.0	ANALYSIS PHASE			
3.1	Interfunctional Analysis	IDEF0 training to working groups. Each working group constructs a context diagram for their own function. The working groups compare each others interfaces to construct a consolidated picture.	Working groups	An IDEF0 model showing key information flow between functions.
3.2	Functional Role and Responsibility Analysis	Each working group identifies their own functions roles and responsibilities Each functions roles and responsibilities is reviewed and agreed by its customer/ supplier functions.	Working groups	Agreed functional roles and responsibilities.
		The functional roles and responsibilities is compared with the steering groups version - see para 2.4 above.	Working groups and steering group	
3.3	Functional Analysis	Each working group constructs an IDEF0 model for the their functional activities based on the agreed roles and responsibilities.	Working group	IDEF0 model showing the information flow within each function. Revised roles and responsibilities.

Table 8.1 Summary of the methodology

PHASE		ACTIVITY/ACTION	RESPONSIBILITY	OUTCOME
3.4	Policy and Procedure Documentation	Working groups document the policies and procedures against each responsibility. The policies and procedures are reviewed by all involved before finalization.	Working groups	Formally documented policies and procedures for key business processes.
4.0	**INTEGRATION PHASE**			
4.1	TQM Workshops	Hold TQM workshops to discuss internal customer supplier relationships and to identify current problems between functions.	Working groups	An awareness of internal customer supplier relationship. List of current problems at functional interfaces and possible causes.
4.2	Integration Meetings	Each working group reviews its customers and suppliers procedures to identify differences and internally discuss possible solutions. Differences and current problems are discussed and possible solutions are identified, proposals are referred to the steering group as necessary.	Working group	Identification of factors preventing full integration. Identification and implementation of solutions
4.3	Revision of policies and procedures	The functional policy and procedure documents are revised to reflect the agreed changes, these are formally issued.	Working group	An integrated business platform
5.0	**Continuous Improvement Phase**			
5.1	Operational Performance Measures	Working groups identify the performance measures most appropriate to their roles and responsibilities. A matrix showing the relationship of the operational and strategic performance measures is constructed.	Working groups	Integrated performance measures
5.2	Performance reviews	Strategic and operational performance reviews at regular intervals to identify possible areas of improvement.	Working/functional groups and the Steering group	Improvement actions and targets.
5.3	Improvement Actions	Formation of improvement teams to resolve problems and issues identified.	All	Continuous integration and business performance improvement.
6.0	**CIM IMPLEMENTATION**			
6.1	Definition of Needs	The business areas which would benefit from CIM modules are identified.	Working groups and Steering group	Clear understanding and definition of needs.
6.2	Requirements Specification	Based on the new procedures a detailed Statement of Requirements is prepared. This is made available to potential suppliers.	Working groups	Statement of requirements
6.3	Evaluation and Selection	Based on the SOR and the suppliers response the level of fit is assessed up on which a decision is made.	Steering group	Selection of appropriate solution
6.4	Implementation	The CIM module is implemented.	All	Working CIM modules

Table 8.1 Summary of the methodology

In this chapter in describing the details of the methodology, application oriented issues were also discussed, with some examples based on the case studies. These application oriented issues were identified as a direct result of applying the methodology in the case study companies as discussed in the next chapter. However it was thought important that these are also included in this chapter to provide a fuller understanding and appreciation of the methodology.

Following sections explores the following questions:-

- How does this methodology satisfy the reference model?

- How does this methodology meet the requirements specification for such a methodology as specified in chapter three?

8.10.1 Methodology and the Reference Model

The objective of this section is to analyse the methodology with respect to the reference model. Table 8.2 relates each performance area and criteria of the reference model to the appropriate phase and activity of the methodology.

REFERENCE MODEL PERFORMANCE AREA & CRITERIA	METHODOLOGY PHASE / ACTIVITY
SHARED VISION	
The current position of the company is defined with respect to competitors and customers, financial performance, internal strengths and weaknesses, external threats and opportunities.	Strategic Phase - Business Situation Review
A long term, realistic, vision is defined.	Strategic Phase - Business Direction Setting
The key competitive criteria which would enable the company to achieve its vision is defined.	Strategic Phase - Business Direction Setting
Items a-c above is understood by employees at all levels and employees can relate their own job functions to the achievement of this vision.	Through the link between the Strategic and Analysis phases.
COMMON STRATEGY AND OBJECTIVES	
The vision is expressed in terms of measurable short and long term goals.	Strategic Phase - Business Strategy Setting - Use of strategic performance measures
A strategy for achieving the vision has been formulated and expressed in measurable terms in the form of short and long term targets and priorities.	Strategic Phase - Business Strategy Setting - Targets and priorities against the strategic performance measures.
Items a and b above are understood by employees at all levels and employees can relate their own job functions to the long and short term strategic targets.	Through the link between the Strategic and Analysis phases.
AWARENESS OR ROLES AND RESPONSIBILITIES	
All strategic and operational processes within the business are identified.	Analysis Phase - Functional Role and Responsibility Analysis
All process responsibilities are allocated to business functions.	Analysis Phase - Functional Role and Responsibility Analysis
All functions clearly understand their process responsibilities.	Analysis Phase - Functional Role and Responsibility Analysis - Policy and Procedure Documentation
All functions demonstrate an awareness of other functions roles and responsibilities.	Integration Phase - Integration Meetings

Table 8.2 The Methodology and the Reference Model (cont.)

REFERENCE MODEL PERFORMANCE AREA & CRITERIA	METHODOLOGY PHASE / ACTIVITY
Integrated Processes	
The objective of each process is defined.	Analysis Phase - Policy and procedure Documentation
The inputs, outputs and controls of each process is clearly defined.	Analysis Phase - Functional Analysis - Policy and Procedure Documentation
The customers (ie the destination of outputs) and suppliers (ie the source of inputs) of for each process is defined.	Analysis Phase - Interfunctional Analysis - Functional Analysis - Policy and Procedure Documentation
The procedure (ie. the actions necessary for converting the inputs into the outputs) for each process is defined.	Analysis Phase - Policy and procedure Documentation
The customers and suppliers agree with the objectives, inputs, outputs and the procedures for each process.	Integration Phase - Integration Meetings - TQM Workshops
All personnel responsible for the process understand above items.	Working Groups (see Awareness Phase)
Conduct regular reviews to ensure that the processes remain integrated.	Integration Phase - TQM Workshops Continuous Improvement Phase
Conforming Working Practices	
Conduct regular audits	Integration Phase - TQM Workshops
Take corrective actions as necessary	Continuous Improvement Phase
Integrated Performance Measures	
Define the performance criteria of each process.	Continuous Improvement Phase - Operational Performance Measures
Identify indicators which measure the ability of these processes to fulfil the performance criteria.	" " "
Establish an understanding of the relationships between the process level performance measures and strategic measures and goals.	" " "
Establish the relative priorities at process levels with respect to strategic priorities.	" " "
Encourage the use of the integrated performance measurement tool as a management tool.	Continuous Improvement Phase - Performance Reviews and Improvement Actions

Table 8.2 The Methodology and the Reference Model

From Table 8.2 it can be seen that all of the performance areas and criteria as specified in the reference model is addressed by the methodology. However there are some areas of weaknesses, such as under the performance areas of Shared Vision and Common Strategy and Objectives, the methodology does not provide a mechanism, tool or technique to facilitate communication to employees at all levels. It relies on the link between the Strategic Phase and the Analysis Phase and on the relationship between the steering group and the working groups. To address this area the methodology attempts to provide guidelines by describing, in detail, the roles and responsibilities of the steering and the working groups. Considerable emphasis is placed upon the organisation of working groups which should ensure that all individuals within a function are involved. However, although the methodology identifies the problems associated with larger functions, where involving all functional staff in a working group would be impractical, it does not offer mechanisms to facilitate this.

8.10.2 Methodology and the Requirements Specification

The objective of this section is to summarise the extent to which the methodology satisfies the requirements specified in chapter 3. Table 8.3 provides a summary of how the methodology satisfies the stated requirements under the three main headings; Scope, Functionality and Application. It also specifies the nature of the tools and techniques employed.

REQUIREMENTS	PROVISION WITHIN A FRAMEWORK	PROVISION OF TOOLS AND TECHNIQUES
SCOPE		
Incremental Approach	Yes - ex. Strategic Phase	
Independency from CIM technology	Yes	
Subsystem for CIM implementation	Yes - not an essential element	
Hard and soft systems orientation	Yes	
FUNCTIONAL		
Commitment and education	Yes	
Shared vision	Yes	SWOT, Procedures and Guidelines
Common objectives	Yes	Strategic Perf. Measures, Guidelines
Accountability and Contribution	Yes	Role and Resp. Analysis, Integration Meetings, Int. Perf. Measures
Process orientation	Yes	Customer/Supplier Concept Modified IDEF0 Policy & Procedure Docs.
Information systems orientation	Yes	Customer/Supplier Concept Modified IDEF0 Policy & Procedure Docs.
Integrated approach	Yes	Integ. Perform. Measures
Ownership	Yes	Steering & Working Groups Integ. Perform. Measures
Continuous improvement	Yes	TQM Workshops Integ. Perform. Measures Reviews and Actions
Performance measurement	Yes	Cust./Sup. Approach Strategic and Operational Performance Measures
APPLICATION		
Low cost	Low up front cost but high hidden costs	
Simplicity	No significant learning curve	
Early benefits	Management influenced	
Structured and planned approach	Yes	
Viable Systems		

Table 8.3 Methodology and the Requirements Specification

8.10.2.1 Scope

The requirements identified under the heading of "Scope" were:-

- An incremental approach
- Independence from CIM technology
- A subsystem for CIM implementation
- Hard and soft systems orientation

The following paragraphs discuss this methodology with respect to the requirements stated above.

The methodology does provide an incremental approach. That is it does not have to be applied to the entirety of an organisation. In other words the boundary of the application is user definable. Therefore, the application of the methodology may be limited to a division or a single department of an organisation. However, the Strategic Phase can not be limited to a division or department of a business. The scope of the Strategic Phase must cover the entire business if sub-optimisation is to be avoided. In this respect providing the vision and strategy for the business is defined the remainder of the methodology may be applied in an incremental manner to selected areas of the business.

The methodology is totally independent from the use of CIM modules such as MRPII. But it provides a subsystem for implementation of such systems where and when necessary. However this subsystem is not an essential requirement to achieve business-wide integration.

As specified in Table 8.3 this methodology provides a set of tools, techniques and procedures to facilitate the achievement of the actions

specified within the framework. These tools, techniques and procedures address the "harder" issues of business integration. The guidelines and procedures provided on the application of the individual tools and techniques address the "softer" issues of business integration such as different personalities, ownership and commitment.

8.10.2.2 Functionality

The requirements identified under the heading of "Functionality" were:-

- Commitment and Education
- Shared Vision
- Common Objectives
- Accountability and Contribution
- Process Orientation
- Information Systems Orientation
- Integrated Approach
- Ownership
- Continuous Improvement
- Performance Measurement

Following paragraphs discuss this methodology with respect to requirements stated under the above headings.

The methodology attempts to gain commitment to business-wide integration through a number of mechanisms. One key mechanism is the involvement of everyone through the steering, working or problem-solving groups. The second mechanism is the communication of a single vision and a common strategy. The third mechanism is formalisation of

functional roles and responsibilities which essentially create greater awareness of one's own and each-others accountabilities with respect to the vision and the strategy. Finally through the implementation of an integrated set of performance measures which ensures that the performance criteria for all areas of the business are complimentary to the overall business objectives.

This methodology, through the Business Situation Review and the Business Direction Setting activities, ensures that a vision for the business is created and the competitive criteria are identified. To achieve this it makes use of the well known SWOT analysis technique and provides certain guidelines.

The Business Strategy Setting activity ensures that the business strategy and objectives are clearly defined in terms of strategic performance indicators together with appropriate priorities and targets.

The Functional Role and Responsibility Analysis together with the Integration Meetings and Operational Performance Measures ensure that each function's accountability is defined and its contribution towards the business strategy and the vision is understood. This also ensures differentiation between various business functions.

Throughout the analysis and integration phases the methodology ensures that all business processes are identified, together with their objectives and associated responsibilities. The inputs and outputs of each process are also identified together with the customers and

suppliers of each process. This is achieved through the Interfunctional and Functional Analysis activities where extensive use of the modified IDEF0 technique is made. The inputs, outputs and procedures associated with each process is also documented in the form of functional policy and procedure manuals which formalises the process orientation within the business.

In defining the processes with their inputs, outputs, customers and suppliers through the modified IDEF0 approach a model of the information system which supports the business processes is created. The Integration and Continuous Improvement phases ensure that the relevance of this information system is maintained and tuned to meet the needs of the business.

The strategic and operational performance measures are integrated through the use of a matrix as part of the Business Strategy Setting and Operational Performance Measurement activities. These ensure that functional priorities, strategies and objectives are in line and complimentary to the business vision and strategy.

This methodology ensures the involvement of all personnel within the business through the steering, working and the problem solving groups. This facilitates certain degree of ownership. In addition, the use of integrated performance measures enhance visibility with respect to accountability and contribution thus enhancing ownership at all levels within the organisation.

The Continuous Improvement phase, through regular reviews of the strategic and operational performance measures and TQM workshops ensures that issues effecting integration is identified on a continuous basis and are resolved through the working groups or problem solving groups.

A key aspect of this methodology is the installation of integrated performance measures within the business. The methodology requires the use of a structure of performance measures at two levels, strategic and operational. It ensures that the relationship between these measures are defined and understood. It also ensures that targets and priorities of the higher level measures are propagated to lower levels to define targets and measures at operational levels which would compliment the strategic objectives.

8.10.2.3 Application

The requirements identified under the heading of "Application" were:-

- Low cost
- Simplicity
- Achievement of early benefits
- Structured and Planned Approach
- Viable Systems

The methodology is a collection of tools and techniques to be implemented within the structured framework. Therefore it does not require extensive investment in new equipment in the form of computer hardware and software. However the real cost of the methodology is

significant because it requires substantial involvement from people at all levels. One major draw back is that at this stage it is not possible to estimate an average time requirement for involvement.

As stated above the methodology is a collection of tools and techniques which individually are simple and do not require a significant learning curve. The majority of the skills required are in the areas of management of meetings, brainstorming etc. Therefore, it may be argued that the methodology is simple and may be applied without any previous experience or training specific to the methodology.

It is envisaged that with appropriate project management skills it is possible to gain early benefits from the implementation of this methodology. However this is entirely under management control. The application of the methodology in itself can not guarantee early benefits as there are other factors in effect, such as commitment. Therefore with respect to this requirement the methodology fails to provide a mechanism to identify projects which would bring early success. All it does is that it recommends careful selection of improvement projects to bring about early benefits

The methodology is quite explicit in what needs to be done, when and in what sequence. Therefore it does provide a structured approach. However it does not provide a time phased plan as this is dependent on the scope and size of each application and therefore could vary significantly from one organisation to other.

With respect to the Viable Systems Model (VSM) (Beer, 1984) which was summarised in chapter three the methodology ensures that the five systems are installed within the organisation at various levels. System one represents the operating units. In this methodology the operating units are seen as a three tier structure, these are:-

- The business
- The functions
- The business processes

Systems four (ie Planning and Development) and five (Policy) exists at the business level as the senior management reviews the current position of the business with respect to its performance and its environment and makes strategic decisions by establishing the business direction and propagating these strategy and priorities through the integrated performance measures. Systems two (Co-ordination and Regulation) and three (ie Communication and Control) exists mainly at the functional level as the strategic decisions and priorities are propagated through the integrated performance measures to functional levels. The functional performance indicators, which are originally defined through the individual business processes, are then regularly reviewed to facilitate day-to-day management of the business processes. The formalised information system ensures that necessary level of communications takes place to ensure that individual processes operate effectively and efficiently, ie Integrated Processes.

8.10.3 Summary of Discussion

In this chapter having described the methodology in detail, the discussion has focused on the extent the methodology satisfies the criteria stipulated in the reference model and the requirements specification.

With respect to the reference model the methodology appears to provide guidelines, tools and techniques to enable the achievement of the performance criteria specified against all areas of the reference model.

Similarly, with respect to the requirements specification the methodology appears to satisfy the majority of the requirements specified.

The reader must appreciate that, the above conclusions are based on a desk-top assessment of the methodology rather then experimental results. Chapter 10 provides the details of the case studies ie. experiments with brief discussions on the application of the methodology. Chapter 11 includes a more detailed discussion on the application of the methodology with specific reference to experimental results.

CHAPTER NINE

EVOLUTION OF THE METHODOLOGY

9.0 DEVELOPMENT OF THE METHODOLOGY

At the beginning of the previous chapter the constituent parts of a methodology were discussed. In this discussion it was outlined that in the context of this work a methodology consists of a structured set of actions which provides the framework and a collection of tools and techniques to facilitate the achievement of the actions within the framework. In describing the methodology in the previous chapter, the framework and the application individual tools and techniques were described in some detail. The objective of this chapter is to describe the development of the methodology. This is achieved by discussing first the criterion and then the development of the framework and the evolution of various phases of the methodology together with appropriate reasoning for the use of the selected tools and techniques in each phase and activity.

9.1 METHODOLOGY: THE MAIN CRITERION

In developing the methodology the following criteria were considered at all times. These were:-

- The methodology should fulfil the requirements specified, as discussed earlier in chapter three.

- The application of the methodology in an organisation should result in the achievement of the objectives specified in the reference model.

- Emphasis would be placed on hard aspects at first in terms of processes, procedures, tools and techniques and then consideration would be given to softer aspects such as application, user-friendliness, involvement and ownership.

9.2 EVOLUTION OF THE STRATEGIC PHASE

In order to achieve integration, it is clear from the literature survey that the organisation must have clearly defined objectives and strategy. Clearly this is a senior management responsibility, however it is also clear that this would have to be communicated across all levels of the organisation. With this requirements in mind the Strategic Phase was created with the following actions:-

- Business Situation Review
- Business Direction Setting
- Business Strategy Setting

It was also thought critical that the individual functional strategies were aligned with the overall business objectives and strategy. However, in order to achieve ownership and maximise involvement at operational levels it was thought important that the functional personnel had considerable input to the strategy formulation process. With this in mind the "Functional Strategy Setting" activity was included in the strategic phase, but with strong links with the analysis phase where the functional personnel are engaged in the process of reviewing functional roles and responsibilities. The Strategic Phase is also the start of the introduction of the integrated set of

performance measures. At this stage the performance measures and associated targets and priorities are defined at a strategic level.

The methodology, during the Business Situation Review and Business Direction Setting activities makes extensive use of existing tools and techniques, such as the SWOT analysis, and provides guidelines. The Business Strategy Setting activity makes use of the technique developed for developing integrated performance measures (Bititci, 1993) which was developed as part of the research work presented in this thesis. At the time of writing the author was involved in the preparation of an SERC-ACME research grant on Integrated Performance Measurement Systems, the literature survey carried out in preparation of this proposal revealed no alternative techniques.

9.3 EVOLUTION OF THE ANALYSIS PHASE

In order to meet the criterion specified within the reference model under the headings of "Awareness of Roles and Responsibilities" and "Integrated Processes" the Analysis Phase was created. Here, originally the IDEF0 technique was adopted to model and analyse business processes and information flow between processes. When compared to other techniques such as Data Flow Diagramming, the IDEF0 technique was preferred because it provided some form of structure by differentiation between ordinary inputs to a process and the controlling inputs, such as policies, limitations and constraints. However, initial practical applications of the IDEF0 technique resulted in the identification of a number of limitations. These were:

- Being process oriented it did not correspond to the existing structure of the organisation.

- By limiting the number of processes at each level it restricted visibility over the business processes applicable at each level of the organisation.

- Initial results produced by the analyst were not readily understood and accepted by the company employees. This was mainly due to the fact that they had difficulty relating the diagrams to the business structure and processes.

- After two levels of decomposition the technique lost its accuracy and became less understandable where it was trying to describe procedures at detail levels.

Bearing in mind that one of the objectives of this work was to develop a user-friendly methodology which could be picked up and applied by the average industrial manager in a short space of time, the limitations listed above presented the first difficulty to be overcome. At this stage use of alternative techniques were investigated. However the structure used by IDEF0 (ie the differentiation between inputs, constraints/controls/policies and mechanisms/resources) provided a powerful analysis tool. At this stage it was decided to modify the technique to overcome the above limitations. The following modifications were carried out:

- At the top level, the IDEF0 technique was applied to analyse the information flow between various functions (ie departments). This ensured that at the highest level the analysis was in line with the structure of the organisation. Furthermore the personnel operating within a function would find it much simpler to use and understand.

- The functional role and responsibility analysis technique was introduced to identify the key processes which fell under the responsibility of each function. By making individuals who operate within a function talk about their daily tasks in a group environment, it became possible to identify the business processes which fell within the boundaries of that function. This, therefore, provided a natural explosion path for IDEF0 analysis. One main advantage of this approach was that the employees within a function, once provided with an example, were able to identify and relate to the business processes.

- The free format policy and procedure documentation allowed further decomposition of the key business processes, roles and responsibilities, in a format that was understood and accepted by the daily users of these policies and procedures. The policy and procedure structure recommended within the methodology was the most commonly used and liked format by the operational staff in various organisations.

The nature of the modifications discussed is depicted in Figure 9.1

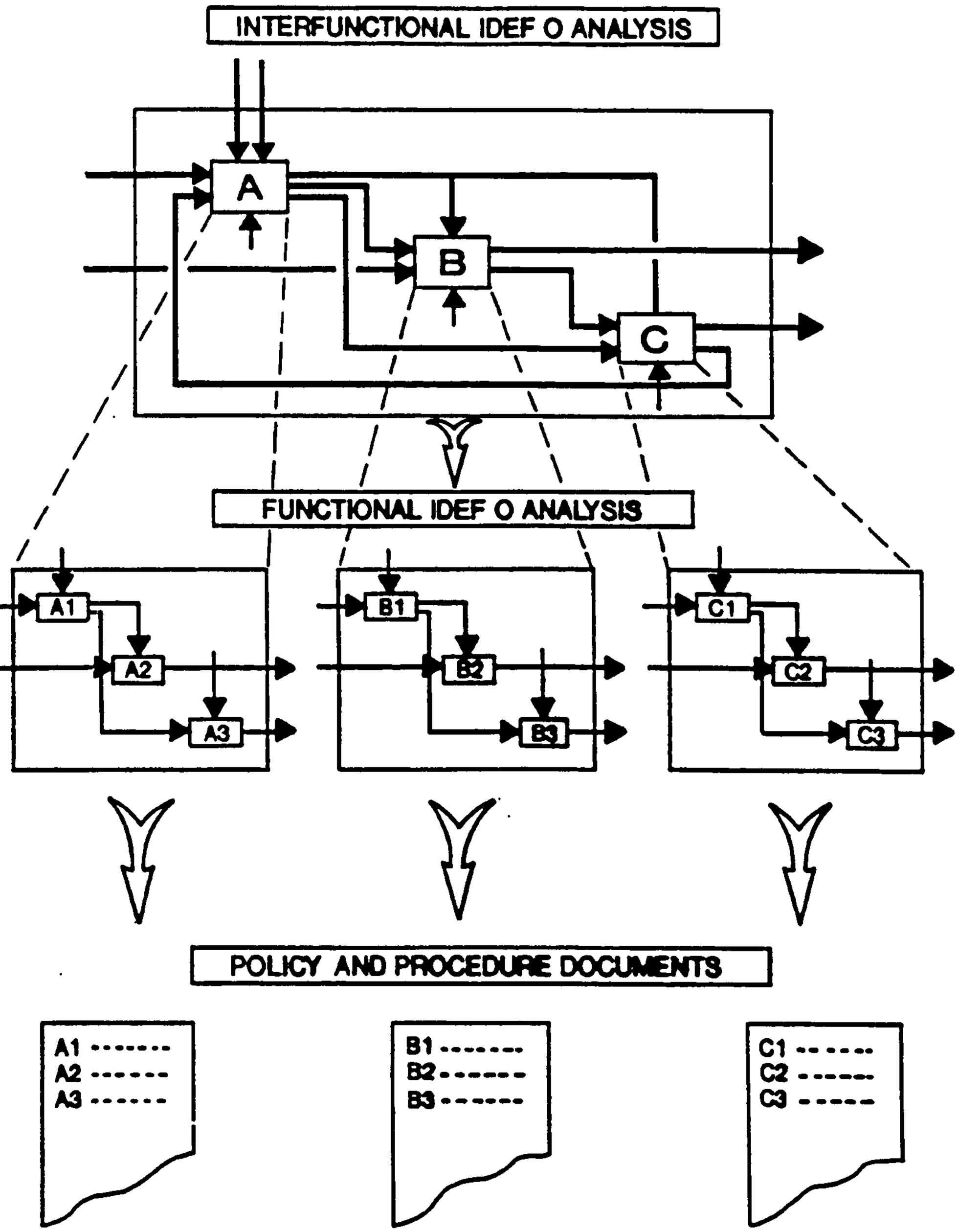


Figure 9.1 The structure of the Modified IDEF0 technique.

These modifications to the original IDEF0 techniques still allow for integrated analysis of business processes and the supporting information system, but overcame the limitations identified earlier. Furthermore, one key benefit here is that these modifications to the original IDEF0 technique makes the technique far more user friendly from the end user, ie operational managers and personnel, point of view. This view was confirmed following the case study applications.

9.4 EVOLUTION OF THE INTEGRATION PHASE

Having completed the developments within the analysis phase the need for a precise and rigorous approach to integration was recognised. The analysis phase provided a set of documents which could be used to analyse the level of integration between various business processes. However this was a tedious task requiring the analyst to mechanistically compare procedures of various functions to identify mismatches. There were two problems associated with this. These were:

- The analyst is not an expert on these business processes and does not have a sufficient understanding of the objectives and requirements of each of the business processes; the people who work with these business processes do have the expertise necessary.

- The comparison and resulting recommendations from the analysis was likely to ignore or overlook some of the key business issues and problems. This could also cause a problem with the ownership and therefore implementation of the recommendations.

To overcome these problems, the internal customer and supplier concept which is one of the fundamental TQM concepts were adopted in the form of a workshop. This would result in the participation of the operational staff in discussing differences and business problems relating to the interfaces between the business processes and functions. The TQM workshops would ensure that the key business issues and problems were identified.

Following the TQM workshops, the need was identified for a forum for discussing the specific policy and procedural differences and linking these to the business issues and problems identified. The integration meetings were designed and introduced to provide such a forum. Through the integration meetings, the operational staff from various functions would be able to discuss and understand each others problems and agree on possible corrective actions.

One additional benefit the integration phase would provide was the increased business awareness of the participants. Having discussed their problems and issues with their internal customers and suppliers the participants would emerge from this phase with considerably improved awareness of what was required of them (and of their contribution) within the overall business.

9.5 EVOLUTION OF THE CONTINUOUS IMPROVEMENT PHASE

The continuous improvement phase evolved in recognition of the need for a formal mechanism for maintaining the integrated business within an dynamic environment. As the concept behind this phase was

developed, it became clear that the integrated performance measures would provide an ideal management tool for monitoring and managing business improvement activities as well as maintaining a level of business integration. After all as discussed in chapter three, the main objective behind business integration is business improvement.

As a result the definition of a two-tier (ie strategic and operational) performance measures, their integration and use as a management tool (Bititci, 1993) forms the foundation of the continuous improvement phase. The remainder of this phase is based on the TQM concept of continuous improvement through action teams (corrective action teams is the correct TQM terminology). In this methodology however the actions are focused on measurable and prioritised business improvements which may be monitored through the integrated performance measures.

9.6 EVOLUTION OF THE AWARENESS PHASE

The awareness phase of the Total-I methodology evolved following the completion of four phases as described above. Based on experiences with the management of organisation wide projects, such as MRPII implementation, the need for commitment from all levels, and most importantly from a senior level, was recognised.

The executive briefing activity was introduced to provide a starting point and to ensure detailed discussion on the various facets of the methodology at a senior level. This develops and ensures that the

initial level of commitment necessary from the senior executives is obtained.

The project organisation, based on previous experiences with MRPII implementation and TQM projects, was identified as being of key importance. Through the initial pilot implementations, a form of project management structure was created. However, as the programme and the methodology evolved the organisation supporting the methodology and the programme evolved with it. In fact, the organisation structure described is a hybrid between the recommended structures for MRPII and TQM projects, with the key difference being the requirement for mapping onto the existing organisation and changing and evolving with it.

The general awareness sessions were obviously necessary to ensure that an initiative of this scale and importance was understood and contributed to by employees at all levels.

9.7 EVOLUTION OF THE CIM IMPLEMENTATION PHASE

As stated in the initial objectives (chapter 2) the need for a procedure for specification selection and implementation of CIM modules were recognised at the outset of the project. It was accepted that CIM modules, where appropriate, play an important role in business integration. Literature review showed that unless they are properly implemented to meet a company's specific requirements both in business and operational terms, CIM modules could result in more dis-integration rather than integration. Therefore, inclusion of a phase

specific for the specification, selection and implementation of CIM modules was seen as an essential phase of any methodology for business integration.

During the literature survey it was made clear that most successful implementations of CIM modules and systems, such as MRPII systems and modules, were focused on detailed specification of the exact requirements of the business. Thus this specific phase of the methodology places emphasis on the requirements specification and subsequent selection of the appropriate system. It is based on the operational policies and procedures which represent an integrated business platform. It was found that the policies and procedures developed as a result of the previous phases of the methodology provided the basis to enable the preparation of an detailed statement of requirements to reflect the company's operational and business needs.

9.8 EVOLUTION OF THE METHODOLOGY - A SUMMARY

The performance criteria specified in the reference model provided the overall direction towards formulation of this methodology. In the main the framework was developed and to date remain unchanged. However, application evolved as a result of practical experience gained and difficulties encountered during application of the methodology.

CHAPTER TEN

CASE STUDIES

10.0 CASE STUDIES

This objective of this chapter is to detail the application of the methodology and the audit method as well as discussing the results of these experiments. Three case studies are presented based on the following organisations:

- IDV Export Ltd
- G N Netcom as
- Scottish Pride Quality Dairy Foods

10.1 IDV EXPORT LTD

10.1.1 An Introduction to IDV Export Ltd

IDV Export Ltd (International Distillers and Vintners - Export - Ltd) is the major subsidiary of the Grand Metropolitan group. It is a London based sales and marketing operation responsible for the management of the international markets for various brands of sprits and French wines. Its brands include: J&B, Dunnhill, Singleton, Smirnoff, Malibu, Archers, Bailey's, Cinzano, Gilbey's, Piat, Aqualibra, Dexters, Purdies etc. IDV Export being the worlds largest wine and sprit suppliers operate from their London based headquarters and coordinate the activities of a large number of production/bottling plants spread across the world. The largest of the production operations is based in Dumbarton, Scotland and is known as J&B Scotland Ltd. At the time of writing the production capacity of the Scottish plant was capable of producing in excess of ten million cases of sprits. The main brand they produce is the J&B Whisky followed by Smirnoff Vodka, Malibu and Archers. The products produced in J&B

Scotland account for over 80% of IDV Export's turnover. The J&B Whisky accounts for over 70% of the output from J&B Scotland.

10.1.2 Background

For many years the J&B Whisky had been the second to the best selling brand Johnny Walker which is owned by United Distillers and Guinness (UDG), a long term competitor of IDV Export. Having recognised the need for developing a competitive advantage in a market place which is already saturated with well known brand names, the senior management/board of IDV Export identified customer service (ie delivery lead times) as a critical area towards success. The concept was to offer guaranteed service levels which would result in much quicker delivery lead times then the competitors whilst maintaining, quality and sales price and improving flexibility. This would minimize the need for the customers' safety stocks, therefore improving the customers' profitability and cash flow, thus making IDV Brands more attractive.

Having agreed this strategy the board also recognised that to achieve their objective the organisation needed to be better controlled, more disciplined and streamlined. The need for business wide integration was recognised. However, integration between HQ and all other production units was considered to be unrealistic. Therefore emphasis was placed on integration of J&B Scotland with the HQ. To achieve this integration and rationalisation the Logistics Initiative was launched. The logistics initiative was modeled upon the framework provided by the methodology presented in this thesis.

10.1.3 The Logistics Initiative

(i) The Awareness Phase

The Logistics initiative started in September 1990. Throughout the initiative the phases of the methodology was applied as described in chapter eight of this thesis. First an executive briefing was held. This was attended by all senior executives including the Managing Director, Operations Director and Finance Director of J&B Scotland. The project was organised in a similar manner to that suggested in chapter four. It consisted of a Steering Group which included the IDV Export's Chief Executive, Finance Director, Brand Directors, Personnel Director, Managing Director of J&B Scotland and the Operations Director of J&B Scotland. The finance Director of IDV Export was appointed as the project coordinator and various working groups were identified. These were:

- Export operations working group (IDV)
- Financial Planning and analysis working group (IDV)
- Financial accounting working group (IDV)
- Data Administration working group (IDV)
- Marketing working group (IDV)
- Production planning working group (J&B Scotland)
- Bottling Working group (J&B Scotland)
- Dispatch and Shipping working group (J&B Scotland)
- Purchasing working group (J&B Scotland)

The original structure for the IDV Export organisation shown in figure 10.1 corresponds to the project structure described above. General

awareness presentations were held for all employees. These seminars were delivered through the management hierarchy in the form of informal discussion sessions.

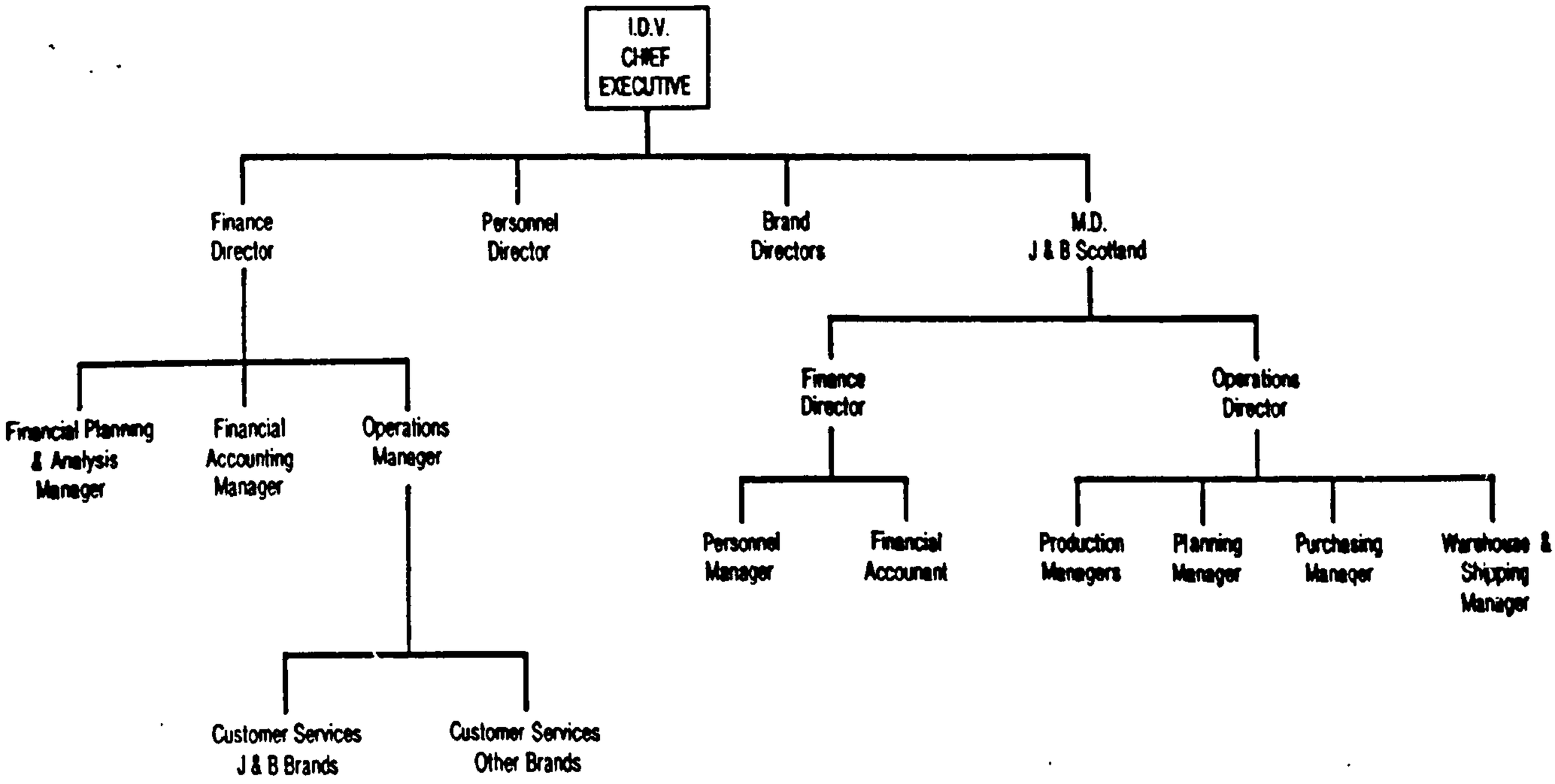


Figure 10.1 Original organisation structure of IDV Export Ltd

(ii) The Strategic Phase

Through out the Logistics initiative the need for this phase was minimized. In that the management team, ie the steering group, had already identified the vision and the key areas of focus for the business. The highest priority area was the customer service levels as discussed above. Other key areas of focus were oriented towards reduction of "cost of sales" and "cost of production". The methodology, through business strategy setting facilitated the identification of the

strategic performance measures against each one of the key areas of focus. Monitoring and reporting systems were specified and installed for each strategic performance measure. For example, initially customer service performance was monitored by monitoring actual shipments and volume of shipments to required delivery dates. Figures 10.2 and 10.3 shows the actual performance measure for shipments against customer orders. Here the customer service is measured in two ways, Figure 10.2 illustrates the percentage of orders shipped according to the customers required timescale. Figure 10.3 reports on the volume, ie number of cases, shipped according to the customers required timescale. At this stage no targets were identified and this activity was deferred to the integration and continuous improvement phases.

During the Logistics initiative the functional strategy setting activity was approached as an integrated process with the analysis and integration phases. The senior management worked closely with the working groups to ensure that the roles and responsibilities identified for each function reflected reality and optimized the business. This allowed rapid implementation of any suggested changes.

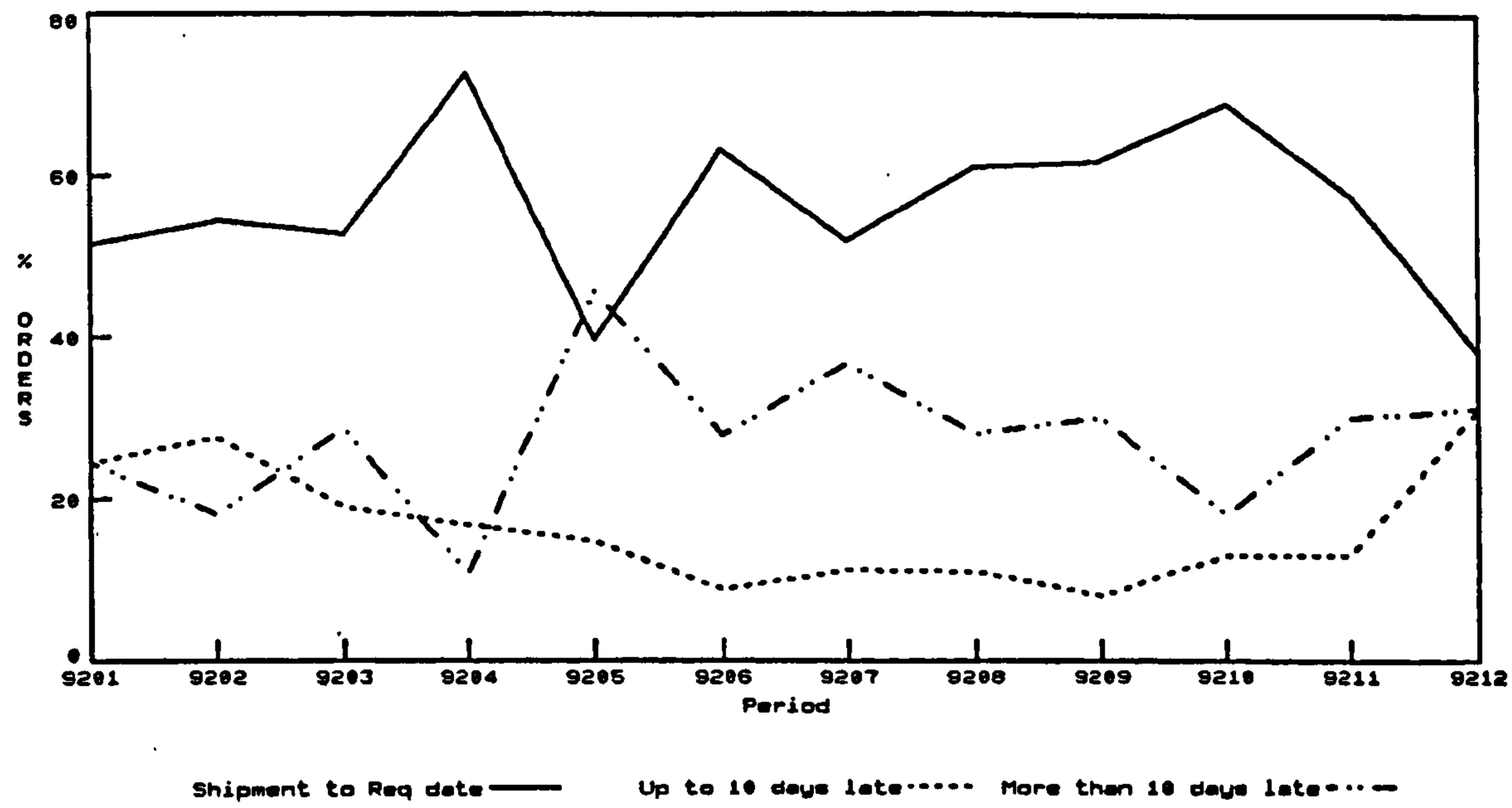


Figure 10.2 Customer service performance report - Orders.

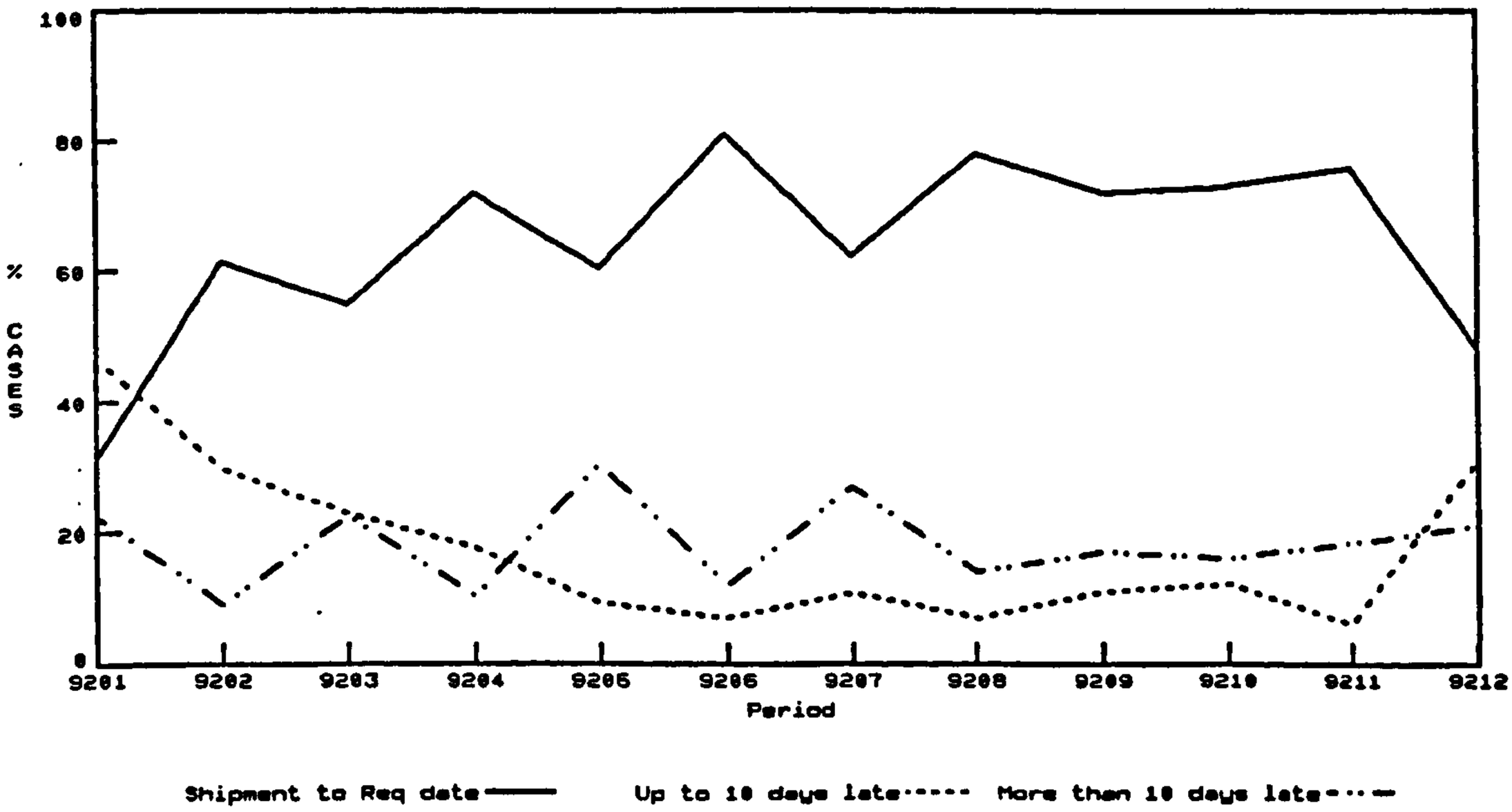


Figure 10.3 Customer service performance report - Volume

(iii) Analysis phase

At the start of this phase each working group was provided with suitable training on the modified IDEF0 technique. The inter-functional analysis was carried out. The functional interfaces were compared and differences were resolved. A consolidated analysis was compiled.

Each working group, through brainstorming sessions, identified the roles and responsibilities of their own functions. These roles and responsibilities were discussed by the internal customers and suppliers of each function through a number of workshops. When the working groups compared their roles and responsibilities to the business direction and strategy set by the steering committee, they identified two areas for organisational change to ensure streamlining of operations. The primary area for change was the IDV's operations department, where two customer service divisions serviced the same markets/customers for different product ranges, therefore making order consolidation logistically more complex. This had a knock on effect on the J&B Scotland's Planning and Shipping functions. The proposal from the working groups was to reorganize the Operations division as shown in figure 10.4 and create mirroring organisations to handle the planning and shipping activities within the planning and shipping functions. The net effect of this reorganisation was that there is a single team of three people who would be responsible for handling any customers order from receipt, through planning to shipping. Although, the three individuals would be based in three separate functions they would be working as a team to ensure that customer orders were progressed efficiently.

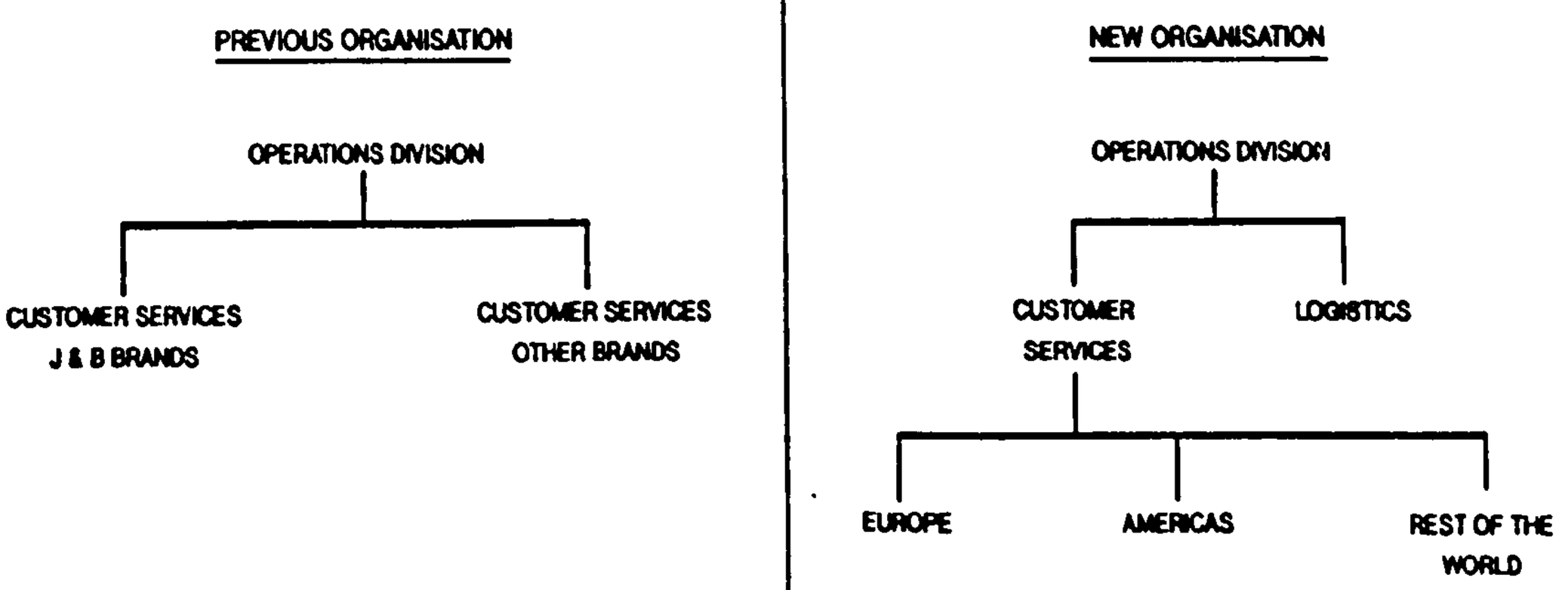


Figure 10.4 Reorganisation of the IDV's Operations Function.

The working groups proposal included the new roles and responsibilities and recognised that the functional procedures would play a critical role to ensure horizontal integration.

As seen in Figure 10.4 the proposals included creation of a logistics division for the handling and management of forecasts. The purpose of the logistics division was to create a logistical link between the market place and the production unit for purposes of demand management. The roles and responsibilities for each function was agreed based on this new structure, as shown in Figure 10.5.

Customer Services
- Proforma invoicing
- Customer and order management
- Order processing
- Progress monitoring
- Delivery performance monitoring
- Maintenance of the customer master file

Marketing
- Sales and Marketing
- Volume forecasting
- Product management
- Coordination of product development
- Distributor/Agent contract management
- Pricing and AMP

Financial accounting
- Financial accounting
- Cash management
- Credit control
- Invoicing
- Credit & debit note processing
- Management of STC's and price changes
- Management and payment of purchase invoices

Production Planning
- Supply planning
- Production planning
- Materials planning

Logistics
- Demand management
- Supply planning
- Stock and consolidation management
- Contract warehouse management
- Forecast performance monitoring
- Strategic service level monitoring

Financial Planning and Analysis
- Business planning
- Quarterly planning
- Supply planning
- Financial analysis
- Pricing control
- Evaluation of commercial proposals

Data Administration
- Data entry and maintenance
- Systems maintenance
- Allocation of product codes
- System enhancements

Shipping
- Order processing
- Order booking
- Cost monitoring
- Stock control
- Customs and excise documentation
- Dispatch planning and control
- Pallet control

Figure 10.5 Roles and responsibilities as agreed by the working groups

One other proposal put forward by the working groups was for the introduction of guaranteed service levels. The concept here was to identify a competitive lead time according to the product and market complexities. Communicate and negotiate these lead times with the customers and ensure that all orders are shipped to these lead times. Although this was an attractive proposal the steering committee initially felt uncomfortable with the concept due to their lack of confidence in the businesses ability to meet competitive guaranteed service levels. The working groups counter proposal was to internally

agree (ie without communicating to customer) a fairly relaxed service levels initially, monitor these and focus the attention of the working groups on incremental improvements to these service levels. This proposal was accepted and implemented. Figures 10.6 and 10.7 illustrate performance reports of shipment of orders and cases against the agreed service levels.

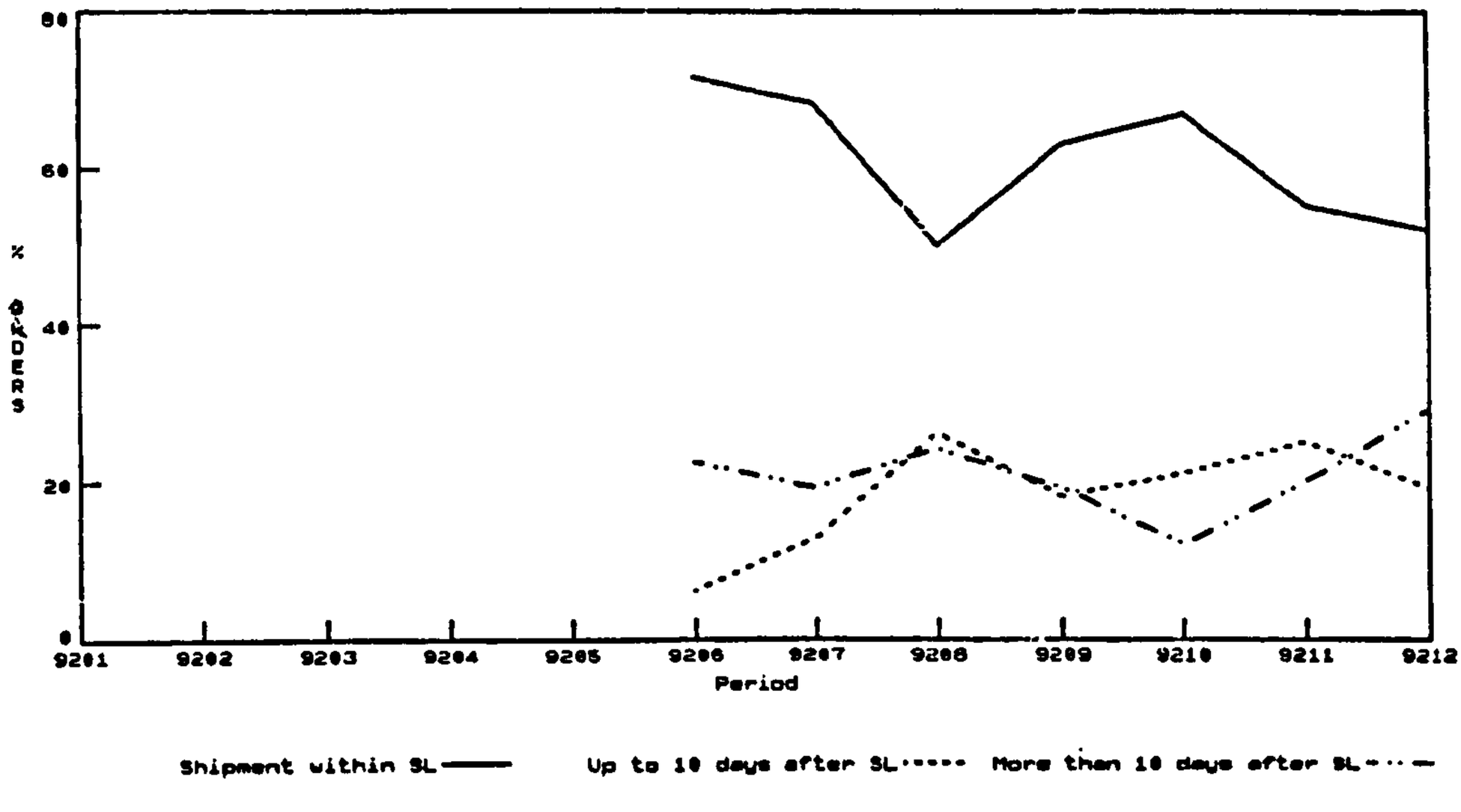


Figure 10.6 Performance against agreed service levels - Orders

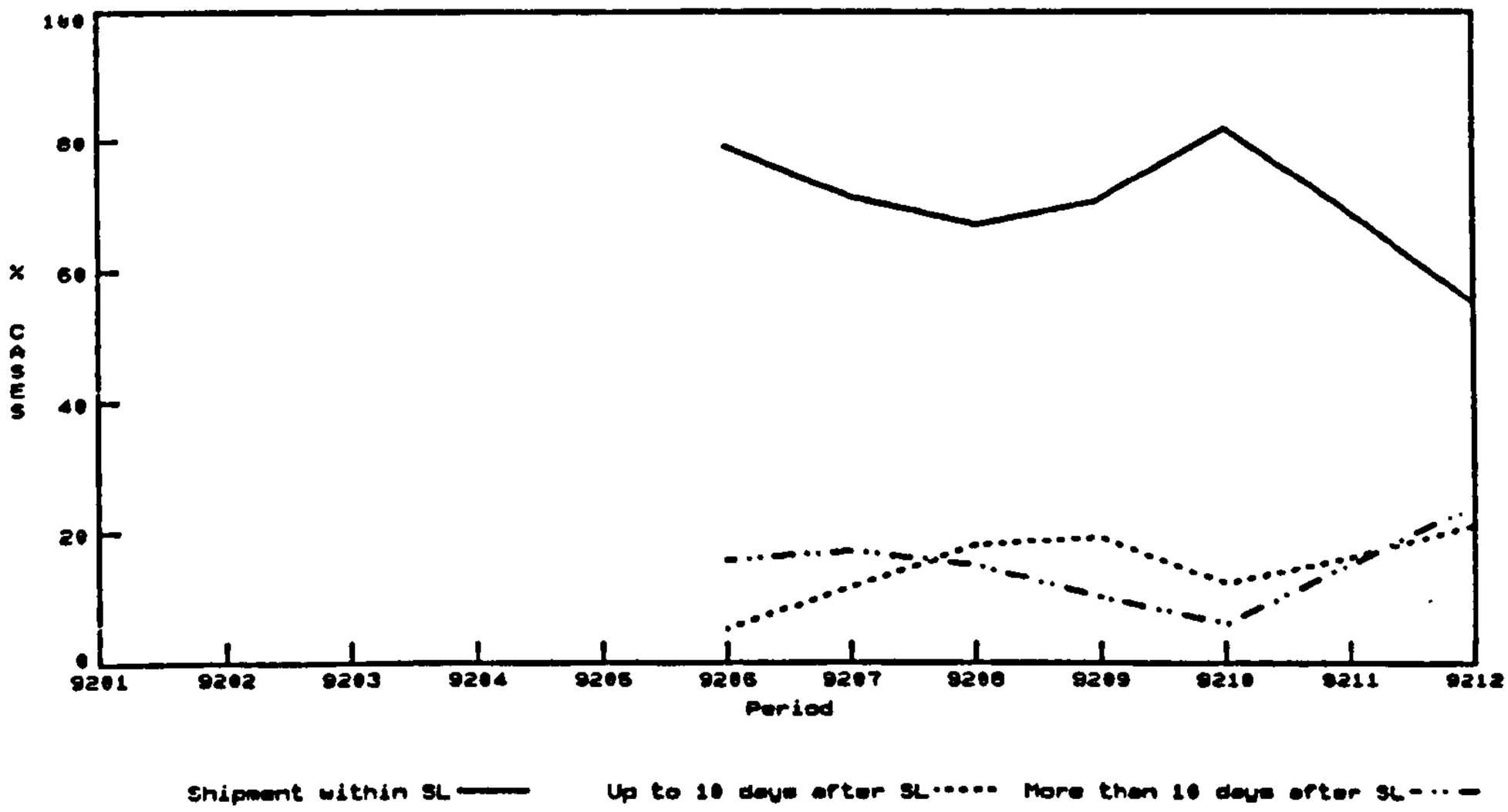


Figure 10.7 Performance against agreed service levels - Cases

Based on the roles and responsibilities identified each working group carried out an functional analysis. The appropriate policy and procedure documents were prepared by each working group.

(iv) Integration phase

During this phase the procedure documents were reviewed by the internal customer and supplier of each function. TQM workshops were held to identify problems and difficulties. These differences were resolved through the integration meetings as discussed earlier in this thesis.

(v) Continuous improvement phase

As suggested within the methodology the first stage of continuous improvement phase was identification of operational performance measures. These were identified for each function through the functional working groups. Figure 10.8 shows a sample of the operational performance measures identified by the shipping working group.

		PERIOD													
OWNER	MEASURE	1	2	3	4	5	6	7	8	9	10	11	12	YEAR AVERAGE	TARGET
	% OF ORDERS 'BOOKED' OR 'THIRD PARTIED' WITHIN TWO WORKING DAYS OF ORDER BEING MADE BOOKABLE														
	% OF ORDERS 'RE-BOOKED' ON A PERIOD BASIS														
	% OF ORDERS 'CLOSED' WITHIN 5 WORKING DAYS OF THE SAILING DATE														
	% OF ORDERS CLOSED WITHIN 10 WORKING DAYS OF THE SAILING DATE														
	% OF ORDERS 'CLOSED' WITHIN 15 WORKING DAYS OF THE SAILING DATE														
	NUMBER OF ORDERS NOT 'CLOSED' WITHIN THE PERIOD OF SAILING														
	NUMBER OF DEBITS AND CREDITS ISSUED														
	% OF ORDERS NOT MEETING REQUIREMENTS														
	NUMBER OF CUSTOMER COMPLAINTS AND ASSOCIATED COSTS														

Figure 10.8 Operational performance measures - shipping.

Performance reviews were held at steering group level on a monthly basis and at working group level on a weekly basis. A multi-functional, multilevel improvement team was created to continually monitor customer service performance, identify and implement actions for improvement. The first action of this team was to install more detailed measures to aid in the analysis and cause investigation. An example of these detailed measures for customer service is included in figure 10.9. These measures assisted in the identification of the reasons for failing to deliver within the agreed service levels.

TOTAL RECEIVED	Orders: Cases: Value:	347 501018	Orders: Cases: Value:	28 3081	Orders: Cases: Value:	40 4409
SHIPMENTS FROM PERIOD DEMAND	Orders: %age: Cases: %age: Value: %age:	211 60.81 381287 76.10	Orders: %age: Cases: %age: Value: %age:	12 42.86 1811 58.78	Orders: %age: Cases: %age: Value: %age:	15 42.86 1811 58.78
SHIPMENTS FROM PRIOR PERIOD DEMAND	Orders: Cases: Value:	83 52821	Orders: Cases: Value:	8 225	Orders: Cases: Value:	20 1014
SHIPMENTS FROM FUTURE PERIOD DEMAND	Orders: Cases: Value:	12 7802	Orders: Cases: Value:		Orders: Cases: Value:	
UNSHIPPED DEMAND FROM PERIOD: DUE CREDIT HOLD	Orders: Cases: Value:	12 5957	Orders: Cases: Value:		Orders: Cases: Value:	3 100
DUE NOT RELEASED	Orders: Cases: Value:	25 27814	Orders: Cases: Value:	4 68	Orders: Cases: Value:	4 106
DUE 3RD PARTY	Orders: Cases: Value:	13 4646	Orders: Cases: Value:	1 250	Orders: Cases: Value:	4 430
DUE TRANSIT	Orders: Cases: Value:	9 12623	Orders: Cases: Value:		Orders: Cases: Value:	
DUE BOOKABLE	Orders: Cases: Value:	8 7825	Orders: Cases: Value:	3 470	Orders: Cases: Value:	1 48

Figure 6.9 Detailed measures to aid in the cause investigation.

The measures shown in figure 10.9 show that 62 out of the 347 orders received were booked on a vessel but not dispatched on time to catch the vessel thus failing to meet the agreed service levels, the cause of these were investigated by the shipping working party. The causes were categorized as being internal and external, it was found that majority of the 62 orders were not dispatched due to errors and inaccuracies in the letters of credit received from the customers. As a result a process was introduced at Customer Services to ensure that before accepting orders all letters of credit are inspected and any errors corrected at an early stage. An operational performance measure to monitor this process was also introduced by the customer services working group.

10.1.4 Discussion

It is thought that the main benefits gained by IDV Export as a result of implementing the methodology are as follows:

- Formalized and agreed systems resulting in improved communications and conformance to requirements.

- Agreed roles and responsibilities for each function eliminating ambiguity and confusion and clarify accountability.

- Alingement of business efforts with business objectives through the operational performance monitors, which were driven from the strategic measures of performance against key business processes.

- Motivation of employees at all levels through their contribution towards success and show an eager willingness to continue.

- Improved relationships between various functions as a result of involvement and teamwork through multi-functional improvement teams.

The continuous improvement phase has been in place since January 1991 and is still continuing. To present date IDV Export had made considerable progress. Customer service has improved considerably, having developed customer confidence in the new systems and processes an extremely competitive set of guaranteed service levels were published to the customers. Over the past years, in a shrinking market place, IDV Export considerably grew its market share and improved its profits. J&B is now the best selling brand of Scotch Whisky world wide. Due to its success IDV is currently engaged in a number of projects to extend this process to its other production an operational units in Italy, France, Greece etc.

However, scientifically it would be incorrect to argue that the improvements in business results are solely due to the application of this methodology. Although other external factors which may have effected the business were outwith the control of the researcher, these were closely monitored throughout the experimental stage and the following facts were noted:-

- No significant change in the customer base, ie no new major customers.

- No changes of personnel at senior and middle management level.

- No significant change in the position of the company's major competitors.

- A steady downwards trend in the world sprits market.

However, the information obtained through the audits conducted at the start, completion and approximately one year after completion of the programme show that there has most definitely been an improvement in the level of integration within the company. Results of these audits are illustrated in Figure 10.10.

PERFORMANCE AREA	BEFORE	AFTER	YEAR AFTER
Shared Vision	37%	100%	100%
Common Strategy and Objectives	42%	87%	92%
Awareness of Roles and Responsibilities	28%	92%	88%
Integrated Processes	67%	100%	93%
Integrated Performance Measures	0%	95%	91%
No. of non-conformances in Working Practices	64	29	36

Figure 10.10 Audit results for IDV Export Ltd

Although at the start of the programme the company already had a clear vision, awareness of this vision was limited to senior management. This is reflected in the score of 37%. During the programme the company made a conscious effort to communicate this vision at all levels and arranged for the vision statement to be posted at strategic areas of their premises, leading to the subsequent scores of 100%.

At the start of the programme the company had a clear strategy. However this was only communicated in the form of Customer Service Levels. The main problem was that operational personnel failed to relate their job function to this strategy. Subsequent audits show a marked improvement in the Common Strategy and Objectives performance area.

Again at the start of the project, awareness of one's own and each others roles and responsibilities were very poor. In the main people were doing a job they were asked to do and they did not appreciate why they were doing things in a certain way because they were not aware of each others roles and responsibilities. There is a marked improvement in this performance area over the period of the programme. However, the final audit shows a slight drop in this performance area. This is because the company has taken on a the financial administration of a new business but had not yet communicated the exact roles and responsibilities associated with this business which effect only the finance function.

With respect to integrated processes, although there were no formal documentation of processes and flows between processes there was a reasonable awareness of what information was required by whom. This resulted in a score of 67% initially, as a result the formalisation of these processes and flows improved to 100% on completion of the programme. The subsequent audit showed slight deterioration in this performance area to 93% is due to introduction of new processes in the finance function as explained in the above paragraph.

Initially the business had no performance measures except the financial measures reported in the management accounts and the customer service level measure. Subsequent audits show considerable increase in this performance area which has been brought about as a direct result of the application of the methodology. The reason the company failed to achieve a score of 100% is due to the practical constraints associated with identifying practical measures of performance for each process.

With respect to the working practices the results show considerable drop in number of non-conformances. However there is a slight increase in this number, which is mainly caused because since the completion of the programme the company failed to hold further TQM workshops to identify these issues and resolve them.

10.2 GN Netcom as

10.2.1 An Introduction to GN Netcom as

GN Netcom as is part of the Great Nordic Group and specialises in the design, manufacture and worldwide supply of telecommunication headsets. Its head quarters is based in Copenhagen, Denmark with manufacturing operations in Washington, Tyne and Wear, UK and Minnesota, USA.

The Danish headquarters also manage a number of sales subsidiaries as well as distributors spread across the world. The original functional organisation of the company was as shown in Figure 10.11.

The Danish based Marketing function acts as a central focus for receipt of orders from customers worldwide. These orders are then passed to the UK based manufacturing company for subsequent planning. The planning function based in the UK is also responsible for loading the USA based factory.

10.2.2 Background

During spring of 1991 GN Netcom's UK based manufacturing division invited the author to conduct a seminar in business integration. This seminar was attended by senior figures from various parts of the company. During the seminar various aspects of the methodology was introduced. Having recognised the need for better integration between the HQ and the manufacturing facilities, the senior management launched a business integration programme during the summer of 1991. The remit of the programme was to follow the methodology as

presented in this thesis. The scope of the programme was to address integration between the HQ and the two manufacturing companies.

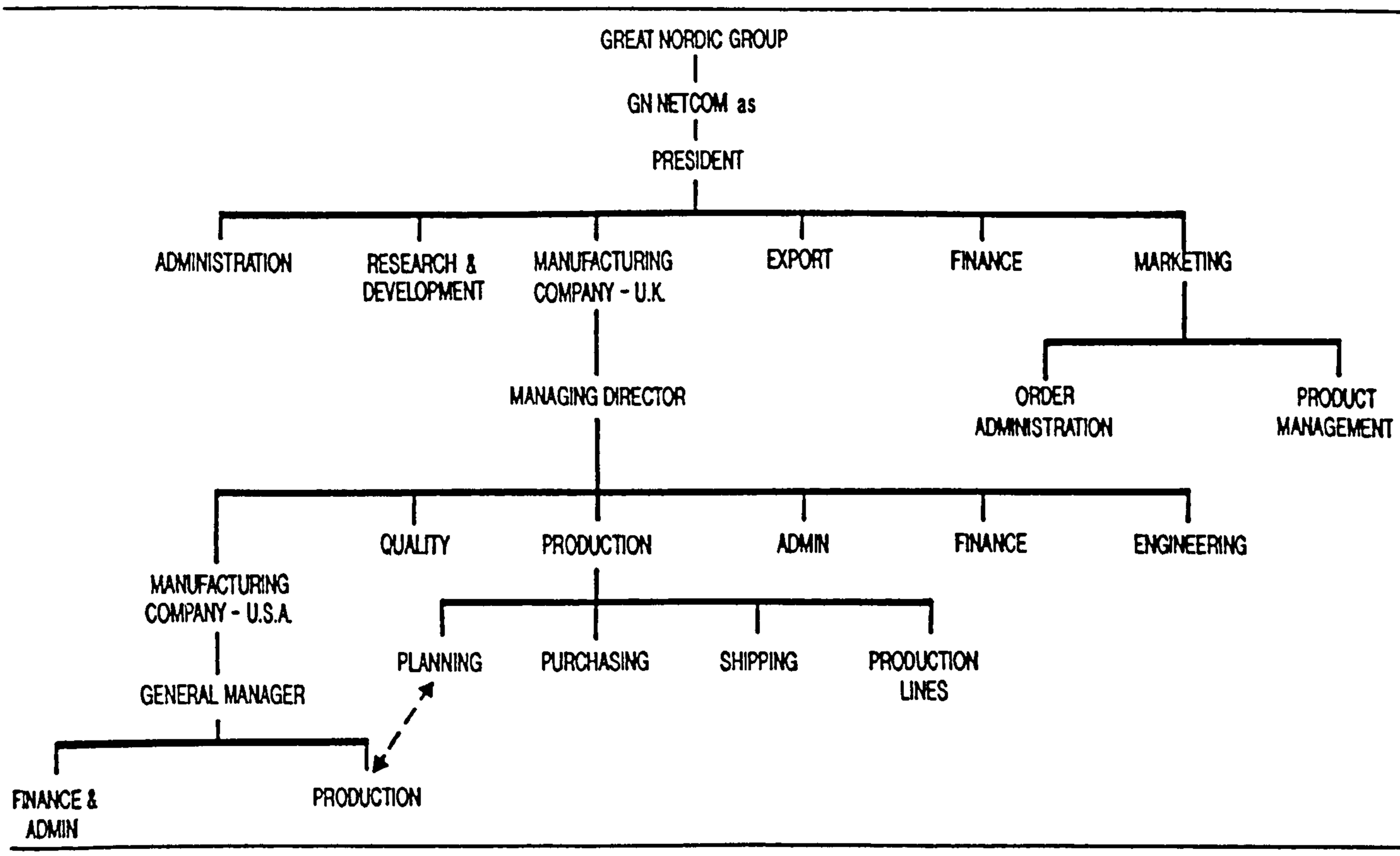


Figure 10.11 Initial functional organisation - GN Netcom as

10.2.3 The Business Integration Programme

(i) Awareness phase

Initially a detailed executive briefing was held. As a result of discussions during and after this executive briefing a full time improvement team was formed with the responsibility to act as the project coordinators. This team was jointly led by the Finance Manager and the Engineering Manager of the UK manufacturing company. One of the leading line supervisors were selected to join the team together with a newly recruited graduate. The remit of the team was to act as the facilitators to rest of the organisation and help progress through the integration programme. The improvement team reported directly to the President of GN Netcom as.

General awareness sessions were held by function to ensure that the aims and objectives of the programme was communicated efficiently and effectively. Majority of the awareness sessions were delivered through the management hierarchy.

(ii) Strategic Phase

GN Netcom as hold an annual strategic planning meeting, where all the senior managers contribute towards the strategic plan for the business. This is normally a financial plan where the forecasts from each market is discussed and a critical data for business planning is identified. The strategic planning meeting which was held during October 1991 was extended to include the senior management workshops to facilitate the completion of the strategic phase.

During the business situation review, the companies competitive position was analyzed with respect to the market place and its competitors. The following facts were noted:

- In a world wide market place GN Netcom was holding a second position in the supply of telecommunication headsets

- In price terms, GN Netcom was not competitive when compared to its competitors, however its products were seen as higher grade products

- Quality of service to customers was considered to be high, however this was due to high stock levels maintained by the distributors and agents

- GN Netcom was already in a profitable position, however to grow further certain breakthroughs were required

- With respect to effectiveness of its operations the company was criticized for high stock levels and poor scrap and productivity performance.

Following the review of the business situation a vision for GN Netcom was established. This was:

To become worlds leading headset supplier by the year 1995 by increasing its market share to 40% and its profits by 30%

Through further workshops the team identified the key areas for focus. These were:

- Maintaining and improving upon the existing image

- Become more competitive in price whilst maintaining and improving on margins

To achieve these vision and objectives outlined above, the business strategy had to focus on the cost related areas. The following points were agreed:

- Cost of production had to be optimized through improvement of efficiency, throughput and internal quality

- The world wide inventory had to be considerably reduced by improving the reliability and response of the supply from the manufacturing companies.

Based on the above areas of focus a number of performance measures for each part of the company were identified. Majority of these measures were oriented towards the manufacturing units. Figure 10.12 illustrates the matrix representing the strategic performance measures identified for the manufacturing companies.

GN NETCOM - WASHINGTON

CRITICAL SUCCESS FACTORS FOR 1992

PERFORMANCE AREA	MEASURE	Frequency of the Information	Supplier of the Information	Achieved Jan - Dec 1991	Jan 1992	Feb 1992	Mar 1992	Apr 1992	May 1992	June 1992	Achieved Jan - June 1992	July 1992	Aug 1992	Sept 1992	Oct 1992	Nov 1992	Dec 1992	Target for 1992	Achieved in 1992
INVENTORY	Turns/Annum - Inc. F.G.S.	Monthly	N. Nolan	3	2.6	2.6	3	3.2	3.6	4.1	4.1	4.9	4.7	4.6	4.7			4	
	Turns/Annum - Exc. F.G.S.	Monthly	N. Nolan	3.1	2.6	2.9	3	3.3	3.9	4.3	4.3	5.1	4.8	4.8	4.6			4	
SCRAP	Material Value	Monthly	N. Nolan	271.5	Gain [1.9]	Gain [0.3]	Loss 17.9	Loss 40	Loss 68.2	Loss 76.9	Loss 76.9	Loss 86.4	Loss 90.1	Loss 121.0	Loss 144.4				
PEOPLE	% of Material Cost	Monthly	N. Nolan	6.7	[0.6]	[0.04]	[1.6]	2.6	3.7	3.3	3.2	3.1	3	3.6	3.6			6.2	
	Absenteeism	Monthly	N. Nolan	7.9	6.1	6.5	6.1	6.1	5.9	4.2	5.8	7.1	4.1	4.0	7.1			Ave. 5	
	% Labour Efficiency	Monthly	N. Nolan	N/A	78	97	108	92	102	96	95.5%	72	87	88	99			90%	
MANUFACTURING LEAD TIME	Days of W.I.P.	Monthly	N. Nolan	16.1	14.5	12.6	9.4	11.9	9.1	10.5	9.8	13.2	11.8	12.5	11.3			Ave. 7.1	
EXTERNAL QUALITY	USA	Monthly	J. C. Hayes	0.46	0	0.1	0.06	0.3	0.2	0.28	0.2	0.2	N/A	N/A	N/A	N/A	N/A	0.1	
	DOA	Monthly	J. C. Hayes	2.2	0.25	0.12	0.8	0.09	0.03	0. 02	0.2	0.03	N/A	N/A	N/A	N/A	N/A	0.1	
	MPA (%)	Monthly	J. C. Hayes	0.1	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A		
INTERNAL QUALITY	Audits Passed (% (Job Shop)	Monthly	A. Walton	86.2	90.1	91	92	91	94	85	90.5	93	95	92	90	91.5		100	
CUSTOMER SERVICE	Order Lines on Time (%)	Monthly	A. Christer	61	58	73	90	56	51	44	62	54	52	40	52	49		100	
	Volume of Headsets on Time (%)	Monthly	A. Christer	41	39	70	89	40	48	51	56.2	39	32	14	29	24		100	
	Number of Order Lines in Backlog	Monthly	A. Christer	94	26	14	21	99	183	151	82.3	156	198	161	102	137		0	
	Number of Headsets in Backlog in K	Monthly	A. Christer	6.5	1.3	1.4	1.6	4.8	7.1	4.3	3.4	3.4	6	5.6	3.6	2.8		0	
PRODUCTION THROUGHPUT	Actual v Target (%)	Monthly	A. Christer	77	90	93	83	99	85	85	89.2	80	36	73	91	94		100	

Figure 10.12 Strategic performance measures

(iii) Analysis phase

During the analysis phase the steps of the methodology was followed. In discussions on functional roles and responsibilities within the working groups it became evident that the planning function with its current structure was somewhat restricted. Discussions between the steering group and the working groups agreed that the profile of the planning function should be raised and the production, quality and engineering functions were combined to form product oriented functions with integral engineering and quality personnel. This product management structure corresponded to and complemented the existing product management structure in the marketing function. The order administration function based in the HQ was seen as an unnecessary step in the process of order management. The responsibility for order administration was transferred to the planning function based in the manufacturing company (UK). The resultant organisation is as shown in Figure 10.13.

The roles and responsibilities for the new structure was agreed. Functional analysis was conducted, samples of these have already been illustrated in chapter eight of this thesis. This phase concluded with the documentation of the detailed policies and procedures against each responsibility for each function.

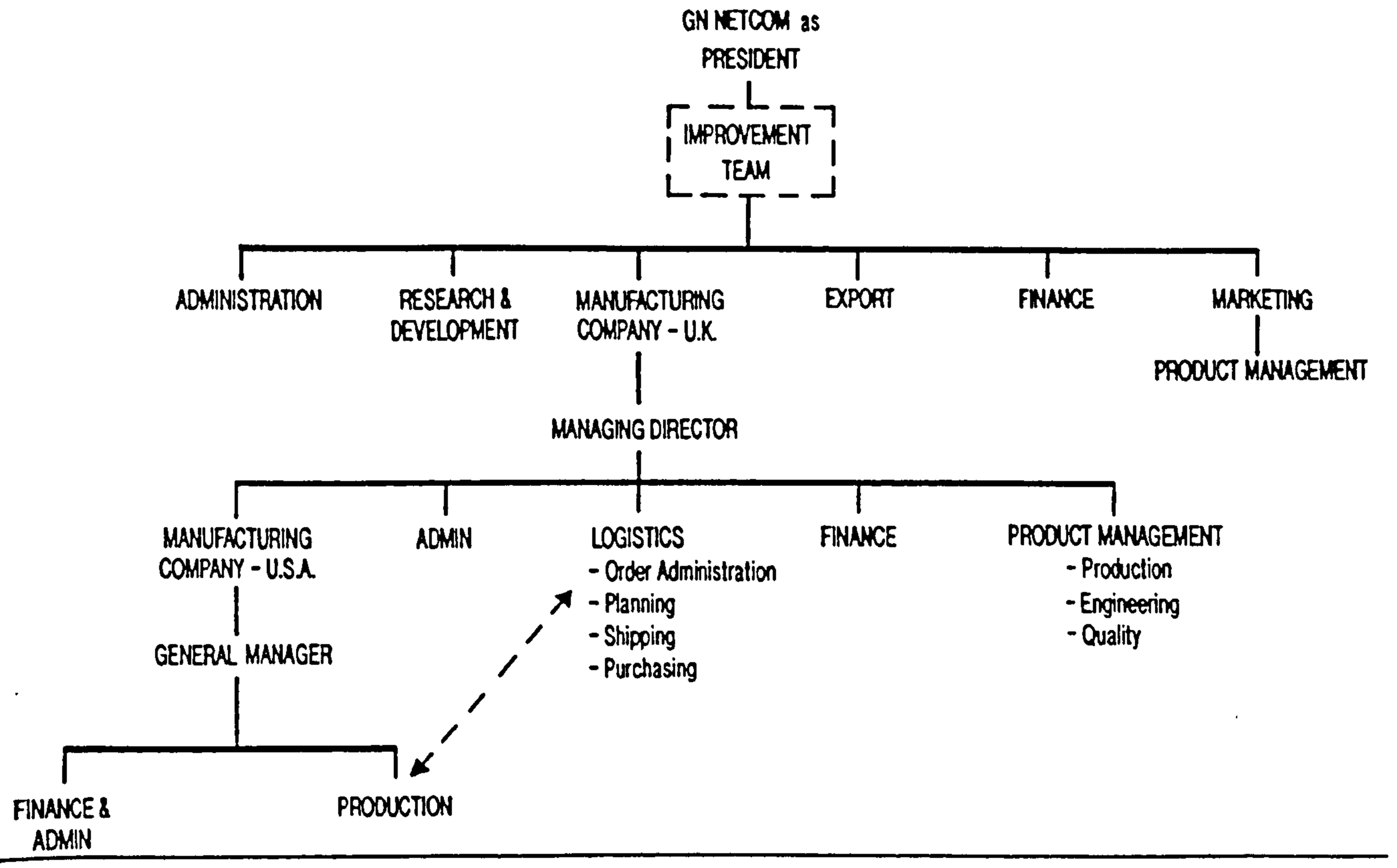
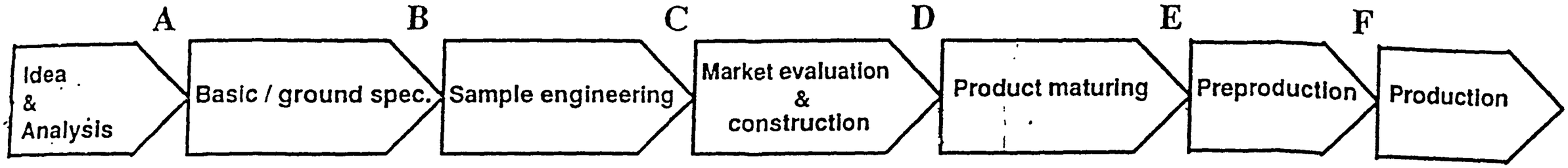


Figure 10.13 The new structure for GN Netcom

(iv) Integration phase

During this phase TQM workshops were held and integration meetings took place to resolve differences. The integration of the R&D, Marketing and Product Management (manufacturing) functions were identified as a major area for concern. An improvement team was set up to address this issue. This resulted in the implementation of a radically different approach to product development. The overview of the procedure (Figure 10.14) adopted illustrates the associated roles and responsibilities of each function.



		A	B	C	D	E	F
	Milestone output	Accept and Project start	Request for sample(s) Project plan	First sample(s)	Final sample Generic doc	Rev. 0 doc ready Tools and tes-equipment OK Factory assessment	Customers' accept Rev. 1 doc ready HIBUS entering Project finish
Export/ subsid's.:		Ideas	(Requesting)	Design review	Design review (accept) with report to MKT Requesting	Forecasting	Fields test/ QA-audit Accept
MKT.:		Ideas Price and market analysis	Project planning Technical description Request for sample(s)	Design review	MKT kick off meeting *Request for new product (generic) *Packaging and user instruction *Preliminary forecast *Service strategy + spare parts def.	RQ for new products (variants) Preliminary prices Forecasting	Design review Service manual Brochures Datasheet Sales planning, delivery date Release of code numbers HIBUS / Price list entering
R&D:		Ideas Technology eval. Cost price eval.	Specifications Project planning	Dummy design, development, and sample engineering	Construction and sample engineering Generic doc	Issue of rev. 0-doc Tools completion and Moulding samples Delivery of tools to pl. supplier(s) Completion of test equipment	Design review Rev. 1 doc + code nos in probus Entering of variant B.O.M. in PROBUS Transfer of info conc. ordering of parts from sub suppliers.
Wton:		Ideas	Project planning	Evaluation of *producibility *quality	Subsupplier selection Evaluation of documentation (generic-doc) Evaluation of producibility and quality	Necessary parts ready Completion of test procedures Quality and factory assessment of product, tools, 0-doc. and suppliers	Design review Production layout, etc. Final approval of rev.0 doc.. Factory and quality approval Ordering parts for production Delivery of field test units Delivery of prod.units Adjustment of cost price Check of B.O.M

Figure 10.14 The new product development procedure.

One other are of concern was the business planning procedure. Traditionally the business plan was purely based on the market forecasts and did not take in to account of the manufacturing capacities and capabilities. An improvement team was formed to address this area. As a result significant changes were made to the business planning procedures to ensure that the business plans reflected the reality this also enured the use of a common set of numbers in all parts of the organisation.

(v) Continuous improvement phase

At the time of writing GN Netcom had just introduced process level performance measures. These measures were constructed for each function by responsibility area and against individual processes. The performance measures were identified through workshops by the working group within each one of the functions. The improvement team under the guidance of the author facilitated these workshops. During these work shops the working group focused their attention on to the strategic performance measures and to the specific business processes within their responsibility area. For example, the Logistics working group used one work shop to focus in on the planning responsibilities. The roles and responsibilities, ie business processes, for the planning activity were identified and agreed during the analysis and integration phases. Having focused on these business processes the following questions were asked.

- How does this process impact the strategic performance measures?

- How do we measure the effectiveness of this process with regards to its contribution towards the strategic measures?

- Is it worth measuring?

- What are the data sources?

- What is the procedure for data collection?

Figure 10.15 illustrates the process level performance measures identified for the planning responsibility area. These measures are grouped by process and are designed to show trends against planning periods.

The strategic performance measures are currently being used by the senior management as a management tool through monthly reviews and associated improvement actions. At the time of writing there is a team with the responsibility to improve customer service levels. Some of the process level performance measures have already been implemented and in some departments these are being used by the functional manager and the working groups as management tools through weekly meetings.

PRODUCTION PLANNING FUNCTION
OPERATIONAL PERFORMANCE MEASURES

PROCESS	MEASURE	1/93	2/93	3/93	4/93	5/93	6/93	7/93	8/93	9/93	10/93	11/93	12/93	YEAR AV.	TARGET FOR 93
Order management	% of orders processed on the day of receipt														
	% of orders processed within two days of receipt														
Rough-cut capacity planning	% accuracy of MPS loading														
	hours of unplanned overtime worked														
Master Production Scheduling	Value of FGS produced ahead of requirements														
	weekly plan v target %														
BOM maintenance	% BOM record accuracy														
Stock allocation	% stock record accuracy														
	% of job orders issued with shortages														
MRP	% job orders with raw material shortages														
	% job orders with job order shortages														

Figure 10.15 Operational performance measures - Planning.

10.2.4 Discussion

It is thought that as a result of applying this method within G N Netcom certain improvements in business performance has been achieved. These are:-

- Increased inventory turns from 3 to 4.8
- Reduced scrap from £271K to £77K
- Reduced WIP levels - by 25%
- Improved internal quality - by 5%
- Improved production throughput by 12% to 89.2%

As in the previous case study, it would not be scientifically correct to claim that these improvements were solely attributable to the application of the methodology. External factors outwith the control of the researcher were closely monitored and the following facts were noted:-

- There were no marked changes with respect to the competitors of the business.

- During the period the of study the market was in recession and in general the demand for company's products were lower than previous years.

- There were two personnel changes. The old production manager was made redundant and the role of his replacement was considerably changed due to the move towards cellular manufacturing. A logistics manager was appointed. But it must be noted that these changes were caused directly as a result of the project.

However, the information obtained through the audits conducted at the start, completion and approximately one year after completion of the programme show that there has most definitely been an improvement in the level of integration within the company. Results of these audits are illustrated in Figure 10.16

PERFORMANCE AREA	BEFORE	AFTER	YEAR AFTER
Shared Vision	18%	94%	100%
Common Strategy and Objectives	13%	88%	84%
Awareness of Roles and Responsibilities	62%	91%	93%
Integrated Processes	59%	100%	100%
Integrated Performance Measures	0%	87%	85%
No. of non-conformances in Working Practices	92	23	19

Figure 10.16 Audit results for GN Netcom as.

At the start of the programme GN Netcom had a very informal understanding of its current position with respect to its operating environment. The only two formally recognised factors was its position in the market place and its profits over the past two to three years. Despite this lack of formal awareness, at the senior management level, ie at the Danish headquarters level there was a common view of the direction the business should be taking. However this was not at all shared at middle management and operational levels. This explains the very low score of 18% at the start of the programme. However, as the company vision was formalised and communicated across all levels of the organisation the performance against this are has improved considerably.

With respect to the performance area of Common Strategy and Objectives, at the start of the programme there was no clear view. Views were confused even at the senior management level. Apparent strategic priorities ranged from cost reduction leading to price reduction to improvements in customer service. This is justified by the low score attained by the company at the start of the programme. Subsequent audits show marked improvements in this performance area where the senior and middle management demonstrated 100% awareness of the company's strategy and objectives and they were able to relate these to their job functions. The scores of 88% and 84% were due to minor lack of awareness at the operational levels mainly by new staff.

At the start of the programme the individual functions within the company demonstrated a reasonably good understanding of their own roles and responsibilities but failed to demonstrate a through understanding of other functions roles ad responsibilities. This lack of awareness was even more prominent for functions such as finance, sales and marketing and product development. The results show that the level of cross functional awareness was also effected by the geography of the company, ie local functions demonstrated a better awareness of each others roles and responsibilities. Again the subsequent audits show a marked improvement in this performance area.

With respect to Integrated Processes, at the start of the programme the company demonstrated certain level of integration between the closely coupled processes, such as Sales Order Processing and Production Planning, but failed to demonstrate the same level of integration between all processes. The formalisation of the links between processes lead to improvements in this performance area which is reflected in the results of the subsequent audits. The reason the company managed to effect and maintain 100% integration of its processes is considered to be due to inclusion of the processes and interfaces within the company's ISO9000 Quality Management system which ensures that the documentation remains valid and up to date. The company was ISO9000 registered before the start of the programme.

At the start of the programme the performance measurement system used by the company was limited to financial measures as reported in the monthly management accounts, thus the score of 0%. As a result of applying the methodology the company identified all the processes and identified the performance criteria for the key processes. On conclusion of the programme the strategic and operational performance measures were being used as a management tool for day to day running of the business, thus the subsequent audit scores of 87% and 85%. The reason the company failed to attain a score of 100% is because the company chose not to monitor performance of certain processes which related to trivial administrative matters.

The three audits show considerable drop in the number of non-conformances recorded against the working practice measure. This is mainly because the company decide to run TQM workshops on six monthly intervals to identify and resolve issues. The researcher believes that this performance area may also be effected by the ISO9000 quality management system which requires regular audits to be carried out against the documented procedures of the company.

10.3 Scottish Pride Quality Dairy Foods (SPQDF)

10.3.1 An Introduction to SPQDF

Scottish Quality Dairy Foods (SPQDF) is part of the Scottish Milk Marketing Board. It specialises in production and distribution of dairy foods such as cheese, UHT milks, yoghurts, etc. It operates from their Paisley based Head Office and a distribution depot with production facilities in Stranraer (Galloway Cheese Company), Kirkcudbright (Kirkcudbright Creamery), Mauchline (Mauchline Creamery), Campbelltown (Campbelltown Creamery), Arran (Arran Creamery) and Rothesay (Rothesay Creamery). All production facilities report directly in to the Paisley based HQ where the main Sales, Marketing, Finance, Engineering Support and Systems functions reside. SPQDF's main market is the British supermarket chains, such as Tesco, Asda, Sainsbury, Wm Low, with own label products. SPQDF also supplies its Scottish Pride labelled products to Cash and Carry type wholesale and distribution agents. In total SPQDF turnover approximately £60-65 million of business per year.

10.3.2 Background

Until late 1990 SPQDF relied on the central Scottish Milk Marketing Board systems which provided less then adequate service to satisfy the needs of a rapidly growing business. With the advent of 1992/1993, ie open trading within the European Markets and facing already increasing competition from other European countries such as France and Denmark the SPQDF board recognised the need to gain better control of the business. Through workshops it was established that availability of key information within the required timescales was a key

limiting factor which reduced the businesses flexibility and ability to react to external pressures. As a result of these workshops the implementation of a computerized, integrated Business Planning System (BPS) was identified as an appropriate solution. A cost/benefit study was commissioned by the board of SPQDF. The author was invited to carry out this cost/benefit study in-conjunction with the key personnel from the company. In the first planning meeting the concept of the Methodology was introduced to the board. During this meeting the difficulty associated with carrying out a cost/benefit study for such as system without clear understanding of business sensitivities was stressed. As a result of this meeting the concept of the Methodology as a means of creating an integrated business platform was accepted with the intension of building a computer system solution upon this platform. As a result the BPS project was initiated during the spring of 1991.

6.3.3 Business Planning System (BPS) Project

(i) Awareness Phase

The planning meeting described above served as the executive briefing activity. A result the recommended project organisation was created. An executive steering committee was set up consisting of all directors and managers reporting directly to the managing Director of SPQDF. The systems manager was assigned as the project coordinator. Various functions within each site were identified and to represent each function a working group was formed. General awareness sessions were held at various stages of the project at all locations to ensure that in the first instance all personnel was made aware of the project. Follow-

up sessions ensured that everybody was kept informed of progress and new developments through out the project.

(ii) Strategic Phase

At the start of the project a detailed understanding of the current situation of the SPQDF business and its objectives were already in place. Some thought was also given to the functional strategies.

The overall business objective of SPQDF was to achieve the following within a aggressive three year target:

- Increase turnover by 30%
- Increase profit by 100%
- Increase profitability by 50-60%

To meet these ambitious objectives the following were identified as key areas of focus:

- Brand development to increase sales, improve margins, broaden trade distribution and saliency.
- Reduction in production costs
- Achievement of expected quality standards
- Improved throughput
- Reduced investment in stock (Product, Packaging and WIP)
- Improved customer communications and service
- Improved internal communication and information availability

In order to justify the investment in the project, which at that time was estimated to be around £0.8-1 million, a cost/benefit study was conducted. This also served to establish targets for the project. The cost/benefit study was carried out by operational site and was based on the 1990/1991 trading accounts. A copy of the cost/benefit study for one of the sites is included in appendix 1 of this thesis. The reader will notice that the benefits are focused on tangible/achievable results and due to insistence of the board less tangible or less clear cut benefits, such as increase in sales volume, were omitted from the cost benefit study. The cost benefit was structured to reflect an easily achievable target, an average target and an ambitious target. The cost benefit, based on the average target shows a return of approximately £2.5 million against an estimated maximum investment of £1 million.

(iii) Analysis Phase

Throughout the analysis phase the approach described by the methodology was employed. An inter-functional model for the whole business was created. The roles and responsibilities of individual functions were analyzed, discussed and agreed. Functional models were created and functional policies and procedures were documented.

During this phase a number of changes to roles and responsibilities and to current procedures were identified and implemented.

(iv) Integration phase

The integration phase of the project included TQM workshops between various functions to identify problems and differences. Integration

meeting were held between various functions to resolve these differences and problems an also to ensure that the functional policies and procedures were complimentary. As a result of this phase a number of changes were agreed and implemented:

- The order processing of all orders were centralized within the Customer Services function. In the past certain types of orders were processes locally at the manufacturing sites which led to a number operational and accounting difficulties.

- The processing of cheese, milk and powder orders were rationalized and simplified. Previous practice required that orders for cheese, milk and powders to be processed through different procedures by different people for the same customer. The new procedure ensured that a single contact point was created for the customer with a simplified and common order processing procedure.

- Lot control was introduced to enhance and aid the statutory traceability requirements. In the past each product unit, eg a carton of milk-shake, was uniquely numbered. This number was recorded in a book with appropriate details such as date of production, machine number etc. However, there was no policy in place for palletizing which resulted in a pallet which contained products with diverse production dates and therefore use by dates. This resulted in a large number of returns from the customers. The new lot control system ensured that all

products produced on the same batch were identified as a lot and the palletizing policy was changed to ensure that a pallet only contained a single lot of products.

- Additional procedures were introduced to ensure the communication of all orders, associated delivery and production dates to transportation function to ensure effective scheduling of distribution.

- A procedure for perpetual stock counts was also introduced at all sites.

As a result of these and other minor changes the policy and procedure documents were revised and reissued.

(v) CIM Implementation Phase

In this project it was difficult to distinguish between the analysis, integration and the definition of needs phases. This was mainly because people already had the systems at the back of their mind. Many of the discussions in resolving problems and differences made reference to use of systems for resolution of these problems. Thus the policy and procedure documents created on completion of the integration phase had already taken in to account interaction with the desired systems.

On detailed study of the new policies and procedures the following areas were identified for systems implementation:

- Order processing including EDI which was becoming a key requirement of major customers. With direct interface to sales ledger and invoicing.
- Stock management of both finished goods (including lot and rotation control) and raw materials.
- Quality management. ie control of the positive release system statutorily required by the food safety act.
- Business / production planning and scheduling. Business planning being central to SPQDF with a distributed production planning facility for each production site.
- Purchasing for all sites with direct interface to central purchase ledger
- Distribution planning
- Invoicing
- Accounting and financial systems.

Based on the procedures a detailed requirements specification was compiled in the format shown in Figure 10.17. the finalized document 'Statement of Requirements (SOR)' was sent to a number of potential suppliers. All suppliers were asked to submit a detailed quotation using the SOR provided. The suppliers were instructed to assess the scale of customisation required to their standard packages and estimate the cost against each item.

No.	PURCHASING	YES STANDARD	YES CUSTOMISE	NO ALTERNATIVE	COMMENTS
4.1	IS THE SYSTEM CAPABLE OF MAINTAINING RECORDS AND PRODUCING REPORTS ON CURRENT SUPPLIERS I.E. DETAILS OF NAME, ADDRESS, TELEPHONE, CONTACTS, LEAD TIMES, PRICE DISCOUNTS AND DELIVERY PERFORMANCE. THESE RECORDS SHOULD BE KEPT FOR ALL PREVIOUS SUPPLIERS.				
4.2	DOES THE SYSTEM PROVIDE A STOCK CONTROL SYSTEM FOR ALL RAW MATERIALS.				
4.3	DOES THE SYSTEM USE THE OUTPUT OF THE MRP MODULE TO GENERATE PURCHASE REQUIREMENTS. THESE REQUIREMENTS SHOULD TAKE INTO ACCOUNT SUPPLIER LEAD TIMES AND ON-HAND STOCK AND SHOULD RECOMMEND WHAT TO BUY, WHEN AND HOW MUCH.				
4.4	DOES THE SYSTEM ALLOW THE MANUAL OVER-RIDE OF THE ABOVE PURCHASE REQUIREMENTS FOR VARIOUS MATERIAL/CATEGORIES.				
4.5	DOES THE SYSTEM ALLOW P.O.'S TO BE CREATED TO MEET MANUALLY CALCULATED REQUIREMENTS IN ADDITION TO THOSE GENERATED BY THE MRP MODULE.				
4.6	DOES THE SYSTEM REPORT ON SUPPLIER SHORTAGES WITHIN SPECIFIED LIMITS.				
4.7	DOES THE SYSTEM AUTOMATICALLY GENERATE PURCHASE ORDERS AND GOODS RECEIVED NOTES.				
4.8	DOES THE SYSTEM REPORT ON ANTICIPATED DELIVERIES TO PERMIT US TO PLAN MORE PRECISELY FOR RECEIVING DOCK PERSONNEL.				
4.9	DOES THE SYSTEM PROVIDE A GOODS RECEIVED ENQUIRY FACILITY WHICH RECORDS GOODS RECEIVED AND RECORD INCOMING INSPECTION RESULTS				
4.10	DOES THE GOODS RECEIVED ENQUIRY FACILITY NEGATE THE NEED FOR A GOODS RECEIVED NOTE TO BE ADVISED TO PURCHASING I.E. A DAILY LIST OF GOODS RECEIVED.				

Figure 10.17 A sample page from the statement of requirements

The received responses were first ranked based on fit, ie the package requiring minimum amount of customiation was ranked the highest. This ranking was then adjusted based on the cost, supplier and other factors. This provided a good platform for negotiation with the suppliers. Eventually the BPCS/AS400 software and hardware package and IMI Computing was selected as the preferred solution. The main reason behind this choice was the level of fit BPCS offered to SPQDF was approximately 95%, the highest of all packages considered.

The implementation of the system was relatively smooth and simple. All users new what to expect and how to use it. Following brief training sessions they were able to use the system. Some teething problems were encountered, but these were of minor nature. To put it in perspective, the BPS project started in March 1991, the SOR was prepared by July 1991, the system was selected by September 1991 and the system was fully functional by May 1992 across all sites with the exception of Arran and Rothosay due to cabling costs. However, procedures were implemented to compensate for the absence of the system and to ensure maximum control over the Arran and Rothosay creameries.

10.3.4 Discussion

The SPQDF's BPS project was unique as far as the use of the methodology. The reason is that the steering group at SPQDF recognized the advantages associated with detailed study, simplification, rationalisation and stream-lining of the business processes. They also recognised the benefits of maximum involvement

by the operational personnel and management under the guidance of the steering group. However, the steering group chose to omit the continuous improvement phase although in agreement with its concepts. This was because the steering group felt that use of integrated performance measures as a management tool would not suit the culture within SPQDF.

The immediate benefits of the application of the methodology are obvious, in that they were able to specify, select and implement a large scale, multi-site business planning system in 13 to 14 months. This was achievable because the methodology through the Strategic, Analysis and Integration phases achieved the following:

- The objectives identified throughout the Strategic phase ensured that the operational policies and procedures were complimentary to the corporate business objectives.

- The work throughout the Analysis and Integration phases resulted in the elimination of duplicated effort and inefficiencies in working practices. This resulted in a simpler set of requirements.

- Due to the participation and involvement of operational personnel and managers, ownership of the new working practices were never an issue.

Due to the absence of process level and strategic level performance measures, at the time of writing the long term benefits were not clear.

This case study demonstrates the use of the Total-I methodology for specification and selection of software (CIM) modules which provides best fit to the requirements of the business. The case study also demonstrated that the use of the continuous improvement phase was not critical for requirements specification and system selection.

The audit results shown in Figure 10.18 show marked improvements in the level of integration within the business from the start of the project to its conclusion. Unfortunately it was not possible to gain access to the company to conduct a final audit due to changes in the structure and key personnel of the company and for the same reasons it is not possible to comment on the business results of the company.

Although at the start of the programme the senior management had a good understanding of the company's current situation, its vision and its strategy and objectives, these were not widely communicated and understood at middle management and in particular at the operational levels. This justifies the low scores of 33% and 46% against the performance areas of Shared Vision and Common Strategy and Objectives. Subsequent audit shows distinct improvements in these performance areas.

PERFORMANCE AREA	BEFORE	AFTER	YEAR AFTER
Shared Vision	33%	88%	
Common Strategy and Objectives	46%	92%	
Awareness of Roles and Responsibilities	53%	67%	N/A
Integrated Processes	36%	100%	
Integrated Performance Measures	0%	0%	
No. of non-conformances in Working Practices	127	36	

Figure 10.18 Audit results for SPQDF.

The improvement in the awareness of roles and responsibilities is somewhat disappointing. This is mainly caused by the project team oriented approach adopted by the company for remote sites. This approach resulted in the involvement of a limited number of individuals from remote sites in the analysis and integration phases, which in turn resulted in poor dissemination of the roles and responsibilities of each function.

As the company choose not to introduce an integrated performance measurement system at both operational and strategic levels the score against this performance area remains 0%.

As expected there is a marked improvement in the number of non-conformances recorded against the performance area of Working Practices.

10.4 CASE STUDIES: SUMMARY

The case studies presented in this chapter demonstrated the application of the methodology for business integration. The first two case studies, with IDV Export and GN Netcom demonstrated the application of the methodology from a business integration and improvement point of view. In both cases the methodology was employed to streamline business activities and achieve certain degree of integration between various parts of the business. Although the business results show clear improvements in business performance this cannot be directly attributed to the application of the methodology. However, the audits conducted at the start, completion and approximately one year after completion of the programme show that the methodology resulted in improved and sustained integration of the businesses.

The third case study was somewhat different. In this case SPQDF used the methodology to streamline its activities and identify areas which requires support from computer based modules. The core phases of the methodology was used to review the companies existing policies and procedures and to define new, simplified and rationalised, operational policies and procedures. The CIM Implementation Phase employed to develop a statement of requirements and for selection of the suitable hardware and software platform. This particular case study demonstrates that the methodology could deliver significant benefits where implementation of CIM modules are required. The real benefit here is that, the methodology through a structured approach streamlines and simplifies operational activities as well as making

people think in detail about how they wish to use the new/proposed systems. The CIM Module Implementation Phase provides the techniques which simplifies the requirements specification and system selection tasks. This results in greatly simplifying the task of systems implementation.

Each case study represented a different company operating in different sectors, in different environments and with different cultures. In each case the application of the methodology proved to be of certain benefit and assisted in the achievement of an integrated business platform.

CHAPTER ELEVEN

DISCUSSION

11.0 DISCUSSION

The objective of this chapter is two fold. One objective is to discuss the relative merits and limitations of the research method employed, the other objective is to discuss the relevance of the results of the research. In summary the section on "Research Method" discusses how the research was conducted with specific reference to the robustness and rigour of the research method and the section on "Research Results" discusses the validity and limitations of the output generated by this research.

11.1 RESEARCH METHOD

The background of this research goes back to mid 1980's where the researcher was involved in the study of tools and techniques for manufacturing systems design and integration. However, the research presented in this thesis did not formally start until 1988/1989 where the author identified the need for business-wide integration rather then integration of manufacturing systems. More specifically the need for methods to facilitate business-wide integration was identified. Effectively this was the start of this study into business integration. From this point on the research followed the structure illustrated in Figure 11.1. which is structured into four major parts. These are:-

- Part 1 - Identification of what is exactly required.
- Part 2 - Definition of how it is going to be done.
- Part 3 - Development of new concepts.
- Part 4 - Verification/Testing of new concepts.

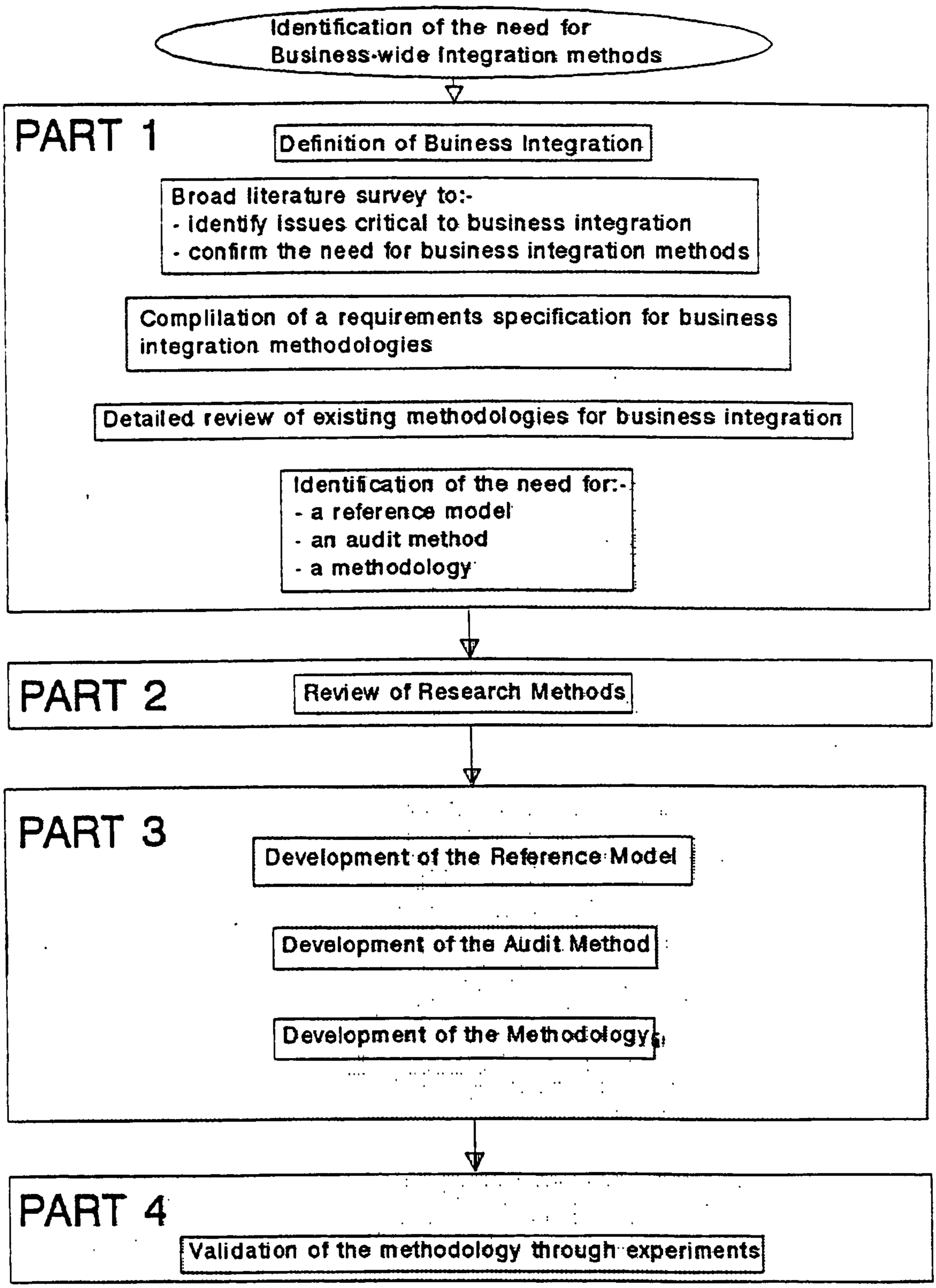


Figure 11.1 The research method.

11.1.1 Definition of Business Integration

The first task of the research was to define Business Integration. With this objective in mind a number of interviews were organised with academics and industrialists to gather data on what business integration meant to them. This data was then analyzed and a definition for business integration was compiled. This definition was then validated by going back to the original interviewees and asking their opinions. This process resulted in the refinement of the definition and led to the formulation of the definition as used in this thesis.

11.1.2 Broad Literature Survey

Having agreed the definition of business integration a broad literature survey was conducted to identify all issues critical to business integration and to confirm the need for business integration methods. This literature survey was conducted by collecting and analysing industrial and research papers published in leading conferences and journals. A search was also conducted through the University's CD Rom system. In analysing the papers identified the key messages were extracted and noted as presented in chapter three.

11.1.3 Compilation of Requirements Specification

The key messages identified through the literature survey were then structured under the headings of Scope, Functional and Application to develop a first cut requirements specification. This requirements specification was then validated by presenting it to the industrialists and academics within the community. The feedback was used to refine

the data leading to requirements specification detailed in chapter three.

11.1.4 Detail Review of Existing Methods

On completion of the requirements specification a detailed review of the existing methods which facilitate business wide integration was conducted against this requirement specification. The availability of such methods were identified through the literature survey and through personal contacts as well as cold calls to leading management consultancy organisations. This review resulted in the following conclusions:-

- There is a need for a reference model for business-wide integration.

- There is a need for an audit method which measures an organisation's position with respect to the reference model.

- There is a need for a complete methodology (ie framework, tools and techniques) which would facilitate the achievement of the reference model.

In arriving at this conclusion a number of weaknesses were identified associated with this stage of the research. These mainly relate to the completeness of the review of the existing methods for business-wide integration. These weaknesses were:-

- The review of existing methods is not exhaustive and other approaches to business integration may have been developed by other management consultancies but are not widely published or remain undiscovered.

- Details of the tools and techniques used within the existing methods by the management consultancies are not disclosed due to commercial and confidentiality reasons.

However, the review has been conducted on a representative sample from leading practitioners in this field and having verified these conclusions with other academics and industrialists the researcher is confident of the validity of these conclusions.

11.1.5 Review of Research Methods

Having identified the development gaps in the field the researcher reviewed the current thinking on research methods to ensure that any potential pitfalls were identified and the remainder of the research, that is the Development and Validation stages, are conducted with rigour and take into account the potential dangers and pitfalls.

11.1.6 Development of the Reference Model

Here the objective was to develop a generic reference model which would summarise the features which an integrated organisation should demonstrate in the form of performance areas and criteria. The thinking was to create a reference model for business-wide integration which would be equivalent to the Baldridge (Malcolm Baldridge

National Quality Award, 1994)) or EFQM (European Quality award, 1993) models for TQM.

The main source of data for this task was the contents of the literature survey and the requirements specification for a methodology which would facilitate business-wide integration. Having compiled the reference model based on this data, the researcher then went on to check the validity of the reference model through discussions with academic and industrial contacts. The contents of the reference model is discussed in further detail later in this chapter.

11.1.7 Development of the Audit Method

The audit method was developed in response to requirements generated from two different sources. These are:-

- The review of existing practice identified the need for a generic reference model and the need for an audit method to identify an organisation's performance against requirements of this reference model.

- The review of the management research methods identified the need for a measurement system which would objectively measure an organisation's level of integration in order to monitor the net-effect of the methodology.

The reference model provided the main source of data used during the development of the audit method which is structured to measure a

company's performance against the each one of the performance areas specified in the reference model. Considerable amount of thought was also given to the application of the audit method. The initial experiment carried out with Ritchie (UK) Ltd showed that use of questionnaire is likely to distort the measurements and that structured interviewing would give much truer results. Having developed the audit method and refined its application through an independent experiment the method was used to measure the level of integration of the case study companies. The audit method itself is discussed in further detail later in this chapter.

11.1.8 Development of the Methodology

The reasoning behind the evolution of the methodology is discussed in detail in chapter nine. The objective of this section is to outline the method employed to develop the methodology.

Here, the main sources of data were again the reference model and the results of the literature survey. The reference model provided the objective, ie "What the methodology had to achieve". The literature survey provided valuable data on tools and techniques available to facilitate the achievement of some of the objectives. The researchers task was to organise these activities, tools and techniques in a logical manner to provide a systematic route towards the achievement of the reference model. In developing the methodology the researcher also had to develop new tools and in some cases modify the existing tools to maintain practicality and ease of application.

Through-out the development of the methodology the researcher tested the validity of the methodology, its various phases, tools and techniques through discussions with academic and industrial contacts. During and after its development the methodology has also been presented in a number of academic research conferences and journals to obtain comments and feedback. These comments and feedback also provided useful data for the development of the methodology.

11.1.9 Validation of the Methodology

The methodology was validated through three case study applications as described in chapter ten. The role of the researcher throughout the case studies is of critical importance which needs to be discussed in some detail. Throughout all three case studies the researcher adopted two basic roles:-

- Mentor: In this capacity the researcher was involved in educating and guiding the senior management through the application of the methodology without actively participating in the application of the methodology.

- Observer: In this capacity the researcher was observing the application of the methodology without participation, but as a Mentor was able to provide feedback to the senior management on observations made to ensure that the methodology was being applied as it was originally intended.

These roles minimise the likelihood of Hawthorne effect caused by the presence of the researcher. However, it does not isolate the Hawthorne effect caused by the focus on business integration. But one may argue that the methodology creates the Hawthorne effect in order to facilitate integration. One might also argue that the improvements demonstrated in the levels of integration by the first two case studies are purely due to this Hawthorne effect. However, if this was true, one would expect that the results of the third audit would show some form of de-integration since these audits reflect the state of integration approximately one year after the end of the programme. Instead, the third audits show some minor positive and negative trends against each performance area which are attributable. With these points in mind one may conclude that the methodology by creating a Hawthorne effect also installs the necessary disciplines and mechanisms to ensure that the improvements are maintained. Where there is a significant change in the audit results the researcher identified a logical explanation of the potential causes which may have effected the audit results.

11.2 THE RESEARCH RESULTS

The objective of this section is to discuss the validity and limitations of the research results. In the context of this section the research results are the contribution this research claims to make to the field. According to Easterby-Smith et al (1991) management research at a Doctoral level could make contribution to the field in three main forms. These are:-

- New knowledge
- New methods,theories or ideas
- New methods of investigation

With respect to these forms of contribution the research work presented in this thesis provides the following contributions to the field:-

- Requirements Specification
- The Development Needs
- The Reference Model
- The Audit Method
- The Methodology
- Experimental Results

Table 11.1 below categorises these contributions according to the types of contribution specified by Easterby-Smith et al (1991).

Contributions	Categories of Contribution		
	New Knowledge	New Theories	New Methods
Requirement Spec.	X		
Development Needs	X		
Reference Model		X	
Audit Method		X	X
Methodology		X	
Experi. Results	X		

Table 11.1 Categories of contribution.

11.2.1 The Requirements Specification

In Table 11.1 above it is claimed that the requirements specification is a contribution to the field in the form of new knowledge. In essence the researcher does not claim that the individual content of the requirements specification is new. Since the main source of data was the literature survey, it is obvious that the content is based on existing knowledge. However, this is the first time this data has been studied interpreted, summarised and structured in this manner to compile a requirements specification for a methodology to improve business-wide integration. Thus, although the individual component parts are existing knowledge, the Requirements Specification in its totality provides a new contribution to knowledge in this field.

11.2.2 The Development Needs

Through the broad literature survey and the critical review of existing methods for business integration, the research identified the need for:-

- **A Reference Model** to specify the criteria which needs to be fulfilled by an organisation in order to achieve business-wide integration

- **An Audit Method** to identify / measure an organisation performance against the Reference Model

- **A Methodology** which would facilitate the achievement of the criteria specified within the reference model.

Within the scope of literature reviewed in conducting this research no other source has identified the need for both a reference model and an audit method. However, the need for methodologies to facilitate business-wide integration was identified in several publications. Therefore, the development needs identified through this research may be categorised as contribution to knowledge.

11.2.3 The Reference Model

The Reference Model was developed by the researcher in response to the development needs identified. It represents, in a distilled form, the messages extracted from the literature review. Therefore majority of the thinking behind each one of its component parts is not new. The exception to this is the performance area titled "Integrated Performance Measures". This area has been developed by the researcher in its entirety during the methodology development process (Bititci, 1993 and Bititci, 1994). Since, to a certain extent, the Reference Model and the Methodology were engineered simultaneously it was possible to incorporate this performance area within the reference model. Therefore, the thinking behind the integrated performance measurement concept as specified in the performance area represents a totally new theory/idea emerging from this research.

With respect to the remainder of the reference model, although based on existing knowledge, the manner in which the data has been interpreted and structured from a business-wide integration viewpoint is new and represents a significant contribution to knowledge.

Realistically, one could not argue that this Reference Model is final and it represents the ultimate with respect to business integration. It must be recognised that it is a first-cut model which will require further development and refinement to take into account new developments, thinking and theories. It represents, based on a broad source of data, one person's thinking and interpretation which has been validated through discussions with industrial and academic colleagues.

Despite the above argument the reference model remains a valid contribution to knowledge providing that the limitations outlined are recognised.

11.2.4 The Audit Method

The Audit Method, like the Reference Model, was developed in response to the needs identified. As it is, it represents a first attempt to measuring a company's level of integration with respect to the Reference Model. It has a number of weaknesses, some of which have already been discussed in chapter seven. These weaknesses are:-

- The relative nature of the audit method.
- Lack of guidance on sample sizes to be used.
- The need for sample uniformity.
- Inability to distinguish between various levels of personnel.
- Time requirement.

Following paragraphs provide further discussion on each one of the above weaknesses.

As it is the audit method does not provide a system for absolute measurement which would allow inter-company comparisons. Its relative nature means that, it can only be used to monitor an organisation's progress towards business-wide integration through time. However, for the purposes of this research, this provides an adequate mechanism for monitoring and measuring the effect of the methodology on the case study companies.

Through the case studies it became apparent that the audit method would be less time consuming and simpler to conduct if it provided guidelines on sample sizes for interviewing personnel from various departments. Thus, throughout the case studies the researcher tried to cover as many staff as possible. In the case of smaller functions 100% of the staff was interviewed. However, in order to maintain consistency the researcher ensured that the percentage interviewee numbers for each function were maintained for subsequent interviews.

The need for sample uniformity was identified early on during the development of the audit method. This is related to the inability of the scoring system to distinguish between various levels of personnel. The reasons for this were discussed in detail in chapter seven. During early stages of application it became apparent that within the case study companies the level of awareness of the company's vision, strategy, etc was far greater at senior management levels then at operational levels. Therefore, in order to maintain objectivity with respect to relativity it became important to ensure that throughout the

organisation, from one audit to another, the ratio of operational staff, senior and middle management remained constant.

The audit method requires considerable time commitment from both the auditor and the participating company. The whole process could be conducted much faster through use of questionnaires, but the difficulties associated with questionnaires have already been discussed in chapter seven. One way of overcoming this difficulty would be to impose examination conditions for completion of the questionnaires. This would minimise the cross referencing between respondents but is deemed to be impractical. The structured interview technique which uses only the basic and explanatory probes have been found to be most practical method, but as explained earlier it tends to be time consuming. However, one advantage of the audit method is that it makes use of the data generated through the application of the methodology and therefore the application of the audit method becomes a lot simpler with less demand on the company's time.

Having identified the limitations of the audit method, it can be concluded that this method is still immature and requires further research and development to reach maturity. However, as demonstrated in the case study applications, if its applied with recognition of its limitations it will provide a rudimentary indication of an organisations performance against the performance criteria specified within the Reference Model.

In the literature, there is no other source which has attempted to develop a method for measuring or auditing an organisation's level of integratedness. From this respect the Audit Method developed as part of this research provides a rudimentary but initial platform to develop more complex and more sophisticated audit/measurement methods.

11.2.5 The Methodology and Experimental Results

The methodology was also developed in response to the development needs identified. The methodology is a fruit of the researcher's logical assembly of existing knowledge, tools and techniques, some with modifications, together with new developments in the form of new concepts, such as the framework for integrated performance measures and associated techniques. In summary the component parts of the methodology is a mix of existing and new techniques. But in its entirety it provides a totally new method for achieving business-wide integration.

The validity of the methodology has been demonstrated through the case studies with the aid of the Audit Method. However, it would not be correct to argue that because the methodology achieved the desired results in the case study companies the methodology would be universally applicable. With respect to the validity of the methodology two elements must be considered. These are:-

- The Time Factor, and
- The Company Culture

With respect to the Time Factor, in the case of the first two case studies, the effect of the methodology has been established to a point one year after the end of the programme. As it is there is no evidence that the current level of integration will me maintained in three or four years time.

With respect to the Company Culture, it is possible that the case study companies were ready for this type of initiative and partially contributed towards the successful application of the methodology. As the sample size is limited to three experiments there is no comparative data available to compare between successful and unsuccessful applications of the methodology. Thus the researcher is unable to comment on the suitability of the methodology for companies with different cultures or state of readiness.

With these limitations in mind it would be appropriate to conclude that the methodology has been valid and effective for the case study companies presented in this thesis. However, its universal validity and its longevity remains to be proven through further research which is outwith the scope of this research project.

11.3 SUMMARY OF DISCUSSION

In this chapter the appropriateness and the rigour of the research method has been discussed together with the contribution of this work to the field.

The research method, in general, followed the research plan outlined in chapter five. Although some weaknesses have been identified, the methods employed through out the research exercised adequate and practical levels of objectivity and rigor.

The main contribution made to the field by this work lies in the pure research/invention category of management research and remains valid within the identified parameters and limitations.

CHAPTER TWELVE

CONCLUSIONS AND FURTHER WORK

12.0 CONCLUSIONS AND FURTHER WORK

The objective of this chapter is to summarise the conclusions emerging from this thesis and outline the further reserach and development needs.

12.1 CONCLUSIONS

The research work presented in this thesis resulted in a number of conclusions. These are presented below with specific reference to the relavant chapters.

- Although the concept of Business-wide Integration emerged from a technological and information systems oriented paradigm, today business-wide integration is seen as a concept which is independent of its technological roots and which extends across all aspects of business encompassing business objectives, people, systems and technology (Chapters 1 and 2).

- Developments in the field have taken two different but increasingly merging viewpoints. These are:- Information Systems viewpoint and Business Improvement viewpoint, which cover all the facets of integration (Chapter 3).

- The field of Business Integration is very broad. The literature identifies a diversity of issues which need to be addressed and in some cases provides appropriate guidance, tools and techniques to address these issues (Chapter 3).

- The distillation of the information from the literature provides a specific requirements specification for methodologies designed to facilitate business-wide integration (Chapter 3).

- The review of the existing methods against this requirements specification reveal that as yet there is no methodology which completely fulfils these requirements (Chapter 4).

- Existing methods for business integration address different areas of business integration at different levels from a variety of viewpoints. This is mainly due to the absence of a Generic Reference Model (Chapter 4).

- Careful and thoughtful design of a research programme is critical to the validity of the research results (Chapter 5).

- In order to maintain rigour and objectivity an audit method is required to evaluate the net effect of the methodology on the case study companies. This audit method should also evaluate the performance of an organisation against the criteria specified in the Reference Model (Chapters 5 and 7).

- The Reference Model, in measurable terms, should reflect the ideal criteria which an organisation should meet to ensure integration (Chapter 6).

- The reference model should reflect the fact that the overall business objectives and strategy drive the integration effort (Chapters 3,4 and 7).

- Measurement of Integration in objective terms is a complex problem. For the purposes of this research an audit method which measures an organisation's performance against the criteria specified within the Reference Model in relative terms would suffice. Attempts to prioritise and weight the results would require subjective assessment of the results and therefore should be avoided (Chapter 7).

- In order to maintain objectivity, during auditing extreme care must be taken to ensure that the consistency of samples are maintained (Chapters 7 and 11).

- The methodology addresses all areas of the Reference Model (Chapter 8).

- Based on a desk-top assessment, the methodology fulfils majority of the requirements specified in chapter 3 and therefore is superior to existing methods reviewed in Chapter 4 (Chapter 8).

- For the case study companies the application of the methodology resulted in considerable improvements in the levels of integration (Chapter 10).

- The results of the audits carried out demonstrate that these improvements were due to the application of the methodology and not merely due to Hawthorne effect (Chapter 11).

- The research work presented in this thesis provides valid contributions to the field (Chapter 11) in the form of:-
  - Requirements Specification
  - Development Needs
  - Reference Model
  - Audit Method
  - Methodology
  - Experimental Results

12.2 FURTHER WORK

The further research and development needs identified at the conclusion of this work may be categorised as primary needs and secondary needs. The primary needs refer to work which needs to be carried out to further the results of this research. The secondary needs refer to other research and development opportunities which have been identified through this work. The following paragraphs briefly summarise the further research and development needs under the two categories.

12.2.1 Primary Research and Development Needs

The further research and development needs identified under this category are:-

- Further validation of the Methodology in companies with different characteristics. This is deemed to necessary because as outlined in the discussion the Methodology remains valid only for the three case study companies. Therefore further experiments are required to validate the usefulness of the methodology in companies with different characteristics such as SME's, non-manufacturing/service organisations, public organisations etc.

- Further validation of the methodology over time in the case study companies. As outlined in the discussion the first two case study companies managed to sustain a higher level of integration for approximately a year following the application of the methodology. To assess the longer term effects of the methodology it would be necessary to conduct further audits to establish the state of integration in these case study companies possibly at years three and five.

- The audit method has several limitations which were identified in the previous chapter. Further research and development work should be carried out in order to overcome these limitations.

12.2.2 Secondary Research and Development Needs

The further research and development needs identified under this category are:-

- Towards the conclusion of this research there has been increasing amount of emphasis being placed on integrated performance measures within the academic and industrial community. The methodology developed as part of the research work presented here includes a sub-methodology for integrated, strategic and process level performance measures. The area of integrated performance measures is broad and there are several issues which need to be addressed. These are:-

i. A study into the structure of and inter-relationships between performance measures used within a business.

ii. The modelling of performance measurement systems, possibly using Computer Aided Systems Engineering tools.

iii. The assessment of the feasibility and specification of a business performance simulator which would simulate the potential effect of a change in one performance measure on the whole business.

vi. Development of a Reference Model for Integrated Performance Measurement Systems addressing the type of measures that should be used at each level.

v. Development of an audit method which identifies whether an organisation is using the correct performance measures at the correct levels in the correct manner.

- The Methodology and the Audit Method developed as part of this research is a manual paper based system which can be cumbersome and time consuming in its application. A computer based support tool may be of some value. However, the feasibility, advantages and limitations of such a tool need to be researched and if deemed feasible a specification should be developed.

12.3 CLOSING REMARKS

The research presented in this thesis set out to study the methods for business integration. In studying this field it has discovered a number of weaknesses. It then went on to invent models, methods, tools and techniques to address these weaknesses. Finally the applicability of these newly developed methods, tools and techniques were tested on three case study companies.

In conducting this work, the researcher developed an in-depth knowledge of the field and in addition developed a through understanding of the techniques and methods for management research.

Following a critical review of the work done the thesis concludes that this research has made a positive contribution to the field in terms of new knowledge, methods and techniques. This is reflected in the publications which emerged from this work (see appendix 1).

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APPENDIX ONE

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