An implementation study of activity based cost management in small - and medium - sized enterprises

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Award date:
1996

Awarding institution:
Coventry University

AN IMPLEMENTATION STUDY OF ACTIVITY BASED COST MANAGEMENT IN SMALL- AND MEDIUM-SIZED ENTERPRISES

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A thesis submitted in partial fulfilment of the university's requirements for the Degree of Doctor of Philosophy

JULY 1996

Coventry University in Collaboration with
Armstrong Laing Systems Limited.

Abstract

The thesis examines the adoption of Activity Based Cost Management (ABCM) by Small- and Medium-Sized Enterprises' (SMEs) in the manufacturing sector. A generic methodology is proposed, developed and tested to enable the target recipients to assess their requirements for an advanced costing system and to facilitate implementation of an ABCM solution.

In support of the methodology, a literature survey, implementation survey and software review have been undertaken. The implementation survey considers the adoption of ABCM by European organisations and the application of published theory. This established the validity behind the adoption of ABCM by SMEs and defined implementation considerations. The software review reports an evaluation of software systems available in the United Kingdom. A software matrix is established by the author to enable organisations to assess their software requirement against their organisational and project orientation.

The distinct and original contribution to knowledge is a methodology for determining the validity of adopting an ABCM approach for SMEs in the manufacturing sector. Part one of the generic methodology establishes the costing system requirement for SMEs. The methodology is based upon a critical examination of the processes, activities and data prevailing in an organisation. This enables an in-depth appraisal of organisational requirements and appropriate solutions to be facilitated.

Part two of the methodology details the implementation of an operational ABCM solution. The designs of ABCM models for three organisations participating in the research programme are presented and the effects upon product and activity cost for these organisations is reported. Utilisation of the methodology and the implementation of ABCM in collaborating SMEs is critically appraised with theory proposed by prominent authors relating to ABCM implementations in large organisations.

The thesis concludes with discussion of the proposed methodology and considerations for its adoption by SMEs. Overall conclusions are established and opportunities for exploitation and further research work are detailed.

Acknowledgements

Manufacturing management research by its very nature requires participation from industry and academia. I would like to thank the respondents to my questionnaire survey, action research participants, and my collaborating establishment Armstrong Laing Systems Limited, for their participation in the research programme. The constructive comments of Mr F. Schmid, Advanced Railway Research Centre, Sheffield, and Dr P. Primrose, University of Manchester Institute of Science and Technology, during the research enhanced the application of the work by industry, and the contribution to knowledge.

The research programme was directly funded by a three year studentship from the Economic and Social Research Council. Funding of this nature must continue to be supported, its contribution to the personal development of researchers, and collaborating establishments cannot be underestimated.

My special gratitude is due to the numerous staff, and researchers in the School of Engineering, and Manufacturing and Supply Chain Management Centre at Coventry University who assisted me during the three years of the research programme. In particular I would like to acknowledge the support of my supervisors Professor S. Harvey, and Mr G. Sara, and the added contribution of my advisor Mr J. Justham.

The primary source of supervision was provided by my Director of Studies, and Director of the Manufacturing and Supply Chain Management Centre Dr D. Steeple. I am indebted for his many helpful suggestions, and comments, during the research, and production of this thesis.

Finally, thanks are due to my family for their patience and support during the research programme. Without their support, this thesis would not have been possible.

CONTENTS

Page

Chapter Four: An Assessment of Current Activity Based Cost Management Practice.

Chapter Five: Survey of Activity Based Cost Management Software

Chapter Six: The Rationale for the Adoption of a Generic Activity Based Cost Management Methodology. Part 1: Determining the Business Solution.

Page

Chapter Seven: Issues in Activity Based Cost Management

Chapter Eight: The Rationale for the Adoption of a Generic Activity Based Cost Management Methodology. Part 2: Implementation of the Business Solution.

Chapter Nine: Discussion

Chapter Ten: Conclusion

Chapter Eleven: Future Work

References
Bibliography

Appendices

List of Tables

List of Figures

Glossary of Terms

Absorption Costing
Procedure enabling overhead costs to be absorbed in product cost, utilising an absorption factor commonly direct labour or machine hours.

Action Research
Resolution of practical issues in day-to-day settings providing contribution to theory.

Activity
A unit of work in an organisation

Activity Based Costing (ABC)
Two stage procedure providing allocation of resource costs to activities and activities to cost objects (commonly products).

Activity Based Management (ABM)
Management technique focusing on the nature and effectiveness of organisational activities.

Activity Based Cost Management (ABCM)
Combined utilisation of Activity Based Costing and Activity Based Management.

Business Process Reengineering
The fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed [59].

Component Supplier
External supplier of parts to customer design

Cost
The expense of resources incurred in meeting customer requirements.

Cost Drivers
Factor used to allocate costs from activities to cost objects in Activity Based Costing.

Original Equipment Manufacturers (OEMs)
Manufacturers of proprietary parts for use in consumer products.

Process
Combination of operational activities designed to meet an organisational objective.

Simultaneous Process Activity and Data Examination (SPADE)
An assessment tool designed to enable precise examination of the organisational environment.

Small- and Medium-Sized Enterprises (SMEs)
Organisations commonly employing less than five hundred personnel and generating a turnover of less than £15 million.

Small- and Medium-Sized Manufacturing Enterprises (SMMEs)
Small- and Medium-sized Enterprises competing in the manufacturing sector.

World Class Manufacturers
Manufacturing organisations that have achieved the highest standards of business performance and are continuously seeking to improve their ability to meet customer needs

Chapter 1

The Origins of the Project

Introduction

In 1993 at the initiation of this research programme Activity Based Costing was emerging as an alternative cost management system. It is not the aim of this chapter to detail its emergence, but to outline the requirement for such a system at the prevailing time.

The 1980s had seen a rationalisation of British industry. Recession at the start of the decade reduced employment and capacity in the manufacturing sector. With the growth of the economy toward the end of the decade it was the emerging foreign competition utilising alternative management techniques, and advanced manufacturing systems that were the dominant factor in British industry. The resultant British manufacturing renaissance was established through adoption of practices similar to those of the competition.

It is the impact upon British industry of the new economic environment and world class manufacturing methods, that constitute the origins of the research programme. This chapter will detail these changes, their impact upon British industry, and outline the aim of this research programme.

1.2 The Industrial Economy

In 1993 the European Union (EU) was the World's leading industrial producer, followed closely by the United States of America and Japan [1]. Such statistics, although of a positive nature, fail to reflect the underlying state of the European economy and that of its constituent countries.

This situation is exemplified by employment levels in manufacturing industry in the EU. Manufacturing employment has declined from 27 million employees in 1980 to 21 million in 1993 [1]. In comparison Japan has realised a moderate increase in manufacturing employment with 11.4 million employees in 1992. British industry in 1993 accounted for 14.8% of total EU production output. In comparison the former West Germany, France and Italy realised 32.3%, 18.1% and 14.4% respectively of EU manufactured goods. This scenario indicates the growth of the global marketplace, and identifies the minimalist position of British industry in the world economy. The rationalisation of British industry occurred in the 1970s, and 1980s when oil crises and social/political factors directly affected the competitiveness of British Industry.

1.3 The British Industrial Economy

The 1980s have been described as the most momentous peacetime period in British manufacturing's twentieth century [2], [3]. It was during this time that manufacturing industry stabilised its export markets [4]. The period 1969 to 1981 had seen a reduction from 11.2% to 8.5% in the export of manufactured goods [4]. The effective scope and resource base of British manufacturing industry was "re-engineered" during the 1980s. But, it was the social, economic, and political environment of the 1960s and 1970s that led to the sudden decline of Britain's manufacturing base.

Inflationary pressures prevailing during this period affected Britain's industrial competitiveness. The expectation of growing prosperity in Britain was immortalised by Prime Minister Macmillan in his 1957 "Most of our people have never had it so good" speech. After the second world war the British government were pre-occupied with the exchange rate against the dollar, an overvalued pound, raw material shortages, increased foreign food prices and the burden of the national debt. A long term strategy for regeneration of the national economy was neglected and short-termism reigned supreme. Thus began the decline of the British economy.

The changing social and political climate of the 1960s and 1970s resulted in the demand for increased wages and improvements in social conditions. The Nationalised

industries in the 1970s were continually supported by the prevailing government through increased taxation (realised by unlimited wage demands that resulted in high inflation) and financial provision from the International Monetary Fund. In particular the survival of British Leyland required subsidisation of £300 million in 1980 [116], and British Steel received capital to enable generation of excess capacity [117]. In addition industry was in decline, low productivity, restrictive practices and lack of discipline were common place.

It was in this period of industrial discontent that foreign imports were increasing. The Japanese had improved their manufacturing capability, with assistance from Western quality guru's including Demming and Juran. The Japanese subsequently began their rise as a vehicle-manufacturing nation and exporter of products to traditional British based markets. Japanese manufacturing output during the period 1975 to 1982 rose by 40%, in comparison British manufacturing output declined by 10% [5].

The "industrial revolution" of the 1980s was initiated by the Conservative government elected in 1979. The dependence upon state aid for Nationalised Industries was removed. No longer could trade unionists demand excessive pay increases, the cost of living was stabilising and inflation was coming under control. Reliance upon the International Monetary Fund was removed and increased employment realised increased taxation revenues for the treasury. This was epitomised by the 1988/1989 public sector debt repayment that was in excess of £14 billion. Additionally the "family silver" (Gas, Water, Oil, Telecommunications, Rover Group, Jaguar, Airways, Airports, Steel and Shipbuilding) was privatised to limit the public sector borrowing requirement.

The decline of the traditional industrial markets of shipbuilding, steel, textiles and metal manufacturing has been to the advantage of emerging technologies and service sector markets. The growth of the service sector is visible from data relating to gross domestic product (GDP).

In 1960 manufacturing accounted for 37% of GDP and services for 45%. By 1988

manufacturing realised 22% of GDP, while the service sector had increased to 70%. Similarly manufactured goods were increasingly being imported, while exports were decreasing.

1.4 The West Midlands Economy

At a regional level West Midlands manufacturing has been indicative of that of Britain. Birmingham has been defined as the manufacturing "capital" of the UK, and a manufacturing centre of European Importance [6]. The manufacturing and economic indicators relating to Birmingham and the West Midlands, are therefore representative of a wider population.

Manufacturing in the West Midlands has historically been founded upon the vehicle industry with Rover, Singer, and Triumph leading the way at the beginning of the 20th century. The decline of the West Midlands economy in the late 1970s and early 1980s mirrored that at a National level. Increased foreign competition reduced manufacturing output in the West Midlands by 20% against a national average of 14%. This directly influenced employment with 280,000 jobs eliminated over the same timescale [7]. While the economy prospered in the late 1980s, it was driven by expansion of the service sector, and manufacturing industry began the adoption of new production technologies, resulting in job losses. In summary the decline of West Midlands manufacturing industry can be observed from the decline in manufacturing employment. Manufacturing employed 54% of the West Midlands labour force in 1971. This reduced to 49% and 29.2% for 1978 and 1990 respectively [8].

The future growth of West Midlands manufacturing is based upon the development of the automotive sector. This can be explained by the fulfilment of strategic development plans of International motor vehicle manufacturers particularly Nissan, Honda and Toyota. Forecast growth for the automotive sector is seen as 6% per annum between 1995 and 2005 [9].

In order to benefit from this growth West Midlands based automotive component

suppliers need to initiate or evolve development programmes relating to their manufacturing standards, and role within the supply chain.

Component suppliers at the lower end of the supply chain need to pursue a policy of continuous improvement. This is restricted by the capital investment available to companies of this nature. These are primarily Small- and Medium- Sized Manufacturing Enterprises (SMMEs) who are a vital part of the West Midlands economy.

Such organisations are under threat as Original Equipment Manufacturers (OEMs) seek to rationalise their supply chains. In order to compete and remain profitable SMMEs are seeking to invest in modern efficient machinery, and to reassess their manufacturing management methods. Such a scenario is being precluded by the extremely tight profit margins that limit retained profit. Although external sources can be utilised for capital injection small enterprises are already utilising such resources. This is indicated by a comparison of cash available to manufacturing companies in the West Midlands. (Table 1.0) The scenario of reducing margins is set to increase as OEMs seek to reduce the price paid for components. This is also indicated by a reduction in sales for West Midlands manufacturing enterprises, while capacity utilisation continues to remain at a high level. [10]

Table 1.0 Analysis of Net Short Term Cash/(Borrowings) Position.

	1994/95	**1993/94**
	Millions	**Millions**
Large Enterprises	1565	873
Medium Enterprises	39	71
Small Enterprises	(26)	(112)
Utilities	356	336
	1934	1168

Source: West Midlands Plc. Annual Report 1995, KPMG Corporate Finance p19.

The situation facing West Midlands SMMEs is a problematic one. For this reason research into the changing manufacturing and business environment relating to such organisations is both timely and relevant. The realisation that the environment facing West Midlands manufacturing is indicative of that of Britain in general, and that this region is a European centre of manufacturing makes the undertaking, and publication of relevant research a vital necessity.

The importance of the SME sector in the economy has been reported by the European community [11], who report the influence of SMEs in employment creation, innovation, change, competition and the complementary relationship with large enterprises. Similarly the Institution of Electrical Engineers [12], discuss the innovation and responsiveness of SMMEs but outline the need for facilitation of best management practice in order to improve competitiveness. Sir John Harvey-Jones [13], has summarised the importance of this sector by commenting that, "It is on the vigour, imagination and professionalism of smaller companies that much of our hopes for the future must lie."

1.5 World Class Manufacturing

World class manufacturers are defined as those that "anticipate the potential of new manufacturing practices and technologies, and seek to acquire expertise in them long before their implications are fully apparent" [14]. Similarly world class manufacturing has been defined as "being the best in your field" [15], and having an aim of being "faster, higher, stronger" [16].

The Japanese particularly during the 1980s were perceived as the epitome of World Class manufacturing. Improvements in quality and productivity were the result of adopting Just-In-Time, Total Quality, Total Employee Involvement, World Class Information Systems and World Class Strategy. It is the integration and holistic consideration of these philosophies that will enable organisations and manufacturing systems to become efficient, responsive and effective in the global marketplace. It is the adoption and advancement of these world class philosophies that will enable

British organisations and their suppliers to enhance national and regional economies.

1.6 Just-In-Time (JIT) Systems

The introduction of Just-In-Time systems has reconciled the requirement for reduction of lead time, reduction of set-up time, reduction of production batch sizes, balance of operations, reduction of inventory and efficient material flows that are the goal of world class manufacturers.

A world class manufacturer is one that instils knowledge of customer and stakeholder requirements throughout the organisation. It is the aim of JIT to achieve customer requirements through a fast, flexible and reliable organisation. In pursuit of this objective the primary driver is the time taken to satisfy the customer need. This involves challenging the traditional conventions of batch manufacturing relating to optimised batch sizes. Reduction in the Economic Order Quantity (EOQ) through rationalisation of the set-up process should enable an EOQ of 1 unit to be realised.

Similarly inherent manufacturing problems should be eliminated either through simplification of the process, or re-engineering. Supplier development programmes to improve quality and distribution can reduce resource consumption and limit line stoppages.

Additionally JIT systems are based upon continuous production that is achieved by multi-skilled labour, and cellular manufacturing to ensure that the impact of variations in product specification, and demand can be minimised. The role of technology in this scenario is to advance the pursuit of the JIT philosophy and not to reconcile the inadequacy of manufacturing management.

1.7 World Class Management

In support of the JIT philosophy it is vital that effective management of quality, people, systems and strategy is maintained. The adoption of quality techniques

including failure modes and effects' analysis (FMEA), Taguchi Methods, Statistical Process Control (SPC) and quality systems (ISO 9000) is vital to support world class manufacturing.

The advancement of world class manufacturing is predominantly people based. It is essentially an attitudinal process. Quality can be controlled and influenced by appropriate techniques, but day-to-day it is the prerogative of individuals to resolve quality issues. Similarly the continuous improvement orientation of world class manufacturers is achieved by recognising the individual, and the team. Such a philosophy can be supported by training and appropriate incentive schemes.

Finally a world class strategy must be maintained through analysis of competitive position, and identification of the paths to the future trading orientation of the organisation.

In order to monitor the world class manufacturing environment it is essential to gather information regarding supplier, inventory and lead time performance; productivity and quality improvements; and cost performance.

The adoption of world class manufacturing management philosophies and enabling technologies, has altered the cost profile of such organisations. Reductions in direct labour, and an increase in overhead as a percentage of total cost have necessitated assessment of traditional direct labour, and machine hour based absorption costing systems.

The traditional absorption methods of analysing and reporting overhead costs are in danger of becoming inaccurate and unreliable. Management may be trying to plan and control the activities of the company with information that is incomplete and may even be misleading. In recent years as competitive pressures have become particularly intense, managers have become more active in looking to identify weaknesses in their own organisations, that give away competitive advantage and market leadership to others [17].

It is important to recognise that cost management systems are vital in the achievement of business objectives, and should support new manufacturing technologies and operational philosophies, and provide information for cost control, investment justification, pricing decisions, and performance measurement.

The deficiencies of traditional absorption costing methods in todays manufacturing environment include:

- The use of direct labour hours as an allocation base, for allocating overhead costs, when direct labour accounts for only 10% of product costs, [18].

- The use of volume related apportioning factors, including direct labour and machine hours. Using volume related factors is correct for volume related activities, but is inaccurate for non-volume related activities such as setting up, and inspection. In modern manufacturing the percentage of non-volume related activities is often high. [18].

- The use of cost pools which are too large and contain machines of varying overhead structures. A mixture of automated and conventional machines within a cost pool is inaccurate. Automated machines have higher associated overheads and require less labour. By allocating machine overhead costs on the basis of direct labour, the overhead cost will be excessive for conventional machines and too low for automated machines. This will result in distorted product and process costs, leading to inherently inaccurate management information. [18].

These deficiencies with traditional cost management systems justify the introduction of new and relevant cost management systems, which reflect accurately the needs and objectives of operational systems and strategies within a manufacturing organisation.

Todd [19] has commented that "A world-class company must have information it can depend on; that must include information about the true cost of manufacturing and it must show accurately the effect that any changes in the manufacturing process

introduced as part of the world-class improvement process, will have on true manufacturing cost. Activity Based Costing (ABC) is probably the most effective way of achieving this objective".

Traditional absorption costing systems allocate overheads to cost centres and then absorb these costs to products by utilisation of a single absorption factor commonly direct labour or machine hours. In comparison ABC takes a different approach, by dividing overheads into activity cost pools and allocates these costs to products on the basis of their consumption of resources, through utilisation of multiple allocation factors known as "cost drivers".

In the search for sustainable cost advantage and an holistic approach to process and product costs, ABC provides structured, relevant, and timely financial and non-financial information for operational managers. Such information is vital to the achievement of a lower cumulative cost in the performance of value activities and, the minimisation and elimination of non-value-added activities, with comparison to the organisations competitors.

The theory surrounding the adoption of ABC will be outlined further in this thesis. The contribution of ABC to world class manufacturing organisations has enabled them to establish the true cost of competing in the marketplace. This is realised through identification of value adding, and non-value adding activities, improvements in cost allocation, and assessment of customer, and product profitability. It is changes of this nature that have directly affected the manufacturing and marketplace environment for component suppliers to a growing breed of world class original equipment manufacturers.

1.8 World Class Manufacturing and Small- and Medium-Sized Manufacturing Enterprises

It is the pursuit of World Class Manufacturer status that has affected the relationship between Original Equipment Manufacturer and component supplier. Small- and

Medium- Sized Manufacturing Enterprises by their nature are reliant upon world class manufacturers as their customers at a higher level in the supply chain. It is the SMME that can adopt the world class techniques critical to its customers in the supply chain that should realise competitive advantage. The prevailing competitive environment, and restricted profit margins facilitate the short-term strategies employed by SMMEs, and limit the degree of adoption of world class techniques.

It is the SMME that can look beyond the short-term, and adopt world class philosophies in this prevailing environment that will become an integral part of the rationalised supply chains of the future and should satisfy the order winning criteria of its world class customers. Hill [20] has defined the range of order winning criteria as; price, delivery reliability, delivery speed, product range, quality, design, distribution, customer base and sales support. While delivery criterion are essential for establishing orders with world class manufacturers, it is the price criterion upon which an SMME must currently compete.

Hill [20] has stated that 'when price is an order winner, low (or anticipated low) margins give manufacturing the clear task of reducing costs in order to maintain or improve available margins'. It is the rationalisation of cost within supplier organisations that will ensure a competitive market position for the short-term, and the ability and time to instigate world class philosophies.

Cost rationalisation programmes of this nature are restricted by the cost management systems currently employed, that fail to meet the requirements of the 'new order' in manufacturing. SMMEs, like their large counterparts, utilise absorption costing. Systems of this nature fail to identify the costs associated with competing in the supply chain. It is the focus upon machine hours, and particularly direct labour in absorption costing that orientates cost reduction measures at direct labour employed activities. This is highly inappropriate when material and overhead costs are an increasing percentage of total costs. Cost reduction efforts by SMMEs should be focused towards eliminating waste, product design, quality, process redesign, production control systems and set-up reduction [20].

It is the inadequacy of traditional cost management systems to identify such opportunities that established the focus for this research programme with its interrelated hypothesis, aims and objectives detailed in figure 1.0

Research Hypothesis

Small- and Medium - Sized Enterprises can utilise an Activity Based Cost Management system, similar to those implemented by larger world class organisations.

Research Aim

To assess the use of Activity Based Cost Management in manufacturing, and to produce a methodology that will identify whether Small- and Medium Sized Enterprises can benefit from Activity Based Cost Management, identify systems required, methods for implementation and process improvement techniques.

Research Objectives

To enable Small- and Medium-Sized Enterprises in the manufacturing sector to:

- Identify their requirement for advanced cost management systems.
- Implement an Activity Based Cost Management system with efficiency, effectiveness, and efficacy.

And to facilitate the:

- Identification and implementation of cost reduction measures.
- Identification of areas for competitive advantage, and the introduction of relevant world class manufacturing, and management techniques.

Ability of Small- and Medium-Sized Enterprises to compete in global supply chains to the benefit of the the regional and national economy.

Figure 1.0 Research Hypothesis, Aims, and Objectives

Chapter 2

Research Methodology and Review of the Thesis

Introduction

The origins of the research programme have been outlined in the previous chapter. The resultant research hypothesis, aims and objectives were defined in figure 1.0 on page 12.

In the resolution of the research aim it is necessary to consider the methods that can be applied, and their validity in the research environment. This chapter will outline the methodological choices prevailing for the research programme and will detail the methodology utilised for the duration of the research programme. The remainder of the chapter will outline the application of the research methodology through a review of the thesis. The contribution of each chapter of the thesis, either as a foundation, or contribution to the existent body of knowledge will be outlined and an holistic view of the thesis established.

2.2 Issues in Research Methodology Selection

The theory surrounding methodological choices in research is as varied and controversial as that concerned with the variety of research areas under study. At a macro level the choices surrounding methodological choices in management research include:

- Qualitative Vs Quantitative
- Inductive Vs Deductive
- Exploration Vs Explanation

- Natural Vs Artificial
- Rational Vs Existential

These strategic choices have been proposed by authors including Gill and Johnson [21], Howard and Peters [22], Gummesson [23], Kirk and Miller [24] and Meridith, Raturi, Gyampah, and Kaplan [25]. In general most management research projects are of a qualitative nature and primarily concerned with how (process) to tackle tasks (content) [21], in essence this is research into organisational change. However quantification in support of qualitative research can only support the validity of developed knowledge. Howard and Peters [22] support this argument in their statement that "If purely qualitative research is undertaken at least as much attention should be paid to structuring its presentation as in the case of quantitative research".

Similarly inductive and deductive approaches to research consider the orientation and degree of participation and integration of the researcher in the research programme. Deductive approaches seek to apply management concepts, enabling hypotheses to be tested and data to be established. In comparison inductive approaches are founded upon observation and reflection enabling general conclusions to be established from selected studies, and development of theory by analysis of the real world.

Other issues in the research programme reflect the nature of the research environments. Artificial and natural environments are utilised in differing research contexts, however management research by its very nature is related to day-to-day scenarios and hence the natural orientation of this specific research programme.

This is also reflected in the rational vs. existential focus of research programmes. The extent to which the area under study is either logical and self-evident or conversely experiential and to some extent illogical will influence the research methodology chosen to investigate the phenomena under study. In summary it will be seen at the conclusion of this chapter that the research programme is of an integrative nature enabling the deficiencies of any one research method to be compensated for by the advantages of another.

2.3 Research methodology Selection

The aim of the research programme defined in figure 1.0 can be divided into its composite parts as follows:

- To assess the use of ABCM in manufacturing
- To produce a methodology to identify whether SMEs can benefit from ABCM.
- To identify systems required, methods for implementation and process improvement techniques.

The underlying primary aim of the research programme that would contribute to original knowledge was seen to be the applicability of ABCM to SMEs in the manufacturing sector. Prior to investigation of this aim it was deemed necessary to determine:

1. The extent of adoption of ABCM by companies of all sizes, and market segments.
2. The specific adoption of ABCM by SMEs in the manufacturing sector.
3. The range of strategic application of ABCM by companies of all sizes and market segments.
4. An overview of the benefits, implementation methods and constraints placed upon organisations adopting ABCM principles.

The commencement of the research programme, as with other traditional research projects proceeds with a literature review. In contrast, grounded theory approaches to research undertake a focused literature review proceeding interpretation of research findings. The area of investigation described in this thesis necessitated an initial reading of the published literature to establish the current state of knowledge, and limitations of the technique under study. In summary the objectives of undertaking a literature review are:

- To critically appraise and compare and contrast publicised theories surrounding ABCM.

- To assess the current level of application of the technique under study.
- To establish a sufficient knowledge of theory and reported application for utilisation in subsequent stages of the research programme.

Specifically the literature review would encompass the origins and failings of cost management. In parallel the review would describe the changing orientation of manufacturing industry and the development and utilisation of alternative cost management systems with particular focus on ABCM.

In assessing the adoption of ABCM, and in particular its implementation in manufacturing, and small- and medium-sized enterprises, it was necessary to develop upon the theoretical base established by undertaking a literature review by conducting a survey of British based organisations who had implemented ABCM. This would be supported by a series of semi-structured interviews to establish and generate knowledge surrounding implementation considerations. The benefits of undertaking such an approach were seen to be:

1. The production of quantitative data enabling the ability to compare and contrast the findings of the research programme with established practice.
2. The provision of qualitative data would enable investigation of the 'soft issues' surrounding the implementation of ABCM to be determined.
3. The ability to develop general inferences from particular instances of ABCM implementation.
4. High population validity and reliability enabling the findings to be generalised and replicated.

The limitations of undertaking survey research were considered to be:

1. The highly interpretative nature of survey research enables minimal examination of related cause and effect variables.
2. Similarly the nature of survey research restricts the ability for data to be utilised in actual defined settings due to focus on aggregation and identification of commonalties between survey respondents.

It is due to these inherent weaknesses of survey research that the data gathered during the survey would be utilised within the proceeding action research phase of the project.

An action research philosophy was seen as an ideal opportunity for the personal development of the researcher as well as enabling the researcher to contribute to theory by resolving practical issues in day-to-day settings.

The aim of action research has been defined by Rapoport [26] as: "to contribute both to the practical concerns of people in an immediate problematic situation, and to the goals of social science by joint collaboration within a mutually acceptable ethical framework."

The benefits of undertaking action research include the opportunity to be subjected to actual events as they take place enabling understanding of the organisational change processes to be established. In comparison survey research and interviewing is static, that is it relates to the personal feelings of the respondent or interviewee at a given point in time, normally after the change process has occurred.

Gummerson [23] supports action research, and comments that desk research, survey techniques (questionnaires and interviews), observation and experiments can only be utilised to complement analysis of processes within a company and that individualistic approaches can be misinterpreted, and are too fragmented.

While survey research is predominantly interpretative in nature, and of restricted access, action research is interventionist with virtually unlimited access to the organisation, and change process under study. Access to suitable organisations is a restricting factor in action research projects. In this research programme, access was gained to organisations with prior experience of the supporting academic establishment.

The action research projects were of a National and International orientation. An International project was undertaken over a fourteen week period of which five weeks were on-site, the project being led by the researcher and facilitated by a steering committee and project team established by the company. The National projects were commonly of the nature of researcher involvement on a two or three day/week basis for a period of three to four months. These projects again under the direct leadership of the researcher.

The prior knowledge of the researcher from the literature, and survey review, enabled the concepts under study to be investigated and implemented utilising client data. The collaborative nature of the action research programme led to identification of the "soft issues" pertaining to the concepts under study. The process of change is never complete, and opportunity for further participation within the change projects remain. The action research project is deemed complete when the client is self-supporting and the "problem" situation has been resolved.

The completion of multiple collaborative projects of an action research nature was deemed sufficient to allow the generalisation of research findings to be completed. The holistic structure of the research methodology was such that the conclusions of the action research phase of the programme could be compared with those pertaining to the survey phase.

In summary the strengths and weaknesses of survey research were balanced with those relating to action research enabling a high degree of validity, reliability and repeatability to be obtained. This conclusion is supported by subsequent utilisation of the research findings at a Regional, National and International level by companies in the manufacturing sector, that is reported in this thesis.

In support of these primary research approaches, an investigative study of ABCM software was undertaken to assess the implications of software advances on implementation methods. This was achieved by survey research, practical utilisation and controlled assessment.

In summary the research methodology designed to meet the aims and objectives of the research programme defined in figure 1.0 (page 12) was:

1. A qualitative assessment, investigating through a questionnaire and supplementary interviews, the use of ABCM in British based companies, and their utilisation of ABCM software systems. The resultant information was qualitatively analysed, drawing parallels of best practice, through analysis of cause and effect, to ascertain under what conditions actions produce positive and negative effects
2. A qualitative investigation into the use of integrated financial software systems incorporating ABCM and 'stand alone' systems, through analysis of existing systems.
3. Investigation into the data gathering, software evaluation, and implementation of ABCM (A practical, qualitative, case study approach).
4. Formulation and testing of procedures to evaluate process improvement, cost reduction opportunities, and implementation method; with careful monitoring of cause and effect. (A practical, qualitative, case study approach with various SMEs).
5. Generalisation of procedures and methodology, for application by other companies. Developed from specific local theory (substantive) to a more general theory (generalised, substantive and formal theory).
6. Evaluation of Results.

The orientation of the research methodology changed over the duration of the project from an indirect perception of reality generated by survey research, and semi-structured interviewing to a direct observation of reality achieved through action research. In parallel the research method changed from being rational and empirical to interpretive and increasingly existential.

2.4 Review of the Thesis

It is the aim of this thesis to enable the programme of research work to be evaluated, its significance and validity to be critically examined and the fulfillment of the

research aims and objectives (figure 1.0) to be appraised. The thesis provides detailed analysis, and critical appraisal of the application of Activity Based Cost Management and its utilisation by Small- and Medium-Sized Manufacturing Enterprises.

The thesis can be divided into four main sections that constitute the method of research, the critical appraisal of current theory, the application of theory and development of knowledge, and evaluation and implications of the research programme. While individual chapters of the thesis can be read 'stand alone' it must be recognised that the related research programme was an evolving process, and as such individual chapters form an integral part of a developing argument. Therefore it is necessary to consider the whole thesis when evaluating its contribution to theory.

The holistic nature of the research programme and of the thesis indicates that a summary of the developing argument would provide valuable information for the reader to evaluate the significance of the research, and its validity.

Chapter 1: The Origins of the Project

- Small- and Medium-Sized Manufacturing Enterprises are an important part of the Regional, and National economy, as employers, and innovators. SMMEs form an integral part of supply chains for Original Equipment Manufacturers, and are complementary to large organisations.
- The adoption of world class manufacturing management philosophies by OEMs has assisted their competition in the global marketplace. To enhance their competitiveness OEMs are seeking the adoption of world class philosophies by their component suppliers.
- SMMEs seeking to adopt world class philosophies are restricted by low profit margins. In order to become world class SMMEs should seek to identify valuable cost reduction opportunities. OEMs are utilising Activity Based Cost Management to control their cost effectiveness. It is the aim of this project to investigate the ability of SMMEs to utilise the principles of ABCM.

Chapter 2: Research Methodology

- Evaluation of the prevailing theoretical principles relating to ABCM shall be undertaken by a literature survey, utilisation survey, and software review.
- The application of theoretical principles shall be investigated by adopting an action research philosophy.
- The deficiencies of any given research method, are balanced by the advantages of another.

Chapter 3: The Rationale for the Adoption of Activity Based Cost Management

- The adoption of Activity Based Cost Management overcomes the challenges faced by utilising absorption costing in environments with a high proportion of indirect labour and fixed costs relative to direct labour and variable costs.
- The adoption of Activity Based Cost Management in the United Kingdom has been limited. There are significant opportunities to conduct research into ABCM, and to develop formal theory.

Chapter 4: An Assessment of Current Activity Based Cost Management Practice

- The adoption of ABCM principles and subsequent benefits, can be realised by SMMEs.
- The design of ABCM models is influenced by organisational size, and system objectives. In theory SMMEs can adopt the principles of ABCM.

Chapter 5: Survey of Activity Based Cost Management Software

- The software currently available in the United Kingdom can support a range of users, and project objectives. These can be defined as ABCM or process Management software orientation. Similarly user orientation can be defined as small- and medium, or large sized enterprise, and manufacturing or service sector.

Chapter 6: The Rationale for the Adoption of a generic Activity Based Cost Management Methodology. Part 1: Determining the Business Solution.

- The utilisation of cause and effect related questions to identify the suitability of ABCM to an SMME was proved inadequate.

- In order to recognise and define the problem situation, and the objectives of any future change project with the SMMEs it was necessary to examine the problem situation. This was achieved by utilisation of a methodology developed from the research programme that defines the dimensions of an organisational assessment as, Process, Activities, and Data. It is the methodology relating to this assessment that forms a contribution to original knowledge.
- An assessment of the applicability of ABCM in the SMMEs participating in the research programme enabled the methodology to be successfully tested and critically appraised.

Chapter 7: Issues in Activity Based Cost Management

- The issues relating to the ABCM were defined by the author as problem definition, organisational factors, implementation methodology and processes.
- The issues relate directly to the implementation of an operational solution that is outlined in Chapter 8.
- Methodologies propounded by prominent authors are critically appraised. Their failure to identify the problem definition is reported, and an alternative methodology is presented by the author.

Chapter 8: The Rationale for the Adoption of a generic Activity Based Cost Management Methodology. Part 2: Implementation of the Business Solution

- The methodology outlined at the end of chapter seven is detailed in this chapter.
- The application of the methodology by research study participants is described.
- The results achieved by adopting ABCM by utilising the methodology presented by the author are seen as entirely consistent with those propounded by prominent authors of ABCM implementations in large enterprises.

2.5 Summary

Chapters 1 and 2 of the thesis outline the reasoning behind the research investigation, and the methods of research applied throughout the three year programme. Chapters 3,4 and 5 detail the development of cost management systems, the current application

of activity based cost management, and report the utilisation of software in supporting ABCM initiatives. Chapters 6.7 and 8 detail the application of knowledge by the researcher in the research environment under study. The remaining chapters then critically discuss the findings of the research and establish conclusions.

Chapter 3

The Rationale for the Adoption of Activity Based Cost Management

Introduction

Outlining and critically appraising the evolution of management accounting principles and philosophies requires a resume of the operational environment that initiated development of accounting systems. In discussing change and rationalisation in accounting, appreciation is needed of the process through which the current body of knowledge developed.

This chapter will outline the origins of traditional Cost management systems based on the work of F.W. Taylor and will outline the identification of their failure in the changing environment of the 1960s and 1970s by management writers. The subsequent relevance lost debate resulted in the generation of alternative approaches. These are discussed and critically appraised with particular focus on Activity Based Cost Management systems.

3.2 The Changing Manufacturing Environment

Accounting history can be traced to the industrial revolution with organisations requiring identification of a price for internal operations. The development of management accounting practice identifiable in its present form was completed by 1925. In parallel was the rise of scientific management fathered by F.W.Taylor.

Scientific management techniques were based on job analysis, dividing a process down into the component parts, rationalisation of each part, and the setting of relevant

standards. The techniques proved adequate for the planning and control of operations for the prevailing environmental conditions. The development of standard costing was based on the standards set through the Scientific Management process. The standard cost could be aggregated with the addition of overhead allocation into a finished product cost that could be used for pricing decisions.

Until the 1960s and 1970s reliance on scientific management methods continued unabated. Technological change forced by the development of increased mechanisation, advanced control systems, and increased competitive pressures from National and International markets gave focus to discrepancies in the methods of Scientific Management theory and practice.

The identification that Scientific and related manufacturing management methods lacked relevance in the new age prevailing in the 1960s and 1970s was identified by several management writers including, Drucker, Skinner (as reproduced overleaf) and latterly Johnson and Kaplan. Skinner outlined a set of challenges forced upon American corporations of the 1970's. He identified re-evaluating cost control as an emerging and urgent challenge [28]. In similar vein Drucker commented upon the shift from direct labour oriented processes to automated production and the changing skills base, replacing direct with indirect labour [29].

The need for improved management accounting systems in response to the changing business environment outlined by Skinner and Drucker was identified by Kaplan and Johnson commencing the "relevance lost" debate in the 1980's. Kaplan and Johnson argued that "In this time of technological change, vigorous global and domestic competition, and enormously expanding information processing capabilities, management accounting systems are not providing useful, timely information for the process control, product costing, and performance evaluation activities of managers" [31].

The Changing Manufacturing Environment

Increased mechanisation, shorter runs, and higher quality generally result in a higher proportion of indirect labour and fixed costs relative to direct labour and variable costs. How does a production manager cope with "stickier" less variable costs? How are indirect labour costs evaluated? Not long ago a time-study department could provide the tools and information necessary for appraisal and effective action regarding the productivity of the bulk of the work force. Today this is often not so. More direct labour time is machine controlled. Many jobs are less repetitive. Financial incentives are generally less effective in motivating workers. More technicians, maintenance men, material handlers, and paperwork personnel are required to service a shrinking direct labour group. The old concepts and techniques of job measurement, time standards, and control are becoming progressively more inadequate. **Skinner[28].**

Standards are still based on the eighteenth century tenet that manual labour is, in the last resort, the only productive resource; manual work the only real effort...Increased productivity in a modern economy is never achieved by muscle effort. It is always the result of doing away with muscle effort, of substituting something else for the labourer. One of these substitutes is of course, capital equipment, that is mechanical energy. At least as important, though unnoticed until recently, is the increase in productivity achieved by replacing manual labour, whether skilled or unskilled, by knowledge, resulting in a shift from labourers to knowledge workers, such as managers, technicians and professionals. **Drucker [30].**

The "Relevance Lost" debate began the re-engineering of management accounting systems. Drucker has outlined the seven key elements in post-war management development, as decentralisation, personnel management, managerial development, marketing and long range planning. In addition Drucker recognised the contribution of scientific management to the growth of Operations Management and identified management accounting for information dissemination and analysis as the basis for improved decision making. [32]

3.3 The "Relevance Lost" Debate.

The "relevance lost" debate began in the early 1980's and was directed by R.S Kaplan, supported by R. Cooper and H.T Johnson. It resulted in the seminal book "Relevance Lost - The Rise and Fall of Management Accounting" [36]. Kaplan and Johnson argue that management accounting systems with arbitrary allocations of overhead costs and based upon an organisation manufacturing a few standardised products with a high

direct labour content are inappropriate for the "new" manufacturing environment. Critical success factors including, quality, flexibility, indirect labour efficiency, and effective use of capital, are replacing direct labour efficiency as the goals of modern management [33]. After analysing four managerial accounting systems, Kaplan argued that there were 4 possible explanations for their obsolescence [34].

The Obsolescence Of Accounting Systems

1. The lack of adequate role models. Even firms that recognise inadequacies in their existing management accounting systems do not have alternatives readily available to use in their place . Each firm has to innovate on its own rather than being able to share in the experiences of successfully innovating firms.

2. The prevalence of computer based Accounting Systems. In theory having an accounting system stored in a programmable computer should permit considerable flexibility for implementing changes. In practice, however it seems difficult to modify accounting programs without risking damage to the entire transactions based accounting system that provides the entries for the firms financial and tax statements. Thus, complex and not easily modified computerised accounting systems provide a barrier to innovative and adaptive changes in the firms managerial accounting system.

3. The emphasis on financial accounting even among Managerial accountants. Recall that most of today's cost accounting practices can be traced to the scientific management movement. The innovators of the scientific management movement were engineers, intimately involved in their company's manufacturing operations. In the past 70 years, however, the operation of the firms accounting system has been delegated to professional accountants frequently separated from plant operations. During this time, there has been a great growth in the importance of the financial reporting system for external constituencies. The firms accountants became more concerned with recording transactions and allocating costs in a consistent and objective manner for these external constituencies. They became removed from concerns as to whether the numbers they were objectively
and consistently recorded held any relevance for describing, motivating, and controlling the firms manufacturing performance.

4. The fourth and most important explanation for accounting lag, however is that senior company management have not emphasised the need to improve the relevance and responsiveness of their management accounting systems. **Kaplan [34].**

In rationalising the reasons for accounting lag and providing a framework for

identification of obsolescence Cooper [35] subsequently developed a complementary set of symptoms through which management could identify the need for re-engineering of the managerial accounting system. In concurrently identifying a set of common flaws in cost system design, Cooper sought to ensure that the mistakes of the past could not be repeated in any enhanced costing system.

The Symptoms

1. Products that are very difficult to produce are reported to be very profitable even though they are not premium priced.
2. Profit margins cannot be easily explained.
3. Some products that are not sold by competitors have high reported margins.
4. The results of bids are difficult to explain.
5. The competitions high-volume products are priced at apparently unrealistically low levels.
6. Vendor bids for parts are considerably lower than expected.
7. Customers ignore price increases , even when there is no corresponding increase in cost.

The Design Flaws

1. Only direct labour hours are used to allocate overhead from cost pools to the products.
2. Only volume related allocation bases are used to allocate overhead from cost pools to products.
3. Cost pools are too large and contain machines that have very different overhead cost structures.
4. The cost of marketing and delivering the product varies dramatically by distribution channel, and yet the cost accounting system effectively ignores marketing costs. **Cooper [35]**

Johnson and Kaplan [36] cite adverse consequences of direct labour allocation systems, timeliness, and the triumph of the financial accounting mentality as reasons for accounting system obsolescence and conclude that "Contemporary cost accounting and management control systems, are no longer providing accurate signals about the efficiency and profitability of internally managed transactions."[36]

Supporters of the "Relevance-Lost" argument have proposed several solutions including, Activity Based Costing, Strategic Cost Management, and Value Chain Analysis. With great foresight, intuition and innovation Drucker has analysed the critical success factors for the future of organisations. Realising a reputation in the 1990s as the "Guru's Guru", Druckers work has been conceptualised in the 1980s, and 1990's and remains a practical guide for management. In 1974 Drucker seemingly

paved the way for the introduction of new managerial philosophies well before their development. Drucker argued:

Management, Tasks, Responsibilities, Practices.

Productivity is vitally affected by organisation structure and by the balance among the various activities within the business. If a lack of clear organisation causes managers to waste their time trying to find out what they are supposed to do rather than doing it , the company's scarcest resource is being wasted...These factors are additional to the factors accountants and economists usually consider, namely productivity of labour, capital, and materials. They are however, fully as important.

We must develop yard sticks to measure the impact on productivity of the substitution of capital for labour, and of knowledge for both- and means to distinguish between creative and parasitical overhead, and to assess the impact on productivity of time utilisation, product mix, process mix, organisation structure and the balance of activities. **Drucker [30].**

3.4 Development of Alternative Cost Management Systems

In response to the "relevance Lost" debate their have been several innovative attempts at re-engineering management accounting to satisfy the requirements of the modern manufacturing environment. The popularised attempts include, Activity Based Cost Management, Throughput Accounting, and Japanese Management Accounting. However it is essential that organisational managers define their requirements accurately and ensure that any alternative system they wish to embrace reflects the organisational cost consumption profile. Bear *et al* have commented that "There are attractive reasons put forward for the adoption of each of the methods, but if the selected technique fails to report the fundamental information needed by management, or if it is not reflective of the resource allocation in the organisation then it is likely that anything generated will only be adding to the already excessive amount of management information."[47]

3.4.1 Throughput Accounting.

Throughput accounting (TA) stems from the assumption that the cost of a factory is fixed in the short to medium term. Waldron and Galloway, [37,38,39, and 40]

describe the technique in detail, and they summarise the ethos as follows, "the rate at which a product contributes money decides relative product profitability; the rate at which a product contributes money relative to the rate at which the factory spends it decides absolute profitability". Innes and Mitchell [41] describe its use in a company, however the technique has not been discussed widely, and the benefits could be missed by those organisations seeking alternative costing methods.

TA can be used where overhead allocation is not the main concern, but where price, volume and material costs have the greatest effect on profitability. This however, highlights its main weakness since it does not allocate costs to products with respect to their use, it is not a complete tool like Activity Based Cost Management. Companies will only benefit from this technique if their production function can undertake regular and detailed analyses of capacity, performance and schedule adherence. TA concentrates on the flow of products and the amount of profit they bring, related to the time they actually take to manufacture.

The theory behind TA stems from the belief that the cost of a factory is fixed in the short- to medium-term, excluding material. The technique focuses upon the bottleneck operation, because the capacity of a plant is equal to the capacity of its bottleneck. The objectives of utilising TA are to optimise the mix of products and manufacturing processes and to provide performance measures related to manufacturing process performance. The contribution approach in accounting is seen as outdated, and with TA this is replaced by "return per factory hour", however the bottleneck is the most important resource and this must be evaluated, [37].

Return per factory hour is therefore :

$$\frac{\text{Sales Price - Material Cost}}{\text{Time on Key Resource (Bottleneck)}}$$

The measure of throughput by which an organisation can analyse the most profitable products to make is a ratio of return per factory hour, over the cost per factory hour.

Cost Per Factory Hour being:

$$\frac{\text{Total Factory Cost}}{\text{Total Time Available on Key Resource}}$$

The throughput accounting ratio is :

$$\frac{\text{Return per Factory Hour}}{\text{Cost per Factory Hour}}$$

TA is often used for the benefit of marketing and production to ascertain the volume of products required by the market and their relative profitability, particularly when total factory capacity is consumed by market demand.

3.4.2 Japanese Management Accounting.

In Japan the emphasis is on cost control rather than cost reporting, and this is not just the responsibility of accountants, the rest of the organisation (designers, engineers, sales personnel, etc.) are expected to make a contribution. Accounting systems are used to motivate employees, by providing discrete component information, improvement teams can focus on cost reduction ideas and benefits. Hiromoto [42], Morgan & Weerakoon [43], Hariman [44], Munday [45] and Kharbanda and Stallworthy [46] describe the Japanese ethos in which there are no detailed techniques for the allocation of overhead. The cost of a product is being continually pushed down so benefits are achieved without detailed analysis of resource consumption

3.4.3 Strategic Cost Management (SCM)

SCM is concerned with identification of the performance of a given set of decisions transferred into operational procedure, and what should happen in the future to further improve performance. This requires a portfolio of information to analyse what has happened, what maybe about to happen, and what the possible subsequent effects are from undertaking a certain course of action.

Rather than a codified technique SCM moves from accounting to financial management providing emphasis on control (Proactive, Involved and Customised), Forward Looking (Judgmental, Potential, Intangible), Outward Looking (Subjective, Values, Adequate Return), and Dynamic (Continuous, Long Term, Cash Flow).[72]. To operate such a system requires awareness, anticipation and adaptation, with the subsequent information requirement including, monitoring, forecasting and decision support.

3.4.4 Value Chain Analysis

Value chain analysis was outlined by Porter in his seminal book Competitive Advantage - Creating and Sustaining Superior Performance [17]. Porter has described the link between the value chain and cost analysis and sees underlying benefits in the identification of the cost of primary value adding activities and the comparison of the associated costs with those of competitors.

The value Chain and Cost Analysis

The behaviour of a firms costs and its relative cost position stem from the value activities the firm performs in competing in an industry. A meaningful cost analysis, therefore, examines costs within these activities and not the costs of the firm as a whole. Each value activity has its own cost structure and the behaviour of its cost may be affected by linkages and interrelationships with other activities both within and outside the firm. Cost advantage results if the firm achieves a lower cumulative cost of performing value activities than its competitors. **Porter [17]**

3.5 Development of Activity Based Cost Management.

The rise of ABCM has been outlined by many authors [48], [49], [50] and is considered as being developed in the 1960s and 1970s in several American organisations. The use of the term Activity Costing has also been recorded as being identified as early as 1925. The current interest and conceptualisation of ABCM was initiated in the middle to late 1980s with a series of Harvard Business School costing case studies authored by Cooper & Kaplan using action based research as a basis for

developing techniques to overcome the flaws in costing systems they had earlier identified.

Cooper outlined four alternative costing system structures [51]. Two approaches based on single stage cost allocation. One approach combining direct labour and supervision cost and allocation to products on the basis of direct labour hours. The second approach isolating the direct labour and supervision costs and allocating them on the basis of direct labour and supervision hours respectively to products.

Both approaches fail to allocate costs accurately. Cooper concluded that the first approach "..assumes that the quantity of every resource consumed by all products is directly proportional to the number of direct labour hours consumed". The second approach "..assumes that the cost per unit of any resource does not vary, depending on where in the production process the resource is consumed".

The two other approaches relied on two stage cost allocation. The first procedure recorded the direct labour and supervision cost related with each machine individually and divided them by the appropriate hours consumed to give overhead recovery rates. Product costing is achieved by multiplying the hours consumed by each product by the appropriate recovery rate. This first process is severely inhibiting because all costs are directly traced and this requires substantial data measurement, and cost allocation transactions.

The second procedure can be seen as a forerunner of ABCM. The direct labour cost for each machine and supervision costs are combined and divided by the respective direct labour and supervision hours to give two recovery rates. The products are then charged an appropriate rate based on the overhead recovery rate and the amount of respective hours consumed by each product. Cooper concluded that the approach "..frequently reports adequately accurate product costs - It assumes that for each cost pool the ratio of the quantity of resource consumed to the number of cost driver units consumed for any resource doesn't depend on the product being produced". This procedure is the basis of ABCM, with the addition of extra cost elements, cost pools

and cost drivers.

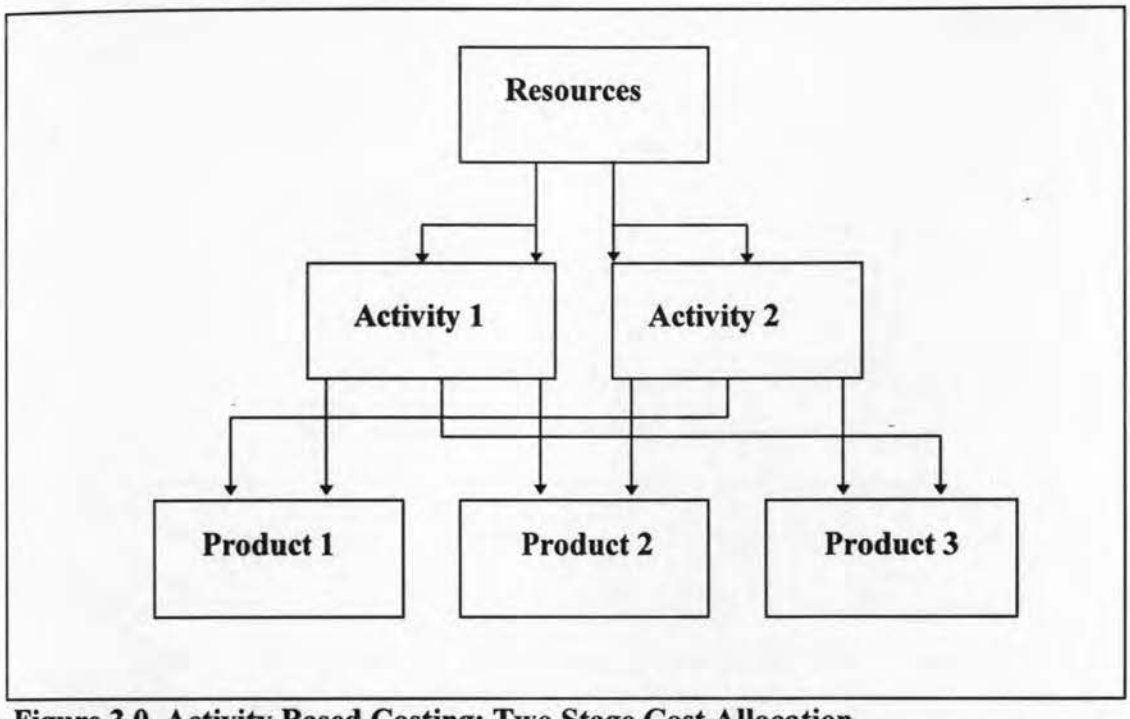


Figure 3.0. Activity Based Costing: Two Stage Cost Allocation

Figure 3.0 shows the allocation of costs using the ABC method. The resources are those accounts based on the general ledger. Resource costs are allocated to activities using resource drivers. Activity costs are then allocated to cost objects, using a cost driver. A cost object can be a product, customer or supplier. A cost driver is an allocation base not related to volume [51].

Cooper [52] outlined how many cost drivers are needed and how they should be selected for use in Activity Based systems. Determining the number of cost drivers is achieved through an assessment of product diversity, the relative costs of activities, volume diversity, and combined with a mixture of judgement and analysis. Selecting the appropriate drivers is a result of a number of factors including obtaining appropriate data, degree of correlation with activity consumption, and the implication of the resultant cost driver information for management.

Johnson [53] argued the case for Activity Based Information as an alternative to traditional transaction based financial accounts. Johnson commented that "Activity

Based Cost Information provides a clear view of how the mix of a company's diverse products, services and activities contribute in the long run to the bottom line. Combined together, non-financial information to control operating activities and Activity Based Cost Information can provide the management information that businesses need in today's competitive environment. Activity Based Management Accounting information is the key to the continuous improvement of profitability, a journey without end".

Cooper and Kaplan [54], outlined a hierarchy of organisational expenses encompassing, unit, batch, product, and facility level activities. This sought to overcome the misinformation which can be given when allocating expenses. Utilising unit level drivers where batch level drivers would be more appropriate can redirect control to an incorrect level. Cost driver selection and activity identification is essential in ensuring an ABCM system reflects the situation currently employed in the organisation.

Research undertaken by the CAM-I Cost Management System project paralleled that of Cooper and Kaplan, however CAM-I established ABC as one element of the cost management system. Turney [55] and Raffish [81] through CAM-I developed the ABC cross which links the cost assignment view and process view of ABCM. Central to both are activities. In the traditional cost assignment view of ABC as codified by Cooper [51], resources are allocated to activities and activities to cost objects. Cost objects can include products, customers, services and suppliers. The cost object creates a demand for resources. Cost however is incurred in the opposite direction. Activity based Costing from this approach can be used to provide information on the resources required by activities, the type of resources required and opportunities for cost reduction measures through the elimination of non-value added resources and activities. The allocation of cost from the activities to cost objects is achieved through the use of a cost driver. The cost driver is the factor which determines the use of resources associated with a particular activity. The consumption of resources throughout the organisation across all activities is the determinant for the cost position of the organisation with respect to its competitors.

Another element of this analysis is the identification of product costs that are defined through analysing the cost of activities and their consumption by the appropriate cost object. This is used to overcome the deficiencies of traditional cost management systems that allocate costs based on either direct labour- or machine-hours.

The second element of ABCM is activity based management which is a process view and forms the basis of an integrated performance measurement system. This utilises information about the work done in an activity, obtained through the use of cost drivers, its relationship to other activities and the operational results achieved by a particular activity through the use of performance measures.

The use of ABM as a performance measurement tool creates operational information that leads to an analysis of why activities are performed, factors that affect the performance of activities, and highlights activity performance through quality and efficiency measures.

ABCM provides two types of activity based information, financial and non-financial [53]. Financial information is used to assess the long-term profitability of an organisations current mix of products and activities. Non-financial information detailing measures such as lead time, quality, service and flexibility is vital operational data for an organisation hoping to compete in world class markets.

Coopers two-stage allocation procedure has been labelled first generation. Subsequent developments have led to four generations of discrete ABC systems [71]. Movement away from Product Costing to Process costing along with the addition of performance measures was championed by Turney [55]. The publicised technique was still visibly "ABC". Third and fourth generation systems are those which merit perhaps the most criticism, moving towards Business units with focus on value chain costing and strategic analysis, well away from the traditional overhead allocation.

The development of these discrete systems has resulted in several negative effects, including, ABC viewed as a panacea, and increasing doubts about its suitability,

which can be seen in the rather limited take-up of such systems. Supporters of first generation ABC have led the call for the activity based revolution to be slowed down if not stopped altogether [50].

3.6 ABCM Critics

No system is intrinsically relevant to any problem, the choice is always subjective. While the need and the system to meet that need was realised by a selection of companies, acceptance of ABCM has been limited. In the late 1980s CIMA [56] concluded that the case for ABCM had yet to be proved and that traditional approaches correctly applied result in accurate cost management. Similarly other critics have outlined arguments against the use of ABCM. In particular Piper and Walley [57,58] criticised the rationale for assuming that activities cause cost and argue that decisions or time are factors influencing cost consumption.

Johnson who had hereto supported and indeed developed Activity Based techniques revised his thinking. While continuing his support of the argument that "Activity-based cost driver information overcomes distortions inherent in traditional cost accounting information", Johnson emphasised that "Activity-Based information does not help companies achieve continuous improvement of globally competitive operations" and added that satisfying customer wants, is the key to business success [50].

3.7 ABCM: COMMON MISCONCEPTIONS

ABCM is a technique that has integrated cost and process performance measures to become an important management information system (MIS). However there are several common misconceptions that are seen by many individuals, departments and organisations as inhibiting factors to the introduction of ABCM.. These include the false perceptions that:

- ABCM is and accountants/accounting system

- ABCM is a complex system and is no different from traditional cost management systems.
- The philosophy behind ABCM, is the same as Total Quality Management (TQM).

In evaluating the perception that ABCM is an accounting system it must be recognised that the technique provides a cross-functional view of an organisation. The information it provides is therefore of interest to all process owners and cost centre managers. ABCM should be classified as a Management Information System. Cost is only in the title of the technique to inform people that it deals with cost information including the identification of product, process and customer costs.

Many organisations have developed ABCM through their financial accounting function, or have dependence upon financial personnel as part of the project team. It is vital that the independence of the system is retained so as to avoid conflict with traditional financial reporting systems, and ensures that it is seen as a complete management tool for utilisation by manufacturing, marketing, sales and other management personnel, without prejudice to traditional financial measures.

In practice the introduction of ABCM has increasingly been undertaken by independent personnel, such as business process managers, or business development managers. This provides ample opportunity for the needs of the whole organisation to be met as these people undertake a cross-functional view of the organisation and its needs.

In examining the perceived complexity of ABCM it must be considered that it is a new technique that requires considerable effort in the implementation phase. Once operational the system is simple to keep updated and relevant for management decision making.

The implementation of the technique is often partnered with an organisational restructuring to a process management viewpoint. This is a method for infrastructure revitalisation as well as minimising the problems that can be inherent in ABCM

implementations; including activity and cost driver identification, and assessment of consumption of resources by cost objects.

The identification and analysis phase of an ABCM implementation is often underestimated in terms of its importance. Inadequate utilisation or misuses of techniques such as interviewing, questionnaires and process mapping are a common cause of system inadequacy or implementation delay.

Training of ABCM implementation staff in software system requirements, reporting procedures and the general methodology will enhance the performance of the system, and maximise the resultant benefits. Training is vital for organisations with no prior knowledge of process management or ABCM. The utilisation of widely available articles, books and videos on ABCM is as important as the common use of consultants and original software suppliers in the implementation phase.

Due to the allocation of general ledger costs through activities to cost objects ABCM is seen by some individuals as just another form of absorption costing. The technique however goes beyond an absorption system. It provides vital data for operational improvement and process monitoring. It assesses opportunities for elimination of waste through the identification and quantification of non-value added activities and highlights vital customer profile cost information for utilisation by marketing personnel.

ABCM is a management information system for use by manufacturing, marketing, and finance for integrated business management, and is not just another form of absorption costing.

Due to the process viewpoint of ABCM it is more appropriate to utilise this data for the elimination of waste. Traditional cost management systems focus on labour, therefore in periods of economic down turn labour is seen as the most viable source of cost to eliminate. In fact labour in general accounts for only 10% of a manufacturing organisations cost. Therefore cutting labour by 10% accounts for overall cost

reduction in the region of 1%. This can be contrasted with the long-term benefits which can be achieved through ABCM, with all gains being achieved through the elimination of non-value added activities and not through labour saving, which often impairs flexibility. Ideally ABCM should be implemented in periods of economic upturn as it can considerably improve competitive advantage.

In examining the role and outcomes of an ABCM project it has been perceived that ABCM in attempting to eradicate non-value added activity is a non-viable alternative to TQM. Whilst both approaches strive for elimination of waste they do so in varying ways, and it can be noted that ABCM supports the same principles as TQM. In fact the information gleaned from an ABCM analysis is vital for prioritising TQM improvements, with cost and process justification, leading to customer satisfaction and organisational profitability.

ABCM primarily uses cost data for the identification of areas for improvement, and any such improvement is monitored through the cost driver "performance measurement" system. ABCM is therefore a system for identification and elimination of operational waste in both the service and manufacturing sectors. It will however bring into utilisation the plethora of TQM tools available, and provide a vital cost analysis to process improvement that should ensure that continued customer service and long-term profitability are maintained.

ABCM has been criticised for utilising historical data for its analysis, however the tools of TQM also base their improvements on the basis of historical data. Both systems are inherent in their belief that those who fail to learn from history are doomed to repeat it; and that cause and effect cycles will repeat unless action is taken to alleviate the causes. This historical analysis when used in conjunction with budget figures provides a vital management planning, control and improvement system.

Business Process Re-Engineering (BPRE) is a similar technique that focuses on the same business process viewpoint as ABCM. BPRE has been defined as "the fundamental rethinking and radical redesign of business processes to achieve dramatic

improvements in critical, contemporary measures of performance such as cost, quality, service and speed" [59]. BPRE involves a radical step change, the concept is that "Kaizen" or continuous improvement only can deal with small step change, whereas to obtain ultimate process improvement the "core" of the process needs to be redesigned. ABCM is useful in the quantification of process performance, and identification of areas for both Kaizen and BPRE to be utilised. Once change has taken place ABCM can quantify the improvement.

3.8 ABCM Utilisation

Throughout the early 1990s the adoption of Advanced Cost Management methods had been slow [60]. The number of users of ABCM systems has been enhanced through the publication of case studies, surveys of current practice, and a plethora of training courses. Development of ABCM has primarily been through, consultancy, software houses and research. With journals requiring a regular dose of ABCM it is not surprising it has been considered a panacea. Such a label creates a level of expectation which given the current body of knowledge is misleading. Macintosh [60] concluded " *(ABCM)*..has a long way to go before it proves to be more than a fad"

Companies in the manufacturing sector utilising ABCM include Evans Medical [63,70], Hewlett Packard [63, 110] Cummins Engines, IBM, Jaguar Cars, Lucas Applied Technology, Nissan Yamato, and Rank Xerox [63].

Reasons for implementation of ABCM are primarily the requirement for improvement product costing and management information for decision making. In the service sector ABCM users include, British Telecom [68], Mercury Communications [69], and Kingston Communication [63]. While ABCM was developed for the manufacturing sector, its use has increased substantially in service sector organisations. This is particularly true of the telecommunications sector where British Telecom and Mercury have implemented ABCM. The solution to the challenge facing BT was to identify the most appropriate determinant of cost causation, this being a variety of non-financial data taken from all parts of the organisation [68]. The

implementation of ABCM at mercury was seen as a catalyst to gain understanding of cost behaviour, identify the contribution of its products, services, customers and market segments, and to further continuous improvement opportunities. [69]

Major surveys on ABCM usage have been undertaken by Bailey [63], Nicholls [64], and Innes & Mitchell [62,65]. Primarily based in large organisations the surveys have focused on the number of companies implementing ABCM, the reasons for adoption, and the subsequent costs of implementation.

Bailey [63], in a survey of just ten companies in 1991 concluded that "The findings of the investigation are positive and live up to the expectations created by ABC pundits. There is a lot evidence that benefits are both obtainable and substantial."

Innes & Mitchell [65], surveyed the Times Top 1000 companies following up their previous survey [62]. Based on the data presented they concluded that large firms, and those in manufacturing, typically had a higher rate of ABC usage. In independently analysing their data it could be concluded that although a higher degree of respondents were manufacturing based *(approximately 70%),* the percentage of ABC users in each sector is approximately equal. *(Approximately 19% of Non-Manufacturing Companies, and 20% of manufacturing companies responding to the survey use ABC).* Likewise their conclusion that larger firms are adopting ABCM techniques at a faster rate than other organisations, is misleading if *"small"* is defined as a turnover under *"£126M".*

They discussed the take up of ABCM, and stated that "One significant attraction of ABC is the variety of management accounting applications which it offers to companies."

Innes and Mitchell concluded their survey with an indication of the research opportunities available within the ABCM framework. These included:

- A broader sectoral study and improved dissemination of more specialist

applications to practitioners.

- The opportunity to study the processes in which management accounting change and development occur.
- A unique opportunity to study in a variety of settings the nature of the process by which change occurs throughout all of the core areas of the management accounting discipline.

This has been elucidated by several authors including Jeffries and Hankes [66]. Reporting on a round up of academic conferences they outlined the comments of Professor Charles Horngren, (Co- author of Cost Accounting: A managerial Emphasis) [80] who believed ABC or more correctly ABM together with Total Quality Management and Continuous Improvement, would be around for some time, although both techniques would evolve further, hereby supporting the conclusions of Glad [67] who predicts the further development of the formal theory relating to ABCM as the number of formal implementation cases increases.

These opportunities have been realised in the research programme pertaining to this thesis that has sought to outline the operational issues of organisations utilising ABCM systems. Through investigating the change process for organisations introducing improved cost management systems a methodology for introducing an ABCM system for organisations in the Small- and Medium-Sized Sector of the economy operating primarily in the manufacturing sector has been established.

Chapter 4

An Assessment of Current Activity Based Cost Management Practice

Introduction

In order to evaluate the success of current theory an assessment of the effectiveness of ABCM implementations is required. This chapter will outline why a questionnaire survey was undertaken. The focus of the study will be critically appraised and comparisons made to published work. The findings will be outlined and the subsequent implications for ABCM theory will be discussed.

4.2 Review of Related ABCM Survey Research

Surveys on the adoption of ABCM systems have been undertaken by Bailey [63], Nicholls [64], and Innes and Mitchell [62,65].

Bailey [63] in early 1991 undertook the first assessment of ABC implementations in the UK. Encompassing 10 companies, through direct interviewing, Bailey revealed data regarding timescales, cost, benefits, and problems in implementing ABC systems. Bailey concluded that "benefits are both attainable and substantial. According to the experiences of the companies investigated, obstacles to implementation would seem to be minimal, which should reassure those contemplating the use of ABC."

Innes and Mitchell [62,65] in their 1991 and 1994 surveys focused upon determining the degree to which ABC had been considered, rejected and implemented in UK organisations. They also sought to outline the reasons why organisations had implemented ABC and the problems with its implementation.

In the 1991 study the response profile included 11 out of 187 respondents who had implemented ABC. The overall response rate for the survey being 26%. The conclusions of the survey were that "ABC is clearly at an early stage in its development in the UK. Practical experience is still the exception and although short-run feedback from those using it is predominantly favourable, a long-run assessment will have to wait for a few years....a strong need is apparent for a continuing research effort and the dissemination of information, particularly about practical experiences with ABC." [62]

The 1994 Innes and Mitchell survey based on 251 usable responses(Rate of return 25.1%) identified 49 organisations utilising ABC, 68 currently considering its adoption. Those companies not considering ABC or rejecting it completely cited the availability of resources, the lack of identifiable benefits, and lack of appropriateness for the organisation as reasons for not developing ABC systems. Innes and Mitchell concluded That " The survey confirms ABC as a major practical development in UK management accounting" [65].

In between the 1991 and 1994 surveys of Innes and Mitchell, Nicholls [39] undertook a survey achieving a response from 62 organisations of which 10% had implemented ABC and in which 62% were assessing its suitability. Such a level of ABC assessment was due to the respondent profile. All the respondents had attended an ABC seminar, and this subsequently provided the correspondence mailing list for the survey. The survey report outlined reasons for the consideration of ABC, the benefits sought or achieved, and practical problems with its implementation.

4.3 Questionnaire Survey Design

In considering the utilisation of an ABC survey as an integral part of the research methodology there were several factors requiring consideration:

1. The ability of the survey to bridge the link between the theory outlined in the literature review and the future application of ABC techniques by the researcher in

collaborating establishments.

2. The design of the survey had to be such as to allow differentiation with previously outlined studies. A degree of originality in both the survey method and its findings was essential.

In assessing these requirements it was decided firstly that the potential respondents would be drawn from organisations utilising "off-the-shelf" ABC software packages. The mailing list for the questionnaire was established through collaborative links with ABC software suppliers in the UK. The mailing list would remain confidential and only those organisations who responded to the questionnaire would be known by the researcher. Subsequent analysis of non-respondents was therefore not an available option.

The survey would not encompass respondents who had not adopted ABC principles. This analysis was deemed to have been adequately assessed by Innes and Mitchell [62,65]. It was decided that the questionnaire would seek to validate the findings of similiar research in terms of the benefits sought and achieved through implementing ABC, and identification of the problems faced during implementation.

ABC Questionnaire Survey

In summary the objectives of the questionnaire survey were as follows:

- To identify the profile of companies implementing ABC.
- To ascertain the degree to which ABC software currently available in the UK meets user requirements.
- To identify the benefits sought and realised from implementing ABC.
- To identify the extent to which operational personnel as distinct from accountants are involved in ABC implementations.

In seeking differentiation from other studies the focus of the survey was seen to encompass ABC implementation, the project team, ABC software analysis, the ABC system and miscellaneous details regarding ABC implementation.

4.4 The ABC Questionnaire Design Outlined.

The information outlined can be referenced against the questionnaire which can be found in appendix A1.

Company Profile

This section outlines the correspondent profile. As well as details regarding the name and address, details on company profile were sought. The size and turnover was related to the research investigation in general which sought to identify the applicability of ABC to Small- and Medium-Sized Enterprises. Similarly identification of the market sectors within which respondents were competing was required to compare the adoption of ABC within various environments.

Activity Based Costing Implementation

In assessing the implementation of ABC, a comparison with previous surveys was essential. Details of the investigation encompassed the benefits sought and achieved from implementing ABC, problems encountered, as well as the methodology utilised by the company. These proposed benefits and problems were drawn from available literature on ABC. Other implementation benefits would be specifically outlined by the questionnaire respondents.

The Project Team

Analysing the project team profile sought to determine the extent to which consultants were involved in the implementation of ABC systems, and in general the details of the personnel involved, and their respective company function. This sought to identify the degree to which non-financial personnel were being involved in ABC.

Miscellaneous Implementation

Outlining the timesales inherent in implementing ABC was considered vital to ensuring the correct resources were available, and the success of the implementation was enhanced. Identifying the reasons for implementation delay was essential, as these factors could be minimised in future implementations. Similarly identification of the

costs incurred would enable organisations considering adoption of ABC principles to effectively budget their implementation.

In concluding the implementation investigation an indication of the degree of success was required. This was achieved by using a Likert type scale on which satisfaction with implementation could be identified.

Activity Based Costing Software

An analysis of the degree to which software was satisfying ABC user demands was considered a unique element of the questionnaire survey. This would also correspond with an assessment of ABC software available in the UK by the researcher.

This section sought to identify reasons for purchase, and differentiation between other packages considered. The identification of benefits and disadvantages of ABC software were seen as compatible with the software review.

The degree of overall satisfaction with ABC software was achieved by using a Likert type scale, and while being subjective, it was envisaged that this could be compared to the satisfaction of ABC implementation previously discussed.

Activity Based Costing System

A vital aspect of ABC system design is the relationship between cost(or activity) drivers and the number of activities. While theory indicates the distinct relationship between accuracy and cost, the practical utilisation and the interdependent relationship has not been investigated. To understand the relationship and its implications the respondents were requested to identify the number of activities and cost drivers utilised in their ABC system on similar scales.

The concluding section of the questionnaire sought to outline quantifiable benefits realised from implementing ABC. To this end questions regarding process improvement and cost reduction targets, and changes to the system as well as implications on running costs and cost reduction measures were seen as vital

justification of the substantial benefits implementing ABC can give.

4.5 Activity Based Cost Management Survey Findings

The survey covered 40 British and European organisations with turnovers ranging from several £m to £1,000m. The survey was undertaken during the final quarter of 1993 and the first half of 1994. Detailed interviews were undertaken with a selection of respondents to gather more detailed information on their ABCM system and its implementation.

The respondents to the survey are classified in relation to the number of personnel employed and the annual turnover of the organisation. The majority of respondents 72.5% can be classified as large, the remainder falling into the category of Small- and Medium Sized. Sectorially 55% of respondents compete in the manufacturing sector, the remainder are based in the service and financial sectors. From the respondent profile outlined in Table 4.0 there is clarification that ABCM is being utilised by a wide range of organisations, including those that service international markets through to those that service local demand. The clarification that such a selection of companies is utilising ABCM concepts makes this survey research timely and relevant.

The 40 organisations responding to this questionnaire had all implemented ABCM. This can be compared to the 1991 and 1994 Chartered Institute of Management Accounting (CIMA) surveys of Innes and Mitchell that elicited 11 and 49 organisations respectively who had implemented ABCM. The limited information revealed by the CIMA surveys on the application of ABCM make this detailed survey an important database of ABCM information.

Implementation Benefits

The most popular benefit realised from implementing ABC is product costing. This coincides with the original development of ABC, outlined by Cooper [51] to overcome the cost distortions present in product costing. Innes & Mitchell [62] outlined accurate product line costing and customer profitability as benefits from

Table 4.0 Activity Based Cost Management Survey. Summary of Questionnaire Respondents

	SMEs	Large Enterprises	Summary By Sector
Service Sector	**2 Organisations**	**6 organisations**	Computing Services Consultancy Leasing Agents Research Logistics Management
Manufacturing Sector	**8 organisations**	**14 Organisations**	Electrical Electronic Presswork Textiles Pharmaceutical Fast Moving Consumer Goods Automotive Vehicles
Financial Sector	**1 organisation**	**9 Organisations**	Banking Insurance Loans Asset Management
Summary By Size	Turnover not exceeding £16 million & No. of Employees not exceeding 250	Turnover exceeding £16 million & No. of Employees exceeding 250	**Overall Summary** **40 Organisations** **All Sectors of the Economy**

implementation. Similarly Bailey [63] and Nicholls [64] identified 100% and 65% or respondents respectively seeking improved product costing. This has been validated through this survey with 65% of respondents indicating likewise.

Customer profitability outlined by Turney [55] in second generation ABC systems is seen by 50% of respondents as a benefit sought from implementing ABC. This compares well with the survey by Nicholls, 47% of respondents indicating a similar requirement for identification of customer profitability. The proposition that "market conditions are often more important than standard costs in establishing selling prices, and that an accurate allocation of all costs is not essential for most companies" is seen as misguided. While this may be true some of the time, it is not correct to assume it is true all of the time. If companies only used market conditions in price setting then they could finish up not making a profit if everything was sold "below cost". Those companies who do base costs on market conditions do still need to identify their most profitable company portfolio in terms of products, customers, and distribution channels. This conjoint analysis approach can be achieved through utilising ABC.

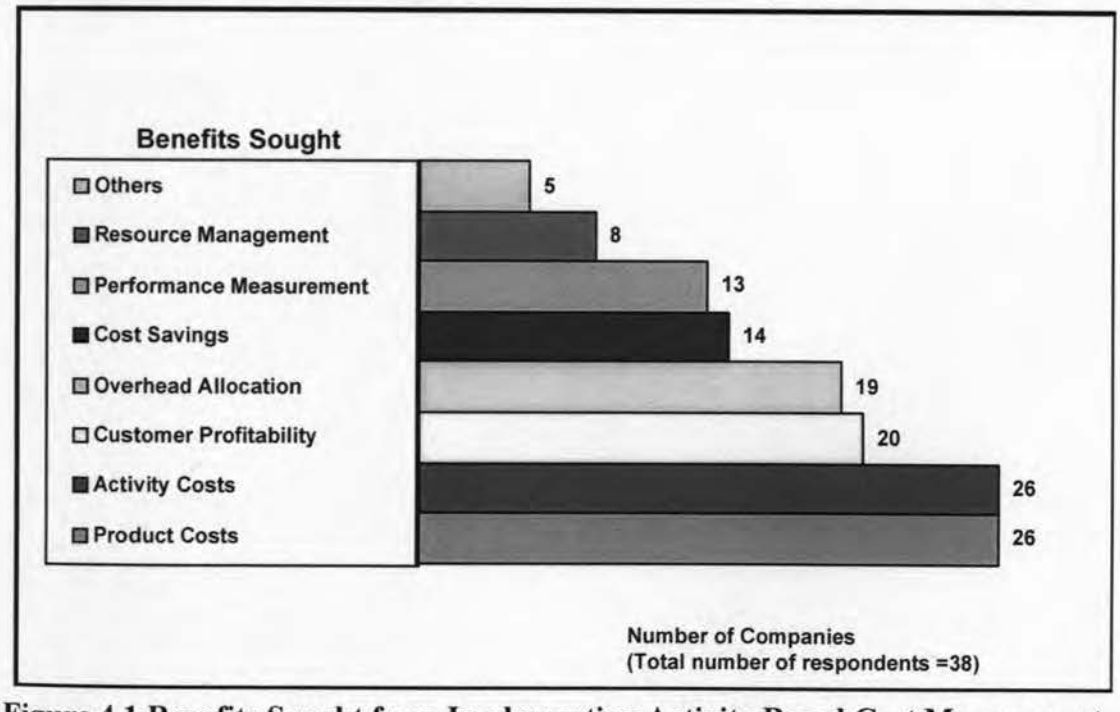


Figure 4.1 Benefits Sought from Implementing Activity Based Cost Management

A major area requiring further investigation is the ability of ABC to deliver cost savings or overhead reduction. This benefit has been indicated as a requirement by

60% [63], and 60% [64] of respondents. Compared to 47.5 % of respondents for this survey. The extent to which cost savings are being achieved is vital in convincing organisations to adopt ABC philosophies. Interestingly, 15% of respondents in the SME category indicated cost savings as a benefit sought, in comparison 9% of large enterprises indicated likewise. Further examination of this benefit is restricted due to implementing companies justifiably identifying such data as being of a private and confidential nature.

Other benefits identified as capable of being realised through implementing ABC validate those outlined by ABC proponents and include performance measurement (32%) and resource management (20%).

The benefits sought from implementing ABC are identified in figure 4.1, and similarly the benefits achieved which indicate that ABC is meeting its implementation objectives can be found in table 4.2.

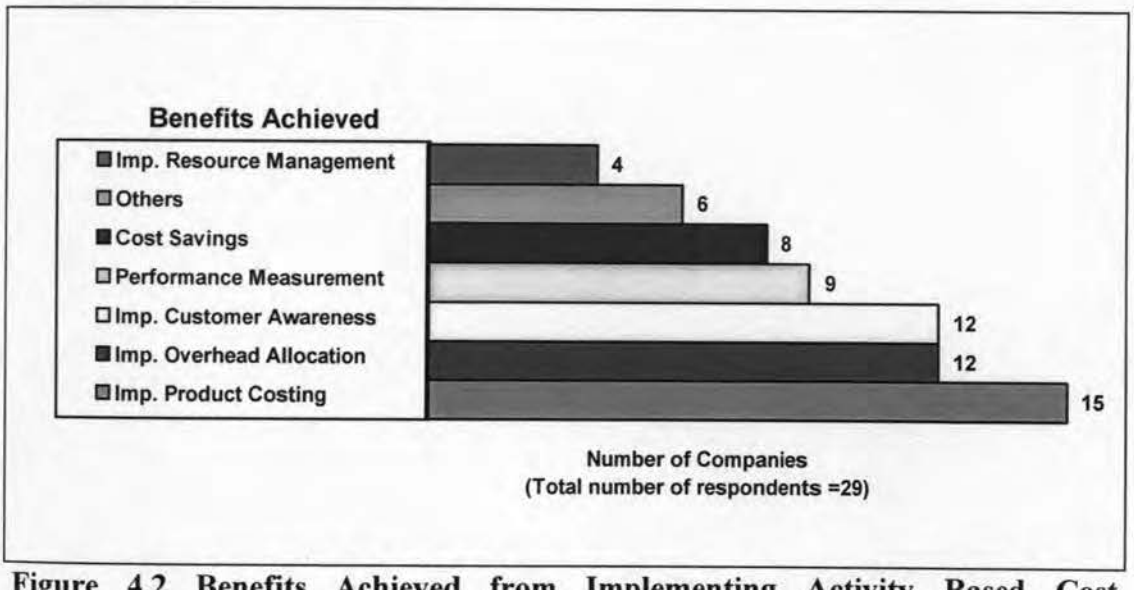


Figure 4.2 Benefits Achieved from Implementing Activity Based Cost Management.

Detailed analysis of actual implementation benefits revealed no major difference in the benefits realised between the large enterprise and SME sector. However, a higher proportion of large enterprise respondents seeking cost savings, realised this objective, compared to similar organisations in the SME sector. Investigation into this anomaly revealed that publicised cost savings are a longer term benefit from ABCM

implementation, and the result of significant change management programmes. Those organisations yet to realise cost savings had only recently implemented ABC, or were ignoring the cost implications presented in the new ABC data.

Implementation Problems

In achieving the benefits required in implementing ABC, organisations have had to overcome several challenges. Data collection is considerably the most common challenge faced. It must be remembered that ABC takes a unique view of an organisations financial performance. This perspective places new demands and learning experiences upon the implementation team. Analysis of the survey data revealed that large organisations were more likely to face data collection problems than their SME counterparts, with 45% compared to 29% of organisations facing this challenge.This is due in part to the size and complexity of the organisational system.

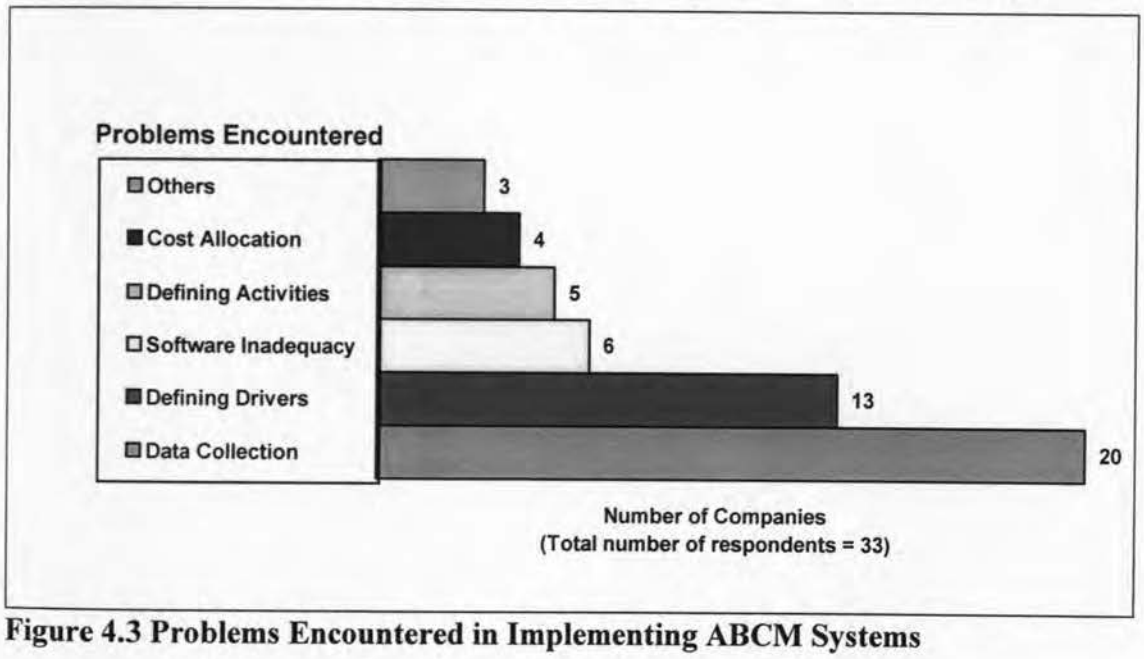


Figure 4.3 Problems Encountered in Implementing ABCM Systems

Previous studies by Nicholls [64], and Bailey [63] identified cost allocation was as a challenge faced during implementation by 38%, and 40% of respondents respectively. In comparison 50% of respondents to this survey indicated cost allocation as a major challenge. Similarly defining drivers was identified by 32.5% of respondents. Other challenges faced include defining activities, software inadequacy, and cost allocation, and these are identified in figure 4.2. 57.5% of respondents indicated that implementation delay did not occur.

The problems of data collection and cost allocation are interlinked. The wrong approach to the gathering of base data and analysis of cost allocations can be substantially distorted by the approach undertaken. The inhibiting factors result from adopting a new approach to management accounting, a comforting factor is that they do not re-appear after the implementation phase of the project.

The Project Team

The personnel involved in the implementation of ABC systems has predominantly been finance based. In general this survey concludes that although production employees are continually supporting ABC initiatives, marketing and sales personnel are being isolated.

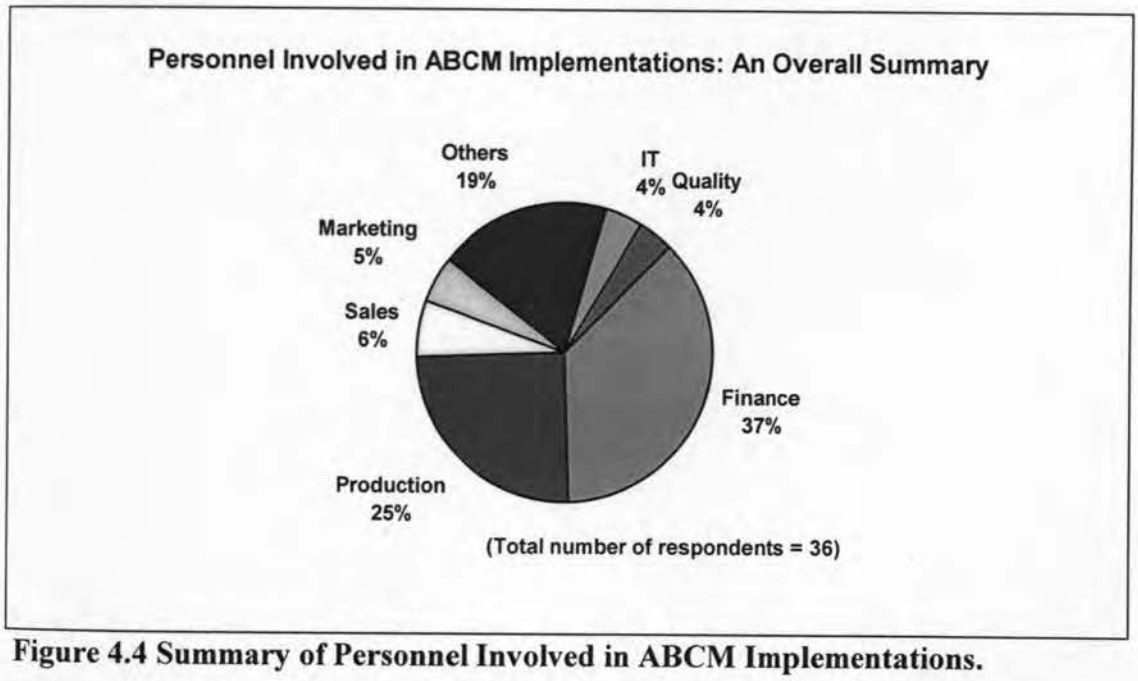


Figure 4.4 Summary of Personnel Involved in ABCM Implementations.

In general there is no differentiation in the personnel employed for ABCM implementations in SME and large enterprises in the manufacturing sector. However in large service, and financial sector organisations there is increased contribution from financial personnel, with them realising 43%, and 71% of implementation personnel for the financial, and service sectors respectively. Additional assistance with implementation is given with increased measure from computing service personnel.

In summary financial personnel constituted 37% of the project team, production, others, marketing, and sales accounting for 25%, 27%, 5%, and 6% respectively. The average project team consisting of 5 members. A finding of this survey has been the identification that computing systems personnel are contributing and assisting in ABC implementations. In particular service sector organisations had the smallest project teams average 2 compared with 5 for both finance and manufacturing enterprises.

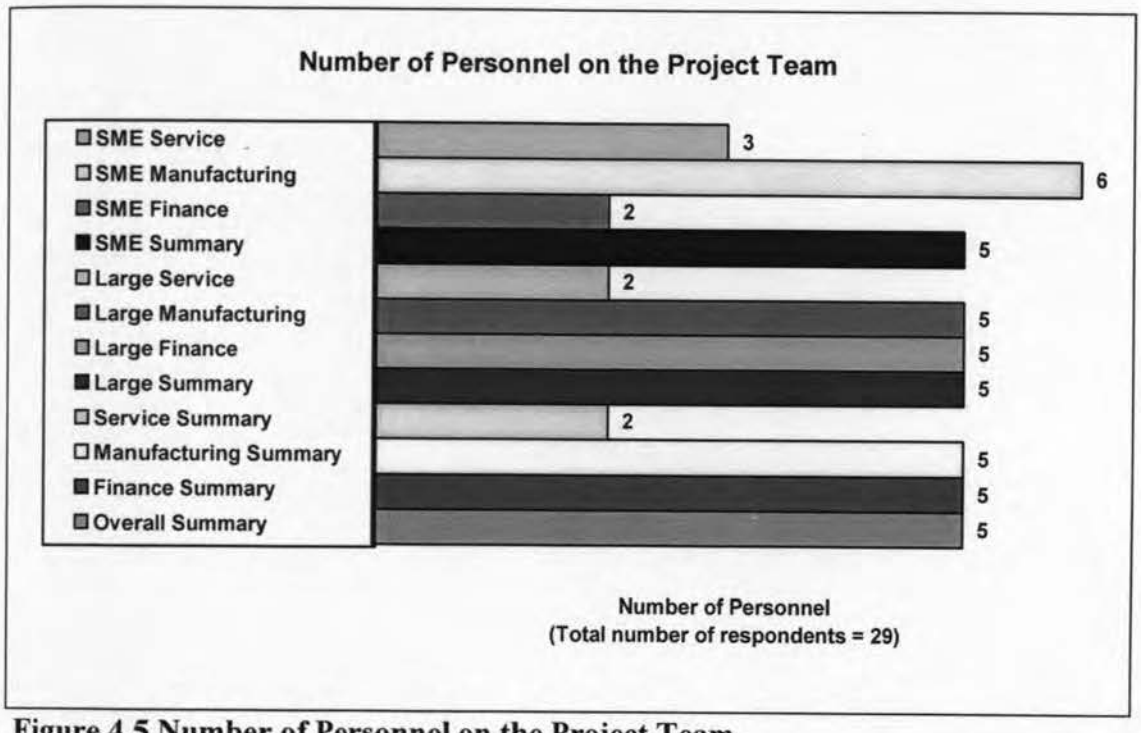


Figure 4.5 Number of Personnel on the Project Team.

Activities and Cost Drivers

The importance of the number of activities and cost drivers can be seen in the degree to which implementing organisations have found challenges in defining drivers and data collection. To measure activity consumption, cost drivers are required. Through cost drivers overhead costs can be allocated down to products. While the number of activities utilised in the system is primarily dependent upon the operating structure and size of the organisation, cost drivers reflect the level of detail that has been specified by the system designer. There is little or no obvious correlation with system operating structure.

Determining which activities to measure and defining them are difficult tasks. The number of activities selected is dependent upon the scope of the study and the size of organisation into which ABCM will be implemented.

The data presented in figure 4.6 outlines the relationship between activities and cost drivers. The graphs are positively skewed indicating the extent to which organisations are embracing the philosophy of Turney [55] who proposes "The model should be as simple as possible - but no simpler" and "As complex as necessary but no more complex". The aggregation of a large number of respondents at one end of the scale concerned with the number of activities utilised, embraces this philosophy. These organisations utilised a small number of drivers, and the scope of their operations negated the use of a larger than anticipated number of activities.

Previous studies have outlined cost drivers in the range of 7 to 45 with an average 15 being utilised [64]. A degree of respondents in this current survey were utilising advanced software packages which enhanced the ability of the organisation to utilise a greater number of drivers, and the subsequent data manipulation.

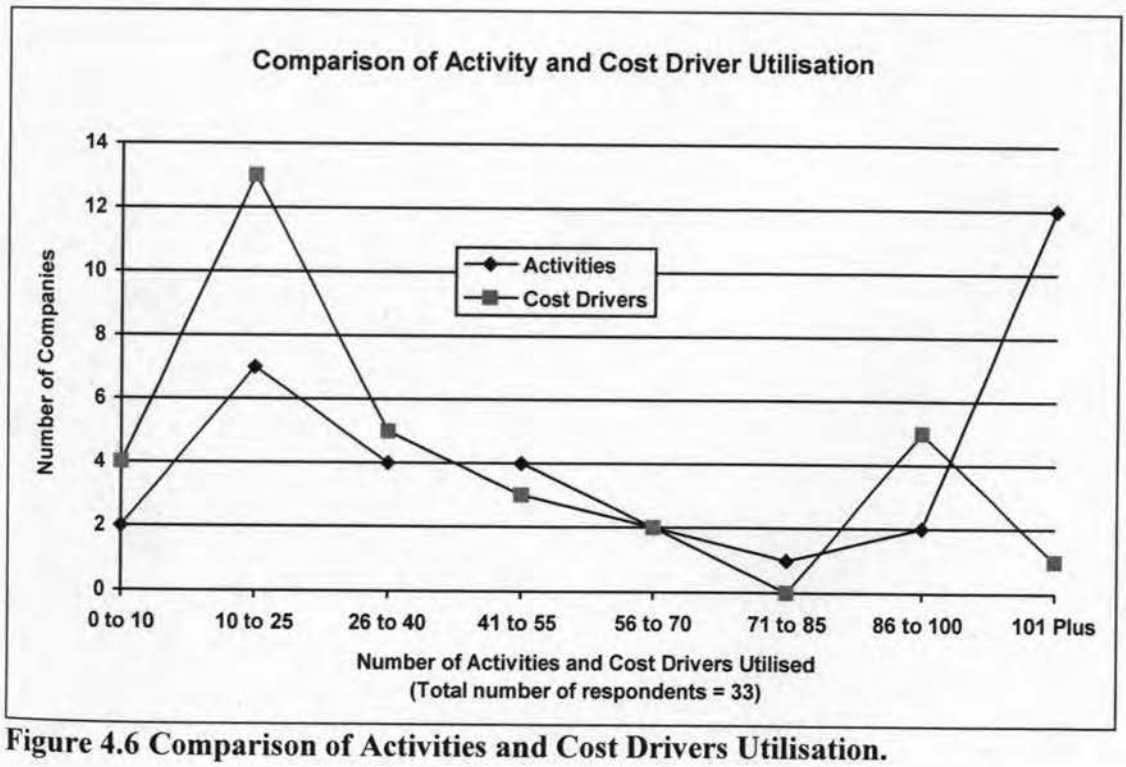


Figure 4.6 Comparison of Activities and Cost Drivers Utilisation.

Implementation Timescales

Analysis of implementation timescales, outlined in figure 4.7 shows planned and actual timescales averaging 21 and 27 weeks respectively. Analysis was undertaken of respondent organisations in the manufacturing sector (subsuming both large, and small- and medium-sized enterprises, large service sector, and large financial sector organisations. Implementation delay did not occur for the majority of respondents. The longest individual implementation was 2 years, against a plan of 1 year, for an SME in the manufacturing sector. Further analysis revealed a piecemeal approach to implementation for this organisation, and insufficient personnel proficient in ABCM principles which is endemic for organisations of this type. In addition large enterprises in the service, and financial sectors realised longer implementation timescales. This is due in part to the complexity in identifying organisational processes and activities in comparison to manufacturing organisations in general, where activities are more tangible.

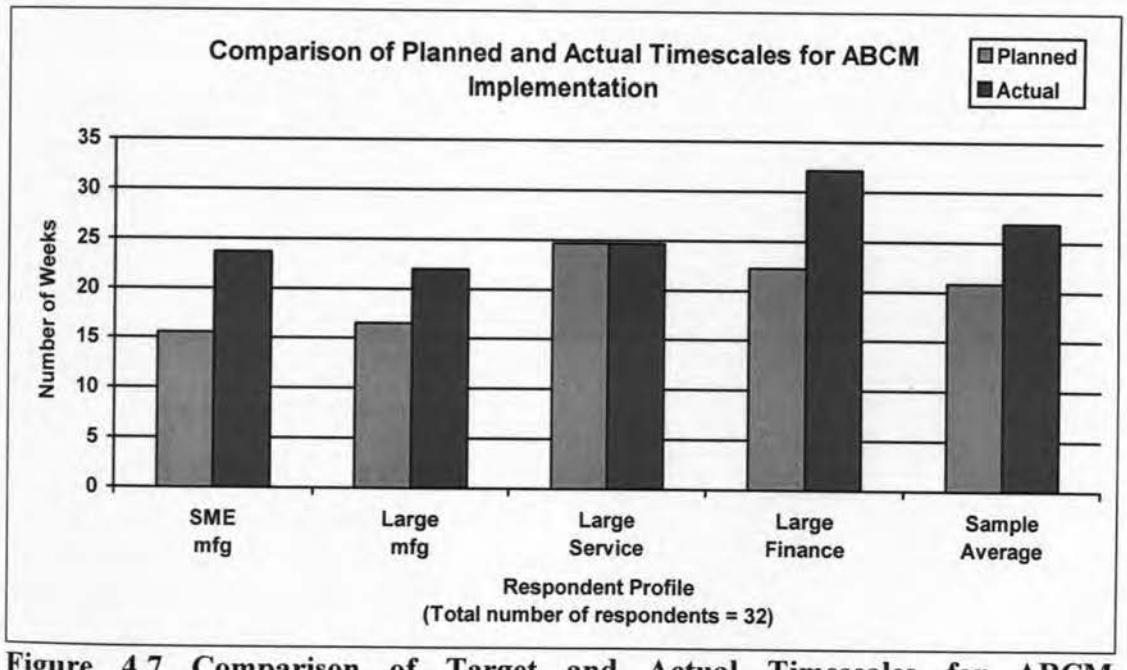


Figure 4.7 Comparison of Target and Actual Timescales for ABCM Implementation.

In comparison Bailey [63] similarly indicated implementation timescales between 20 and 42 weeks. The publication of ABC implementation case studies has enabled organisations to gain valuable information regarding implementation methods and tools thereby enabling timescales to be reduced and adhered to. Comparison of large and small- and medium-sized manufacturing enterprises reveals no major differentiation in implementation timescale. It may be concluded that implementation timescale is technique dependant rather than organisational dependant.

Implementation Cost

Previous studies [63] have identified implementation cost for ABC systems having an value of £48,500. With a growth in knowledgeable personnel implementing ABC significant improvements in the implementation learning curve have resulted. This has manifested itself in an increased ability to introduce systems more rapidly and to target timescales. A resultant benefit has been a reduction in the cost of implementation with data from this survey indicating an average cost of £28,500.

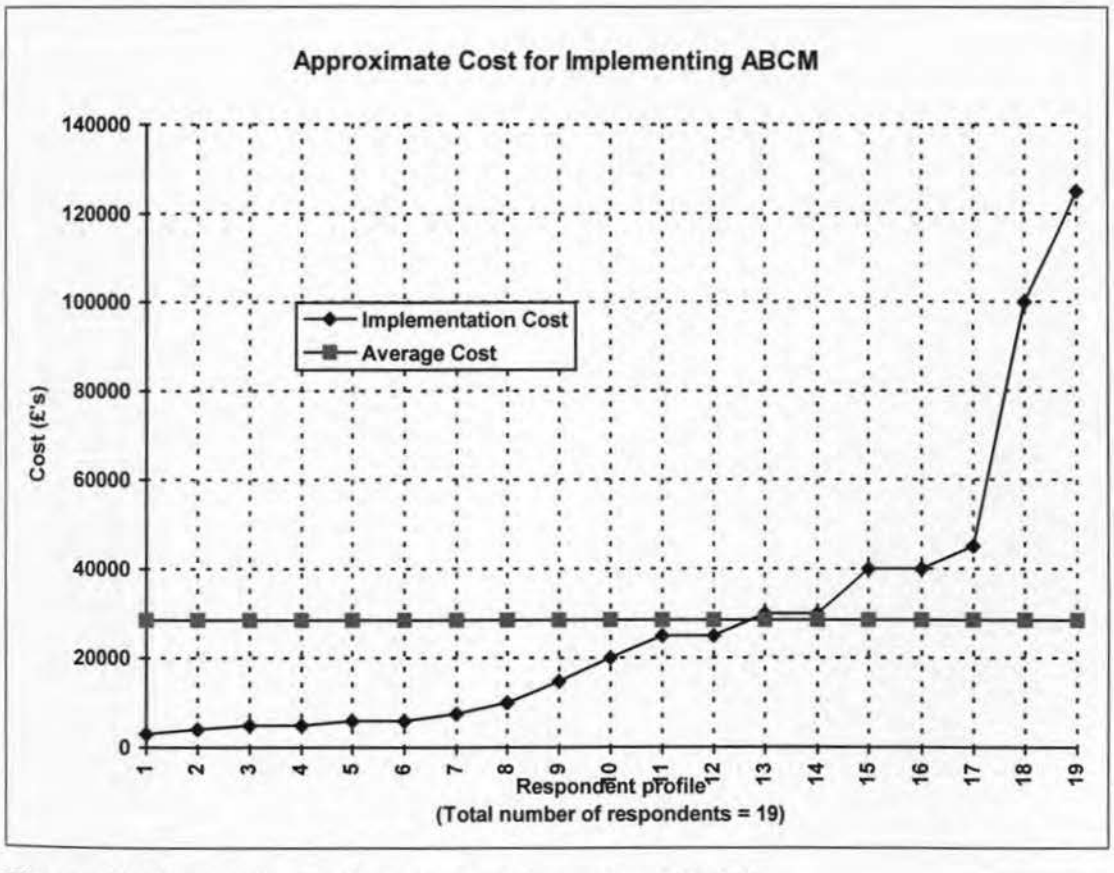


Figure 4.8 Approximate Cost for Implementing ABCM

While improvement in implementation techniques realised from advances in the knowledge base and information dissemination are a cause of reducing costs, the data also reflects the increased degree of acceptance of ABC by Small- and Medium-Sized Enterprises.

With SMEs embracing ABC more readily the average cost of implementation is reducing as the demands on time and resources mirror the reduced scope of systems being implemented. Future implications for implementation cost are based on the ability of software suppliers to provide solutions to suit particular market sectors and organisational size.

Current advances in ABC software have left SMEs with increased software cost and a higher degree of software redundancy. Larger companies are benefiting from the increased functionality and manipulation of current systems at the expense of SMEs requiring more basic affordable systems.

Survey of Software Systems

A review of the findings on software systems can be found in chapter 5 that details information of the systems available in the UK and their application.

Implementation and Software Satisfaction

In conclusion the degree of success of implementing ABC and of utilising a software solution can be seen from the graphs of satisfaction outlined in figure 4.9. While implementation satisfaction is predominantly good the degree of satisfaction with the software utilised, identifies significant opportunity for software suppliers to enhance or release advanced software in the UK market. Organisations identifying dissatisfaction with their implementation similarly identified dissatisfaction with their software system.

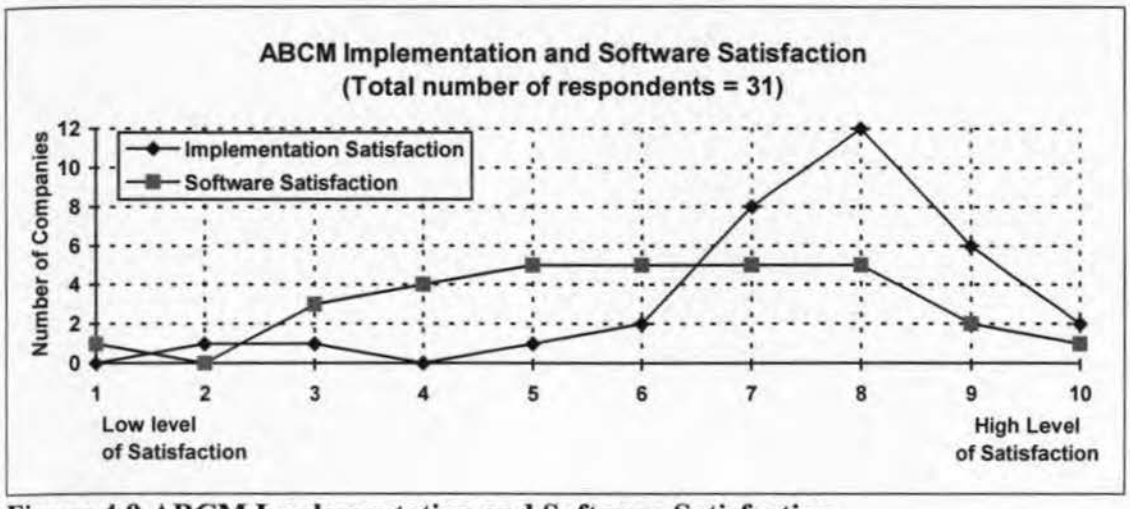


Figure 4.9 ABCM Implementation and Software Satisfaction

4.6 Implementing ABC: Examples and Illustrations

This section provides examples of ABC implementation. They are intended to show not only approaches to meet different needs, but also to illustrate some of the issues raised so far. The examples are based on information provided by several survey respondents in semi-structured interviews, and are representative of approaches to the introduction of activity based philosophies

Hill [73] has concluded that there are two distinct uses of ABC information: product decisions and cost reduction opportunities. Hill reflects that product related decisions can aid management in product pricing, life-cycle, and customer relations decisions. This in essence is the direct result of applying the principles of first generation ABC as propounded by Cooper.

Similarly Hill comments that establishing the size and scope of non-value added cost will enable management to systematically review overhead costs. This approach is influenced predominantly by Turney [55] in second generation systems, and forms the basis of Activity Based Management (ABM). Hill concludes that "... any organisation that has not systematically reduced overhead costs as a direct result of ABC has failed to use this approach in its true sense."[73]. The two approaches discussed by Hill are visible in the examples which follow. They do not seek to illustrate good or bad Activity Based Cost Management practice but serve to outline the variety of scenarios which can be reflected in implementing an activity based system.

Example 1

A major supplier of electrical equipment to the building industry sought to implement an Activity Based Costing (ABC) system in order to clarify product costs, customer profitability, and overhead allocation. This allowed the organisation to instigate cost savings and implement relevant performance measures.

The scope of the ABC implementation involved the analysis of activities directly associated with products, and the application of ABC overhead to product groups. The implementation involved the identification and definition of resources, activities, and cost objects. Cost and resource drivers were selected and allocation paths determined.

The implementation was phased with focus initially placed on an overall company model, generating at a macro level identification of product and market profitability. This was enhanced in subsequent phases to determine detailed product costs, and market profitability. Future development of the system would place focus on the export market, service and maintenance, and new product development areas.

The current ABC model utilises 45 activities 55 cost objects, and 18 cost drivers. The major activities identified are *inter alia* as follows:

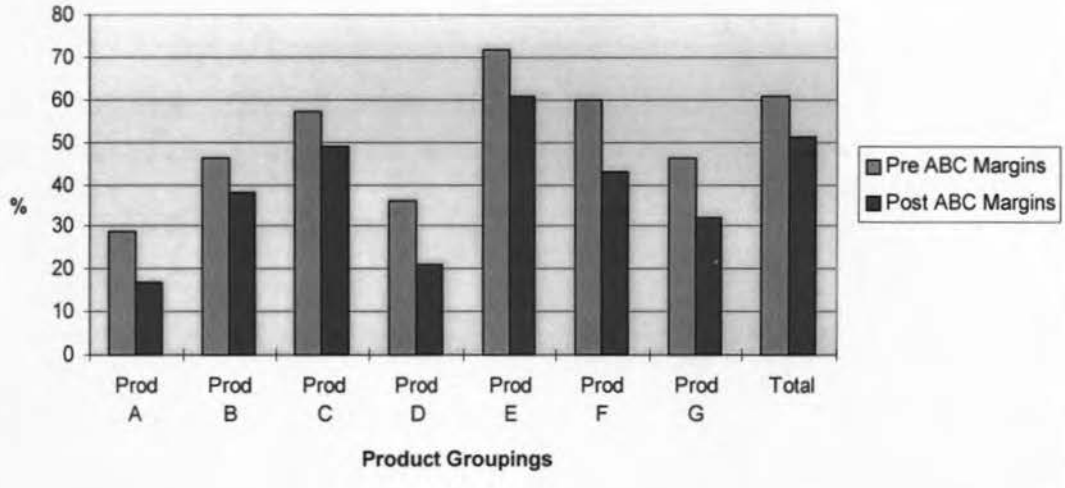
- Processing Customer orders
- Engineering Changes
- Systems Support
- Quality Support
- Materials ordering
- Expediting
- Purchasing

The cost objects relate to the 55 product groupings that encompass the distinct market areas serviced by the organisation. Activity Costs were allocated to the cost objects utilising cost drivers. 18 cost drivers have been determined which *inter alia* are as

follows:

- Labour hours
- No. of Despatches
- No. of Engineering Changes
- No. of Finished Products
- No. of Operations
- No. of purchased Components

Example 1:Product Margin Analysis



The information gleaned from implementing an ABC system has enabled assessments on products, life cycles, and market presence, as well as profit margin improvement and overhead reduction to be undertaken. A comparison or pre and post ABC margins can be seen in the chart displayed above. The implementation of ABC has resulted in improved product costing, overhead allocation, and performance measurement and generated cost savings.

Example 2

A British Based Small- and Medium Sized Enterprise (SME) supplying fast moving consumer goods implemented Activity Based Costing to gain improved awareness of product costs, customer profitability, overhead allocation, and to generate cost savings through identification of value- and non value-adding activities.

The company realises an annual turnover of £13 million, employing 300 personnel. Supplying the clothing industry the company manufactures 700 products within 150 product ranges. The brands range from 'own label' through to products manufactured and supplied as 'own label' for retail chains.

The traditional costing system utilised an overhead allocation base of direct labour hours. Manufacturing attention was focused on machine efficiency in order to maximise overhead recovery. A resultant effect was a 'back log' of customer orders. This was similarly impinged upon by the manufacturing system layout that was functional in orientation. This negated the use of excessive material movements..

Non-value activities also encompassed the colour dying process. This bottleneck operation was receiving and processing defective products. Quality checking has subsequently been introduced pre-dying to eliminate any similar future occurrence.

Customer profitability was influenced by the servicing requirements of the distinct customer types. Small local retail outlets with low order volumes and levels, necessitated utilisation of non-standard stock keeping units. major retail outlets meanwhile purchased in higher volume incurring lower order servicing costs.

The implementation of ABC was achieved in a period of 8 weeks. It was undertaken by a multi-functional team of 6 personnel. The implementation approach was as follows.

1. Identify the need
2. Specify the output requirements

(continued)

3. Identify Software
4. Collect Data
5. Build Test Model
6. Review results
7. Build Final Model
8. Implement

The development of the model included an activity analysis of indirect personnel and assessment of cost drivers, and cost driver data. The ABC model developed initially encompassed 70 activities, and 25 cost drivers. However subsequent rationalisation of the model has reduced the number of activities to 25, utilising 7 cost drivers, with no subsequent deterioration in accuracy.

The implementation of ABC and the subsequent customer analysis revealed that 50% of volume accounted for 5% of profit. By deduction the remaining 50% of production volume accounted for 95% of the organisational profits. Subsequently the organisation reassessed its customer profile, and eliminated 50% of its sales volume, that was low value, high cost based.

Developments of the ABC system are integration with the management information system, and a review of current activities to reflect current practice. The review will provide improved accuracy, and full product costs by customer.

Example 3

An international Brewing corporation sought to implement Activity Based Management (ABM) in order to increase Cost and Profit awareness and to gain insights into cost behaviour. The process was undertaken in three distinct stages. Stage one involved the improvement in data quality, the external (financial) reporting system, and utilisation of strategic costing, and operational control procedures.

(continued)

Stage two involved the transition from previous techniques through to the introduction of uniform data standards across all sites within the corporation. This was in preparation for the implementation of an integrated management information system. In parallel an ABC system and an operational control and performance measurement system was introduced. In the final stage the management information system was integrated and an improved ABM system introduced. This negated changes in financial reporting and operational control and performance measurement systems.

The objective of increased profit and cost awareness through the introduction of ABM was achieved by utilising 6 distinct analyses. The first Cost Driver analysis involved assessing cost driver rates and the resources utilised in servicing the related activities. Profitability Analysis involved analysis of distribution channels and brand types. In essence this would provide identification of costs incurred in servicing different types of customer who purchase the product in different ways for example off-licence Sales, Public House and the product purchased e.g. Beer on draught, Bottled Beer, Canned Beer. The other analyses predominantly emanated from the work of Michael Porter and include Functional Activity analysis, Comparability analysis, strategic positioning analysis, and value chain analysis.

The success of the project predominantly was based on the preconditions that were defined at the outset. These included: -

- Sufficient backing from the board
- Acceptance and Involvement of Management
- Sufficient analysis capability and capacity
- Adequate resources through co-operation
- Multi-functional approach
- Adequate priority setting

The implementation of an activity based system was realised in 4 months and the system encompassed in excess of 100 activities utilising 20 cost drivers. The system has enabled the company to gain an increased awareness of costs and profit, and provided the facility to undertake inter company comparative benchmarking.

4.7 Conclusion

The objectives of this chapter were to examine the practical adoption of activity based cost management techniques and the integration of theoretical principles.

The survey indicated the increased utilisation of ABCM among companies of a small- and medium-sized nature operating within the manufacturing sector. The costs of undertaking an ABCM initiative are currently not prohibitive for organisations of this type. Similarly the survey indicated the utilisation of ABCM diversifying from the manufacturing sector, and encompassing at an increased rate organisations competing in service and financial sectors of the economy.

In relation to the ABCM technique the survey reveals the increased utilisation of a model for multiple objectives. i.e. to determine customer profitability, and to provide a brand of performance measurement. This is in contradiction to the advice propounded by numerous ABCM authors to determine the exact nature of the information requirement, and to focus upon those considerations. This is deemed to be a factor relating to the published observations that ABCM is the solution for cost management, and the ultimate panacea.

The survey establishes the connection between the theory outlined in the literature review and the application of ABCM techniques by the author, that will be outlined in subsequent chapters. In particular it may be concluded that:

1. The benefits of implementing ABCM propounded by authors researching application in Large enterprises, are realisable in Small- and Medium-Sized Manufacturing Enterprises.
2. The costs of implementation are governed by the utilisation of an ABC software system, but other implementation costs are primarily influenced by organisation and model size.
3. The quantity of activities and cost drivers can be minimised to reduce the costs of system operation, with little or no deterioration in cost accuracy.

4. The determination of cost drivers is an attitudinal process. Those with experience of ABC and the individual operating environment are those for whom the complexity of defining activities and drivers has reduced.

In subsequent chapters analysis of applicability of ABCM, and its application through a generic methodology resulting from the research programme with colloborating establishments will be outlined.

Chapter 5

Survey of Activity Based Cost Management Software

Introduction

The purpose of this chapter is to outline information regarding software currently available within the UK for implementation of Activity Based Costing, Activity Based Management, and Business Process Analysis. The objective is not to recommend any one product over any other, but to reflect the scope and variety of packages currently available. For this purpose the software packages that have been personally reviewed by the researcher are not identified by their marketed name. Factors affecting the choice of a particular package will be outlined, and results from the 1993/1994 survey into software utilisation and satisfaction will be disseminated. In discussion the variety of available packages will be reviewed with respect to organisational size and operational orientation.

5.2 Issues in ABCM Software Selection

Authors including Connolly [74], and Hitt and Newing [75], have propounded the use of specialist ABCM software systems, and their bespoke counterparts. At a macro level the distinction and choice between, specialist, bespoke, and spreadsheet packages is an argument based upon a cost/ benefit analysis. Bespoke applications are commonly utilised by larger organisations with distinct needs. This was particularly the case in the early days of ABC, when software systems were limited in variety. Spreadsheets meanwhile are often utilised for pilot study applications, and implementations in small- and medium-sized enterprises. Specialist ABCM packages are utilised by a variety of organisations, from multi-national to Small- and Medium-Sized Enterprises. Such specialist packages currently offer the functionality, and detail

required that was common in bespoke applications of the early 1990s.

At a micro level the increase in specialist packages during the early to mid 1990s has necessitated a more detailed analysis of software, in particular specialist packages, by organisations considering ABCM. Indeed Geishecker [76] concluded that "forward looking companies are capitalising on new, enabling technologies to support their business information needs. They are harnessing the power of activity-based information systems, improving their operations, and achieving a significant return on their technology investment."

The introduction of an ABCM software solution creates many issues. An analysis needs to be undertaken, not only of available software options, but also the respective implementation methodology, and changes to operational procedures. The selection process of an ABCM software system should assess:

- Price
- Performance
- Vendor Reputation
- Existing User Base
- Flexibility
- Future Direction
- Risk

The cost of software currently available in the UK market place is marketed between £3000 to £15,000. Pilot versions of the same software are commonly available for less than £1000. Price is often a reflection of the performance and flexibility associated with the software system. Multi-dimensionality is a feature of current software that is reflected in cost. Software that can assess a variety of operational environments commonly costs more than the traditional system structure based upon allocation of resources to activities, and activities to cost objects, with restricted reporting capability.

The increased availability of software systems necessitates an assessment of supplier capability. Organisations utilising ABCM are competing in dynamic markets. The ability for a supplier to meet a customers requirements in the future is vital. Purchasers of ABCM software should consider the rate of software system change, and the ability of a supplier to meet consumer demands for improvement and development. The existing user base is a good indicator of software capability. Organisations of specific size and orientation commonly utilise software systems of a related nature.

5.3 Review of British Based ABCM Software

The review of British based ABCM software reports the assessment of 7 "off-the-shelf" packages available in the United Kingdom. The software products are labelled Product A through G at the discretion of the author. A full list of ABCM software suppliers, and software products is listed in appendix A2.

Product A.

This software is utilised for the costing of products, processes, and services. It also provides facility for the preparation of more accurate budgets, to co-ordinate benchmarking initiatives, plan rationalisation strategies, and to assess options for improving productivity and reducing costs.

The software operates under a windows 3.1 environment, requiring an 80386 processor, with 2MB Ram, and 2MB hard disk space. The software is graphically orientated and the construction of an ABC model needs to be thought out accurately.

The graphical orientation of the model however gives a point and click ability to change organisational variables, and provides instant display of results, and similarly enabling what if scenarios to be constructed. This is also facilitated by the ability to construct customised reports.

The model is primarily designed for utilisation by manufacturing, and sales and

marketing personnel. The model provides the ability to detail capacity constraints, and to provide visibility of profitability changes with related changes to the product mix. The terminology used in the software is highly interpretive, and cost allocations are often unclear due to the visible detail of the model. The three primary stages of the model are supply, process, and demand, which is distinctly different to that structure propounded within other software systems. These three primary stages are supported by route and inventory areas.

Product B

Product B is an Activity Based Costing software that operates in the Windows environment. It is used to enhance the understanding of the overall cost of the organisation for product costing, customer profitability, and organisational efficiency analysis. It takes a functional view as well as a process view of the business and, consequently can be utilised for activity based costing, and business process re-engineering.

Product B provides 50 standard report formats and the ability to customise by transfer of data to Lotus or Excel spreadsheets. The format of the ABC model developed is both graphical and tabular providing an alternative to other software systems. The simple table format for input of data, activity analysis, and consumption of resources, enables the software system to be utilised with a large degree of effectiveness. Activities can be defined in the model as operational, support, and organisational support. The outputs from the model give selling prices and target profit margins based on production quantity, and the number of batches. Customer analysis can be undertaken by market and product grouping.

Product C

Product C is a tightly integrated set of activity based operational management software tools that enables the user to - and then strategically apply on a continual basis - crucial activity information. Product C is a network solution for activity based management. Product C is the network version of an original "Stand-Alone" packages, that established itself as one the world leading software packages for ABC.

Utilising the standard version of the software, the activity based model was simple to generate, enabling a comparison of actual and budgeted costs. The standard reports available through the package can be sent to either printer or file. However printed reports from the package were restricted due to the hardware lock present on the authors version of the software. Product C is simple to use and allows for assessment of customer and product profitability

The Product C software suite supports the inadequacies of the "stand-alone" application. Additional modules can provide extensive reporting capabilities, of a customised nature, and similarly an additional module provides connections to external applications including spreadsheets, relational databases, and host applications i.e. general ledger and MRP II systems.

Product D.

Product D is a stand alone product whose system structure can be classified into three main areas for analysis that are as follows:

1.Activity Costing Analysis

The main area for system design, this section will take information from traditional financial systems, primarily the general ledger, and provide the primary data source for departmental cost through general ledger account classification and quantification. Once activities are defined departmental costs can be allocated to them.

Activities can be assigned as support and as such their respective cost can be reallocated to other departments on an objective basis, relating to the consumption of the activity. Likewise activities that are direct in nature, and therefore do not service other departments are allocated down to products.

Having identified the structure of the model in terms of department, activity definition, and the utilisation of primary data (i.e. general ledger codes and values) it is necessary to undertake a cost object analysis.

2.Cost Object Analysis

When all the activities have been analysed the cost of activities needs to be assigned to cost objects. The cost drivers utilised to do this are user specified. ABC Power will allow the user to define a customer or product hierarchy for detailed analysis by product or customer segment.

3.Profitability Analysis

After product and customer costs have been calculated a further analysis is undertaken of profitability. This is achieved through the introduction of customer revenues and product values. A conjoint analysis of products and customers is useful to identify the most profitable mix.

The three main elements of the software allow the integration of data from other systems, utilising an electronic data capture facility. The main model design area of the software has no size limitation and can perform validation and calculation functions. The resultant data can be exported through dynamic links to spreadsheets.

Product D is one of the leading ABC software applications currently available in Europe. The tabular structure of the model provides a greater utilisation for accountants than production personnel in comparison to other packages. The product currently runs under Windows and future developments include more 'what if' facilities, graphical interfacing, and improved automatic linking to external databases.

Product E.

This product operates in a Lotus 123 environment, which enhances the reporting capability of the package enabling the generation of 21 graphs, and 37 reports. The product does not however produce unit costing for core activities (products) based on volume sales. The software can handle material costs and turnover for each core activity, giving profit margin, and breakdown figures. The information required to service the model is quite detailed, and this may preclude organisations from utilising this software package.

In summary the product divides activities into core and business support, without the capability for bill of materials, that precludes the analysis of component part usage.

Product F

Product F operates within a relational database. The modular operating structure can be classified as follows:

1.Master File Development

This module enables the dimensions of the analysis to be defined, and is used to divide up costs, and is considered to be a route map for understanding costs. The module allows for the classification of costs, activities, cost drivers, functions, resources, and product lines. Resource classification allows for the summary of activities according to the principal elements of the profit and loss account. defining product lines allows for the preparation of a product group analysis of costs, which forms the basis for profitability analysis.

The dimensions can be used in any way to split the business needs. They need to be defined carefully as the real power of Activa lies in its analysis potential, and a little thought at the outset will ensure that its full potential is realised.

2.Inter-departmental Distribution.

Some departments within an organisation provide activities which cannot be directly related to specific products, as these activities are utilised by other departments. This module provides a method akin to a direct charging mechanism for the allocation of service department costs. Within the module activity pools for distribution are allocated costs, appropriate bases are selected for the distribution, and then redistribution is carried out.

3.Activity Based Rate Development.

The development of Activity Based cost rates is the heart of ABC. Within this module departments can be selected and cost values assigned to particular activities, therefore developing rates for particular activities.

4. Product Costing.

In the above modules activities within departments have had costs assigned to them. Within this module materials are introduced into the system, and products can therefore be defined as a combination of a specific set of resources involving both activities and materials, using appropriate driver rates. this module can deal with either a single- or multi - level bill of materials.

Within Product F there are options for graphical and tabular analysis. This provides a detailed information on product costs, driver rates, activity rates and a comparative cost analysis. A graphical representation is always more visual in its impact, reports in tabular form will still be necessary, in particular to aid reconciliation with the accounts.

Product G

Product G is based upon the ABC hierarchy defined by Cooper and Kaplan that defines activities as unit, batch, product sustaining, or facility sustaining. This structure provides a unique ability to identify the nature and causes of cost at each distinct activity level. The ability of the software to drive costs to components and sub-assemblies as well as completed products and customers enables assessment to be undertaken of the influences of design costs.

Product G produces reports of product and component costs, activity costs, resource costs, product profitability, and additional reports that subsume analysis of commonly used parts, production volume analysis, and labour and machine costs plus the ability to transfer data to external spreadsheets.

5.4 Spreadsheet ABCM Models

Spreadsheet software is commonly available in many organisations. The advantages of designing a bespoke ABCM spreadsheet include cost, flexibility, and learning curve. Pilot studies are commonly undertaken utilising spreadsheets due to the limited focus and data structure prevailing in the model. Long-term usage of spreadsheet systems for ABCM has been reported by Drumheller [115] in his report on Tycos a

manufacturer of blood pressure gauges and stethoscopes.

Spreadsheet Application of ABCM at Tycos

Some companies have resorted to buying software to ease the installation of an ABC system, but we felt that doing this would just make it harder to explain ABC to our staff. Therefore we chose to set up our own system. Based on a pilot program, we concluded that managers would not act when they doubted the data. These observations and conclusions were painfully reached after we had spent a year studying and evaluating articles, books, pamphlets, and software packages.

For an ABC package to become truly functional, the conclusions reached by using the system need to become obvious. The more assumptions and the greater the complexity of the ABC system, the less likely managers are to use information generated by the system. Simplicity and relevance are needed to motivate action.

At Tycos we developed an ABC system using a common spreadsheet. Using a spreadsheet that the staff already use is important, because when managers can understand the calculations, they more readily accept the answers.

Drumheller [115]

Rupp [77] similarly has described a pilot study where 22,000 allocation paths needed to be created, the specialist ABCM package was found to be inadequate, and a spreadsheet was utilised. This provided improved ability to modify, update, control, and report organisational information.

5.5 Integrated Manufacturing, Distribution, Accounting and ABC Software.

An integrated approach to implementing ABCM provides interfaces with general, ledger, bill of material, and other modules. The underlying cost calculations are an integral part of such systems. Integrated ABCM precludes data import and export facilities that are common to stand alone systems.

It must be recognised that the current stand alone systems developed by companies in the ABCM market are more appropriate to the technique as they were developed within a competitive environment. The inherent features of specialised ABCM software systems are the result of accurate user requirements specification, and post implementation analysis and consolidation.

Software suppliers with integrated products rarely offer the features prevailing in specialised applications, however they provide a simple if restricted introduction to ABCM. The future of such application modules is dependant upon them mirroring the functionality of specialist software.

5.6 Practical Utilisation of ABCM Software

Practical utilisation of ABCM software systems was analysed through a questionnaire and semi-structured interviews. Forty organisations from various business sectors, of differing organisational size responded to the questionnaire. The primary function of the questionnaire was assessment of the adoption of ABCM, and the application of principles, and techniques. The software survey was predominantly undertaken to reflect the ability of software systems to integrate with the project implementation.

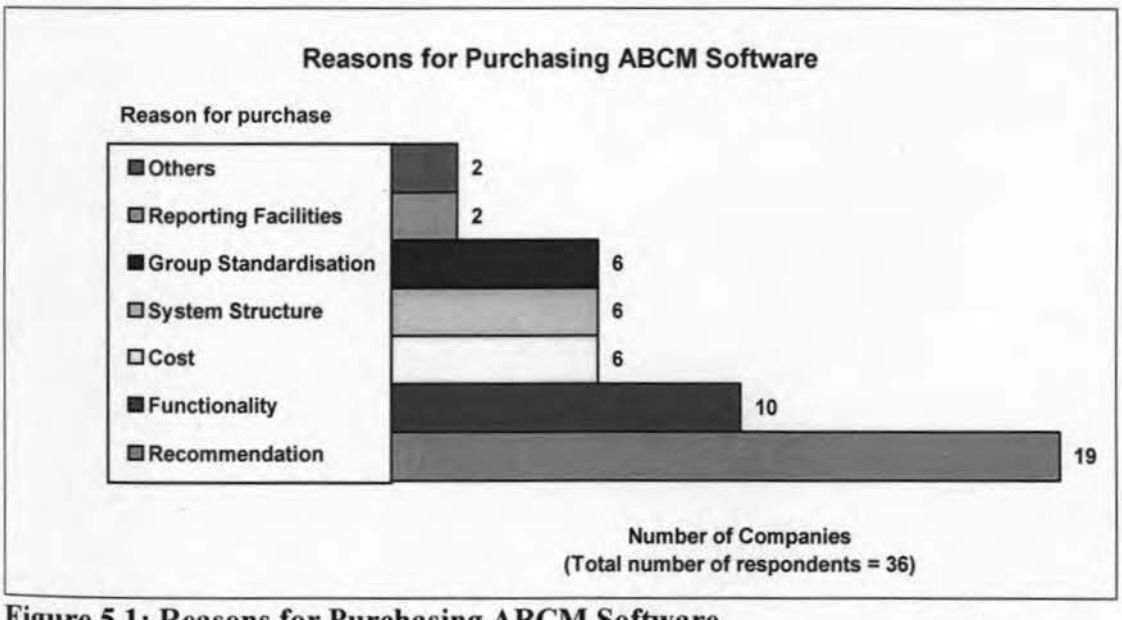


Figure 5.1: Reasons for Purchasing ABCM Software

ABCM software was generally selected on the basis of system structure, functionality, cost, and reporting facilities. Figure 5.1 details the reasons given for software system selection. Where organisations compared and contrasted software systems, major areas of differentiation included, cost, functionality, flexibility and software supplier provision. Figure 5.2 details the basis of differentiation between software systems.

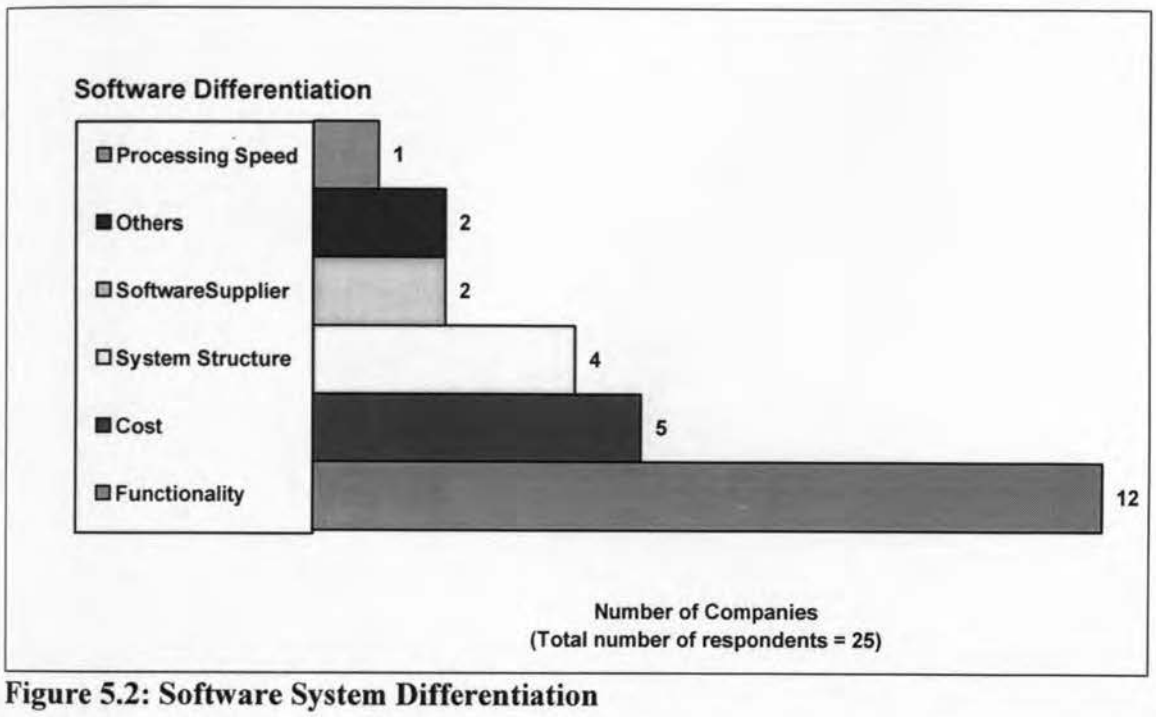


Figure 5.2: Software System Differentiation

The respondents to the survey indicated their satisfaction with the software system they had purchased through comparison to implementation satisfaction. Utilising a ten point Likert type scale approximately 65% of respondents indicated satisfaction with their software, compared to approximately 35% of respondents who indicated they were unsatisfied with their software system..

The data relating to software satisfaction brings into question the selection of ABCM software packages by recommendation. This primary method of selection can be interpreted as providing organisations with systems that do not suit their requirements.

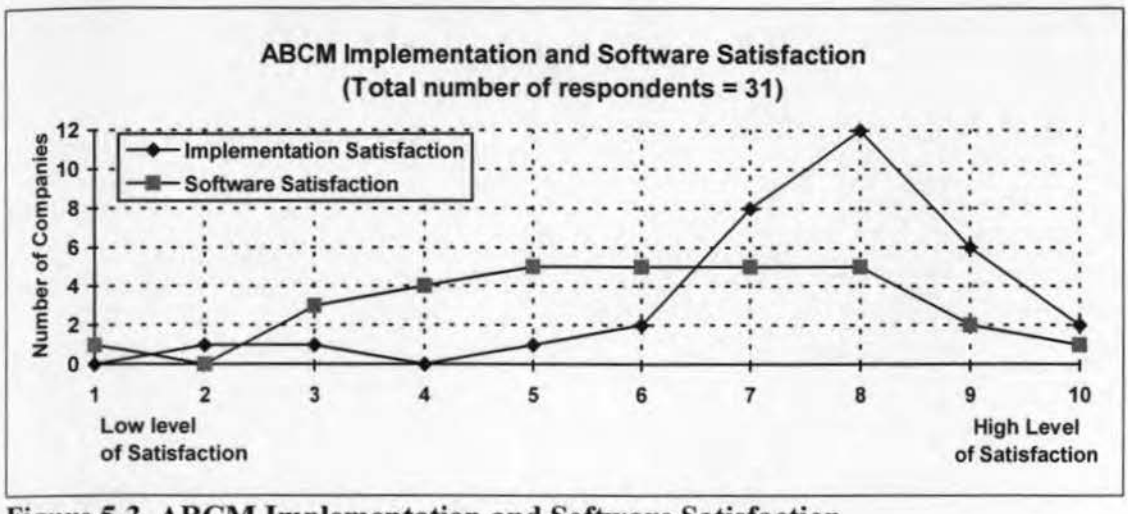


Figure 5.3. ABCM Implementation and Software Satisfaction

This conclusion is supported by the realisation that recommendations are primarily given by consultancy companies with related software houses. The initial adoption of ABC by UK companies commonly required assistance from consultancy and software companies. Combined with the minimal range of systems available during the early 1990s it is not surprising that organisations felt disillusioned with their software

5.7 Evaluating Software Choice

Activity Based Cost Management software can be differentiated on the basis of orientation. Established ABCM packages follow a tabular structure indicative of published theory, and similar to traditional financial control systems. Recently released software is more graphical in orientation. This approach is predominantly utilised by organisations undertaking business process- and activity-analysis. This software differentiation is visible from the assessment of packages outlined previously in this chapter.

While software can be categorised on the basis of functionality, the application of software can also be differentiated on the basis of organisational size. The issues outlined at the start of the chapter are reflected in the software system structure. Subsequently organisations of similar size, and project scope utilise software systems with common orientation. Table 5.0 outlines the variety of choices, and criteria for consideration in software selection with relation to organisational size, project

orientation, and competitive environment.

5.7.1 Large Enterprises

Large enterprises commonly demand advanced functionality of an ABCM package. This reflects their utilisation of a substantial number of resources, activities, and cost objects in their model structure. This dictates their requirement for unlimited modelling capability. This is augmented by issues pertaining to the analysis of resultant information. Multi-dimensionality is an emerging feature at the advanced end of the ABCM software market. This provides the capability to report numerous analyses, including cost centres, accounts, time periods, products, customers and distribution channels. All of these outlined features apply equally to service and manufacturing sector organisations.

Large manufacturing sector organisations also demand integration capabilities. ABCM systems commonly require dynamic links to external databases including the general or nominal ledger, bills of material, direct cost, product data, and financial reporting systems. The introduction of ABCM modules capable of interfacing directly in such systems is a consideration for large manufacturing organisations. However the current status of such 'additional modules' outlined previously restricts the development of large ABCM models. Similarly limited multi-functionality restricts reporting capability.

Process Management initiatives demand software of graphical orientation rather than a tabular financial accounting format propounded in activity based costing packages. Software developments of this nature are commonly employed for business process analysis/re-engineering, or activity based management.

Typically larger companies with unrestricted financial purchasing capability utilise software capable of achieving both process management, and ABCM objectives. This enables managers to assess the organisational structures and processes prevailing within their company, and simultaneously to assess the cost implications of implementing change in the manufacturing environment, and the impact on the

customer and product profile. The optimum levels of cost, process speed, and customer orientation will be realisable through utilisation and application of the software system, and resultant information.

Large manufacturing organisations additionally require the facility to plan operational capacity, and analyse resource constraints dependant upon product mix. In addition the ability to perform 'what-if' scenarios against defined operational environments, and process parameters increases software system flexibility, and enhances the range of organisational information.

5.7.2 Small- and Medium-Sized Enterprises

In determining the software requirement for Small- and Medium-Sized Enterprises the primary consideration against which selection should be made is cost effectiveness. This is valid for process management, and activity based cost management initiatives in manufacturing and service sectors.

ABCM initiatives in organisations of this type require the information reporting capability of those advanced software packages. However the requirement for cost effectiveness is realised by utilisation of systems with limited modelling capability. Such packages commonly include those propounded for pilot study implementation, and bespoke spreadsheet applications. Organisations considering software of this type must ensure their requirements for model design can be realised, and that the volume of data from the general or nominal ledger, and that pertaining to activities, and cost objects can be integrated into the model structure.

Process Management initiatives in the SME sector are constrained by the cost effectiveness of software. The integration of cost management information similar to that reported by ABC systems is restricted, and process cost forms an integral part of such software.

Table 5.0: Software Requirement Matrix for Organisational, and Project Orientation

	Manufacturing Sector		*Service Sector*	
	Activity Based Cost Management	***Process Management***	***Activity Based Cost Management***	***Process Management***
Large Enterprises	• Bill of Material Capability • Direct product Cost Capability • Integration Capability • Customer/Product Profitability • Unlimited Activities • Unlimited Cost Objects • Unlimited Reports	• Activity Based Costing • Process-View Analysis • Capacity Planning • Constraint Checking • What-if Analysis • Unlimited Reports	• Integration Capability • Unlimited Activities • Unlimited Cost Objects • Unlimited Reports • Customer Profitability	• Activity Based Costing • Process-View Analysis • Unlimited Reports • Customer Focus
Small- and Medium-Sized Enterprises	• Sufficient Modelling Capability • Advanced Learning Curve • Cost Effective • Product profitability analysis • Direct Cost Integration	• Process mapping capability • Process Cost Analysis • Evaluation of business rules • Numerous output charts • Cost Effective	• Advanced learning Curve • Customer profitability analysis • Cost Effective • Sufficient Modelling Capability	• Cost Effective • Process-View Analysis • Customer Focus • Process Cost Analysis

Organisations considering software of this type need to ensure accurate process mapping capability, and appropriate integration of business constraints in order to reflect an accurate customer focus. Software applications of this classification are commonly referred to as data analysers or flowcharters. The information reported by these systems is utilised for applications including ISO 9000 quality programs, process analysis or re-engineering, and activity based management.

5.8 Conclusion

The objective of this chapter was to outline the issues surrounding the introduction of ABCM software packages, to outline the variety available, and consider the software choices prevailing for organisations of a distinct size, and project orientation.

The software currently available in the UK marketplace can simulate a variety of project objectives, and organisational issues. The range of specialist packages currently available necessitates an accurate determination of organisational need, and assessment of software, and vendor capability to meet current and future demands. While an increase in specialist systems has developed the flexibility, and utilisation of ABCM and process management systems, personal idiosyncrasies pertaining to the implementing organisation may necessitate consideration of bespoke systems.

In conclusion the introduction of ABCM and process management software provides cost and operational information, not instantaneous solutions for the business. It is the role of the steering committee, project team, and organisational managers participating in the implementation of an ABCM system to ensure that information produced by the software system is acted upon in accordance with the business strategy.

Chapter 6

The Rationale for the Adoption of a Generic Activity Based Cost Management Methodology.

Part 1: Determining the Business Solution.

Introduction

> We do not need theories so much as the experience that is the source of the theory. We are not satisfied with faith in the sense of an implausible hypothesis irrationally held. We demand to experience the evidence. Laing[72].

In discussing changes and additions to current theory, appreciation is needed of the organisations within which the research hypothesis (Page 12. figure 1.0) was tested. This chapter outlines the profile of the organisations who participated in the research programme. Situations encompassed as the organisations sought to address their quest for an improved cost management system will be reported. Factors that influenced the organisations will be pinpointed and subsequent failings and successes of the research hypotheses are discussed. A generic methodology is developed in parallel to outline an appropriate timing and utilisation of techniques when implementing an ABCM system.

6.2 The Research Study Participants

Testing the research hypothesis outlined in figure 1.0 was carried out in five companies in the manufacturing sector. With varying organisational and product profiles the opportunity for generalisation of methodologies developed through the research programme was enhanced. The five companies participating in the research work are shown in table 6.1[1]

[1] All companies that participated in the research work are identified by a fictional name for reasons of confidentiality. Any fictional name that is the same or similar to another company in existence is purely coincidental, is done so without intent, and no inference should be made.

Company	Employees	Turnover	Business Sector
Plassein	120	£6 Million	Industrial Plastics Manufacturer
Keramos	400	£30 Million	Industrial Ceramic Manufacturer
Ingenium	1500	£40 Million	Reduction gearbox Manufacturer
Engenium	30	£2 Million	Traditional Engineering Manufacturer
Rivulet	25	£1 Million	Screw and Rivet Manufacturer

Table 6.1 Research Study Participants

Plassein.

Plassein is a small- and medium-sized enterprise operating in the automotive component supply sector. Plassein was established in 1948 and employs approximately 120 people. The company manufactures a range of 80 standard injection and foam moulded parts supplying a small range of original equipment manufacturers, realising a turnover of £6 Million annually.

Keramos

Keramos is a Multi-National corporation of UK origin operating in the engineering sector. The company incorporates 150 businesses that operate in 40 countries and sell in more than 120. The businesses develop, manufacture, and market technologically advanced materials, chemicals, and components. The business selected for the research participation employees 400 people. The company manufactures a range of 1000 parts to customer order. Products include Piezo-Electric devices, microwave and domestic heating components, domestic mixer tap seals, textile machine thread guides and dielectric resonators realising an annual turnover of £30 Million.

Ingenium

Ingenium is located in Central Europe, employing 2000 people with a turnover of £40 Million. The product range varies from the manufacture of pump screws, small portable reduction gearboxes, actuator control mechanisms, through to very large reduction gearboxes. The products are used in a variety of demanding industrial sectors, that *inter alia* are mining, oil, chemical, agriculture, food, and construction.

Engenium

Engenium is a British Based manufacturer of general engineering components, manufactured to customer order. This small- and medium-sized enterprise has a small administrative base, and utilises several services from its sister company that itself is part of a greater group. The company employs 30 people and has an annual turnover of £1.5 Million.

Rivulet

Rivulet is a British Based manufacturer of screws and rivets. They supply to a wide range of industrial sectors including automotive component suppliers, and white goods manufacturers. Employing 25 people the company realises an annual turnover of £1 Million. In its recent history the company has been taken over by 3 new directors who have expanded the existing customer base and doubled turnover in a period of under three years.

6.3 The Changing Accounting Environment

The process of change is ever present and ever constant. There is no way to prevent it, and little can be done to avoid it. However in today's manufacturing environment organisations are experiencing change in a much more rapid and drastic fashion than ever before. Indeed in an uncertain world the only certainty is change.

Change has affected manufacturing and service based functions dramatically. The introduction of advanced manufacturing technology, and flexible manufacturing systems that can produce components with shorter lead times, and increased flexibility has created a market where time is an essential purchasing criterion, and indeed the primary measure of manufacturing capability. Similarly after sales support has required advances in performance to meet the demand for increased service.

Hill [79] commented that "Accountants have generally been reactive in responding to the changing needs of business and have spent too much of their time keeping records rather than providing information for, and partaking in, the control and development of the business. The description of bean-counter sits well."

It is disappointing to see that accountants have not changed their perceptions, and approaches to meet the changing needs of the business. Indeed Drucker [32], identified managerial accounting, as one of seven conceptual foundations to the management boom. The belief that analysis and utilisation of managerial information can form the foundation of managerial decision making has to an extent proved misguided.

Hill [79] concluded that "The potential contribution of accounting and finance functions is significant. The key insights and overall executive role it can bring to a business are considerable. However to realise this level of effectiveness, companies must recognise changes in need and respond to them in an appropriate manner."

6.3.1 Changing the Accounting Environment.

In response to the conclusion by Hill, and other academics and practitioners innovative attempts at re-engineering management accounting to meet the changing commercial and business environment have been developed. This has resulted in the adoption of accounting information and control systems that seemingly engender themselves to the organisational strategy and objectives.

Unfortunately such implementations have often been in response to harsh commercial and financial realities rather than an idealistic holistic view of the organisation and its objectives.

The adoption of advanced costing systems have commonly resulted from organisational financial decline. These pressures can be summarised as:

- A declining or lack of profit
- An inability to meet target financial performance measures

- Immediate acceptance by customers of quotations for a contract that is complex and demanding on resources.
- Increased competition in particular market sectors
- An inability to meet the business objectives

In comparison methods for determining the circumstances in which an advanced cost management system is necessary have been propounded by several authors. These include Horngren [80], Innes *et al* [49], and Cooper [18]. An example similar to that propounded by Cooper in his paper *"Does your company need a new cost system?"* [18] is that of Innes *et al*. They stated that if any of the following questions is answered positively then Activity Based Cost Management is worthy of serious consideration:

1. Does the organisation have more than one product or service output?
2. Are the product lines diverse (for example high and low direct labour content, customised, prototype, and standard products)?
3. Is overhead a significant element of total cost?
4. Is overhead cost growing significantly?
5. Do significant elements of overhead cost relate to scheduling, balancing, quality, and change activities?
6. Do existing overhead rates incorporate conventional bases such as direct labour or machine hours?
7. Are products marketed differently or sold through different distribution channels?
8. Do customers require different levels of attention or servicing?

In many organisations such questions are predominantly answered in the positive. A scenario then presents itself in which all organisations would be seeking to improve or reassess the ability of the organisational managerial accounting systems to reflect the current and future strategic position of the organisation. To what extent can overhead be considered a significant element of total cost? Is it sufficient to consider the adoption of activity based principles if overhead were 60%, or 30% of total cost? It has been expounded that organisations that traditionally consider adopting

innovative approaches to managerial accounting have cost profiles of 5%-15% Direct Labour, 45% - 55% Material, and Overhead realising 30% - 50% of total cost [81]. It has been concluded that such organisations utilise costing systems that probably do not reflect the true costs of products [81].

Where does this scenario leave organisations for whom the adoption of activity based principles is not a certainty, but for who the competitive pressures of the changing commercial and manufacturing environment necessitate change? The scenario is one that faces the small- and medium-sized enterprise (SME). Authors including Levy [12] have considered it necessary to *"facilitate the spread of best management practice among SMEs"*, this is particularly important in accounting and financial management where change has directly influenced profitability. The remainder of this chapter will outline the development of methods through which organisations, predominantly SMEs can determine approaches to be undertaken to identify changes that can be introduced to effect improved contribution of the financial and accounting functions.

6.3.2 Re-engineering the Accounting Environment.

In 1991 Davies *et al.* [82] in a survey of cost management techniques and practices concluded that organisations should support manufacturing philosophies and business objectives by "Critically reviewing existing systems to eliminate irrelevant reporting and ensure the accuracy and credibility of those that remain laying sound foundations".

The competitive challenges facing all the research study participants are indicative of those faced by Keramos. The challenges primarily relate to the financial pressures rather than marketing and manufacturing pressures that are causal factors.

In evaluating the current accounting systems as described by Davies *et al* [82] it was necessary to determine the cost profile of the research study participants. Primarily the participants were small- and medium-sized enterprises and it was appropriate to

consider the extent to which a certain type of cost, such as direct labour was incurred in their organisation.

The cost profiles of the research study participants are outlined in Figure 6.1.5 For comparison costing structures reported in a CAM-I survey [83] for 1960, and 1986, and that propounded by Raffish [81] in 1994 are displayed in figure 6.1.

Accounting and Financial Pressures at Keramos

1. Return on Sales (ROS) fluctuating between +/- 5.0%
2. Pressure from profit centre management to validate the accuracy of the costing, quotation, and estimating systems. Primarily to identify the implications of a full order book on the target ROS. In essence if all textbook costing principles are applied then the target ROS should be achieved.
3. A varying customer profile, and the existence of cross-subsidisation of products with other profit centres.

The data presented in figure 6.1 indicates a decline in direct labour as a percentage of total cost, and a substantial increase in percentage overhead over the same period. This reflects the changing nature of cost occurrence, which is epitomised by technological change, and vigorous global, and domestic competition.

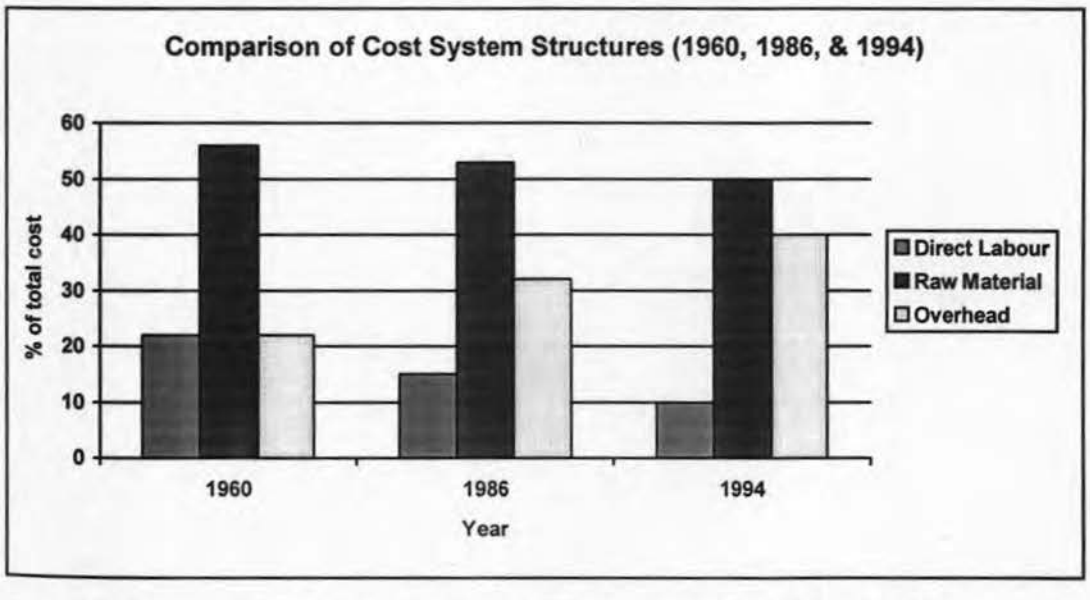


Figure 6.1 Comparison of Cost System Structures (1960, 1986, & 1994)

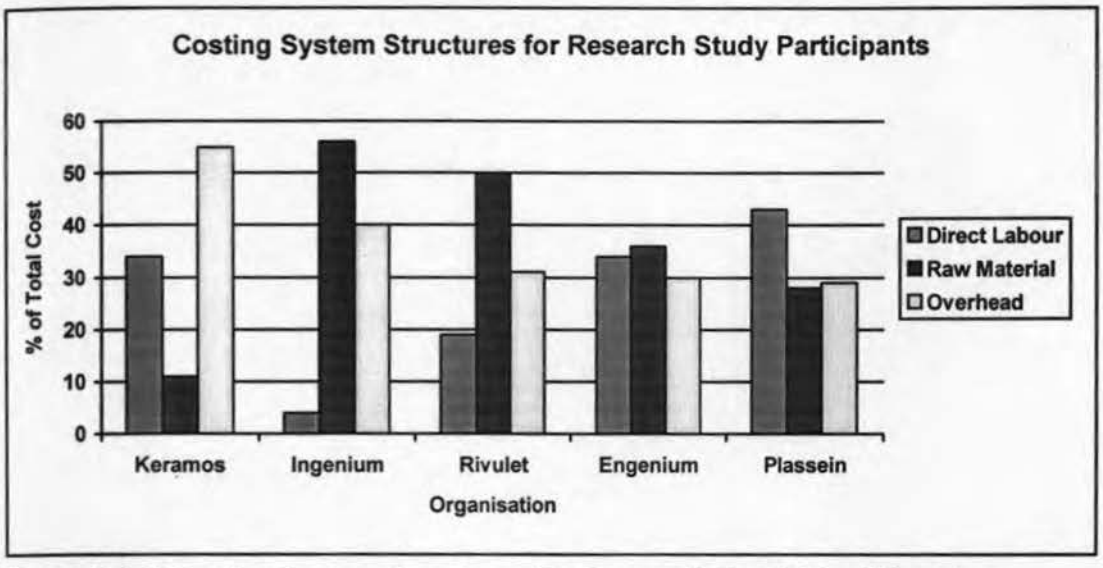


Figure 6.1.5 Costing System Structures for Research Study Participants

Analysis of the cost profiles for the research study participants indicates the extreme variety of cost profile prevailing for manufacturing organisations, with direct labour varying from 4% to 42% of total cost, and material from 11% to 55%.

Cost profiles are dependant upon the operational environment, and product specification, e.g. Keramos manufacture direct labour intensive products, from ceramic material, whilst Ingenium manufacture reduction gearboxes on high technology machines, with high material wastage. Analysing the cost profiles of the research study participants identified that direct labour and material are an important percentage of total cost for many organisations. Traditionally these costs are assessed and controlled utilising standard costing procedures.

6.3.3 The Implications of Standard Costing

Standard costing reflects the cost and utilisation of resources for producing a given component. Variance analysis is undertaken to reflect differences in performance between the established standard and the realised actual.

Changes in manufacturing systems resulting in direct labour reductions have focused

attention on the ability of standard costing systems to meet the needs of management. Innes et al. [49] have outlined four factors that affect the reliability of variance information, these are summarised below.

Limitations of Variance Analysis

1. Variances may not simply be due to operational factors but also to poorly set standards.
2. Variances may be related and therefore to associate each with one individual may be misleading
3. Overhead cost can be influenced by factors other than simply direct labour hours.
4. The standard cost of actual production implies a linear relationship between cost and output.

Innes *et al* [49]

They concluded that the benefits of standard costing must be weighed against these potential difficulties, and against the cost of developing and maintaining unit standards where products are complex and changeable. Hiromoto similarly has commented upon the demise of standard costing and the introduction of market driven management:

The Demise of Standard Costing: A Japanese Perspective

"Standard costs reflect an engineering mind-set, and technology driven management. The goal is to minimise variances between budgeted and actual costs - to perform as closely as possible to best available practice. Market driven management on the other hand emphasises doing what it takes to achieve a desired performance level under market conditions. How efficiently a company should be able to build a product is less important to the Japanese than how efficiently it must be able to build it for maximum marketplace success."

Hiromoto [42].

The re-evaluation of standard costing as a control mechanism has primarily been influenced by changes in manufacturing environment. Manufacturing initiatives such as Just-In-Time (JIT) necessitated change in labour and material reporting. Backflushing in JIT systems takes the finished end item and explodes it through the

bill of material to calculate raw material, component, and sub-assembly usage. Similarly direct labour can be backflushed or analysed by exception. That is direct labour recording their indirect tasks. Indeed in many organisations with very low direct labour content, direct labour now forms a constituent element of overhead cost.

Such changes have primarily been the domain of the large enterprise, and in particular end item assemblers, and original equipment manufacturers. Where does this scenario leave SME component suppliers, and batch manufacturers?

It has been propounded by several authors including Morgan and Weerakoon [43], DeThomas *et al* [84], and Keegan and Eiler [85], that the choice between standard costing and an advanced costing system is a black or white scenario. The author based upon his work in SMEs supports the conclusions of Horngren [80], and Koehler [86], that companies can combine traditional and advanced cost management techniques.

Kaplan [87], has argued that cost system designers have failed to recognise that their systems need to address the functions of; Inventory Control,Operational Control, and Product Cost Management. Kaplan and Cooper [88] argue that no single system can adequately cover all three functions. Traditional methods of allocation are appropriate for inventory valuation but advanced cost management systems should be utilised for operational control, and product pricing.

"Traditional" and "Advanced" Management Accounting Principles: A Combinatory Approach.

Activity Based Accounting is generic - that is, it can be a part of a job order product costing system, or a process product costing system. Horngren [80].

We can use the good ideas of the "new" management accounting without giving up the useful aspects of "traditional" management accounting. Koehler [86].

From a manufacturing management perspective standard costs can assist in inventory costing, planning, and control. Utilising records of material and direct labour usage

can assist managers in monitoring and predicting the work remaining on current work orders, and to provide a "benchmark" for quotations of similar jobs in the future.
It is this vital manufacturing perspective that led the author to examine the way that standard costs are established, and the extent of variances encompassed in the manufacturing environments prevailing for the research study participants. This would outline the degree of accuracy and repeatability affecting the manufacturing and financial functions.

From the degrees of variation present within the representative sample it was concluded that the control, reporting, and costing of direct labour is inaccurate. This supports the conclusion of Hill [89] who states that standard costs are invariably inaccurate, and that the inaccuracy distorts any decision based upon them. Current management accounting theory propounds the belief that improving overhead allocation will restore the profitability and competitiveness of the organisation.

This analysis indicates that such a belief can only be taken on board when direct labour, and material costs are accurately determined, and accuracy and repeatability consistently maintained.

The variations outlined led the author to initiate a widespread examination of the costing systems and their ability to meet the needs of the organisation. This encompassed labour, and material reporting, and sought to ascertain the degree to which overhead costs are correctly allocated. The method of the analysis and its subsequent conclusions form the remainder of this chapter.

6.4 An Holistic Investigation of the Costing Systems Employed for Research Participants.

A method of analysis was developed during periods of cost system appraisal with Keramos, and Ingenium. The iterative process of the investigations resulted in the development of a methodology that Simultaneously examines the Processes, Activities, and Data of the organisation. The methodology is summarised by the mnemonic SPADE, and is subsequently used for the remaining research study

participants. The application of the methodology provided greater identification of the organisational need and approaches for rectification of the costing system orientation.

The Simultaneous Process Activity and Data Examination (SPADE) Methodology

Simultaneous

Investigation of the three dimensions of assessment (process, activity and data) to establish the competence of the organisation to meet its stated objectives.

Process

A set of activities performed to achieve a specific operational objective. Processes commonly cut across functional departmental boundaries. Investigation determines the reason behind activity flow.

Activity

An element of a process where work is undertaken. Investigation of why and how work is carried out and its contribution to the overall process.

and

Data

The result of undertaking operational activities and processes. Data is used to assess operations by comparing actual procedure to official procedure and identifcation of discrepancies.

Examination

6.4.1 Evaluation of Business Processes

Hammer and Champy [59] in their seminal book Re-engineering the Corporation defined process as, "A collection of activities that takes one or more kinds of input and creates an output that is of value to the customer.". Turney [55] is less specific in the orientation of process defining it as "A series of activities that are linked to

perform a specific objective."

The process culture emanated from increased competitive pressures during the 1980s. The increase of Japanese competition and their policies of competitor, product, technology, and market need analysis necessitated change. The prevalence of time based competition required the re-orientation of business to the marketplace. Essentially the organisational hierarchy propounded by Smith [90] in the Wealth of Nations where recognition of specialist personnel prevails, has been reversed. Organisational structure is no longer based upon internal management desires, but upon the customer, and the competitive and changing environment. Process management is the realisation of that change.

Macro-level processes are categorised by CIM-OSA [91], into three main areas, Manage, Operate, and Support. At a more detailed level Hammer and Champy [59], have commented that process definitions should reflect the initial input and final output. They explain that manufacturing could be redefined as procurement to shipment and similarly;

Product Development	:	Concept to Prototype
Sales	:	Prospect to Order
Order Fulfilment	:	Order to Payment
Service	:	Inquiry to Resolution

The organisations selected for participation in the research programme were investigated in the process perspective. The investigation would reveal the extent of organisational awareness, and the degree of reflection of organisational structure and processes in the costing system. At a macro level most manufacturing companies have a generic process structure. The similarities between two of the companies participating in the research programme can be seen by comparison of the process flowcharts for Ingenium figure 6.2, and Keramos figure 6.3. These flowcharts identify the core process of satisfying a customer order, and the activities undertaken.

Figure 6.2 Ingenium: Process and Activity Analysis

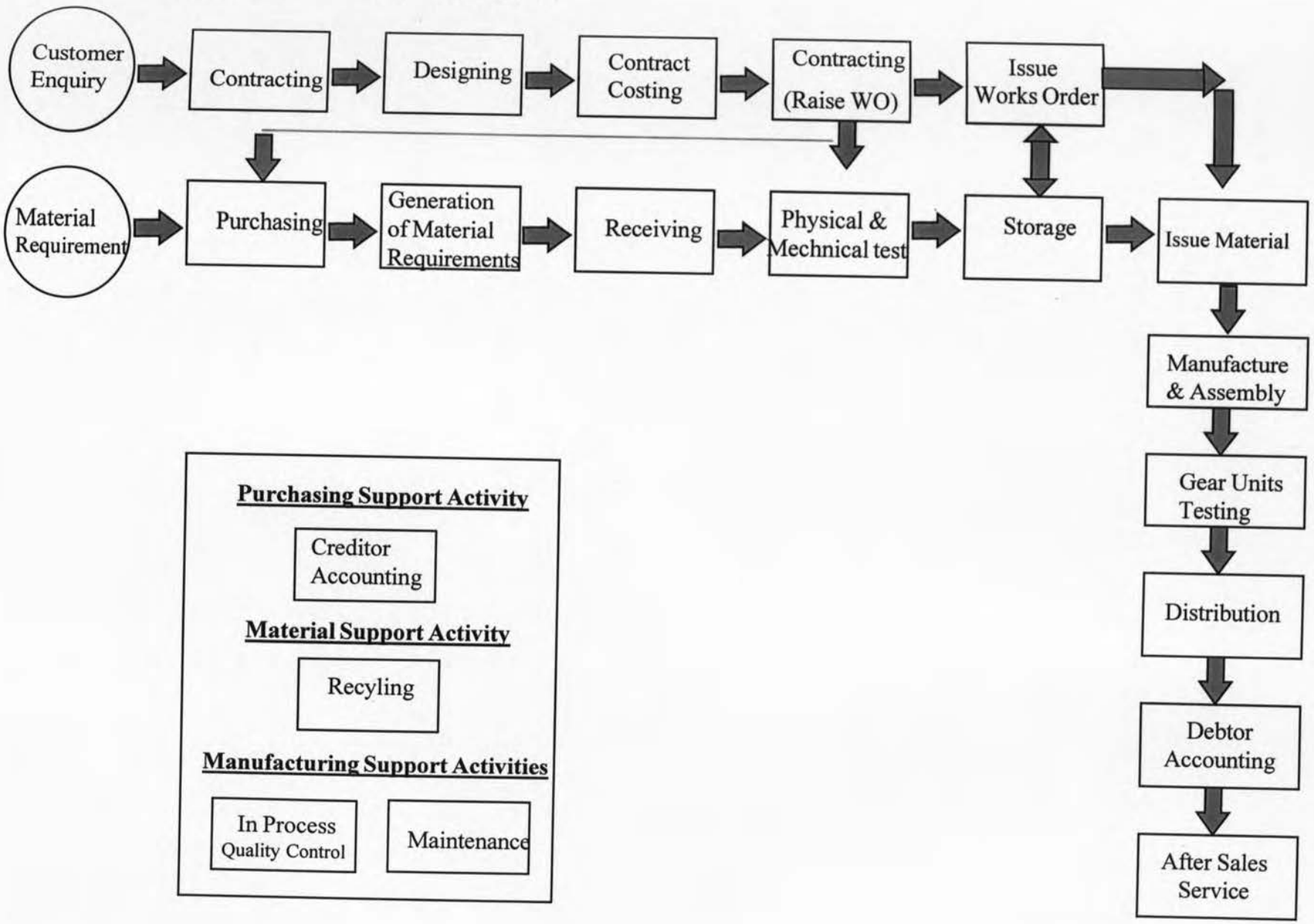
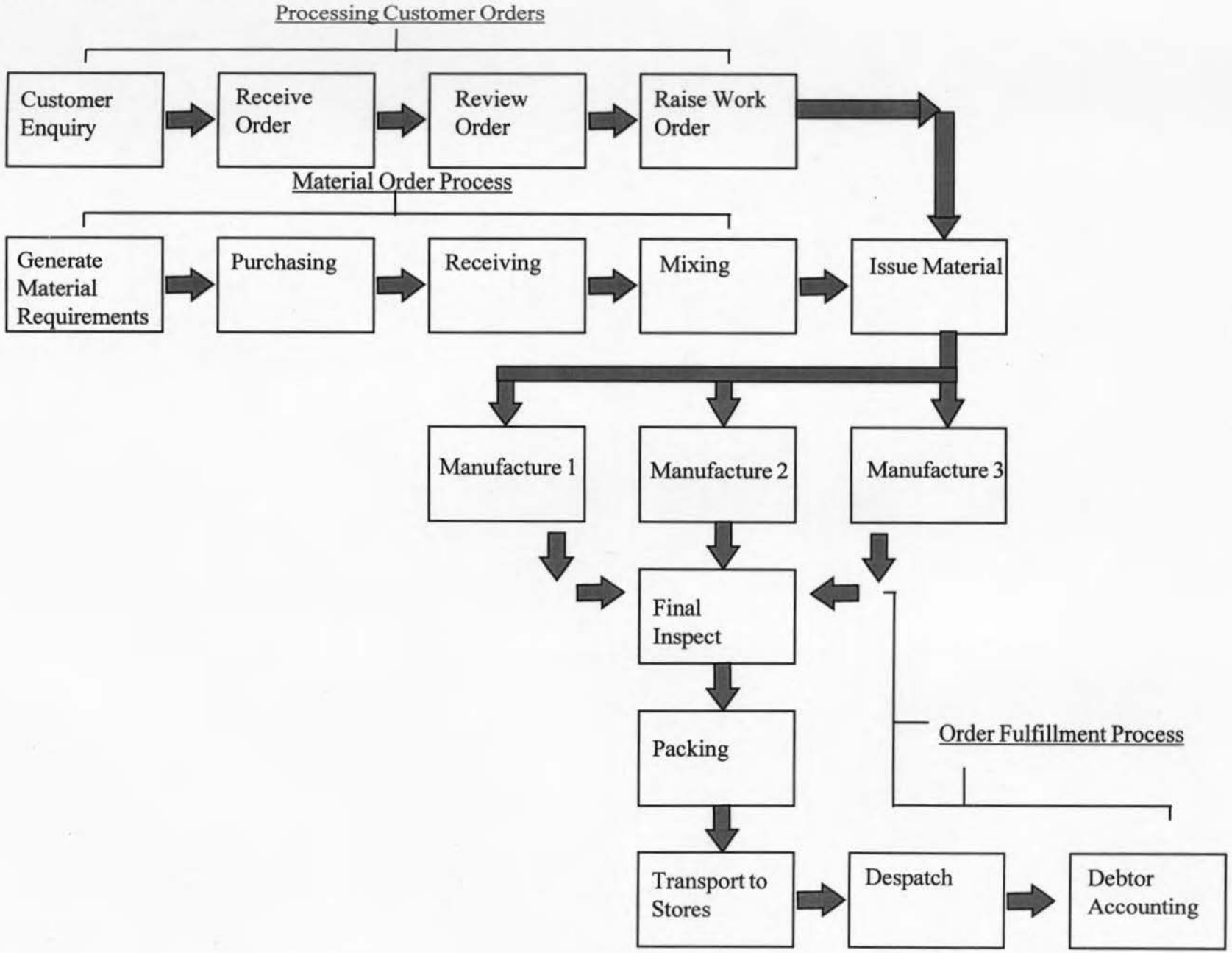


Figure 6.3 keramos: Process and Activity Analysis



The process encompasses processing customer.orders, generation and receipt of material requirements, product manufacture, and order fulfilment. These lower level processes can reveal deficiencies in the structure and utilisation of the costing system. Indeed at the start of the research programme it was necessary to consider which business processes were liable to uncover areas of inconsistency in managerial, and operational accounting.

6.4.2 Evaluation of Operational Activities

Turney [55] has defined activity as, "A unit of work performed within an organisation. A description of the work that goes on in the organisation and consumes resources".

Three distinct methods of analysing activities have been defined; physical mapping, workflow analysis, and interviewing. Activities can be categorised with respect to their operational significance. Brimson and Burtha [92], categorise activities as primary and support. Primary activities are directly involved in the resolution of customer service. Support activities intuitively, support primary activities. Bellis-Jones [93] categorises activities as core, support, and diversionary. The most common categorisation system is value added, and non value added. This distinction reflects the customer perspective of whether an activity adds value to the product.

Common business activities that can be selected for further investigation *inter alia* are as follows.

Product and Engineering Change procedures
Sales Order Processing and despatch
Formulation of production plans
Generation of requirements for assemblies, components and purchased items
The planning of capacity, loading of machines and people.
Goods inward, stores issue, and receipt procedures.
Scrap Accounting and the causes
Determination of batch sizes.

Determination of, and accounting for set-up costs.
Setting of standard labour and machine times by component
The measurement of and reasons for variations to standard
The booking of direct labour to indirect tasks, and the reasons.

Activities are assessed by defining current procedure, comparing actual procedure to official procedure, and determining the extent and nature of variations. The efficacy, efficiency, and effectiveness of the activities is examined by defining the inputs and output of each activity step. For each input the source is noted, manipulation of the input data is recorded, and the structure and destination of the output are documented.

This method of investigation enables the building of a modular structure of an organisation. It is utilised to identify the degree of effectiveness, absence of procedure, and non-value added work for current activities and processes. The process and activity analysis elements of the SPADE methodology are classified as constituting a "top-down" approach to establishing problem definition. The approach identifies operational elements that are at conflict with business objectives.

Assessing the processes and activities of an organisation is not restricted to the conceptualised techniques of Activity Based Costing, and Business Process Re-engineering. It is essential for the resolution of business objectives. The degree to which organisational systems meet business requirements is vital. It is this primary systems assessment that will determine the extent of change within the costing system. Similarly a SPADE analysis can outline the extent of change required in manufacturing and production control systems, and non-computerised areas. SPADE is generic. Any business, can utilise SPADE to resolve the underlying problems and challenges prevailing in today's competitive environment.

6.4.3 Evaluation of Operational Performance data.

Data is defined in the Oxford English Dictionary [94] as "a thing given or granted. Something known or assumed as fact, and made the basis of reasoning or calculation;

an assumption or premiss from which inferences are drawn." and this can be related to the activities and processes undertaken in the organisation. Data is a measure of the ability of the processes and activities to meet defined performance measures.

The data interacts at the intersection of the processes and activities, and this is where operations are undertaken. Data is available at many levels. From the general level (i.e. strategic) to the detailed level (i.e. Operational). When a problem analysis is undertaken it is essential to develop a complete picture of the current situation. It can be likened to a criminal investigation, with the varying types of evidence being :

Substantive Evidence: Evidence solid in foundation or basis. Analysis of data and activities forms the basis of the investigation, from this questions can be asked at a more general level.

Circumstantial Evidence: Indirect evidence that tends to establish a conclusion by inference. Processes and strategy are those factors that may give rise to confirmation of why activities are undertaken, or why certain deficiencies in the data exist. The ultimate problem may be due to a process or business objective pursued.

The essence of SPADE is the relationship between processes, activities, and data. The assessment of data in relation to processes and activities within the SPADE methodology is classified as constituting a "bottom-up" approach. Arthur Conan Doyle [95] in his literary classic "A Scandal in Bohemia" draws upon the relationship between theory and data. When Dr. Watson exclaims "This is indeed a mystery...What do you imagine it means?" Holmes replies: "I have no data yet. It is a capital mistake to theorise before one has data. Insensibly one begins to twist facts to suit theories instead of theories to suit facts."

Analysis of material, and direct labour cost is achieved through assessment of current work orders. This primarily evaluates the degree of accuracy prevailing in traditional costing systems. The allocation of overhead is appraised through comparison of the

relationship between the allocation base and overhead consumption. Datar, and Gupta [96] have undertaken numerical analysis of the underlying logic behind utilising multiple cost pools , and activity drivers. The degree of aggregation prevailing in the cost system will determine the extent of re-engineering, and rationalisation required to achieve relevant product costing.

6.5 Results of the SPADE Analysis.

Evidence at a macro level is generically classified as substantive and circumstantial. Evidence pertaining to the SPADE assessment incorporates the substantive and circumstantial. There are three primary classifications of evidence.

1. Organisational
2. Systemic
3. Operational

6.5.1 Organisational Evidence

Organisational evidence is defined as evidence of a circumstantial nature that identifies the background influences affecting the orientation of the costing system and the organisation. This subsumes marketplace, and inter-organisational dynamics.

Marketplace Dynamics

In the marketplace the research study participants were facing varying degrees and forms of change. The changing competitive environment had forced Keramos to maintain its market position through competition on price. The leading edge market position enjoyed by Keramos was founded and enhanced by developments in product specification, and quality management. Competition primarily from the Far East and the Orient had forced Keramos to assess the viability of its high volume, low margin business.

While Keramos encountered increased pressure from the Far East, and the Orient,

Ingenium faced expansion of its export markets. Following political and social change in 1990 Ingenium has adapted the organisational orientation to the demands of a free market. This has seen an increase in production and sales of reducers of over 30% in the last three years. Increased export to Western First World countries is a causal factor. Prior to 1990 exports were predominantly focused on countries from Eastern Europe and the Third World.

Ingenium and Keramos had distinctive competitive pressures of increased market, and increased competition respectively, while Plassein had become entrapped by its own market position.

The customer profile of Plassein was predominantly automotive, and while attempts at diversification away from this sector, it remains the primary market. The market entrapment is epitomised in the realisation that one customer generates 80% of business. In summary the competitive pressures faced by Keramos, Ingenium, and Plassein are market retraction, market expansion, and market retrenchment.

Inter-organisational Dynamics

Internally the competitive pressures manifested themselves in the organisational structure, and primarily in the interaction between manufacturing and accounting personnel. The profit centre business philosophy pursued by Keramos ensured accountability for performance in the marketplace was pushed well down the line. It also lent itself to a flat management structure ensuring good communication, quick response, flexibility, and tight management control. The profit centre approach necessitates control of all embracing policies of cost allocation, and business conduct. In the marketplace Keramos' customer needs are often serviced by multiple profit centres. Inherent in such circumstances is the loss leader approach whereby the maximisation of profit is achieved through the core competence of the organisation. Similarly the interaction of profit centres exists in the provision of a central support service function for non-manufacturing activities.

The criticisms of the prevailing financial accounting systems in Keramos predominantly focused upon allocation of overhead incurred through the central

support and sales service function, and the allocation of profit centre generated production overhead. In attempting to overcome the outlined problems the finance manager had attempted to rationalise the cost centre structure of the accounting system. This failed to achieve the major improvements in overhead allocation. Re-engineering of the costing system was the only solution.

In achieving the required manufacturing throughput the achievement of target financial ratios was expected by profit centre personnel. The relationship between profit and output is however not a linear one, and maximisation of profit can only be achieved through detailed analysis of the customer and product profile. In not meeting the financial targets when output was maximised the profit centre personnel focused their attention on cost allocation.

While Keramos sought to realign the costing system to eliminate cross-subsidisation of product costs to determine the extent of competitive advantage, Ingenium sought to identify true product costs. This would determine the nature of resource consumption and profitability of its export market.

The manufacturing strategy was a combination of make to order, and make to stock, with batch manufacture of standard products, sharing the same facility as one-off customer designed items. The Ingenium product range varies from the manufacture of pump screws, small, portable reduction gearboxes, actuator control mechanisms, through to very large reduction gearboxes. The products are utilised in a variety of demanding industrial sectors, which *inter alia* are mining, oil, chemical, agriculture, food, and construction.

The manufacturing systems employed covered all aspects of manufacture, from base raw material, through to end item assembly. The manufacturing areas included a foundry, machining, toolroom (ostensibly for the manufacture of tools for machining shops), fabrication, and assembly. The demands of an export market led the design and development department to instigate modernisation of products. This was achieved through assessment of functional product parameters and resulted in

improved quality and performance.

While Keramos sought to increase understanding and allocation of its increasing overhead base with relation to its varied customer and product profile, Rivulet have sought to establish their market position and maintain, and develop profitability.

In recent history Rivulet has been taken-over by three new directors, who have expanded the existing customer base, and doubled turnover in a period of under three years. Saving the company from liquidation the directors have sought to increase profitability, and improve manufacturing effectiveness, through the elimination of waste and the improvement in quality and quantity of customer orders. Subsequently Rivulet has introduced improved machining and production control facilities. It is these internal changes that have instigated assessment of the costing system orientation.

In summary the inter-organisational dynamics were a direct response to the competitive environment. Keramos had placed significant importance on traditional financial performance measures. In the competitive environment pressure to achieve these targets increased and failure despite manufacturing success required assessment of the accounting system. Similarly within Ingenium cost dynamics were influenced by customer, and product characteristics. Market expansion influenced the reliability of the costing system and necessitated change. In comparison Rivulet needed to consolidate its improved trading position and reflect current operational dynamics in the costing system.

6.5.2 Systemic Evidence

Systemic evidence is defined as evidence of a substantive and circumstantial nature that identifies the nature, scope, and discrepancies of operational control systems.

Keramos utilise an Integrated Manufacturing and Production Control system across all 4 profit centres. While the system is a product of the increased interest in the

capability of MRP II in the 1980's it still sufficiently meets the organisational requirement. While the networked software services the organisational need, inconsistencies in data have given rise to "model collapse". With no "champion" of the system with ultimate responsibility for its general maintenance the system degenerated until a position where production routings, bills of material, and standard costing details no longer related to operational activities.

This position was reached by Keramos and was considered indirectly to affect its ability to service internal and external requirements. Subsequently the strategy of diversification to overcome the demands of high volume and low margin business was severely inhibited.

Similarly within Ingenium the interaction of material and direct labour cost data was collated from several sources including production planning, data processing, and the cost department. Although the data from planning sheets were utilised in both the computing system (with respect to direct labour), and the cost department (with respect to contracting), the computing system was not updated with current information with respect to machine hours. The initiation of new contracts utilised information which failed to take into account data, with respect to actual direct labour content, and material, from previous work orders. In both cases there were major discrepancies between actual and standards.

6.5.3 Operational Evidence

Operational evidence is defined as data relating directly to manufacturing and support activities. This is purely substantive in nature and subsumes direct manufacturing costs, manufacturing support costs, and non-volume related, non manufacturing overhead cost.

Plassein

Within the Vacuum forming facility of Plassein the reporting of variable costs can be substantially improved. The reporting of material usage is accurate due to the material

being supplied in kit form, reporting of this usage is carried out through the works order system. Direct Labour can also be reported through the works order system, although this is not current practice. Major variations in direct labour were recorded and were significantly lower than the standards reported in the works order system.

Within the foam moulding facility at Plassein the requirement is for greater accuracy in the recording and reporting of both material usage and labour utilisation. This cannot be achieved with the works order system currently in place. Presently no formal control system is in place to monitor production in this area. While such discrepancies may in the short term reduce profitability the longer term implications need greater analysis. Plassein during the period of the research participation have contracted and implemented a new foam moulding facility. The implications of the new system and discrepancies in production control and finance have focused attention on the profitability, efficiency, and effectiveness of the new manufacturing system, and the products which utilise the facility.

Overhead for the foam moulding and vacuum forming facilities is currently allocated on the basis of square footage. This method of allocation has been installed as company policy due to the demands placed upon it by the company's major automotive customer. Such a method of allocation is seriously misguided. The overhead which is incurred is not reflected in the amount of square footage utilised. In essence the automotive manufacturer is seeking to minimise the cost of its products through dictating inappropriate methods of cost allocation.

These factors are seen to affect the degree to which the company can achieve their target financial performance ratios. This will significantly influence their attempts at diversification into other market sectors, and will place considerable long-term pressure on the sources and utilisation of capital.

Keramos

Analysis of the operational activities on the shop floor and the related data was considered to validate the information given by managers. To this end an assessment

of three types of work order was carried out encompassing high, medium, and low volume products. The assessment covered the following areas :

Operational standards against operational actual.
The utilisation of indirect staff in the production process.
The use of direct staff to undertake indirect tasks.
The allocation of overhead to the varying types of product.
The appropriateness of the current cost centres in relation to the operational activities.

Within Keramos the diversification of products, product routings, production volumes, and customer requirements creates a demand for resources in a manner which cannot normally be accurately reported and reflected by traditional costing systems. Such variations, combined with inaccurate data reporting can distort product costs as the apportionment of production overhead on a direct labour hour basis does not necessarily reflect the consumption of these overheads.

The detailed sampling and investigation revealed that the way costs are incurred in practice is not truly reflected in the accounting system. The recording and allocation of costs is considered inaccurate in the following areas:

Setting up: The setting up time for products is not measured, therefore any variation is not monitored and not accounted for in contracts to be established. Similarly consumables utilised during set-up are not recorded against product but by cost centre. Certain products are more difficult to set-up than others, but this complexity is not reflected in the product pricing. Setting up a machine for pressing a component can take anywhere between 2 days to 2 weeks. When the physical setting of a machine is complete a product batch is sent for kiln firing. Only after successful firing with dimensional stability of the component established will production be released.

Tool-Setting: A standard tool setter attention time (indirect cost) is utilised in most processes. However this standard indication needs revision to reflect current processes where substantial variation in the amount of tool-setter attention time exists.

Maintenance: Maintenance takes two forms, planned maintenance and breakdown maintenance. Both types of maintenance are recorded against cost centre. In the case of breakdown maintenance no record is kept of the particular product running when the breakdown occurred.

Rework and Scrap: Rework and scrap costs are important elements of understanding production and product costs. Currently the costs incurred in producing scrap and rework are not visible. This identification is important as certain products require more rework and higher scrap levels than others.

Consumables: Consumable costs are not always allocated to the exact cost centre in which they are consumed.

Cost allocation: The method of allocation on the basis of process time is seen to be inaccurate as the process time varies. An improved method of allocation on the basis of units, plates, or sets is seen as more accurate and meaningful.

Rivulet

In addressing the project objectives it was necessary to examine the costing and quotation system and compare the data from the administrative systems to that gained by analysing current manufacturing practice.

The investigation revealed that the way in which costs are incurred in practice is not reflected in the current costing system. In particular it was recognised that the existing costing rates were based on cost data with estimated production volume. Any variation in the order characteristics of those contracts undertaken will distort the costing and quotation rates due to the inherent effect of batch costs. A comparison of standard costing and time records was severely restricted by a lack of data on the appropriate works orders. It was decided to utilise data collection sheets to obtain information on current production orders and attempt to reflect the order characteristics in any updated costing rates.

It was determined that three separate data collection sheets be utilised to reflect the complexities of the manufacturing operations. In direct response to the project objectives, and based upon the initial investigation two spreadsheet models have been developed in Microsoft Excel 5.0 to facilitate any future assessment of contract or piecework rates.

The spreadsheet model developed for assessing and determining piecework rates utilises two primary sources of data. Firstly a machining record to identify machining hours, works order, and parts produced, and secondly operator piecework books detailing appropriate piecework rates against work order and operator.

This information is brought together in the spreadsheet in the form of a ratio. In essence it identifies the actual time taken to produce 1000 parts and a benchmark £4.50 per hour labour rate and compares this to the standard piecework rate by utilisation of the piecework ratio.

$$\text{Piecework Ratio} = \frac{\text{Actual Piecework Rate/Hour}}{\text{Benchmark Rate/Hour (£4.50)}}$$

A piecework ratio of less than 1 is an indicator that the operator has not exceeded the standard production rate for a particular operation. Conversely a piecework ratio in excess of 1 indicates an operator has produced parts at a rate faster than standard. Such a range of scenarios exist and this necessitates the need for a balanced approach to defining piecework rates. Major deviations below standard can result in negative responses from operators, whilst managers should try to avoid piecework rates which are excessive in comparison to the production time expended.

The figures established through research are indicative of the results of utilising piecework rates and highlights the complexities of obtaining rates which are contractually and politically (in terms of operator payment) correct.

Ingenium

Initial investigations established that the focus of improving the cost management system should be toward overhead and material cost analysis. Subsequent analysis of the overhead structure for production and support services functions identified that the allocation of the respective overhead on direct labour hours consumed was inaccurate. To analyse correctly the overheads consumed in Ingenium it was determined that a method of analysis which could reflect the multi - product environment was required.

Engenium

In the preparation of quotations, up-to-date material prices are requested from suppliers. Any variance can only occur in the consumption of material at Engenium in the form of losses. While possible variances should be checked, this was not considered a major area of cost distortion.

In the preparation of a quotation direct labour is charged at the rate of £8/hour at Engenium. This however includes an overhead recovery element. The actual direct labour charge is in the range of: £4.50 - £5.50. The £8/hour direct labour rate is applied to all processes regardless of the manufacturing equipment and product requirements. The set-up although costed separately is still costed at £8/hour (inc. overhead) for all processes.

The single rate of £8/hour applied to all operations including set-up is seen as the major form of costing distortion. The implication of this can be seen in the trading profitability of Engenium. Quotations are based on a margin of 25 - 30% in general, trading results indicate a break even situation over the year.

The shortcomings of the quotation and costing system applied at Engenium are summarised as follows:

1.Inaccurate overhead recovery procedure.
2.No variance analysis on direct labour undertaken.
3.No analysis of actual set-up times and resources utilised.

Table 6.2 Organisational Assessment Summary Matrix

	Ingenium	Rivulet	Keramos	Plassein	Engenium
Manufacturing Competence	Reduction Gearboxes	Screws and Rivets	Industrial Ceramics	Foam and Injection Moulded Components	General Engineering
Marketplace Dynamics	Market expansion	Consolidation & review of market position	Market Retraction	Market Retrenchment	General competitve pressures.
	Political revolution has given the company full access to western markets.	Recent takeover has neccesitated consolidation of business activity	Increased competition from the Far East and Orient has affected high volume business.	80% of business undertaken with one customer. Difficulty in diversifying into alternative markets.	Competition on price, quality, and delivery terms.
Inter-Organisational Dynamics	Demand from customers in emerging markets is affecting product characteristics, and manufacturing facilities.	Takeover has resulted in changes in operational activity, and the introduction of improved manufacturing facilities.	Profit centre business philosophy is affecting customer profitability and internal company relationships.	Current market position has resulted in the commencement of multiple projects of a complex nature. This has affected day-to-day operations, and resulted in company stagnation.	Sister company is controlling operational activity. Little or no change possible.
Systemic Evidence	3 different paper and computer based systems employed that collect similar information. Discrepancies are not reconciled.	Paper based system that was inaccurate, incomplete and unutilised. Recent adoption of a computerised system.	Product routes and operational data is not maintained resulting in an inaccurrate integrated manufacturing and production control system.	Computer based system that was inaccurate, unutilised, and incompatible with the manufacturing system employed.	Computer based system for the preparation of quotations and product routes.
Operational Evidence	Utilisation of a direct labour allocation system, even though labour is 4% of total cost. Significant non-manufacturing activities undertaken.	Current costing rates were established utilising production volumes that are not indicative of current production volumes, and manufacturing activity.	Overhead allocated on a standard Direct labour hour basis. Manufacturing support and non-manufacturing activity costs not correctly reflected in current product costs.	Overhead allocation on square footage enforced by primary automotive customer. Variable cost data inaccurate.	Utilisation of standard direct labour and overhead rates regardless of product or manufacturing complexity.

4.No analysis of direct labour undertaking indirect tasks.

5.No separation of overhead and direct labour in quotations.

In summary the operational data relating to the financial systems for the research study participants was inconsistent with the manufacturing environment. Direct labour, and material was incorrectly recorded, and overhead incorrectly allocated. These factors directly influenced the costing and quotation systems and subsequently affected profitability. A summary of the results from the organisational assessment can be found in table 6.2.

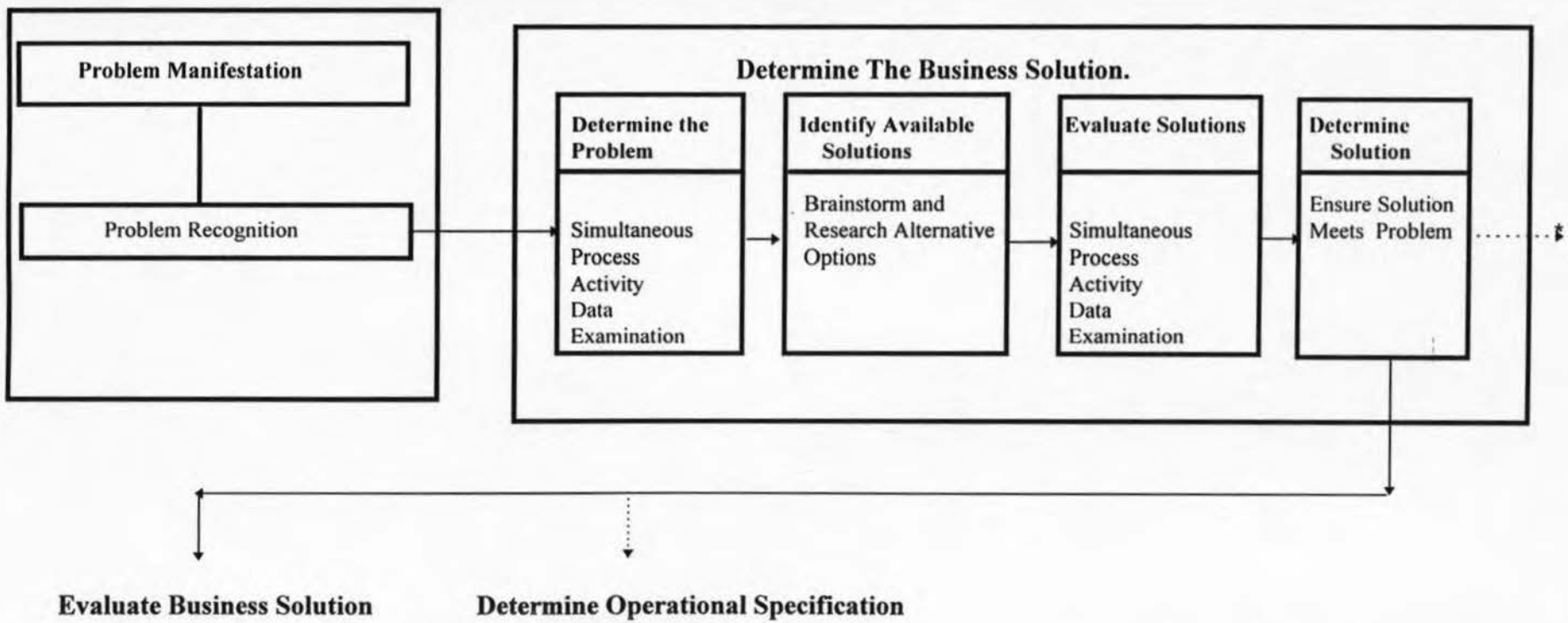
The SPADE methodology is an integral part of the Activity Based Cost Management methodology for determining the business solution. The first stage of the methodology developed by the author is presented in figure 6.4.

After recognising and determining the cause of the problem situation the formulation of solutions can be undertaken. Three options are available for the determination of the possible business solution(s). These are as follows :-

- Determine a singular choice
- Determine best possible choices
- Determine the primary function of the system and outline relevant issue based systems.

A singular choice would encompass circumstances where the appropriate need meeting system is unique, well defined and no alternative system exists. In identifying one singular choice the inherent risk of premature judgement of the solution presents itself. The solution must meet the defined need to a large degree for such a solution to be acceptable. A resultant factor can be a large degree of redundancy in the system. Identification of the best possible choices through brainstorming and literature investigations presents the opportunity for redundancy. Using "off the shelf" choices and transplanting the techniques directly into the organisation maybe misguided. This risk can be minimised with a subjective appraisal of the issues relating to the

Figure 6.4: ABCM METHODOLOGY: Part 1: Determining the Business Solution.



* The first stage of the methodology concerned with determining the business solution can result in a number of solutions being identified. The resultant technique chosen may not be Activity Based Cost Management, and hence at this point deviation from the model is necessary.

specification of the system.

This has been outlined by Checkland [97] as identification of the systems primary function and subsequently outlining the issues which the system(s) is seeking to address. The transformation process converting input to output is used as a basis for conceptualising the system required. This conceptualisation may impinge upon the structure of singular and best possible choices, without the premature judgement of solution. Once conceptualised the need meeting system can be defined.

Initially development of solutions is by utilising the organisational information databases and external information agencies. This development phase should encompass the views of cross-functional personnel to envisage the type of need meeting system required.

The evaluation of solutions utilises the SPADE methodology as its base. In this circumstance the possible solutions are compared with respect to how they engender themselves to the organisational strategy. Subsequently if they are found to meet business objectives the effects on processes, activities and data are analysed. The techniques should translate themselves into processes and activities which suit the organisational culture, philosophies and support the systems currently employed. Similarly the data structure should adhere itself to the organisational philosophies.

In meeting the organisational evaluation the solution(s) remaining will be subjected to a control mechanism. By evaluating the solution(s) against the initial problem this should ensure any final selection process is undertaken and that the business need is satisfied.

6.6 Conclusion

Small- and Medium-Sized Manufacturing Enterprises have a generically distinct cost profile of percentage Raw Material, Direct Labour, and Overhead in comparison to large organisations. Publicised case studies of ABC implementation in large

organisations cite cost profiles in the range of 5% - 15% Direct Labour, 45% - 55% Raw Material, and 30% - 50% Overhead [100, 101, 102]. Such cost profiles readily engender the organisations to applying ABC principles.

An approach for SMME's to determine their requirement for an advanced costing system in a changing environment is essential. The differences in organisational cost profile are such that assessment of all cost elements is required including Direct Labour and Material. This is to ensure all costs are correctly assessed in estimating and quotation systems. An indirect consequence of this assessment is the clarification that Bills of Material, Standard process Routes, and Standard times all utilised in the scheduling and production control systems are valid.

The SPADE methodology for determining the business solution provide a unique way of overcoming the challenges faced by SMMEs in determining the inadequacies of their current costing system. It is seen to overcome the current criticisms levelled against Activity Based techniques. By assessing the capability of current costing systems and advanced solutions to meet the organisational objective and strategy a panacea driven approach to improvement is eliminated.

It may be concluded that a major factor influencing the introduction of an advanced management accounting system is the validity of the production control information. Activity Based Cost Management systems, associated derivatives, and alternative costing systems can be seen as a luxurious, high profile finale to a long term organisational change project.

Chapter 7

Issues in Activity Based Cost Management

Introduction

Developing upon the methodology presented for determining the business solution this chapter details implementation issues pertaining to the introduction of ABCM. The chapter will discuss and critically appraise the implementation of an operational solution, and compare and contrast published methodologies. The issues detailed in this chapter will subsequently be utilised in the implementation of an operational solution outlined in chapter 8.

7.2 The Issues

In 1991 Davies *et al* [82] in a survey of cost management techniques and practices commented upon "follow the leader" and "me too" approaches to ABC and other cost management techniques. They advocated a radical reappraisal of cost management systems in order to provide systems which support manufacturing philosophies and achievement of business objectives. Similarly Hill [103], has commented upon the implications of adopting a panacea approach to change management.

Resolution of Business Problems through Panaceas

"A panacea approach will at best only distract management from the essential resolution of its strategic direction, and at worse will imply that there is no longer any need to be concerned - all is at hand...Solutions presuppose that market requirements and hence corporate characteristics are the same. But today nothing is further from the truth. Markets are not characterised by similarity but by difference."

Hill [103]

In order to support manufacturing philosophies and business objectives Davies *et al* [82] concluded that organisations should:

1.Critically review existing systems to eliminate irrelevant reporting and ensure the accuracy and credibility of those which remain - laying sound foundations.
2.Ensure that senior managers of all disciplines understand the features and benefits of cost management techniques.
3.Select those techniques which will provide tangible benefits and avoid piecemeal developments.
4.Develop implementation plans with clear deliverables.

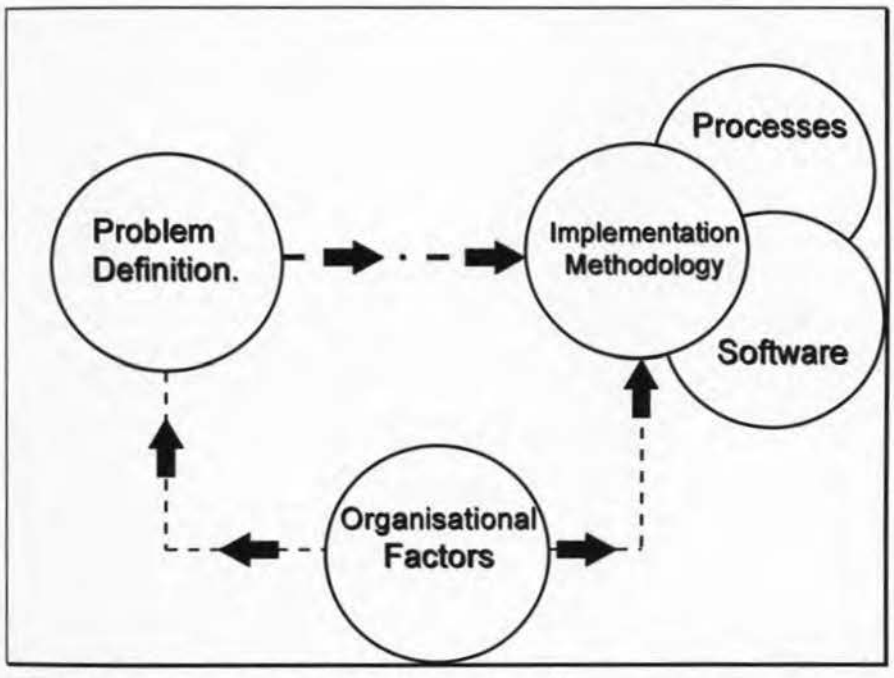


Figure 7.1 Issues in Activity Based Cost Management.

The critique outlined by Davis *et al* has been assessed by the author and impinged upon the identification of the underlying Issues in Activity Based Cost Management. These incorporate and integrate Problem Definition, Software, Processes, Implementation Methodology, and Organisational Factors. The relationship is outlined in Figure 7.1. Of the quintet the implementation methodology principally indicates the procedures utilised during implementation.

7.3 Problem Definition

Problem definition is assessed independently of all others, excluding the organisational factors. This integration has been considered in determining the business solution. The problem definition should be undertaken with focus on hard and soft issues relating to the existing accounting and management control systems and with an holistic view of the organisation. The problem definition has been reflected in chapter 6, that investigates the problem situation.

7.4 Organisational Issues

The organisational issues indirectly influence the problem situation and implementation of an improved system. The organisation issues *inter alia* are: training, organisational size, change management, and the project team.

7.4.1 Training

Training is essential if the introduction of ABC into an organisation is to be successful. The training should encompass both "Hard" and "Soft" issues. Traditional project management team and personal skills are labelled "Soft", and include : -

- Communication
- Planning
- Team Roles

The "Hard" issues relate directly to the implementation and include : -

- Standard ABCM Education
- Education Pilot
- Agreeing Policies and Parameters
- Milestone Planning
- Detailed Project Planning

The training undertaken with the research study participants reflects these hard and soft issues. Management in the form of the steering committee, needed a general overview of the project, and a detailed understanding of some critical elements in order to direct its future progress. The members of the project team needed skills to ensure successful completion of the project. These skills included technical activity based cost management knowledge, system design, software modelling, project organisation, team building, communication, and project and system information reporting capabilities.

7.4.2 The Implementation Team

Turney [55] has outlined three elements to the structure of ABC project team

1. The Project Team - Responsible for Implementing ABC.
2. The Project Manager - Leader of the project team.
3. The Steering Committee - Oversees planning and implementation and determines project objectives.

Rivulet

The project team for the implementation of the solution encompassed the 3 operational directors, and 6 additional personnel representing the manufacturing and support service functions in the company. Although this project team is small in comparison to those employed by larger organisations for ABC implementations in relative terms the project team can be considered large.

The responsibilities of the project team included data collection, of a financial and non-financial nature. This was facilitated by the operational directors who subsequently were utilised in defining the detail of the system, and implementing the solution. In comparison to a large enterprise the employment of the operational directors in the system design can be considered unique. This was essential due to the limited management skills base prevailing at the time.

Ingenium

A steering committee consisting of the chief executive officer, the finance and production directors, and the internal technical and financial consultants was established. A project team of 13 operational managers and staff was formed to undertake the data collection and analysis, to determine new operational procedures and practices, to define the detail of the system, and to agree and implement the solution. The project team had representatives from sales, production, production control, manufacturing engineering, design, and finance. It was observed in the implementation survey (Chapter 4) that sales personnel rarely participated in ABCM project teams, that most companies considered that this was a weakness and created problems during the implementation and operational stages. The author therefore made sure that sales were represented on the project team.

The role of the steering committee was to demonstrate the importance of and commitment to the programme, to set objectives and milestones and monitor progress, to remove obstructions to progress and ensure that time was made available for the project team to carry out their tasks. It transpired towards the end of the project that the steering committee had been particularly thoughtful and careful about the selection of the project team members. Nine of the thirteen were hungry for change and had no inhibitions or fears about the tasks or potential solutions. The remaining four were uncommitted and negative at first (although not destructive about proposals), however by the end of the project they were as committed and positive as the rest of the team.

Keramos

The implementation of an operational solution in Keramos was facilitated by a project team encompassing 10 personnel. The team was led by the financial manager and was supported by 4 other personnel involved at a site level. At a profit centre level 5 personnel from the centre were utilised for the implementation.

The personnel involved encompassed the majority of functions at a site and profit centre level. The introduction of a shop floor data collection system and re-evaluation

of product routings and raw material process routes had primarily established a core team with responsibilities for manufacturing and production control. The nature of the companys' personnel structure and production complexities necessitated the introduction of section managers.

7.4.3 Organisational Size.

The size of an organisation affects the implementation. The scope of the research programme is concerned with SMEs. The importance of the SME sector in the economy has been reported by the European community [11], who report the influence of SMEs in employment creation, innovation, change, competition, and the complementary relationship with large enterprises. Similarly the Institution of Electrical Engineers [12], outline the innovation, and responsiveness of SMEs but comment upon the facilitation of best management practice in order to improve competitiveness.

While the needs of large organisations are being serviced albeit somewhat erratically by consultants combined with internal specialists, the needs of SMEs are being left unserviced due to the cost effectiveness of utilising consultants for such a substantial organisational project, and the appropriate skills base in the organisation. The development of a generic system solution for SMEs incorporating a methodology for establishing problem definition and implementation will aid ABCM utilisation within the SME sector.

7.4.4 Change Management

Change is the most important factor in any project implementation. The benefits for change need to be outlined, so that organisational personnel can identify the real project issues. This is vital for determining whether continuation of the existing system is preferred in comparison to change. It is often the case of "better the devil you know than the devil you don't". Identifying implementation benefits and establishing an accurate problem definition can overcome any reluctance to change.

The degree and rate of change are essential to identify, and a comfort factor is vital. If the implementation team are trained in the strategy to be pursued, are competent in the techniques to be applied, the software to be utilised, and the focused implementation methodology a high comfort will exist. The degree of change will have a direct bearing upon the rate of change, e.g. if the degree of change is large then a slow phased rate of change is essential to minimise reluctance to implement.

The implementation methodology is similarly impinged upon by software, organisational and process factors. The implementation of ABC in an SME compared with Large enterprises is not characterised by similarity but by difference. Large organisations can provide external training and higher specification software for their implementation. Such a scenario is not indicative of the SME. Similarly their model structure while following standard procedure is affected by an indifferent cost profile. Such organisational differences cannot be allowed to lead to competitive disadvantage. This has been recognised by authors including Levy [12], who considers it necessary to "Facilitate the spread of best management practice among SMEs".

Process changes are the resultant factor of implementing an ABC system. At a low level changes in the structure of the data, its collection, and reporting will be necessitated. At a higher level approaches including Business Process Re-engineering are seen as indicative of the emerging change management scenarios resulting from implementing an ABC system.

7.5 Implementation Methodology

The implementation methodology can be defined as the means through which transition from existing processes to new processes is completed. It has at its core the procedural requirement for implementing an ABC system.

The implementation of an operational solution necessitates the utilisation of an appropriate holistic methodology. This remainder of this chapter will outline at a macro and micro level the methodology developed as an outcome of the research

programme. Comparison to other publicised methodologies, and the varying nature of methodologies is made.

Methodology is defined in the Oxford English dictionary as "The system of methods and principles used in a particular discipline". Alternatively Checkland [104] defines methodology as "the science of procedures". Checkland argues that the traditional propounded relationship between method and methodology is fundamentally misguided. Checkland comments that "My sense of the word is that the outcome of the research is not a method but a set of principles of method which in any particular situation have to be reduced to a method uniquely suitable to that particular situation."

Boardman [105] has outlined the traditional sequence of events that orchestrates a methodology as follows:

1. Recognition of Problem
2. Definition of Problem
3. Action to Solve Problem
4. Problem Solved

Methodologies, Philosophies, and Techniques.

I take a methodology to be intermediate in status between a philosophy, using that word in a general rather than a professional sense, and a technique or method. A philosophy will be a broad non-specific guideline for action.

At the other extreme a technique is a precise specific programme of action that will produce a standard result.

A methodology will lack the precision of a technique but will be a firmer guide to action than a philosophy. Where a technique tells you 'how' and a philosophy tells you 'what', a methodology will contain elements of both 'what' and 'how'

Checkland [104]

Checkland based on research in soft-systems methodologies, has defined the relationship between methodology, philosophy, and techniques. Boardman [105], outlined the underlying differences between traditional hard systems methodologies,

and their soft system counterparts. In summary a soft systems methodology is a systemic process of enquiry that can be utilised in the complex real world, where well-defined objectives, universally agreed problem definitions, recognisable alternatives, well-specified criteria for performance measurement are elusive, cannot be stated clearly and are ambiguous.

ABCM implementation methodologies defined by Morrow [48], and Innes, *et al* [49] focus on pre-design considerations, system design, and data gathering. They follow a similar structure to that propounded by Cooper [106] in the five steps to ABC system design.

The generic approach outlined by Morrow [48] to the design and implementation of cost management systems, reflects the identification of the changing manufacturing environment, and circumstantial factors outlined by Cooper [106], and Innes *et al* [49].

Implementation Approach 1: Morrow

1. Identifying the nature of the business requirement
2. Specifying Information Requirements
3. Designing the System
4. Identifying, evaluating and selecting the systems solution including prototyping
5. Implementing the System
6. Roll-out and use

The approach subsumes a hard systems methodology where the need and need meeting system are considered essentially well defined. The final four stages are those that consider the business orientation and the implementation and structure of the Activity Based Costing system.

Turney [55] details a methodology that subsumes the system design considerations defined by Cooper, and approaches propounded by practitioners. At a macro level it

identifies those project activities necessary for successful implementation. At a micro level it provides precise instructions to complete the appropriate implementation stages. Proceeding from convincing management to change, the methodology encompasses planning the implementation, gathering the information, designing the model, planning for use, and planning for change.

Implementation Approach 2: Turney

1. Convincing management to change
2. Planning the Implementation
3. Gathering the Information
4. Designing the Model
5. Planning for Use
6. Planning for Change

This approach, while of a detailed nature predominantly, focuses upon the need meeting system rather than defining the need. Similarly implementation considerations including software choice are neglected. However Turney integrates within his approach implementation planning. This subsumes defining deliverables, organising and staffing the project, and training the project team .

Methodologies utilised in practical application have been publicised by Gwynne and Ashworth [69], and Norkiewicz [107]. While identifying particular challenges and providing solutions they focus on individual organisations and their particular requirements. Such approaches lack the detail and supporting evidence of wider use to be classified generically applicable.

Methodologies propounded by software suppliers follow a similar macro structure to those proposed by prominent ABC authors. They provide information to enable integration of the software system during implementation. Such methodologies follow the modular structure of the software system, and can be considered limited in application due to their coexistent relationship with the software system.

The two approaches outlined reflect a common mindset on the implementation of ABC. Modular sections 3,4,5, and 6 of the approach presented by Turney reflect steps 2,3,5, and 6 of that propounded by Morrow. The four common stages of Information gathering, model design, implementation, and utilisation can also be seen in approaches publicised by Cooper [106], and Norkiewicz [107], and the methodology presented by the author.

The design of the methodology was impinged upon directly by systems engineering and indirectly by crisis intervention, an integral part of clinical psychology. A crisis is defined in Greek as meaning judgement, a moment of truth for the individual [108]. It has a connotation of transition of old values to new, of seeking a restoration of stability. The methodology developed for the implementation of ABCM treats each situation as unique regardless of familiarity with the operational environment of the company involved. The methodology treats the organisational challenge as different and new.

The initial five stages of the methodology, problem recognition, problem determination, identification of solution, evaluate solution, and selection of solution, are developed and critically appraised in chapter 6.0. These stages differ substantially from the two previous approaches that neglect to investigate the organisational system and determine without prejudice the need, and the need meeting system. These five stages are fundamental to Small- and Medium-Sized Enterprises to determine an approach for improved cost management. The implementation methodology is outlined in Figure 7.2. Details of specific use of the implementation methodology can be found in appendices A3 and A4.

The final five stages of the methodology reflect implementation of the appropriate need meeting system. This half of the methodology is designed to ensure that ABC is implemented with efficacy, efficiency, and effectiveness.

Figure 7.2 ABCM METHODOLOGY

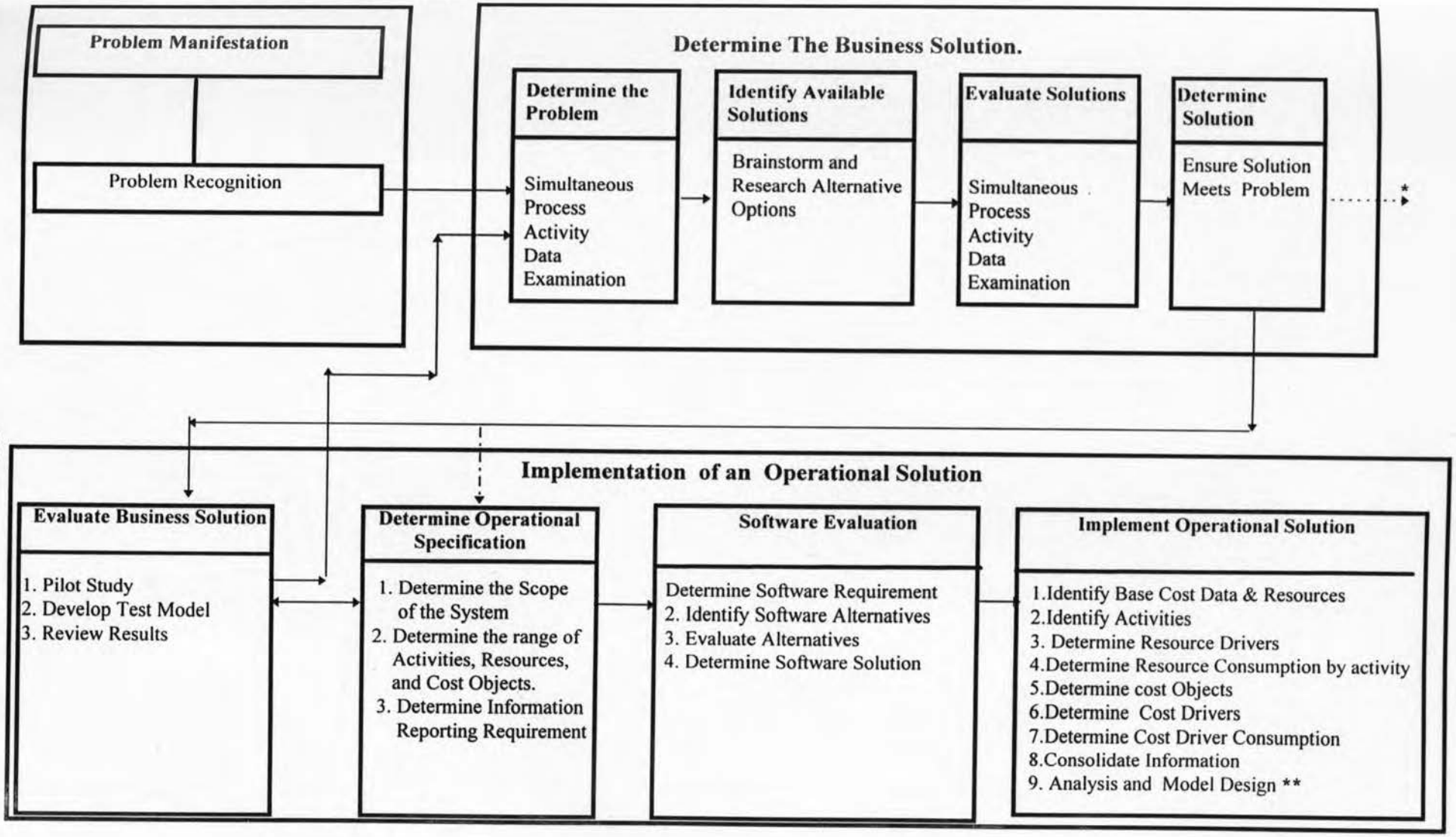


Figure 7.2 (continued) ABCM METHODOLOGY

Utilisation of Operational Solution
1.Run Model 2.Validate Model 3. Compare Old vs New Information 4. Report Information 5. Change Pricing and Quotation Procedures 6. Continually Refine System

NOTES:

* The first stage of the methodology concerned with determing the business solution can result in a number of solutions being identified. The resultant technique chosen may not be Activity Based Cost Management, and hence at this point deviation from the model is necessary.

** At this point continuation of the methodology is with the Utilisation of an Operational Solution as seen above.

1. Obtain senior management approval and commitment both in the problem definition phase and in the implementation of the technique. Employee and management awareness should be carried out throughout the project. Training of the cross functional implementation team should be carried out on an ongoing basis and as needs dictate.

2. Once implemented the environment should be analysed and the holistic effects considered.

The principles applied can be utilised by all organisations regardless of organisational size or sector. Stages 5-8 develop the fundamental understanding required to implement ABC into a particular organisation, with a particular software system. These stages integrate the opportunity for pilot study, and ensure that organisational requirements are disseminated within the new system, and that software requirements parallel those of the organisation. Stages 9 and 10 incorporate the methods derived by Turney, Cooper, and Kaplan for data gathering, model design, and initialisation for use. The final five stages of the methodology, and its subsequent use with the research study participants form chapter 8.

Chapter 8

The Rationale for the Adoption of a Generic Activity Based Cost Management Methodology.

Part 2. Implementation of the Business Solution

Introduction

The objective of this chapter is to detail the generic methodology for implementing ABCM. The application and development of the implementation methodology is critically assessed through actual utilisation in three companies participating in the research programme. The results of their implementation are compared and contrasted with those publicised for large organisations. The implications of the results are then discussed.

8.2 Review of Research Study Participants

Of the five companies outlined previously, two participants (Plassein and Engenium) decided not to proceed further with the improvement of their costing systems. They cited the introduction of a re-engineered foam moulding facility, and lack of co-operation from the holding company respectively for not developing the costing systems further. Such a scenario is typical of the Small- and Medium-Sized Enterprise. Multiple projects of a significant nature are avoided by organisations of this type due to perceived resource constraints. While this limits the ability of the organisations to maximise profitability, the assessment of the problem situation identified areas where short term solutions can be implemented without detracting from the ability to implement a long term solution.

8.3 Evaluating the Business Solution

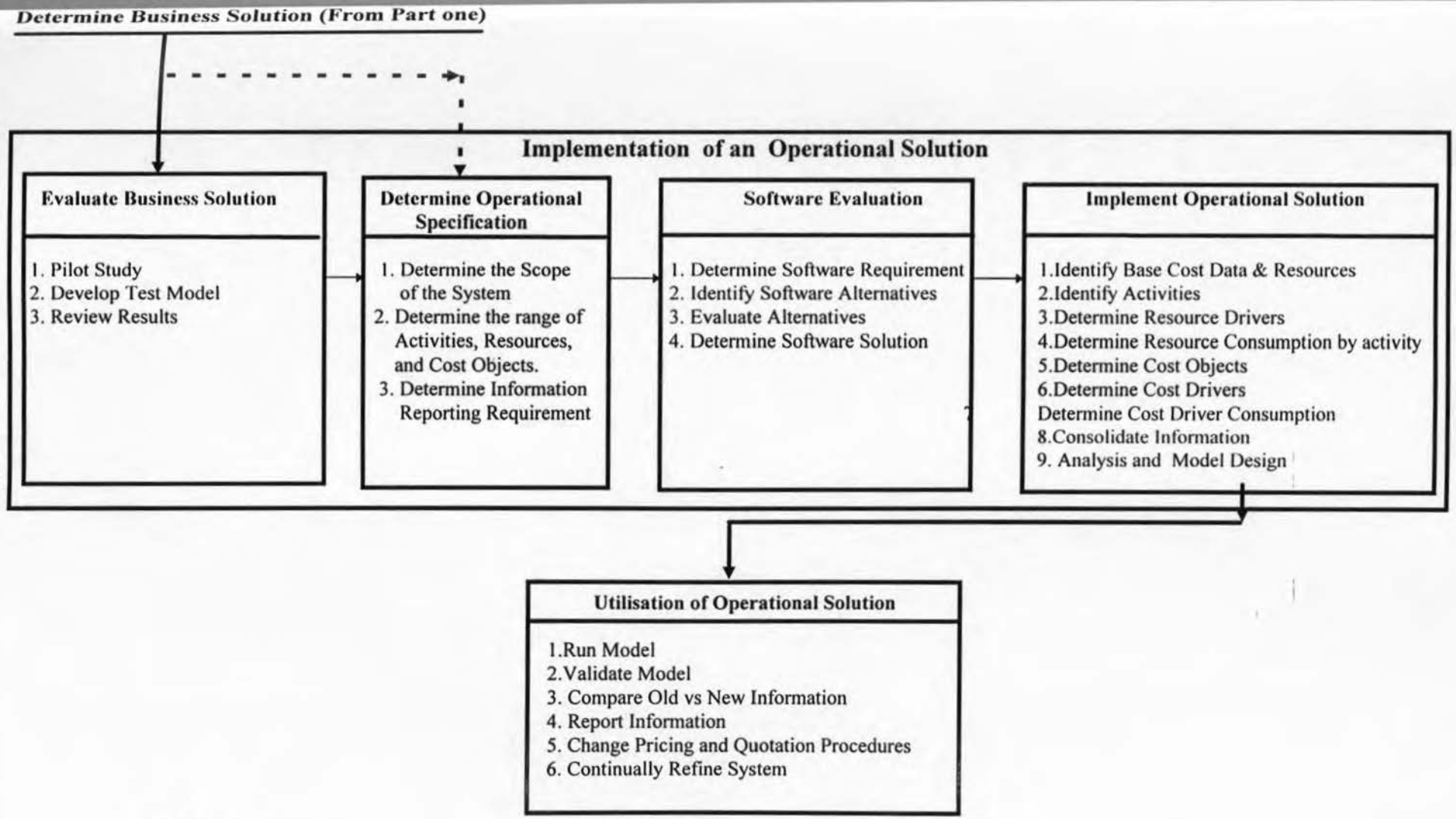
The utilisation of the SPADE methodology in determining the business solution similarly minimises the need for undertaking a pilot study. However such a pilot study advances knowledge surrounding ABCM, and the adoption of improved ABCM implementation techniques.

Pilot studies traditionally follow the methodology propounded for full implementation. The focus of the study commonly assesses those products, services, and customer costs that will yield the most interesting results. Similarly analysing activity costs should reveal the costs incurred in servicing distinct types of order. The data surrounding the pilot study is that most recently reported, and is usually either monthly or quarterly.

In practice the pilot study implementation should be undertaken by those with most to gain from change, and those with significant knowledge of the organisation. The pilot study team as with any full implementation should be multi-functional in nature to facilitate support for the results obtained, and the conclusions developed. Rupp [77], details the implementation of a pilot study in Lord Corporation, and outlines the continuation of the study into a successful company wide implementation. Similarly Gwynne and Ashworth [69] utilised a pilot study approach at Mercury Communications to assess the ability of Activity Based Management to provide improved understanding of cost/volume dynamics, customer and product profitability, overhead analysis, and performance improvement. Nicholls [64], reported that 27% of respondents to his survey conducted a pilot study prior to full implementation to enable the successful implementation of activity based techniques.

8.4 Determining the Operational Specification

The operational specification will outline the range of activities, resource costs, and cost objects prevailing in the system. Information reporting requirements will be determined in order that system objectives are realised.



NOTES:

1. Obtain senior management approval and commitment both in the problem definition phase and in the implementation of the technique. Employee and management awareness should be carried out throughout the project. Training of the cross functional implementation team should be carried out on an ongoing basis and as needs dictate.

2. Once implemented the environment should be analysed and the holistic effects considered.

The objectives of implementing an ABCM system should be apparent from undertaking a pilot study, and SPADE analysis. The objectives of the system can be *inter alia* as follows:

- To assess manufacturing activities
- To assess non-manufacturing activities
- To evaluate the cost implications of product design
- To determine market segment profitability
- To determine product profitability
- To determine customer profitability
- To appraise make or buy decisions

Chapter 4 outlined the extent of usage of Activity Based principles by service sector and manufacturing organisations. Model design is impinged upon by operational environment, and at a macro level by the orientation and purpose of the operational, and support service activities.

Customer, product, and market segment profitability analyses are commonly undertaken by organisations implementing activity based techniques. These reflect the ability of the organisation to compete in the market place. They provide a common approach to the identification and utilisation of information concerning resource and activity costs, with differentiation in cost object analysis.

These objectives for the implementation of ABCM will directly influence the scope of the model. The defined activities and cost objects will reflect the objective of the model. A level of aggregation in the model design is essential. Cost objects should be aggregated to a reasonable level. Lord Corporation [77] implemented a spreadsheet based model of 11 activities, and 2000 product parts. This scenario highlights the complexities of determining an appropriate level of activities, cost drivers, and cost objects. Further reference should be made to the implementation of an operational solution that identifies implementation rules for cost drivers and activities. Determining the scope of the model and proposed number of allocation paths will

assist the organisation in determining the appropriate software system for their requirements.

8.5 Software Evaluation and Selection

The long term success of an ABCM project is to some extent governed by the effective processing of data within an ABCM package. The identification of software system structure is vital for an organisation undertaking an assessment of ABCM as a management information system. While the introduction of updated and enhanced ABCM packages is beneficial, it is important to recognise that such systems will only provide cost information, not instantaneous solutions for the business.

Software packages being considered for ABCM should be evaluated in the following areas:

- Functionality
- Performance
- Vendor Reputation
- Proven User Base
- Flexibility
- Price
- Forward Direction (Software)
- Risk Free

Further discussion of available ABCM software and implications for organisations of varying organisational sectors and sizes can be found in chapter 5. This chapter also outlines how organisational requirements can be reflected in the software system.

8.6 Implementing the Operational Solution

First Stage Cost Assignment

The implementation of the operational solution proceeds with identification of base cost data and resource costs. These costs are to be found in the general ledger which

is, the domain of the accounting department. Changes to the structure of the general ledger can precede ABCM implementations. However most ABCM implementations parallel the existing cost management system, and aggregation of general ledger costs rather than re-engineering is common.

Activity identification is the second stage of the 'top-down' implementation process. The theory surrounding the identification of activities, and cost drivers has been widely publicised. Innes *et al.* propose three methods of activity identification; physical mapping, interviewing, and workflow analysis. Physical mapping depicts the structural layout of the plant. Workflow analysis assesses the organisational processes. This can be in the format of a diagram or through consolidation of organisational procedures that identify activities, and inputs and outputs in departmental areas. This approach was utilised in the SPADE analysis. Interviewing is by far the most popular method of identifying activities. The interview should seek to identify activities undertaken, resources consumed in performing an activity, and its focus.

Turney [55], similarly utilises functional decomposition to determine activities. This manipulates the organisational structure to outline macro level activities, and through decomposition and the techniques outlined by Innes *et al.* micro level activities are defined. Turney has identified four key rules for identifying activities.

1. Match the detail to the purpose of the model.
2. Use macro level activities to balance conflicting objectives.
3. Combine insignificant items.
4. Describe activities clearly and consistently.

The first stage of cost allocation within an ABCM system is complete when resource costs are assigned to the identified activities. The link between the resource cost and activity is the resource driver. The resource driver assigns an appropriate percentage of each resource to the relevant activity based upon attributable consumption.

The first stage cost assignment enables organisations to determine the costs of performing activities, enabling comparison to be made to their perceived value. Activity costing provides valuable identification of cost occurrence, and opportunity for assessment of organisational spending.

Second Stage Cost Allocation

The second stage cost allocation procedure attributes costs to products based on their consumption of resources. Traditionally activity costs have been allocated to products, and customers. The target of the allocation is termed the cost object. These can be grouped by product line, or customer segment. Steeple and Winters [109], have also outlined procedures for utilising a supplier as a cost object. Information about cost objects can commonly be found in management information systems.

The allocation of activity costs to cost objects' results from selecting and implementing cost drivers. Cooper [52], concludes that there are two factors which impinge upon the design of an ABCM system; the number of cost drivers, and the selection of the appropriate cost driver. Influencing this choice are three circumstantial factors; measurement costs, correlation with activities, and behavioural effects.

Innes *et al.* [49], outline three different types of cost driver as pure volume related, weighted volume related, and situational. Volume related cost drivers reflects the measure of activity output i.e. the number of set-ups. However different machines may require different levels of consumption so weighted volume is introduced to reflect the variances between the machine groupings. Situational drivers reflect the requirement of management to influence the way costs are incurred. i.e. the number of suppliers. This influences the numbers of suppliers, and promotes rationalisation of the supplier base.

Turney [55], utilises the term 'activity driver' proposed by CAM-I rather than 'cost driver' proposed by Cooper. Turney has proposed six rules for selecting activity drivers;

1. Pick activity drivers that match the type of activity.
2. Pick activity drivers that correlate well with the actual consumption of the activity.
3. Minimise the number of unique drivers.
4. Pick activity drivers that encourage improved performance
5. Pick activity drivers having a modest cost of measurement.
6. Do not pick activity drivers that require new measurements.

One of the major challenges facing organisations implementing ABCM is the selection of cost drivers [55], [52], [49]. The challenge can be minimised by adopting the rules proposed by Turney. It is essential to focus on the high cost areas of the ABCM model, and improve the detail. Accurate planning and careful design at the outset will minimise implementation problems. The data associated with cost drivers can be retrieved from the management information system. Data collection is a long job, and in order to optimise the process driver data collection must be automated as far as possible. Examples of automatic data collection systems include bar code readers and swipe cards.

8.6.1 Implementation of an Operational Solution with Research Study Participants

Rivulet

The data collection phase of the project was enhanced through utilisation of appropriate forms that sought to reflect and identify the batch, unit and product activities. The utilisation of the forms was facilitated by training and information dissemination with respect to the project, its aims and objectives, and the data collection task.

Subsequently the identification of activities and cost drivers was undertaken. This was preceded by training sessions which outlined the implications of design decisions on the costing and quotation system. 5 macro level activities were identified which reflected the batch level, whilst at a unit level, 3 macro activities were defined.

The rivulet costing and quotation system is based on the previous direct costing system and incorporates changes in the method of allocation for production and support service overheads (See Figure 8.2).

Direct costing procedures have been retained for secondary operations (milling, drilling, turning, rolling) and related production overheads are allocated on the basis of direct labour hours. Similarly material cost is considered at a batch and unit level. This subsumes the material utilised for tooling and component part manufacture.

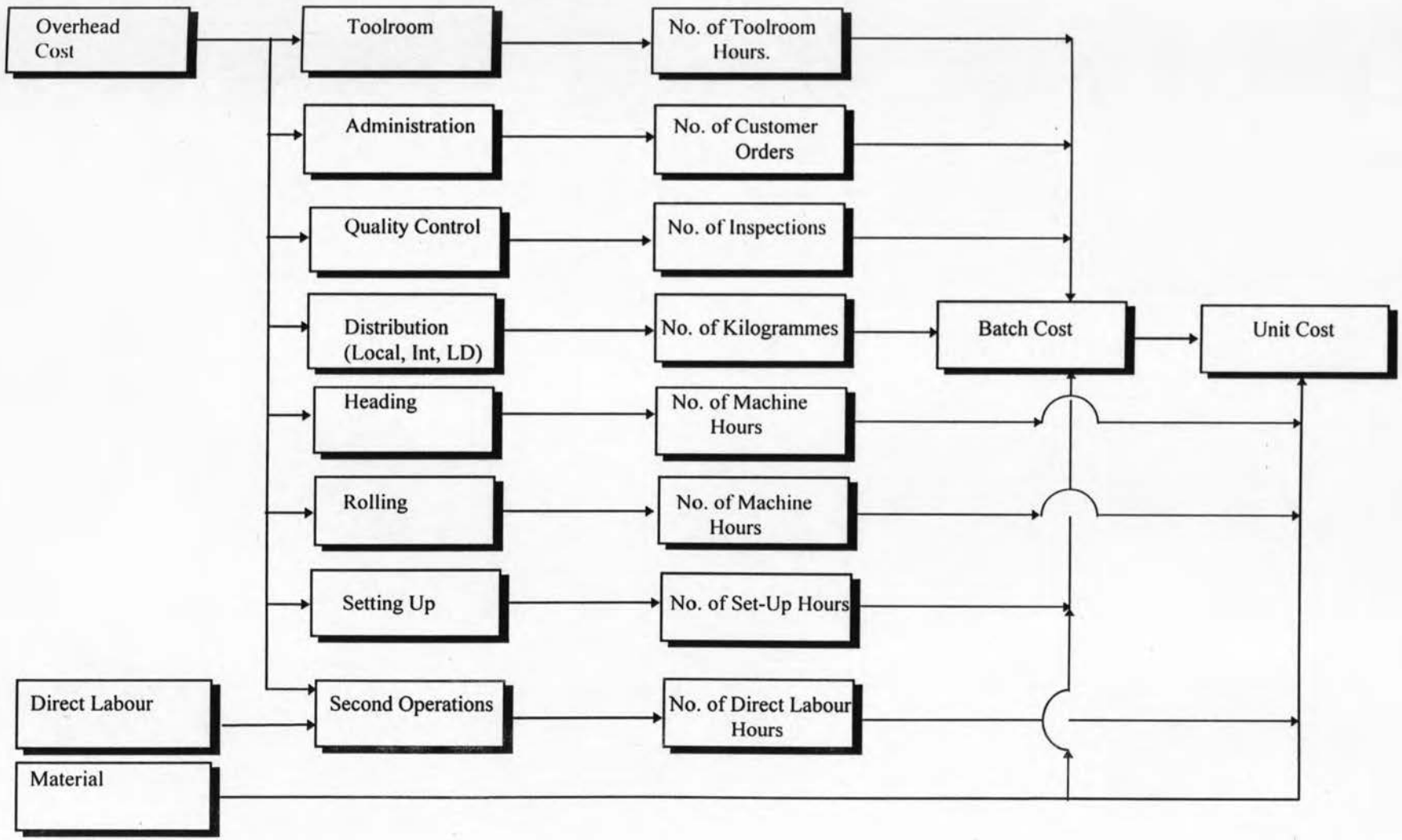
The rivulet system predominantly reflects the emphasis placed on the manufacturing function with 7 out of 13 activities reflecting manufacturing operations.

The allocation of distribution costs (3 pools - banded local, intermediate, and long distance) on the basis of the number of kilogrammes reflects the nature of the company's product profile with weight rather than cubic capacity a predominant factor.

Managerial administration activities subsume (contracting, purchasing, personnel, and financial functions). The allocation on the basis of customer orders reflects the pre-occupancy with obtaining and servicing customer contracts. SMEs by their very nature utilise managerial systems which are multi-disciplinary. Rivulet is indicative of manufacturing SMEs with personnel and financial functions an insignificant part of overhead costs but focus placed upon maximising and servicing the available production capacity

The initial model satisfied the defined organisational objectives in identification of non-value added time and activities, and to produce more accurate cost estimates and labour rates. Similarly it provided an ability to associate non-direct production costs with products, profit with products and customers, and overhead with products, thus providing a greater degree of accuracy. The model has facilitated improved identification of the ways in which costs are incurred and allocated, and can be expanded and modified to mirror any future organisational change or expansion.

Figure 8.2 Rivulet Costing and Quotation System.



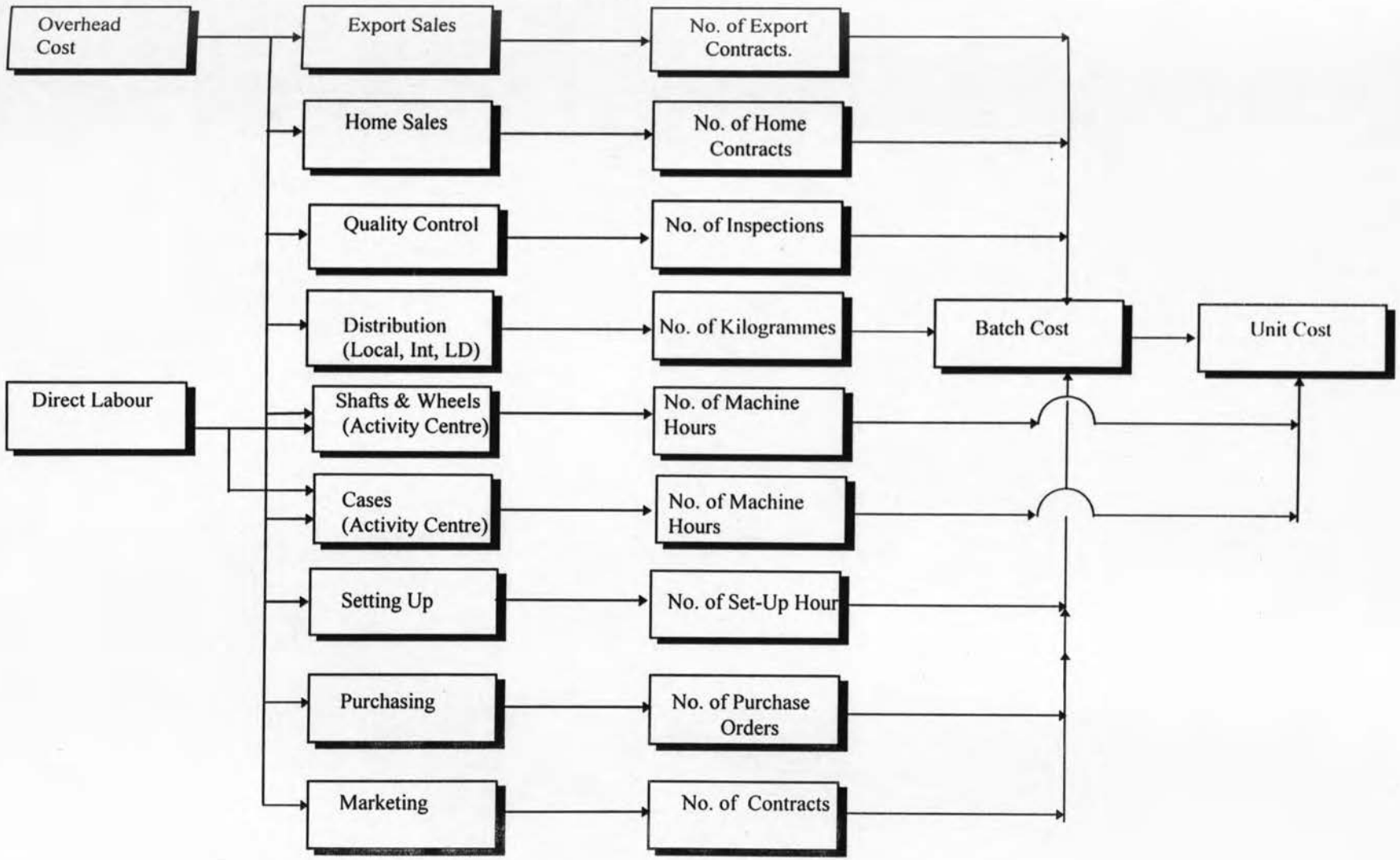
Ingenium

Similar in design to the Rivulet costing system the Ingenium model focuses on the manufacturing and administrative support activities. The influence of direct costs is again present in the model design in the form of direct labour and material costs. The manufacturing activities are represented by the activity centres - shafts and wheels, and cases, which each subsume 11 activities respectively. All the activities are similarly allocated on a machine hour basis. In support of these manufacturing operations activities including setting up, quality control, goods receiving, stores, assembly, maintenance and production planning have been defined.

Administrative activities which warrant particular interest include, contract costing which subsumes planning, quoting, analysing, and negotiating of contracts. This can be contrasted with the financial function which includes debtor and creditor transactions, and general banking. In respect of those core processes which are designed to add value to the customer export sales and home sales offer to ABC proponents a classic scenario of traditional overhead apportionment being considered inaccurate. Export sales includes the compiling of tenders, contracting, customs preparation and correspondence costs involved in servicing the International marketplace. In direct comparison the tasks involved in home selling reflect the national marketplace and includes, contracting, correspondence, and monitoring.

Marketing activity subsumes market research, planning, and advertising. The performance of such an activity is driven and performance measured by the number of contracts, number of home sales, and no of export sales. The value of the contracts being established is indicative of the position and respectability of the company in the marketplace. In comparing and contrasting the model designed for Ingenium (figure 8.3) and that for Rivulet it is easy to distinguish between the large enterprise and small- and medium-sized enterprise. While both are visibly manufacturing the aggregation of support activities in the Ingenium model is significantly less than that proposed for rivulet. A direct influence on this inherent model design feature has been the value of the activities performed which is characterised by their nature, and the organisational environment.

Figure 8.3 Ingenium Costing and Quotation System.



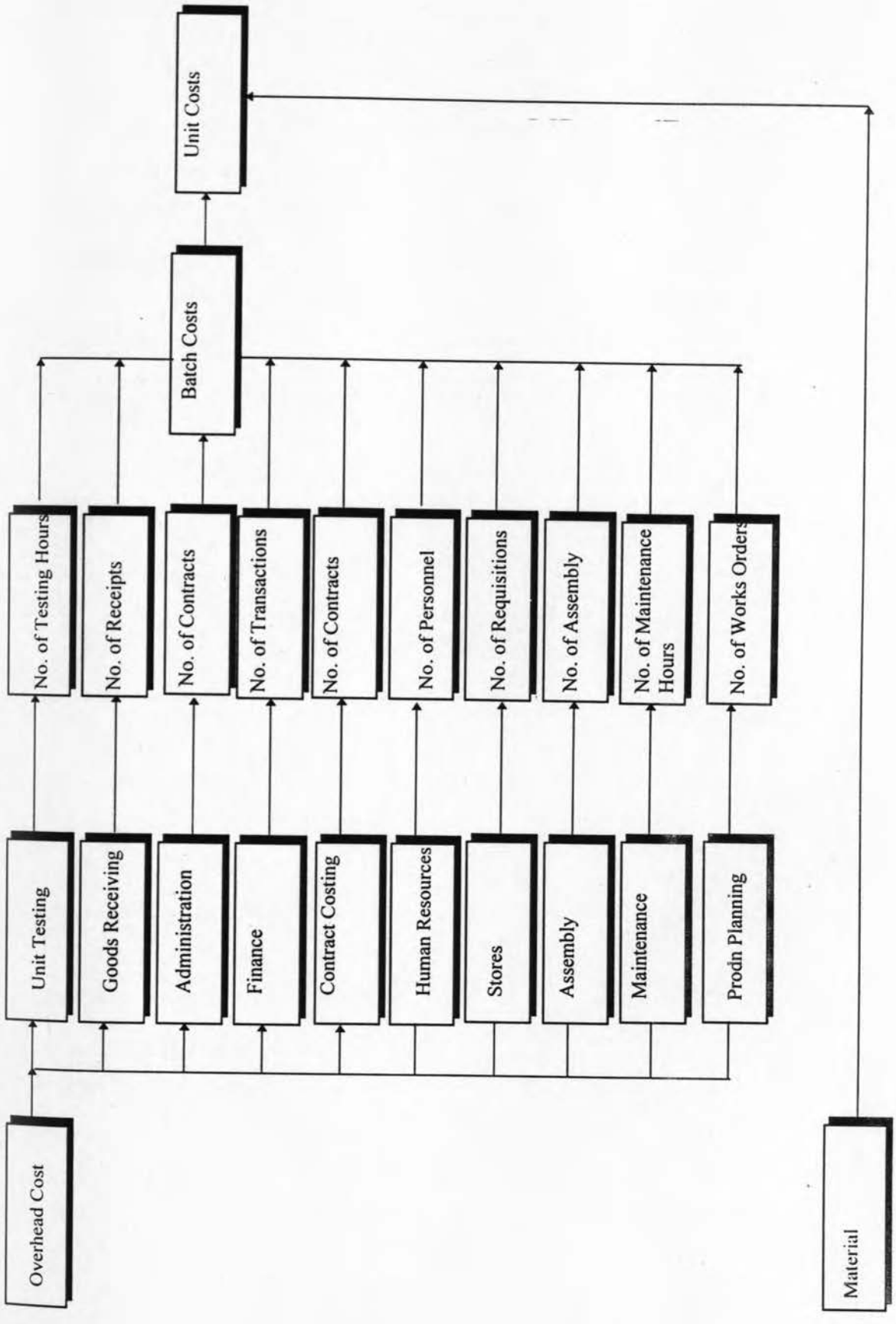


Figure 8.3 Ingenium Costing and Quotation System (continued)

Keramos

The approach undertaken was for the project team to utilise the improved information database from the re-engineering of the production control system, and independently to assess non-manufacturing activities. This had been preceded by training for personnel in component data control, bill of material, shop floor control, and manufacturing cost control modules of the production control system.

This approach resulted in the identification of a wide range of manufacturing and non-manufacturing activities at a batch and unit level. Simultaneously the determination of appropriate drivers was facilitated. The consequence of this approach was a system which encompassed 13 batch level activities and 5 unit level activities.

The introduction of the advanced costing system is seen to meet the organisational objectives and requirements for a system to mirror, report and reflect the diversification of products, product routings, production volumes, and the requisite demand for resources.

The new costing and quotation system was designed to reflect more accurately the complexities of manufacturing industrial ceramics. The model design incorporates overhead incurred at a site and profit centre level. Activities undertaken at a site level include finance, purchasing, and marketing.

Of the activities undertaken in the profit centre particular focus was placed on those activities servicing the varied customer profile. Sales administration therefore subsumes export and home sales and is allocated on the basis of the number of contracts. Similarly distribution costs for home and export contracts is differentiated and allocated on the basis of cubic capacity rather than weight in kilogrammes due to the nature of the product. Quite clearly ceramic components will weigh less than steel components of the same cubic capacity therefore influencing distribution policy and cost allocation.

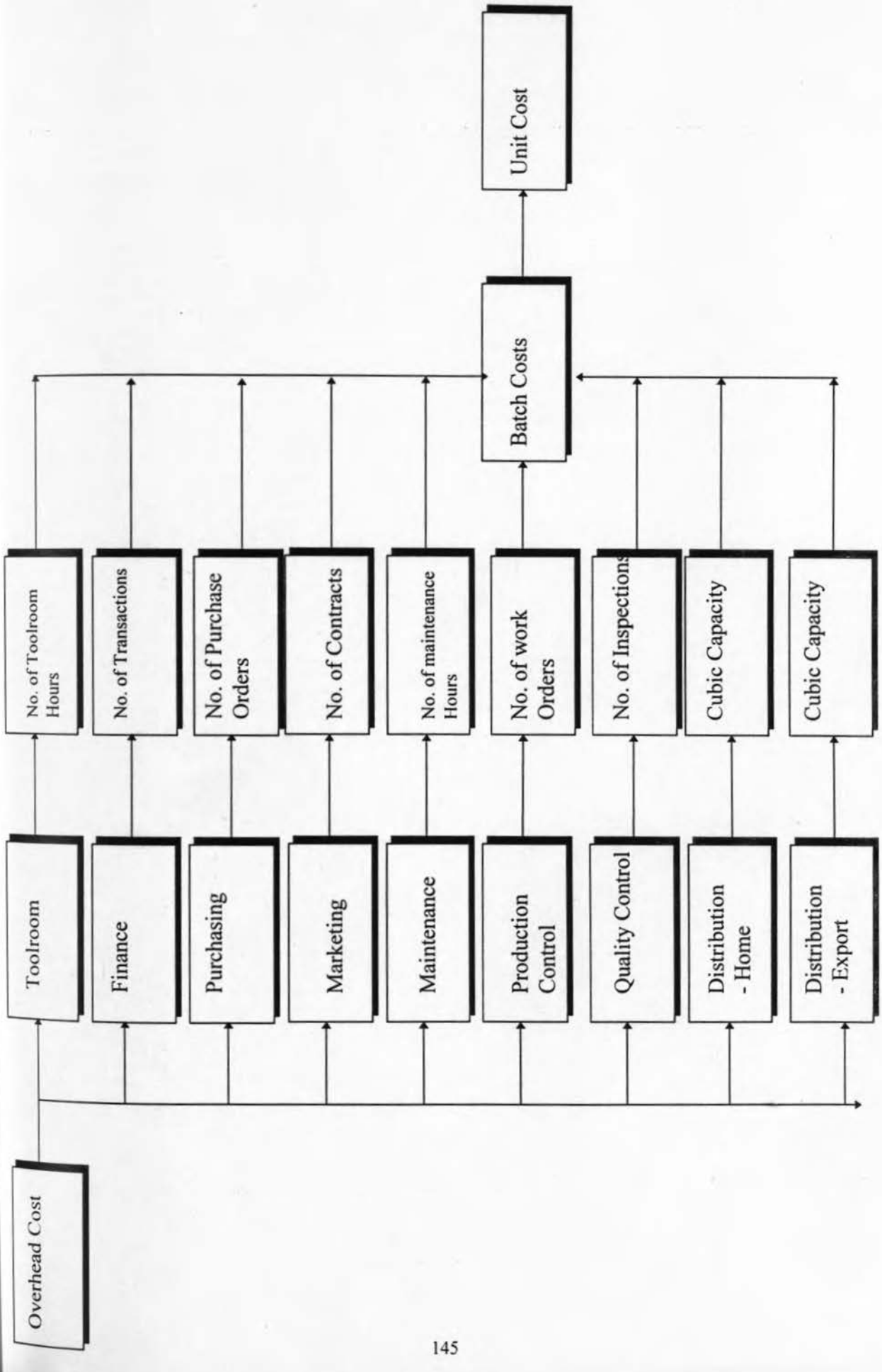


Figure 8.4 Keramos Costing and Quotation System.

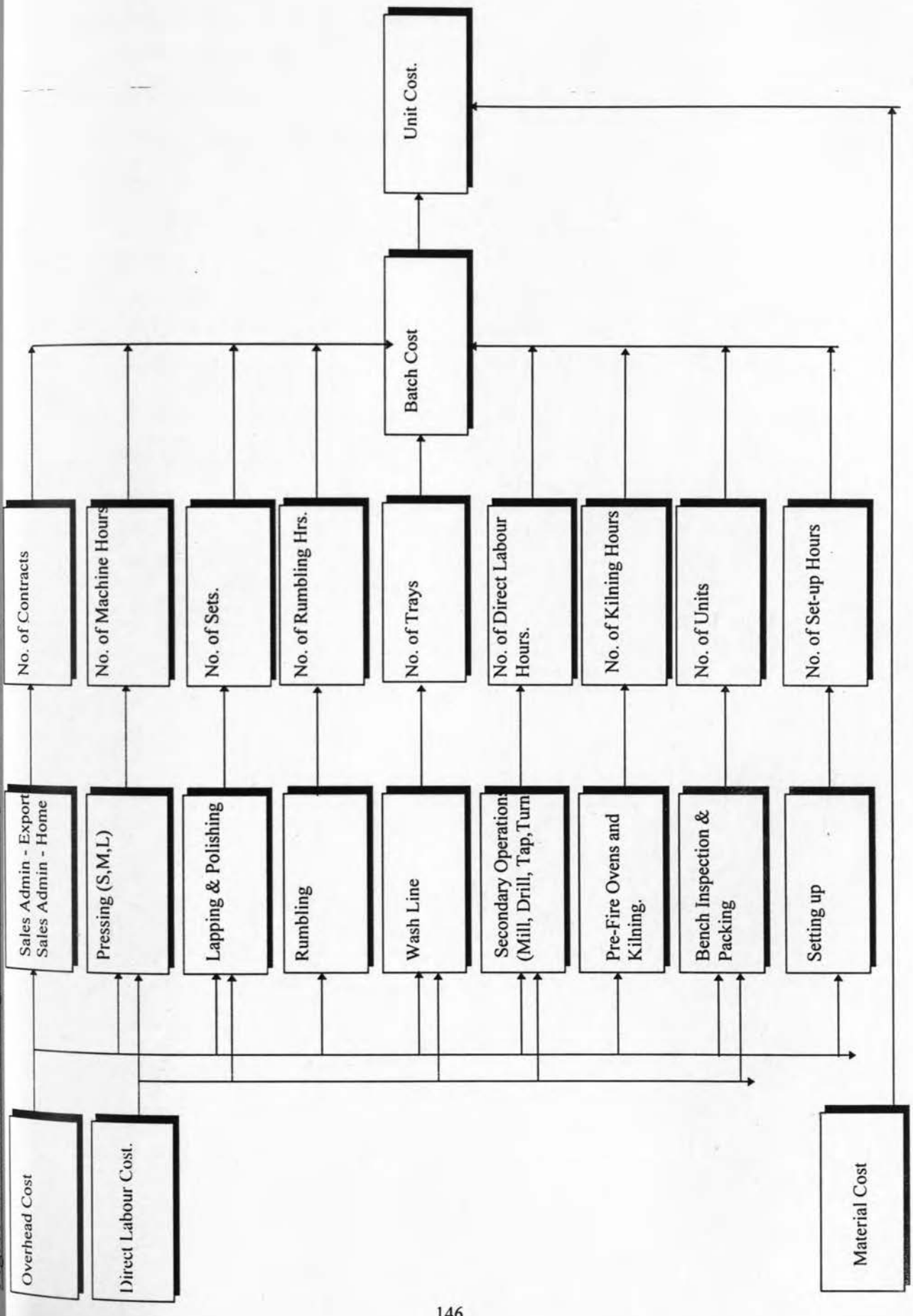


Figure 8.4 Keramos Costing and Quotation System (Continued)

The manufacturing facilities focus on the factors which influence the consumption of resources. particular interest was paid to lapping and polishing which utilised a diamond cutting medium. Machine hours was considered as an allocation base but was rejected as polishing and lapping times do not vary by component. The method of allocation was determined to be the number of sets. A set contained a given number of components which will vary between given parts.

The Keramos model is indicative of any manufacturing company. Organisational factors namely the profit centre approach, can be seen when comparisons are made to the Ingenium model. All of the three models follow the guidelines laid out by ABC proponents that an ABC model should contain as many activities as necessary but no more. With activities in the three models numbering a maximum of 40 the models compare well with those outlined in the ABC utilisation survey. A detailed example in which the generic methodology has been applied in Rivulet can be found on pages 148 and 149.

8.7 Utilisation of Operational Solution

Traditionally the results achieved from implementing Activity Based Costing have indicated that low volume products have been under costed with respect to their consumption of resources. Approaches to rectify this scenario include changes to product prices, product specification, and rationalisation of the product range. Similarly high volume products have traditionally been over costed, prompting the lowering of prices after the introduction of ABCM. The result of these strategic changes should be reflected in the product mix, and in the effective consumption of organisational resources.

Cooper and Kaplan [100] in an original case study outline the consequences of implementing ABCM at Schrader Bellows, an American company competing in the fluid power industry. Figure 8.5 outlines percentage changes to unit costs resulting from the utilisation of ABCM at Schrader Bellows.

Example: Method of Implementation for Rivulet

Problem Recognition

- Identified by organisational managers
- Belief that different products contribute different levels of profitability
- Need to reflect current business activity in company costing rates.

Determine the Problem

- Undertake general overview of company operations.
  - Identify process and information flows
  - Identify product mix
  - Pareto analysis of product value and volume
  - Examination of work orders
- Undertake detailed analysis of manufacturing and support activities
  - Setting up
  - Production planning procedures
  - Quality control
  - Material ordering
  - Administration
- Design and implement data collection forms
- Compare actual activity consumption to that reported in organisational records (financial and non-financial)
- Report to organisational managers the problem situation - Utilisation of out of date production volumes in costing rates. Inaccurate absorption of overhead costs by direct labour hours.

Identify Available Solutions

- Consider the adoption of revolutionary and evolutionary cost management systems to meet the problem situation.
  - Modification of current direct labour hour allocation system
  - ABCM model to reflect overhead consumption by activity
  - Treat direct labour as a fixed cost in the short term. Material as the only direct cost
  - Use direct labour as an allocation base and performance indicator
  - Identify cost/profit centres with transfer costs

Evaluate Solutions

- Consider the ability of the organisation to implement given solutions
- Consider the organisational changes required to facilitate introduction of the proposed system.

Determine Solution

- Ensure that the defined solution can be implemented, utilised and maintained effectively by the organisation.
  - Examine resource capability
  - Undertake initial test on the validity of the new approach
  - Agree solution with management

Example: Method of Implementation for Rivulet (continued)

Evaluate Business Solution

- Pilot implementation not required in this implementation due to the small nature of the project - In a larger organisation a pilot model would be constructed.

Determine Operational Specification

- System to be primarily focused upon the determination of current shop-floor manufacturing rates, for utilisation in quotations. (Seen in the consolidation of administrative functions in the final model)
- Development of manufacturing activity rates was the priority to enable aggregation of final product costs.

Software Evaluation

- Cost benefit analysis of available "off-the-shelf" software led to the adoption of a suitable spreadsheet solution.
- Spreadsheet produced in Excel 5.0a
- Utilisation of separate but interlinked sheets for distinct areas of the cost system. Facilitated by the use of macros.
- Quick update facility introduced through adoption of separate sheets for resource and administrative expenses and cost driver data. Eliminates the need for editing of the complex cost allocation sheet.

Implement Operational Solution

- Resource costs identified from the Trading account (P&L) and Schedule of Administrative expenses.
- Resource costs consolidated into eight main groupings.
- Undertake general overview of company operations.
- Activities identified and consolidated into 8 main groupings and 1 subset for secondary operations. Consolidation on the basis of value (£s) and operational significance.
- Cost Driver rates identified by examining the nature of activity consumption. Facilitated by detailed analysis of activities. 7 distinct cost driver rates identified.
- Consumption of activities monitored and recorded through paper based data collection sheets and examination of operational records.
- Model design completed and reflected in the spreadsheet software system.

Utilisation of Operational Solution

- Resultant data from spreadsheet model analysed and evaluated in the context of current business activity. Comparison made to old contractual rates.
- Information reported to management
- New contractual rates adopted by management
- System data refined and updated by provision of monthly resource costs and activity consumption data.

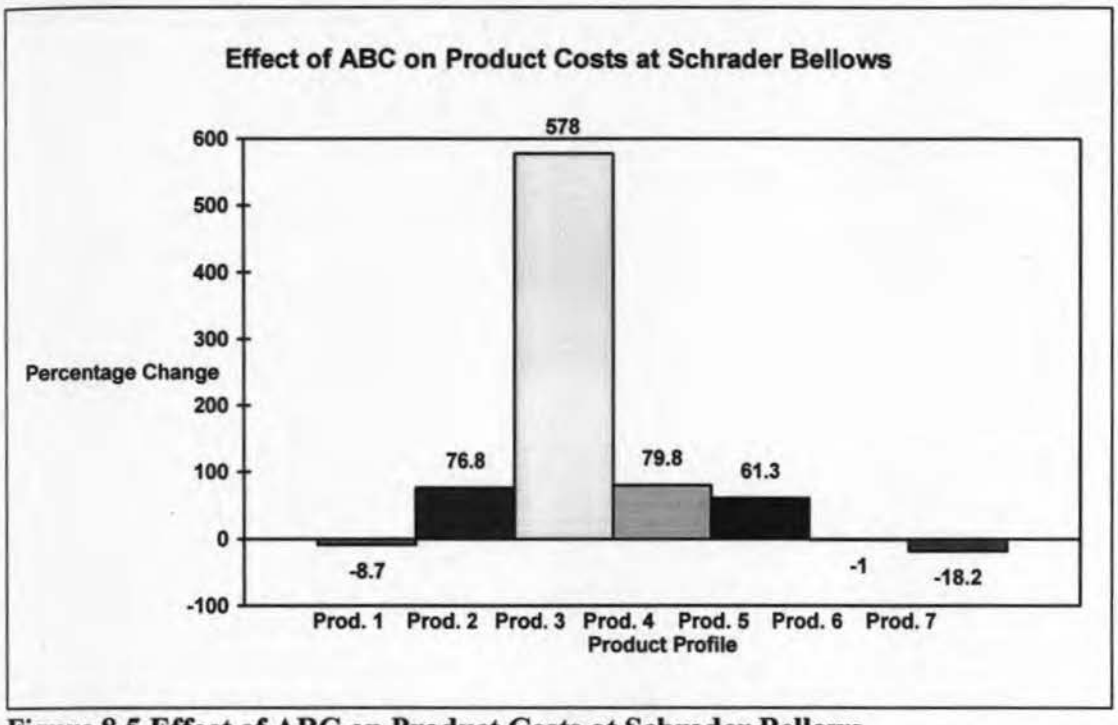


Figure 8.5 Effect of ABC on Product Costs at Schrader Bellows

Similarly Merz and Hardy implemented ABC at Hewlett Packard [110], the multi-functional approach resulting in significant changes to design costs. The traditional allocation method on the basis of material cost was found to be inaccurate, and the implications of utilising ABC were that product cost increased for a majority of products. Figure 8.6 reports percentage change product costs incurred at Hewlett Packard resulting from adopting ABC.

The utilisation of the operational solution at Keramos, Rivulet, and Ingenium began with the calculation of the model and subsequently the validation of resultant data and comparison between the ABC approach and the standard costing procedures utilised by the companies. Table 8.0 details the allocation of costs pertaining to the Rivulet ABC model. Figures 8.7 and 8.8 detail changes to activity, and product costs resulting from introducing ABC in Rivulet and Keramos respectively. The first results from the ABC models were treated with the utmost care due to possible inaccuracies in the identification and allocation of costs. Incorrect information would have led to management decisions incongruent with organisational objectives. Before the new information was released, a high degree of information accuracy was established.

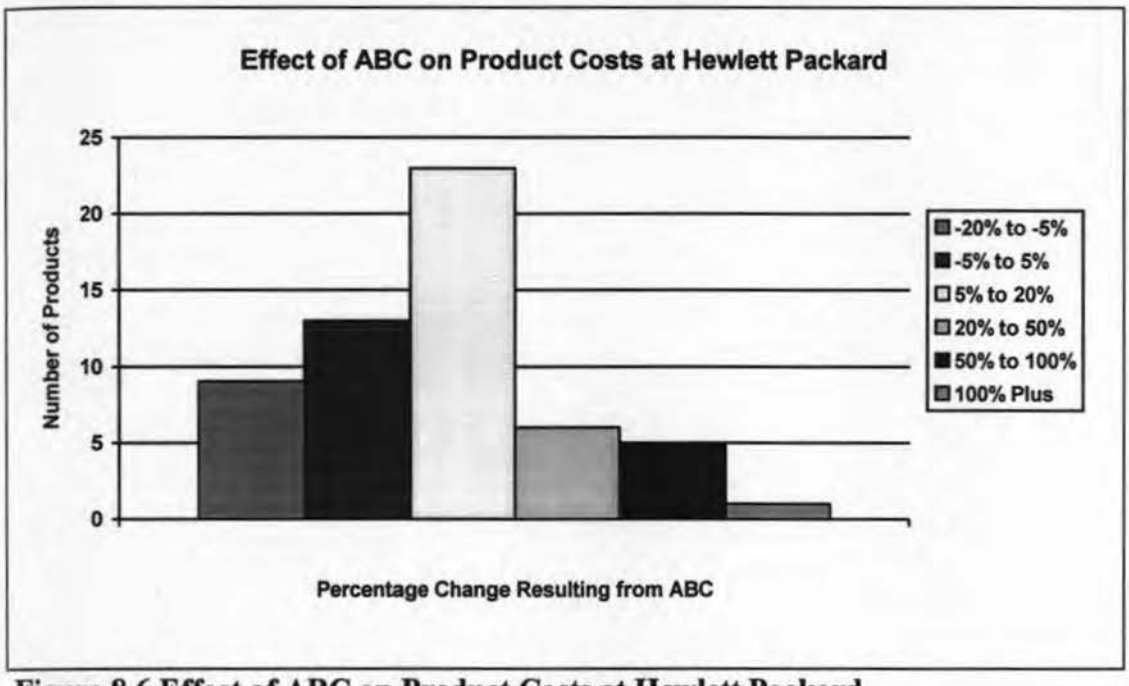


Figure 8.6 Effect of ABC on Product Costs at Hewlett Packard.

The results of the implementation of ABC within Keramos and Rivulet are indicative of those generally propounded by ABC proponents. The implications for small- and Medium-Sized Enterprises are substantial and just as great as those indicated in published literature for large enterprises.

The successful implementation of ABC at Rivulet realised significant changes to activity costs, detailed in Figure 8.7. The major increases in activity cost rates were predominantly the result of low volume output. This was caused by the introduction of advanced manufacturing technologies, making several traditional processes obsolete for all but a small number of components. This graph (figure 8.7) is significant because it shows the losses being incurred by the organisation on products using these low utilisation processes. The introduction of ABC identified the core competencies, and limitations of the organisation. This enabled sub-contracting to be considered a significant opportunity for high cost activities, in order to improve profit margin performance. Other increases in activity rates resulted from organisational factors including long set-up time, and high indirect labour contribution. In general the introduction of ABC has enabled increased accuracy of quotations to be established, improved information for managerial decision making, and facilitated assessment of change management projects.

Table 8.0 Rivulet: Calculation of ABC Activity Rates

Exhibit 1: Allocation of Resource Costs to Activities

	Total	Administration	Quality Control	Despatch	Heading	Rolling	Set-up	2nd Ops	Townsend	Toolroom
Wages	£ 15,068.00	£ -	£ 1,185.00	£ 2,118.00	£ 2,911.00	£ 881.00	£ 1,632.00	£ 2,581.00	£ 2,270.00	£ 1,490.00
Manufacturing	£ 4,841.45	£ -	£ -	£ -	£ 1,163.00	£ 425.00	£ 728.00	£ 482.45	£ 1,861.00	£ 182.00
Depreciation	£ 22,060.00	£ -	£ 124.00	£ 703.00	£ 8,370.00	£ 3,474.00	£ 3,546.00	£ 3,454.00	£ 1,604.00	£ 785.00
Management	£ 8,242.00	£ 8,242.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
Site	£ 4,601.00	£ -	£ -	£ -	£ 1,109.00	£ 394.00	£ 691.00	£ 460.00	£ 1,774.00	£ 173.00
Administration	£ 3,397.00	£ 3,397.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -
Total Activity	£ 58,209.45	£ 11,639.00	£ 1,309.00	£ 2,821.00	£ 13,553.00	£ 5,174.00	£ 6,597.00	£ 6,977.45	£ 7,509.00	£ 2,630.00

Exhibit 2: Process Costs

	Administratior	Quality Control	Despatch	Heading	Rolling	Set-up	2nd Ops	Townsend	Toolroom
Process Costs	£ 11,639.00	£ 1,309.00	£ 2,821.00	£ 13,553.00	£ 5,174.00	£ 6,597.00	£ 6,977.45	£ 7,509.00	£ 2,630.00
Outputs	119	300	119	729	269	600	415	773	134
Process Cost/Output	£ 98.00	£ 4.36	£ 24.00	£ 18.58	£ 19.23	£ 11.00	£ 16.81	£ 9.71	£ 19.60

Similarly, Ingenium through embracing ABC has enabled differences in product complexity, and order servicing requirements to be accurately reflected in the costing system, increasing the accuracy of quotations. The ABC system provided opportunity for the introduction of an advanced performance measurement system throughout the organisation enabling an increase in customer service to be supported. Analysis of value and non-value adding activities revealed opportunities for optimising set-up through increased training, material movement reduced by changing machine layout, and improved profitability achieved through increased accuracy of costing rates and production planning.

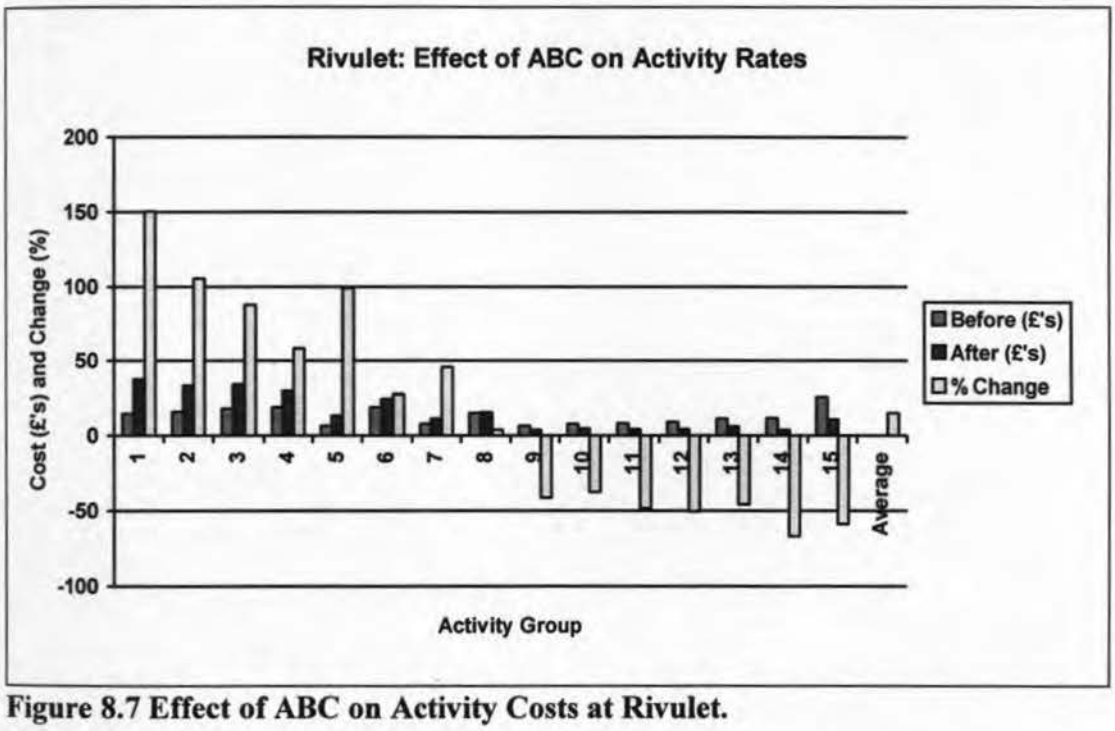


Figure 8.7 Effect of ABC on Activity Costs at Rivulet.

In contrast, implementation of ABC at Keramos (Figure 8.8) resulted in significant changes in product costs. These changes are predominantly increases and are significant because they show directly the affect of product complexity on product cost. The implementation resolved many of the conflicts between manufacturing, and finance departments that existed before ABC, in particular it revealed the extent of cross subsidisation of product costs between profit centres. At an operational level ABC quantified the cost of providing quality checking for products supplied to the medical sector, and revealed their lack of profitability. In general the implementation

of ABC identified the cost differential between high, and low volume products, and the varying degrees of product complexity. Other benefits included assessing the implication of selling products below total cost, and the impact on costs, and resource management of taking on additional business. Further details on the Ingenium and Rivulet research programmes can be found in Appendix 3, and 4 respectively.

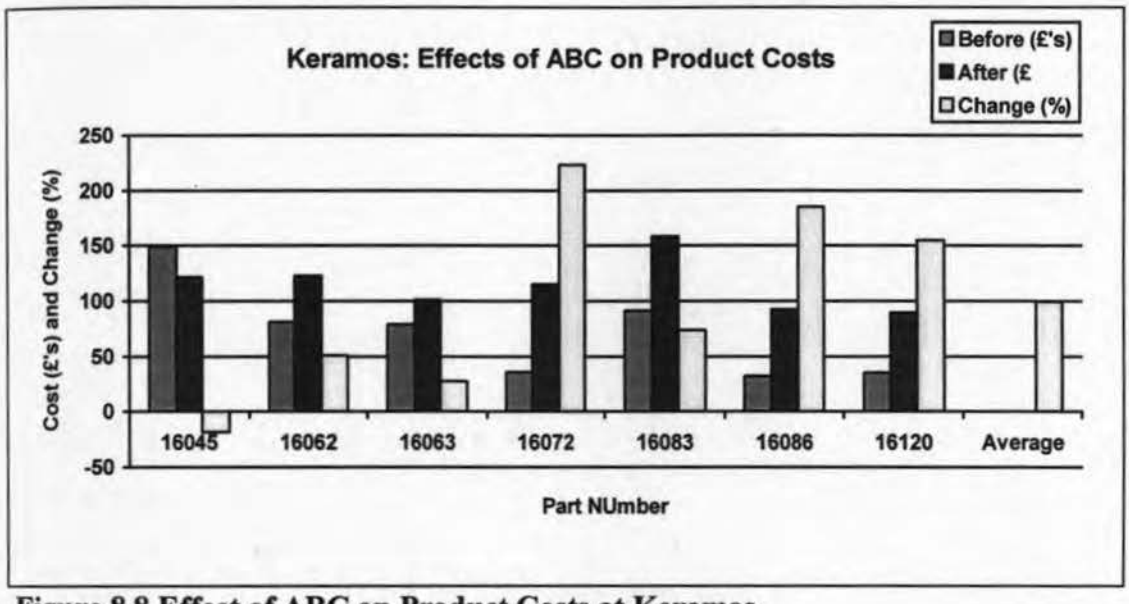


Figure 8.8 Effect of ABC on Product Costs at Keramos.

Analysis of the results for Keramos, Rivulet, Hewlett Packard, and Schrader Bellows reveals the result of adopting modern manufacturing and production control techniques such as Just-in Time, and MRP II. The increased flexibility of manufacturing systems has manifested itself in the adoption of smaller batches of parts with regular delivery. This has seen an increase in overhead relating to manufacturing set-up costs, and in sales order processing. The data presented shows substantial increases in product costs in the region of 20% to 100%. The data presented for Rivulet slightly distorts the assessment due to the focus on activity costs rather than product cost. The findings of the research are entirely consistent with that propounded by other ABC authors, and successfully proves the authors' hypotheses concerning problem definition and data analysis.

The implications for companies in manufacturing industry regardless of organisational size remain. Small- and Medium-Sized Enterprises supplying Original Equipment Manufacturers (OEMs) need to reflect the cost - volume dynamics of processing an order of a given size in its costing and quotation system (See Figure 8.9). Traditional costing systems rarely identify the effects of varying production volumes. Hill [111], has concluded, 'It is usual for manufacturing's task to be based on a proposed of forecast level of volumes. Rarely are costings provided for the different volume levels. It is essential to establish costings for varying levels of throughput'.

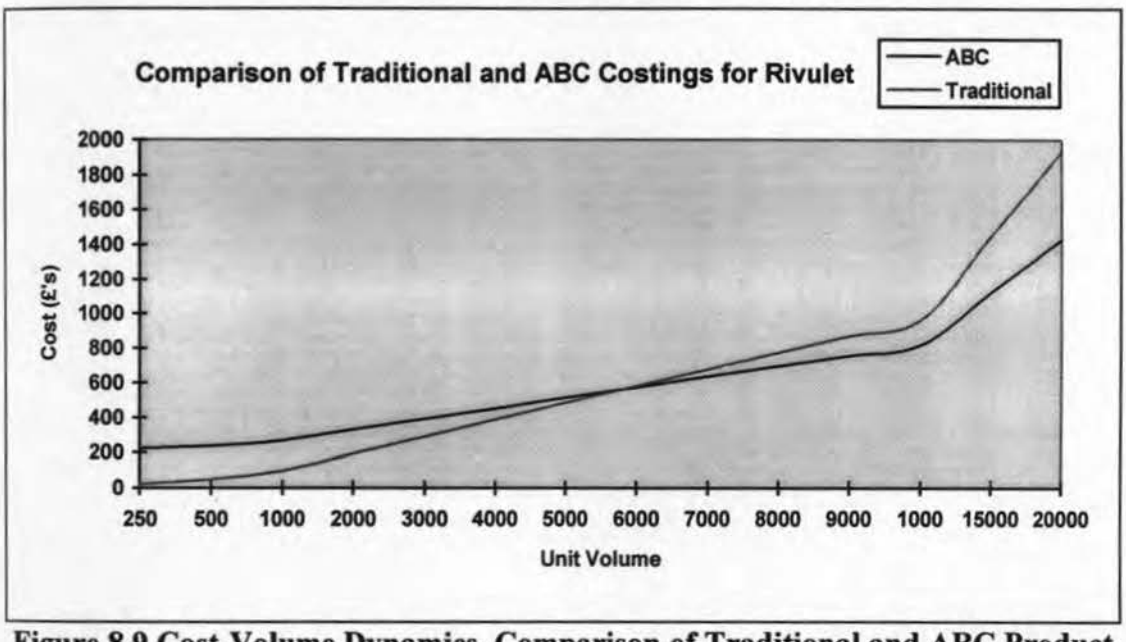


Figure 8.9 Cost-Volume Dynamics. Comparison of Traditional and ABC Product Cost for Rivulet (For 1 Part)

Rupp [77] concluded from an implementation at Lord Corporation, that 'activity costing provides some balance to a "Just-in Time" environment. A pure JIT philosophy is not necessarily the best financial decision, and activity costing reflects that fact'. The adoption of activity based principles can resolve the underlying conflict surrounding cost allocation and the under- and over-pricing of customer orders. The effects of cost and volume on product range has been identified by Hill [111]. He commented that "Manufacturing's role is to continue to develop processes that are flexible enough to cope with product range differences and provide low-cost results. It needs therefore to be able to bridge these essential differences in order to retain the volume base so essential to efficient manufacturing"

Similarly improvements in non-manufacturing activities has been advanced by adopting techniques including benchmarking, continuous improvement, and business process re-engineering.

The analysing of cost drivers and activities through ABCM will bring focus upon value added and non-value added activities. The benchmarking of activities within an organisation can identify opportunities for improvement, likewise, analysing the structural determinants of an activity can provide identification of areas for continual improvement. It must be recognised that ABCM only provides quantification of driver quantities and resource usage.

It will be the prerogative of management to utilise this information to drive change. The continual improvement approach within ABCM can be applied to all organisational activities, including business and manufacturing support activities, not just direct manufacturing. Once improvement has taken place the cost driver units consumed and their appropriate cost can be monitored through ABCM to quantify the success of the improvement project.

Using ABCM data an organisation can identify the structural determinants of a process. In some circumstances to gain substantial long term improvement the process must re-engineered. Re-engineering has been defined [59] as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service, and speed". Re-engineering will ultimately affect the cost drivers being measured, not only in consumption but also the appropriate driver. After re-engineering activities can be monitored as before.

In the early development stages of ABCM its main aim was to improve the accuracy of product costing. Traditionally overhead has been allocated on the basis of either direct labour hours or machine hours. However due to changes in technology allocating overhead by direct labour hours and machine hours was seen as inaccurate [35], likewise differences in production volume also causes problems. The activity analysis and cost driver approach was utilised to provide a more accurate way of allocating costs.

This approach highlights variances in product costs between the absorption approach and the new cost driver approach. This can lead to a change in focus or repositioning of a product in the marketplace. This often involves increases in product price to ensure overhead is fully recovered, or a change in the structural determinants of a product is undertaken. This can be achieved by the elimination of product features or elimination of value added activities in the production process.

As the ABCM process has evolved the introduction of a customer profile cost analysis has been particularly beneficial. While products visibly create a demand for resources and these are quantifiable through the cost driver approach, many organisations have not realised that in the same way customers create a demand for resources. While customers can purchase standard products, their delivery requirements, change in product specification and product volume and other requirements create a change in the demand for resources. This in turn alters the cost driver units consumed by a particular activity. It is only acceptable that any additional requirements which cause additional costs to be incurred, be paid for by the customer that incurs them, not subsidised by customers who purchase goods with standard recognised requirements. Such an approach can cause changes in product prices and customer profile.

Changes in customer and product profile can affect an organisations strategic position in the market place. It must be remembered that servicing the needs of customers who demand varying quality, delivery, lead time and service requirements should always be met profitably, and not subsidised by other customers. That is not to say that these factors are not important but that differences in customer demand be recognised.

ABCM can be of benefit in improving the cost of providing the additional demands of many customers through analysis of the process of servicing those requirements, and undertaking process re-engineering or continuous improvement activities as outlined previously for the benefit of all customers.

8.8 Discussion

Traditionally ABC implementations are predominantly top down in orientation. Resource costs are allocated to activities, and activity costs driven to cost objects. Although accountants and finance personnel usually utilise this primary method of implementation, a 'bottom up' method to the implementation of ABC commonly reveals sources of waste within operational processes.

Approaches including work-force activity based management, and similarly business process re-engineering traditionally encompass the 'bottom-up method'. The implementation methodology presented within this thesis subsumes a 'top-down' and 'bottom-up' method.

Initially the implementation methodology is driven by SPADE. Because SPADE highlights the areas of greatest leverage. This impinges upon general cost management procedures, that is cost allocation, and assessment of operations. The strengths of utilising the methodology are that it can overcome the problems of a 'top down' method that is:

- Requirement to allocate all costs accurately
- Excessive number of cost drivers
- Excessive number of activities
- High costs of measurement
- A finance system rather than an operations management System

The bottom-up method focuses upon basic tasks, and although aggregation of activities is undertaken a large level of detail remains. The weaknesses of this method are:

- A process control system rather than a cost system
- A large level of detail at the lower end of the model
- Control of process established, but lack of control over cost objects
- Finance staff become disillusioned with the ABC process

The implementation of ABC is driven by a belief that profits will improve either by cost reduction or by rationalisation of the customer and product mix. The cost benefits are often long term. A top-down method traditionally incurs a long payback due to the rationalisation required when the ABC results are obtained. A bottom-up method in contrast has early success through the motivation of groups of workers. However control of product and customer mix is a longer term objective.

Utilising a combination of the method's results in cost reductions at an early stage that drives the customer and product profitability analyses, enabling a viable assessment of implementing ABC to be undertaken.

8.9 Conclusion

The objectives of this chapter were to examine the adoption of a generic methodology for the implementation of activity based costing developed through the research programme. The methodology gives greater awareness of the implementation steps involved for companies of all sizes. It provides a detailed structure that can followed for the achievement of organisational objectives. The 'top-down/bottom-up' combined approach to implementation enables organisations and ABC project managers in particular to deliver substantial results at an early stage in the project.

The models developed for the companies participating in the research programme are of a common nature. This is primarily due to the manufacturing orientation of the organisations. The level of aggregation prevailing in the models, is the only visible factor that distinguishes the small- and medium-sized enterprise (SME) from their large counterparts. The results obtained from the implementations are consistent with those propounded by prominent authors. This confirms the original hypothesis of the researcher that, SMEs can effectively utilise ABC for improved control, and visibility of overheads, and for improved clarification of customer and product profitability. This conclusion is dependant upon the organisation undertaking an ABC/Organisational compatibility study, utilising the SPADE methodology.

Chapter 9

Discussion

Introduction

This chapter outlines the results realised from this research programme. Discussion of the results is facilitated through analysis of the contribution of each chapter to the overall objective of the research programme. This will enable critical examination of the applicability, validity and utilisation of the generic implementation methodology.

9.2 The Thesis

At the conclusion of the origins of the project in chapter 1 the overall aim of the research programme was defined as:

"To assess the use of Activity Based Cost Management in manufacturing, and to produce a methodology that will identify whether Small- and Medium-Sized enterprises can benefit from ABCM, identify systems required, methods for implementation, and process improvement techniques."

The method through which the aim has been investigated is defined in chapter 2. In summary the research programme has been of an integrative, and holistic nature. The deficiencies of any one research method were compensated for by the benefits of another. The thesis has been presented in a manner that seeks to reflect the evolving nature of the research programme. That is, the initial understanding of theoretical principles, established the issues surrounding the practical adoption of the technique. This enabled a questionnaire, and supplementary interviews to be undertaken with ABCM users. Knowledge surrounding the practical adoption of ABCM then facilitated the application of ABCM by the author in a variety of environments.

9.3 The Research Programme

At the inception of the research programme in 1993, the adoption of Activity Based Cost Management systems by organisations in the United Kingdom was limited. Indeed the development of the formalised technique had only been established by late 1988 in the United States of America. Those organisations that had instigated ABCM upon its development, were primarily multi-national organisations, with a manufacturing orientation. These organisations were attempting to use ABCM to control overhead costs that had become a high percentage of total cost, in an environment where traditional absorption costing procedures were deemed inappropriate. The utilisation of ABCM by such organisations was epitomised by the case study examples relating to John Deere Component works [112], and Tektronix [113].

While the adoption of ABCM systems among Multi-National organisations accelerated during the early 1990s, its utilisation by smaller organisations had yet to be investigated. The competitive pressures faced by Small- and Medium-Sized Enterprises supplying original equipment manufacturers have been detailed in Chapter 1. In summary the pressure on SMEs to compete on quality, cost, and delivery were intense. It was realised that the adoption of ABCM by organisations of this type may enable them to achieve, and enhance their world class ambitions. Equally the inadequacies of the traditional absorption costing procedures had yet to be fully examined in smaller organisations. The increasing challenges facing SMEs led to this research programme, with its hypothesis that:

"Small- and Medium-Sized Enterprises can utilise an Activity Based Cost Management system, similar to those implemented by larger world class organisations."

In validation of the hypothesis it was deemed necessary to determine the extent of adoption of ABCM by UK organisations, the techniques applied, and the benefits

realised. Consideration of these findings would be made to assess the implications for the adoption of ABCM by SMEs.

This phase of the research programme established that the benefits propounded by authors researching the application of ABCM in large enterprises are realisable by SMEs. Of the many issues surrounding the implementation of ABCM the cost of running such a system has received much publicity. Indeed this is of vital importance to SMEs. It was determined through the implementation survey that the costs involved with ABCM are governed by the utilisation of an appropriate software system. Other implementation costs are primarily influenced by organisation- and model- size. At the conclusion of this phase of the research programme the importance of ABCM in the manufacturing sector had been established. This provided the foundation of theoretical, and practical knowledge necessary for the researcher to investigate the primary aim of the research programme. That being the development of methodologies to identify whether SMEs can benefit from an ABCM approach, and for subsequent implementation.

Although implementation methodologies for ABCM had been propounded before the initiation of the research programme, these were primarily developed through research with large enterprises.

Methods for identification of applicability of ABCM commonly include cause and effect related questions [49], [35], and cost profile analysis of potential users [81], [49]. Such approaches are deemed to have limited value to SMEs as most of the cause and effect related questions are predominantly answered in the positive. Similarly SMEs in the manufacturing sector have a cost profile different to those of larger original equipment manufacturers. This established the need for a technique that SMEs could utilise to investigate the prevailing organisational, and operational environment to determine the inadequacies of traditional absorption costing systems.

Implementation methodologies propounded for ABCM are restricted by their precise focus on the design of an ABCM model, and data gathering. This is epitomised by the

approaches proposed by Turney [55], and Morrow [48] that fail to reflect the operational requirements that a management information system of this nature engenders. The theory relating to the gathering of model data, and model design has been refined over the lifetime of ABCM. Although these phases of implementation often give cause for concern there is minimum leverage in the development of theory relating to this area.

The research hypothesis that SMEs can utilise Activity Based Cost Management was investigated in a variety of manufacturing organisations. The varying operational, and organisational environments pertaining to the research study participants enabled the generalisation of methodologies developed by the author. The research approach adopted during this phase of the programme followed an action research philosophy. This gave the research a primary objective of addressing, and resolving the concerns of organisational management, and to contribute to theory.

9.4 Contribution to Knowledge

The distinct and original contribution to knowledge developed from the research programme is a methodology for determining the validity of adopting an ABCM approach for SMEs in the manufacturing sector. The requirements' methodology (Simultaneous Process Activity and Data Examination) is integrated into a larger implementation methodology. This incorporates, and integrates the issues pertaining to the implementation of ABCM defined by the author. These are, problem definition, processes, software, organisational factors, and implementation methodology.

The evolution of the requirements (SPADE) methodology, and its subsequent validation was undertaken in five organisations. Subsequently two of these organisations did not continue with implementation of an ABCM system. This was due to perceived resource constraints, that are indicative of SMEs in the manufacturing sector. The remaining organisations implemented ABCM successfully using the methodology developed by the author.

The importance of the SPADE methodology is that it enables a picture of an organisation to be built by comparing procedure with practice, and by comparing outputs with inputs horizontally and vertically in the company. This provides the ability to determine without prejudice; the need, and the need meeting system.

The application of the ABCM implementation methodology enabled the development of ABCM models for all three research study participants. The models reflect the varying nature of the operational environments, and the resultant cost information is indicative of those propounded from ABCM implementations. This confirms the original hypothesis that SMEs can utilise ABCM for improved control, visibility of overheads, and improved clarification of customer and product profitability.

9.5 Implementation Considerations for Small- and Medium- Sized Manufacturing Enterprises

While the applicability of ABCM in the SMEs examined in this research programme has proved successful, the appropriateness of ABCM for future application by SMEs may be questioned by learned researchers. Arguments that may be levelled against the adoption of ABCM predominantly surround the "soft Issues" of implementation.

At the outset the costs incurred in undertaking the initiative, should be compared to the realisable benefits. Initially this may preclude SMEs from adopting "off-the-shelf" software for ABCM in favour of a spreadsheet solution. The nature of the models developed in such systems will not degenerate the resultant data. It is the interpretation and implementation of results from the ABCM system that will provide realisable financial benefits.

Similarly, at the inception of the implementation, it is vital that senior management publicise their commitment to the project, and create a framework to enable ABCM to be implemented effectively. The "bottom up" implementation of ABCM requires the full participation and empowerment of lower and middle management. This can only be achieved through elimination of any blame for utilisation of incorrect procedures.

Such a scenario is not restricted to the adoption of an ABCM system, it is an inherent feature of any organisational change programme.

Senior management commitment to change programmes can be restricted by perceived or real capability constraints. These can be organisational or personnel dependant. It was concluded through the research programme that operational control systems utilised by SMEs and large organisations are based upon data that has degenerated, and that no longer reflects current practice. Such a scenario should preclude these organisations from adopting ABCM. It is a fundamental requirement that data management policies be established, and that current systems are assessed impartially before the adoption of an advanced cost management system is considered.

An additional capability constraint is the availability of appropriate personnel. The nature of an ABCM implementation requires that a multi-functional project team is established. While training can be provided in the essentials of ABCM as outlined in chapter 7, there is a vital prerequisite that the project team have a determined intellectual capability, and sufficient organisational knowledge. Such prerequisites may not affect the large enterprise, but SMEs with their continual fire fighting may find insufficient time, and available personnel to implement ABCM successfully.

While these "soft issues" may preclude some SMEs from completing an ABCM implementation, utilisation of the requirements, and implementation methodology proposed by the author will minimise their occurrence.

9.6 Summary

The research programme has established a methodology for SMEs in the manufacturing sector to identify their cost management system requirements. In addition the research has provided a methodology for the implementation of Activity Based Cost Management.

The outcomes of the research programme have enabled, and will further enable SMEs

in the manufacturing sector to establish through further change management programmes substantial competitive advantage. This has, and will be achieved through re-engineering of business processes, rationalisation of customer, and product profiles, eradication of non-value adding activities, and elimination of non-profit making products. It is the skill, and commitment of management in SMEs that will provide the means to address the issues reported from implementing an ABCM system, and develop their world class orientation. It is upon their dedication and business acumen that the regeneration of the regional, and national manufacturing economy depends.

Chapter 10

Conclusion

Activity Based Cost Management (ABCM) has gained increased acceptance as an alternative cost management system in manufacturing and service enterprises. The publicised benefits of ABCM have been realised in practical application. Small- and Medium-Sized Enterprises (SMEs) should recognise the advantages of adopting ABCM in a World class manufacturing environment.

Traditional systems engineering approaches to implementation have proved invalid for SMEs. The Simultaneous, Process, Activity and Data Examination (SPADE) methodology developed in this thesis has given SMEs a tool that has enabled:

1. Precise definition of problem situations
2. Accurate assessment of available solutions

Subsequent use of the generic implementation methodology has provided:

1. A structured route to implementation
2. Awareness of the implementation process
3. Integration of organisational objectives
4. Substantive results at an early stage

The results obtained from implementation in SMEs are entirely consistent with those of large enterprises. Their adoption has facilitated:

1. Control and visibility of overhead costs
2. Clarification of customer and product profitability
3. Improvement in profitability
4. Organisational stability

This research has shown that Small- and Medium-Sized Enterprises in the manufacturing sector can successfully adopt Activity Based Cost Management systems. This conclusion is directly relevant to organisations exhibiting the following characteristics:

1. Employment of more than 20 personnel and commonly less than 500
2. Market multiple products
3. Operative in the manufacturing sector

For SMEs to achieve the benefits detailed in this conclusion a greater awareness of ABCM needs to be promoted.

Chapter 11

Future Work

Successful adoption of Activity Based Cost Management (ABCM) by Small- and Medium-Sized Enterprises has identified the need for its integration in a world class management framework. This should be facilitated by:

- Examining the long term implications of adopting ABCM. Through a 3-5 year reassessment of questionnaire respondents and collaborating organisations.
- Development of a "data health check" to enable accuracy of core information to be determined.
- Application of Simultaneous, Process, Activity and Data Examination to other change management programmes.
- Wider independent testing of the ABCM implementation methodology
- Incorporation of ABCM in product data management systems
- Exploitation of the established tools and techniques in National and International organisations
- Further promotion of ABCM.

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Appendix A1. Activity Based Cost Management Questionnaire.

ALL INFORMATION GIVEN WILL REMAIN CONFIDENTIAL

ACTIVITY-BASED COST MANAGEMENT

QUESTIONNAIRE

School of Engineering
Coventry University

Please Return your completed Questionnaire to:

Clive Winters
Manufacturing and Supply Chain Management Centre
'T' Block, School of Engineering
Coventry University
Priory Street
Coventry
CV1 5FB

Tel No: (01203) 631313 Ext 7232

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Activity Based Cost Management Questionnaire

Company Profile

Your Name: _____
Title: _____
Company Name: _____
Company Address: _____
_____
_____
_____
Phone Number: _____ Fax Number: _____
Approximate Annual Turnover _____ Number of Employees _____
Number of Products/Product Ranges _____
Industrial Sector (eg. Automotive Component Supplier) _____

Activity Based Cost Management Implementation

What benefits were sought by the company in Implementing ABCM?

- ❒ Performance Measurement
- ❒ Understanding Product Costs
- ❒ Understanding Activity Costs
- ❒ Cost Savings
- ❒ Others (Please Specify) _____
- ❒ Resource Management
- ❒ Overhead Allocation
- ❒ Cost Savings
- ❒ Customer profitability

How has your company actually benefitted from implemeting ABCM?

- ❒ Performance Measurement
- ❒ Improved Product Costing
- ❒ Improved Customer Awareness
- ❒ Others (Please Specify) _____
- ❒Improved Resource Management
- ❒Cost Savings
- ❒Improved Overhead Allocation

Briefly outline the stages involved in your ABCM Implementation:

_____
_____
_____
_____
_____
_____
_____
_____

What problems did you encounter with your ABCM Implementation

- ❒ Cost Allocation
- ❒ Data Collection
- ❒ Software Inadequacy
- ❒ Others (Please Specify) _____
- ❒ Defining Drivers
- ❒ Defining Activities

The Project Team

Who were the members of the project team?

❒Consultants Only ❒Consultants & Company Staff ❒Company Staff Only

How many personnel were involved in the system implementation on a full- and part-time basis:

[ ] Full-Time & [ ] Part-Time

Identify the number of personnel from each company function involved in the implementation of the system:

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Finance [ ], Production [ ], Marketing [ ], Sales [ ], Others [ ]

Miscellaneous Implementation

If training courses were undertaken who was responsible for them?

❒ Consultants ❒ Software Supplier ❒ Inhouse

What was the target timescale for the implementation of the sytem?

_____ (Weeks)

What was the actual timescale for the implementation of the system?

_____ (Weeks)

What, if any were the reasons for not adhering to the target timescale?

❒ Data Collection problems ❒ Cost Allocation Problems
❒ Software problems ❒ Resource problems
❒ Others (Please Specify) _____

What was the approximate cost for the complete introduction of ABCM into the organisation? £_____

On a scale of one to ten how satisfied were you with the introduction of your ABCM system?

❒1 ❒2 ❒3 ❒4 ❒5 ❒6 ❒7 ❒8 ❒9 ❒10

(not satisfied) *(satisfied)*

Activity Based Costing Software

What were your reasons for purchasing ********?**

❒ Reporting Facilities ❒ Recommendation ❒ System Structure
❒ Group Standardisation ❒ Functionality ❒ Cost
❒ Others (Please Specify) _____

Did you consider using other ABCM packages? YES / NO
If yes, what were they?

❒ xxxxxxxxxx ❒ **********
❒ *********** ❒ xxxxxxxxxx
❒ Others (Please Specify) _____

What differentiated *** from these other packages?**

❒ Functionality ❒System Structure ❒ Cost
❒ Processing Speed ❒Software Supplier
❒ Others (Please Specify) _____

What, in your opinion are the major benefits of using *** ?**

_____
_____
_____

What, in your opinion are the major disadvantages of using *** ?**

_____
_____
_____

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On a scale of 1 to 10 how satisfied are you with your ABCM software Package ?

❒1 ❒2 ❒3 ❒4 ❒5 ❒6 ❒7 ❒8 ❒9 ❒10

(not satisfied) *(satisfied)*

The Activity Based Cost Management System

Identify the number of activities you are currently analysing:

Less than 10❒ 10-25❒ 26-40❒ 41-55❒ 56-70❒ 71-85❒ 86-100❒ 101+❒

Identify the number of cost drivers you are using to analyse these activities:

Less than 10❒ 10-25❒ 26-40❒ 41-55❒ 56-70❒ 71-85❒ 86-100❒ 101+❒

Do you have process improvement and cost reduction targets which have been developed through your ABCM system? If so what are they?

Do you have any plans to develop or change your ABCM system? If so what are they?

What has been the effect on running costs after the ABCM Implementation? £.....Increase / Decrease

What has been the scale of cost reduction measures achieved through ABCM? £.....

Comments

If you have any further comments on ABCM, ABCM Software, and/or the use of the technique in general these would be appreciated.

As part of my further research work I wish to interview key personnel in several organisations regarding the implementation of ABCM, and subsequently possibly to work with these organisations to analyse the long term benefits of Introducing ABCM. I would be grateful if you indicate whether you would be willing to participate further in this research work.

❒ **YES**, I am Willing to participate further in this research work.
❒ **NO**, I do not wish to participate in any future research work in this area

May I thank you for your time in the completion of this Questionnaire.

Appendix A2. British Based Activity Based Cost Management Software Suppliers.

ABCM Software Suppliers

- **Net Prophet II**

  Sapling Corporation Europe
  Suite 9, Swan Business Centre
  Fishers Lane, Chiswick
  London W4 1RX

  Tel: 0181 995 1331
  Fax: 0181 742 7301

- **Cost Control**

  Quality Production and Research UK Ltd
  1st Floor, Allied House,
  29-39 London Road, Twickenham
  Middlesex TW1 3SZ

  Tel: 0181 744 0041
  Fax: 0181 744 9492

- **ABC Power**

  Armstrong Laing Systems Ltd
  22/24 Princess Street
  Knutsford
  Cheshire
  WA16 6BU

  0565 750030
  0565 750040

- **Activa**

  Price Waterhouse
  Consultancy offices throughout the UK.

- **Oros and Easy ABC Plus**

  ABC Technologies Ltd
  P.O. Box 69
  Waterlooville
  Hampshire
  PO7 6PY

  Tel: 01705 230 280
  Fax: 01705 268 011

- **BPS - ABCM**

  BPS Software
  2 The Ridings
  Queniborough
  Leicester
  LE7 8DT

  Tel 01533 697293

- **Profit Manager**

  KPMG Peat Marwick
  Consultancy based throughout the UK

- **ABC Toolkit (Process Management Software)**

  Micrografx
  Golde House
  Stroudley Road, Basingstoke,
  Hampshire RG24 8BR

  Tel 0800 626 009
  Fax 01256 53339

Appendix A3. Production Cost Analysis, and Product Cost Definition: Case Study. Repede-Fiman Project. Romania.

REPEDE - FIMAN
Fundatia Internationala de Management.
Bucharest, Romania.

Institutional Development Orientated To Enterprise Problem Solving

Case Study Report

PARTICIPANTS

Foreign Consultants : - CROWN AGENTS - UK

Romanian Consultants : - SC QUASARO srl Bucharest

Romanian Enterprise : - SC INGENIUM SA, Campina

PREFACE

This case study is one of the outcomes of the PHARE - Repede-Fiman pilot project "Management Development by Problem Solving".

The objective of the pilot project is to build the capacity of Romanian consultants to solve problems and to give advice to Romanian industries and businesses through co-operation with international consultants and experts.

The Participants

Romanian Enterprise

INGENIUM, Campina
General Manager : Dipl. Eng. Radu Fratila

Romanian Consultants

Quasaro, Bucharest
Director of Operations : Mihai Valeanu
Management Consultant : Marian Martazan

Foreign Consultants

CROWN AGENTS, UK
Director of Human Resource Development: Robin Wain
In association with Coventry University, School of Engineering
Dr Derek Steeple
Mr Clive Winters

Quasaro and Crown Agents had previous experience of working together through a project in 1993 to assist in the development of a Romania National Quality System. Mutual understanding of the respective skills and competencies were already established. The further combination of quality management and human resource development expertise for the purposes of this project is seen as an ideal extension of the working relationship.

Initial discussions between QUASARO and Crown Agents identified a number of previous clients of Quasaro that might be suitable enterprises for the programme. Four were contacted, three responded in a positive manner and INGENIUM were identified as being most able to meet the programme criteria.

Crown Agents Director of HRD and QUASARO Director of Operations visited INGENIUM in Campina to establish a basis for co-operation on the project.

They demonstrated a very enthusiastic attitude for the project and were quick to appreciate both the immediate benefits to themselves and the wider applications of the

case study in the national context. Furthermore INGENIUM agreed to contribute to the cost of the project by providing for the board and lodging of the consultants whilst in Campina and for Bucharest - Campina travel.

After consideration INGENIUM provided four priority areas they recognised as having both systems deficiencies and management skill deficiencies. They were:

1 Production costs and overheads analysis to develop a methodology for their control and to provide a basis for product pricing.

2 Materials management and stock control, including supplier evaluation, specifications, tendering, bid evaluation, goods receipt and inspection, and store design.

3 Reliability, methodologies for data collection and analysis, and applications to product development.

4 Internal budgetary control systems and budget planning.

After considerable discussion it was agreed that although all four subject areas were important Number 1 was the most fundamental to company survival and competitiveness in a market economy, and that therefore **Production Cost Analysis and Product Cost Definition** should be the subject of the consultancy.

Resulting from the agreement on the precise problem solving area, Crown Agents identified and appointed two experts from the School of Engineering at Coventry University.

Objectives of Consultancy

1 To develop a methodology to identify and quantify the costs of production and related overheads leading to the build-up and definition of product cost.
2 To identify INGENIUM staff development and training needs in respect of objective 1 and to recommend appropriate actions.
3 To assist and train QUASARO personnel to develop expertise in up-to- date techniques of production control and to enhance their management training skills.

The pilot project started on 16 August 1994 and was completed on 11 November 1994, it involved 350 man hours of work by the international consultants and 750 man hours by the Romanian consultants. The man hours devoted by the Romanian host company were not accurately quantified but the members of a 15 man team accumulated in excess of 1500 hours.

FIMAN : Fundatia Internationala de Management.
Bucharest, Romania.

Institutional Development Orientated To Enterprise Problem Solving.

Contents : **Page**

Appendices

Appendix 1: List of Quasaro Personnel

Appendix 2: Training programme and appropriate objectives for Quasaro consultants

Appendix 3: Examples of procedures produced by Ingenium.

Appendix 4: Initial activities and performance measures identified by Ingenium.

Appendix 5: Revised activities and performance measures

Appendix 6: Outline cost centres, cost centre elements and allocation methods for factory one.

Appendix 7: List of cost drivers for general Ingenium overheads.

Appendix 8: Work order investigation

Appendix 9: List of Crown Agents personnel

1) General Approach To The Project

In general most manufacturing challenges distil to a common and finite set of problems. What was important therefore was to get a rapid understanding of the detail of the available information.

The methodology relied on company employees reporting on procedure and practice and having all threats of blame for poor procedures and inaccurate information removed. This was particularly important in order that actual facts could be reported, rather than "What the consultants wanted to hear".

Therefore at the start the project it was necessary to consider which business processes were liable to uncover areas for further investigation to give clues to the actual problems. To show Company commitment and ensure progression of the project it was necessary to form a Steering Committee which consisted of managers, at the highest possible level with line management responsibility for the functions which were being investigated. The investigation of actual procedure and practice was carried out by a Project Team which was made up of staff and supervisors who have day - to - day responsibility for the business processes under investigation. Each member of the Project Team reported to a member of the Steering Committee, which met regularly to evaluate the findings and determine the next steps of action.

The business processes which were selected for further investigation were :-

Product and engineering change procedures
Sales order processing and despatch
Formation of production plans
Generation of requirements for assemblies, components and purchased items
The planning of capacity, the loading of machines and people
Goods inwards and stores issue and receipt procedures
Scrap accounting and the causes
Determination of batch sizes
Determination of, and accounting for set up costs
Setting of standard labour and machine times by component
The measurement of and reasons for variations to standard
The booking of direct labour to indirect jobs, and the reasons

The method of investigation was as follows :-

Define and write down official procedure in a step by step way

Define and write down the practice of what happens and note any variations to official procedure

Analyse each step of the procedure and determine the inputs and outputs of each step

For each input note the source, what has to be done with the input information before it can be used, and what is done with the input

For each output, note the destination, and what it is used for

This enabled the consultants to build a picture of the organisation by comparing procedure (if any) with practice, and by comparing outputs with inputs horizontally and vertically in the company. The objective was to identify :-

What things were good and happening effectively

Where there was an absence of procedure

Where there was non-value added work taking place

Where things were happening ineffectively

The result was identification of areas for further investigation. This was a "top down" approach, where things were being investigated generally with a view to determining how the project objectives would be achieved.

In parallel with this the consultants investigated the detail of the accounts. By applying Pareto principles, by value and volume, it was possible to establish the likely areas for subsequent detailed investigation of quantities and figures. This approach was the "bottom up" method. For example it was discovered that overheads were 40% of total costs, direct labour a few %, and direct labour was being used to apportion overheads to products. Given the diversity of products and operations it is unlikely that this formula represents the way in which value is added to products in practice.

This methodology resulted in obtaining a greater understanding of the company and potential problems. The "top down" approach identified areas where things were going wrong from an operational view, the "bottom up" approach identified was going wrong from a data point of view. The next stage was to focus on the areas which revealed the causes which were giving rise to the symptoms identified. In this case it was decided to investigate the work orders for the month of August.

The analysis of all the information gathered resulted in the recommendations and the implementation training programme detailed in the case study.

List of Ingenium Staff involved in the project.

The Crown Agents and Quasaro staff would like to thank the following Ingenium staff for their whole hearted commitment and enthusiasm during the project.

Mr Fratila
Mr Popescu
Dr Miloiu
Mr Buzatu
Mr Plesa
Mr Marinescu
Mr Dascaru
Mr Hauer
Mr Pandelescu
Mrs Pahontu
Mr Costea
Mr Stonescu
Mr Simache
Mr Naghel
Mr Cosmineanu
Mr Vintila
Mrs Coconea
Mrs Palamida
Mrs Hogea
Mr Bengescu
Mr Irimescu
Mr Moisescu
Miss Poenaru
Mrs Grecu
Mr Popa

Mr Viorel Rosianu was expert, dedicated and constructive in his assistance with translation.

Glossary of Terms

Activity
A unit of work performed in an organisation. A description of the work that goes on in the organisation and consumes resources.

Activity Based Costing
A method of measuring the cost and performance of activities and cost objects. Assigns costs to activities based on their use of resources, and assigns cost to cost objects based on their use of activities.

Activity Based Management
A discipline that focuses on the management of activities as the route to continuously improving the value received by customers and the profit achieved by providing this value.

Activity centre
A report of information in a function. The sum of all the cost elements assigned to an activity.

Activity Cost Pool.
Total cost assigned to an activity. The sum of all the cost elements assigned to an activity.

Allocation
Indirect assignment of costs, usually in a manner that spreads cost arbitrarily across multiple benefiting activities.

Cost
Is the total expenditure incurred in manufacturing the product.

Cost Centre
A location, function or item of equipment in respect of which costs be ascertained and related to cost units for control purposes.

Cost Driver
A factor used to assign cost from an activity to a cost Object. A measure of the frequency and intensity of use of an activity by a cost object.

Cost Element
The amount paid for a resource and assigned to a cost centre or activity pool / centre.

Cost Object
The reason for performing an activity, Products and customers for example.

Performance Measure
An indicator of the work performed and the results achieved in an activity. A measure of how well an activity meets the needs of its customers. A performance measure can be financial and non-financial.

Price
Is what the user or customer pays the manufacturer for a product

2) Introduction

The INGENIUM company is based in Campina, Romania. Ingenium currently manufacture reduction gearboxes for specialist applications and also maintain a standard product profile and service National and International markets. Ingenium currently operate 4 factories and a central administration and support services function based on one site. The 4 factories can be seen to accommodate the following manufacturing functions : -

Factory 1 : Manufacture and assembly of specialist reduction gearboxes.
Factory 2 : Batch manufacture of regular pumps and gearboxes.
Factory 3 : Manufacture of tooling for internal and external consumption.
Factory 4 : Foundry facility

The project aim is to undertake a production cost and overhead analysis exercise within INGENIUM as a vehicle to :-

1. Develop a methodology for their control and to provide a basis for product pricing.

2. Assist and train QUASARO personnel to develop expertise in up-to-date techniques of cost management and to enhance their management training skills. This training element was undertaken prior to the initial production cost and overhead analysis exercise with INGENIUM.

The training programme for Quasaro was entitled Production Cost Analysis Techniques and was delivered during the first week. A session on management training techniques was included and a summary of the programme and appropriate objectives is listed in appendix 2, and a list of Quasaro staff can be found in appendix 1.

3. Combine the skills of the Romanian and Foreign consultants to identify INGENIUM staff development and training needs with respect to the project objective. This training took place in phase 2 of the project.

The information specified in this report and the implications and subsequent identifications of areas for improvement were identified through a cost analysis exercise with INGENIUM. The initial and subsequent information has enabled an implementation methodology for an advanced cost management and product pricing system to be developed.

3) Production Cost and Overheads Analysis Exercise

Development of Base Cost Data

The development of base cost data was initiated by analysing the accounts of Factory 1 within Ingenium.

The cost elements within Factory 1 for the period of July 1994 were found to be as follows:

		'000 Lei
Raw Material	12.0%	40252
Bought in Material Castings	45%	291440
Unemployment Benefits	0.2%	1143
Direct Salaries	4.3%	22857
Taxes	1.1%	5714
Overhead Factory 1	22.2%	118301
Overhead (General)	17.9%	100957
Waste / Losses	0.15%	1018

Subtracted form these cost elements are the following:

Scrap/ Material Allowance	0.3%
Transportation Overhead	2.6%

Also forming part of the product cost are those elements of cost associated with other factories. For this particular period it consists as follows : -

Internal Bought In - 11.5%.
Subcontracted - 2.7%.

Initial indications were that Overhead, both with respect to factory one, general Ingenium overheads and material were the areas on which greatest focus should be maintained. Understanding that the overheads were allocated on the basis of direct labour hours gave valuable insights. This led to further investigations encompassing an analysis of 20 work orders. This information is detailed in appendix 8. This detailed actual and planed consumption of material and direct labour, with information from several sources. These sources consisting of, production planning, data processing, and cost department (accounting - factory 1). Although the data from the planning sheets were utilised in both the computing system (with respect to direct labour), and the cost department (with respect to contracting), the computing system was not given current information with respect to machine hours. When the actual data had been collected the initiation of new contracts failed to take into account the data with respect to actual direct labour content and material prices from previous work orders.

With respect to factory one the direct labour hours can be seen to consist of assembly and machining and the appropriate figures are as follows : -

Machining 177 Workers or 248,041 hours
Assembly 76 Workers or 83,374 hours

Overhead

The overhead for Factory 1 was divided into two parts. The overhead incurred directly in Factory 1 and the overhead incurred centrally and allocated between the factories. All overhead being allocated on the basis of Direct Labour Hours within that particular factory. To analyse the overhead aspect further it is essential to find out where the costs are being incurred with respect to both Factory 1 and the general overhead.

General Overhead

It was important to analyse how the costs for overhead are incurred between the functional departments. The following is a summary of the overhead elements which make up the general overhead and their appropriate costs. The values were obtained from the general accounting records. All overheads being recorded in the general ledger by cost element. These figures relate to the year 1993.

	'000 Lei
Research and Development	95421
Automation	31350.3
Quality and Service	275574.85
Computing Services	66409.2
Administration	251168.26
Marketing	14421.12
External Contracts	10442.88
Management salaries (14)	73331.953
Personnel / Human Resources	39912.61
Financial	30982.0
Accounting	28893.0
Cost Department	22502.0
Legal Department	6064.0
Counsellors	15526.5
Security	8303.6
Internal Contracts	74994.5
Sales and purchasing	299424.74
Foreign Travel	53000.0
Total	**1504924.484**

Areas in which greater visibility of costs is required are Quality and Service, Sales and Purchasing, and Administration. The following information details how these areas were subdivided to achieve a greater level of detail.

Quality and Service	'000 Lei
Quality Assurance	6417.3
Laboratories - Physical, Standards	33364.7
Metrology	25530.1
Goods inwards Inspection	41642.91
In process Inspection and Testing	106955.0
After Sales Service	61664.85

Sales and Purchasing

Accounting	25651.585
Purchasing	57375.341
Distribution	39979.813
Transport	139977.99
Sub Contracting	19974.413
Stores	16465.744

Administration

Maintenance	8856.48
Investments	102866.47
Utilities	90310.02
Social Charges	49135.33

The allocation of the general overhead on the basis of direct labour is seen to distort the product pricing. As particular products consume varying amounts of the general overhead resources. Product cost may not be truly reflected in the allocation on the basis of direct labour. A key and detailed aspect of the consultants work was in the facilitation for Ingenium to identify in each department procedures comprising:

Activity Analysis
Input-Output Analysis
Performance Measures
Process Documentation

An example of the procedures is found in appendix 3, and all the defined activities are found in appendix 5. Proceeding this was an identification of the possible activity centres, activities, cost drivers, and performance measures. These may subsequently by the Ingenium staff.

Factory 1 Overhead.

The factory one overhead consists of the following elements. Current consumption of these resources is not at present monitored or recorded independently.

Depreciation
Repairs
Utilities
Tooling
Consumables
Maintenance
Accounting
Engineering
Production Control
Computing
Administration

The method of overhead allocation on the basis of direct labour hours (DLH's) distorts the product pricing because the total DLH's consist of both direct labour with respect to machining and assembly. This initial identification was further accentuated

by the acknowledgement that within the direct manufacturing activity there are machines of inherently different overhead structures. An example of this is the Klingenberg machining centre which by its nature and value incurs a higher rate of depreciation, tooling, maintenance and consumables cost, with respect to the traditional machinery located in factory one. Examples being standard lathes, milling drilling and grinding machines.

Also within the factory one overhead were the supporting services (previously outlined). The realisation that most of these costs are incurred not with respect to direct labour but with respect to other elements such as machine hours initiated the preliminary development of cost centres, cost centre elements and more suitable cost allocation methods for factory one.

The initial identification of possible cost centres for factory one was through a detailed analysis of the manufacturing and support service functions in factory one. These were subsequently redefined as appropriate and possible methods of cost allocation with respect to the cost centres were developed.

Subsequent training may lead to the cost centres and appropriate allocation methods being redefined.

Material

Regarding material prices an important factor is that of inflation. Ingenium, quotes from suppliers are received with respect to the materials for a particular three monthly period.

Examples of the possible increase in material prices are :-

Electrical motors: 40%
Bearings: 35%
Steel: 20%
Aluminium alloy: 25%
Bronze: 30%
Fittings: 30%
Miscellaneous: 35%

That means an estimate average growth for material prices of 30%

This factor is then applied to the original material price on a mark up basis.

Example

$$\text{Mark up} = \frac{\text{Book Price - Cost}}{\text{Cost}}$$

Cost being defined as - the total expenditure incurred in manufacturing the product.

Price being defined as - What the user or customer pays the manufacturer.

and as a practical example : -

Original Material Cost = 1000 lei
Mark - up = 30%

$30\% = \frac{\text{Price - 1000}}{1000}$: price = 1300 Lei

The same approach is utilised for labour and overhead costs. This method of dealing with inflationary pressures is seen to be appropriate. However changes in inflation are difficult to predict and may not subsequently affect the market price for material. As an example the average monthly inflation rate during the period of January - July 1993 was 12.3%, and dropped substantially to 1.6% for July 1994. (Source : Romanian Business News, Sept/Oct 1993, Sept/Oct 1994.)

The only element with respect to material which could be improved is that concerning work orders. There are distinct differences between the planned and actual material prices incurred on the example 20 work orders. This is due in the main to the transfer of material requisitions for particular parts from one work order to another. Subsequently the actual data regarding material may not be realised until several months after the completion of the work order.

Concerning stock valuation, Ingenium apply the last-in, first-out (LIFO) system correctly and the data from this is utilised effectively

4) Overview - Production Cost and Overheads Analysis exercise

The initial indications from the factory one accounts were that the focus of the project should be toward overhead and material cost analysis as the direct labour element of the total cost was only4%. This labour element only needed to be analysed in terms of the current method of overhead allocation.

It was seen by subsequently analysing the overhead structure of both factory one and the general supporting services that the allocation of the respective overhead on direct labour hours consumed was inaccurate. To analyse correctly the overheads consumed in Ingenium it was determined that a method of analysis which could reflect the multi - product environment was required.

This advanced cost management system was seen to be Activity Based Cost Management. By seeking to identify centres or pools of cost with distinct overhead structures the areas of factory one and general support service overhead could be subsequently allocated to products in a more meaningful way.

The initial identification of these cost centres was achieved through the development of procedures regarding the general overhead, and a detailed visual analysis of the work undertaken in factory one. (Examples of the procedures produced by Ingenium can be found in appendix 3) Within the cost centres or activity pools there will be cost elements which can be utilised for budgetary control.

When establishing a contract a current fundamental flaw is that when establishing a contract price, an analysis of previous work orders is not undertaken. Therefore the system can be seen to operate as an open loop.

The analysis of material costs concluded that the procedure for dealing with inflationary pressures was accurate. The project could therefore be seen to focus on the general overhead and factory specific overhead.

A specific challenge identified during the base cost development phase was ensuring that the data collected was accurate. This was overcome by analysing how the data had been collected and developed. This was essential as any distortion of costs would affect the proceeding analysis with respect to the implementation methodology.

The development of base cost data was initiated by the consultants and continued by Ingenium with assistance and analysis from Quasaro. The information was subsequently reported back to the UK at regular intervals, for analysis. The information formed the basis for the next phase of the project which consisted of the development of an implementation methodology, case study report and training for Ingenium and Quasaro personnel in the key elements of the project referring to the implementation methodology.

5) Implementation Methodology

The implementation can be seen to focus on two areas of costs within Ingenium. These are as follows :

- Factory Overheads
- General organisation overheads

Regarding these two areas the objectives of the project and of the implementation can be listed as follows.

Objectives

1. To introduce an improved system for the identification, quantification and subsequent allocation of production costs with a detailed focus on overhead.

2. To introduce an improved system for the identification, quantification and subsequent allocation of the general organisational expenses.

3. To subsequently improve the method in which contract prices are established, given special reference to the two objectives outlined above.

Deliverables

The improved information that will be required to satisfy these objectives is as follows.

1. For the production costs and overhead, the improved information will provide details of overhead groupings, overhead elements, and the relationship between the product and the operational activity undertaken, giving more specific data with respect to a particular cost function. This will enable Ingenium to analyse and control their manufacturing activities in a more meaningful way, through the identification of the costs incurred in practice.

2. Regarding the General Organisational overhead the improved system will provide costed activities, activity definition of value added / Non - Value added, performance measures, and identification of the processes through which work is undertaken, and an indicator of the way costs are incurred with respect to the manufactured products.

3. Improved contract pricing will be established through the provision of information with respect to manufacturing processes undertaken for a particular part, and an improved overhead allocation rate based on the appropriate process. This will be supported by improved utilisation and recording of actual data with respect to current standards.

Scope of the Project.

The scope of the project for production overhead will be to analyse only factory one. The information gained from implementation within factory one can be utilised for application within the other factory units at a later date. The general organisational overhead will be analysed by department, and the activities identified are to be at a general level.

It is essential that the accounting periods developed for this implementation and for subsequent use are the same within both the general overhead and the production overhead analysis. It is envisaged that analysing costs on a quarterly basis will be sufficient at the outset, however this can subsequently be revised to reflect the type of information needed, and reported within the organisation.

Organisation Structure.

The implementation team consists of a Project Team, and Steering Committee comprising:

Project team

1.	Mr Pandelescu,	Finance
2.	Mrs Pahontu,	Cost Accountant
3.	Mr Costea,	Head of Computing
4.	Mr I Simache,	Chief Production controller, factory 1
5.	Mr A Naghel,	Planning / Engineering - factory 1
6.	Mr V Cosmineanu,	Design
7.	Mrs Coconea,	Internal Sales
8.	Mrs Hogea,	Chief Factory 1 accountant
9.	Miss C Poenaru,	Chief Accountant, Factory 4
10.	Mrs Grecu,	General Accounting
11.	Mr Moisescu,	Machine Shop, Factory 1

Steering Committee

1. Mr Hauer	Management Consultant
2. Mr Marinescu,	Technical Director
3. Dr Miloiu,	Technical consultant
4. Mr Buzatu,	Factory 1 Director
5. Mr Plesa,	Finance Director

Training Requirements

Management in the form of the Steering Committee, need a general overview of the project and detailed understanding of some critical elements in order to direct its future progress. The members of the Project Team need to have the skills to ensure successful completion of the project. These skills may include technical design skills, software modelling, project organisation, and the development of reports for users of the system. Depending upon future directions of the project they may need to acquire additional skills at later dates.

Outline Training programme for the implementation of a costing and estimating system.

Communication and Interpersonal Skills
Team building
Team roles and managing projects

Review of project activities and progress

Overview of Activity Based Costing / Management

Project Implementation and methodology

Application of Activity Based Management to Project

Data Collection documentation and retrieval

Detailed System Design

Application to Spreadsheets

Budgetary control and Utilisation of Activity Based Management data for Business Process management

Action planning

Project Plan.

The project plan can be seen to consist of the following elements.

A) Development of base cost data
B) Preliminary identification of activities
C) Preliminary identification of cost centres
D) Refinement of data

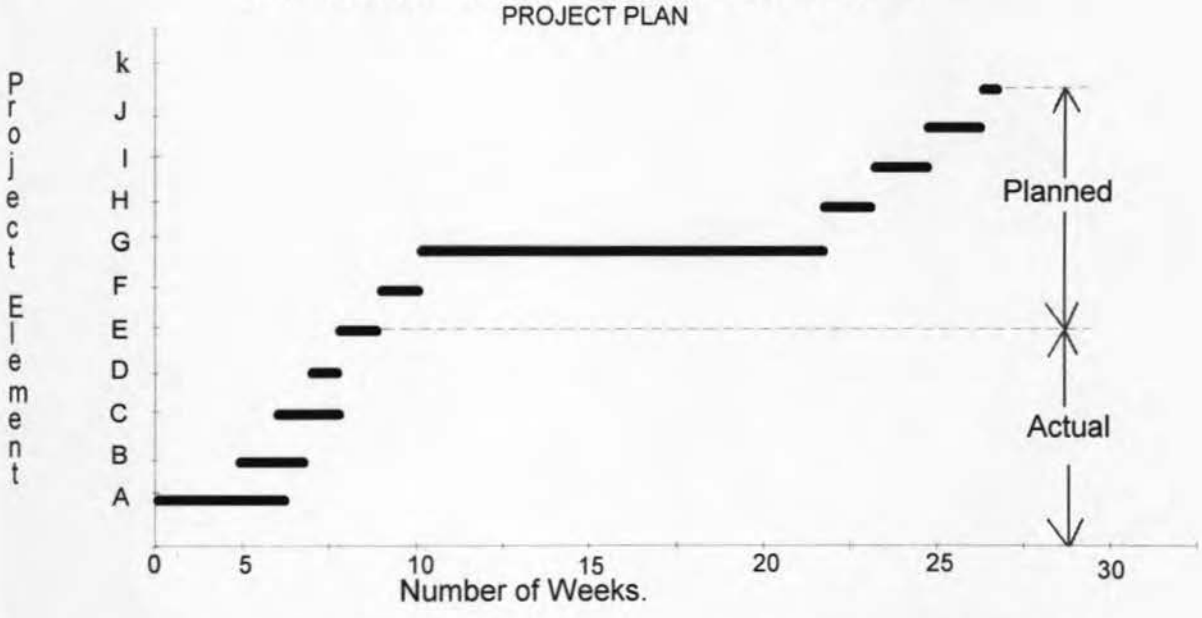
E) Training
F) Finalisation of cost drivers, cost centres, cost elements, and activities.
G) Identification of actual data
H) Data Manipulation
I) Data Reporting
J) User feedback
K) System maintenance

Elements **A,B,C,D** and **E** being undertaken as part of the project by Ingenium, Quasaro, and Crown Agents.

The implementation timescales with respect to these elements are outlined in the diagram below. A discussion of the elements following the training **(E)** can be found on the proceeding pages.

NEPTUN : PRODUCT / PRODUCTION COSTIING

PROJECT PLAN



F) Finalisation of cost drivers, cost centres, cost elements, and activities.

A range of cost centres which breakdown the factory one overhead has been developed. These cost centres or overhead groupings consist of both administration, and direct and indirect manufacturing activity in factory one. The cost or overhead elements within these overhead groupings, are those resources utilised by that respective overhead group or cost centre. Each cost centre and cost element will have a code, like those utilised in the general ledger. The total cost of the cost centre elements will be allocated to products through an appropriate cost driver. As with the cost centres and cost elements, an appropriate list of cost drivers has been established. A list of the overhead groups, overhead elements, and appropriate cost drivers has been established and these can be found in appendix 6. The cost drivers and cost centres can be subsequently revised after the training has been undertaken.

G) Collection of actual data.

The data to be collected in respect of the cost centres outlined will be with respect to the particular cost elements outlined. The data with respect to salaries for example will detail the cost centre within which that cost was incurred. Likewise the data with respect to consumable purchases and tooling. This cost information will be allocated against a particular cost centre. This can be achieved through recording the particular cost centre number on the appropriate purchase order, or work slip for example.

The data with respect to the allocation bases will detail the appropriate consumption of a particular allocation base. For example the budgeted figures for number of machine hours, and the actual figures for machine hours. The appropriate allocation base for each cost centre should be simple to measure, easy to understand, and a fair reflection of the way costs are incurred.

In respect of the data to be collected and appropriate cost allocation bases, it will be necessary to ensure the establishment of data collection with respect to the cost centre elements and methods of allocation. It is essential to ensure that all data collected is with respect to exactly the same period as distortions will occur if the data is not correctly reported.

H) Data manipulation

Once the data has been collected it can be manipulated for utilisation. The total value of each cost centre being achieved through the addition of each cost centre element. The total value of each cost centre will form the basis of a cost driver rate. To achieve this it is necessary to have the appropriate consumption of cost driver units identified. This will be actual data from the same time period as the cost centre value information

Examples

The activity known as stores has as its allocation base the number of material requisitions. The cost for a particular period might be 12,000,000 Lei, and the appropriate number of material requisitions for the same period might be 5,000.

The appropriate cost driver rate can then be developed, as follows.

$$\frac{12{,}000{,}000 \text{ Lei}}{5{,}000} = 2{,}400 \text{ Lei / stores material requisition.}$$

Likewise the development of a cost driver rate for a manufacturing cost centre would operate in the same way.

Example

The Klingenberg machining centre may cost 10,000,000 lei for a particular period, and consume in the same period 3000 machine hours. The cost driver rate would then be developed as follows.

$$\frac{10,000,000 \text{ Lei}}{3,000} = 3333.33 \text{ Lei / Machine hour}$$

The build up of the product cost will therefore consist of each cost driver rate and the appropriate consumption of cost driver units for each product in respect of that particular cost centre. The application of developing the product cost can be carried out using a computerised spreadsheet. The information that can be reported and utilised consisting of budget, historical, and actual data. The application of developing a contract price with respect to cost centres and driver rates within a computerised spreadsheet formed an integral part of the training course.

The material costs with respect to the product cost will be calculated in the normal manner, as will the sub-contracted and internal bought-in parts.

I) Data Reporting

The reporting of data will take place after the information has been collected for the particular time period, and subsequently manipulated. The information that can be given to the Ingenium managers can consist of :-

Cost and Activity Centre Analysis:

This will be achieved through the reporting of cost centre elements, with respect to budget, actual and historical data. Together with the cost driver units consumed, and an appropriate driver cost this will give an indication of the actual performance against the planned performance with respect to particular time period.
Performance Measure Data.

Another indication for Ingenium managers of how successful the organisation has been in a particular time period is the utilisation of performance measures. Appropriate performance measures have been developed by Ingenium, with assistance from Crown Agents and these can be found in appendix 5. The performance measures can be both financial and non-financial. An appropriate way of presenting the performance measure data, will be in the form of a graphical bar chart consisting of planned, actual and future performance. Performance measures can be used throughout the organisation, in both support departments, and factory units.

J) User Feedback

After the reports have been issued to the appropriate managers, it is essential to have feedback from those same managers. Feedback can take many forms.

1) Requests for further data.

Some personnel may not receive all the information. Some information may have restricted access. It is possible that some managers may request information so that they can identify the appropriate performance of other departments with whom they work. Like wise the further information may be needed to clarify some of their own data and give a more holistic viewpoint.

2) Requests for information not currently reported.

After the reports have been established it is possible that gaps in the reporting profile may appear. In this case extra reporting of data can be developed. In some cases the information may be for a specific project, in this case it could be wise to manipulate the data already available to give different perspectives.

3) Validation of Data.

The information within the system is an indicator of company performance. It is essential to ensure that the data collected is valid and not a distortion of the truth. Data validation is therefore essential if the users of the system are to utilise and act upon the system information.

4) Discussion of the data

In a continuous improvement environment it is essential that the data is discussed. Further development of the system could take place from such a discussion. The reporting of the data should not be seen as an end in itself. It is the subsequent use of the data that will determine whether the system is a success.

K) System Maintenance

System maintenance is an essential part of the project structure. In the early phases of running the new system it will become evident that certain elements of the system require modification. Likewise on a regular basis the system needs to have its validity questioned.
For example the questions that might be asked are :

Are the current cost centres still appropriate?
Should New cost centres be introduced?
Should new cost elements be introduced?
Are the methods of cost allocation still correct?
Are the performance measures still relevant?
Should new performance measures be developed?

The answers to such questions will determine whether the system needs updating. The system is ongoing and as the company changes with time all systems need to change to reflect the new position. But in the early stages beware of creating too many cost centres, such that data collection is duplicated, and / or redundant cost centres maintained.

6) Overview - Advanced Cost Management System

The advanced cost management system outlined provides for Ingenium a more appropriate way of allocating costs in respect of both the General Overhead and the factory one overhead.

The solution put forward consists of several key elements.

1) Identification of more appropriate cost centres and activity pools. This will provide more meaningful overhead groupings, which is vital if the costs incurred are to be more accurately allocated.

2) Identification of comprehensive cost elements within each cost or activity centre. This will provide vital information in respect of budgetary planning, and an indication of to which overhead areas Ingenium may wish to allocate future resources. The comparison of budgetary information with those costs actually incurred provides one of the methods through which the performance of departmental managers could be analysed.

3) Identification of more meaningful ways to allocate costs from cost or activity centres to products. This is a vital step forward as the current method of allocation of overhead on a direct labour hour basis is inaccurate. The system design which has been developed with Ingenium gives various methods of allocation, which seeks to reflect more accurately in the product pricing a particular product's consumption of resources.

4) Identification of performance measures which seek to provide along with cost data improved operational information. Improved information is vital for the continuous improvement of the organisation and control of the areas of overhead. Managers need up to date information to make informed decisions and this system is a starting point for advanced management information.

5) Introduction of a computerised system for the preparation of product prices. As the overhead groupings with respect to both factory one and general overhead will have cost driver rates established, a method through which the product price can be established in a quick and accurate manner is vital. This is seen to be achieved through a computerised spreadsheet system. It must be noted that the traditional methods of dealing with inflationary pressures will remain, and that the material cost will be developed independently of the spreadsheet. Although a computerised bill of materials would give valuable assistance in establishing contract prices.

7) Concluding Project Remarks

The project has been seen to support several key improvement opportunities for both the Romanian consultants, and Romanian enterprise.

With respect to the Romanian consultants, Quasaro, the project has provided a foundation of knowledge in traditional financial and cost management techniques. This foundation was initiated and advanced by the training programme of which an integral part was advanced cost management techniques.

The learning experience for Quasaro was made complete through their active participation in the production cost and Overheads analysis exercise with the Romanian enterprise SC Ingenium SA.

The improvement opportunities for the Romanian enterprise, Ingenium, has been in the acknowledgement through a detailed analysis of base cost data that the allocation of costs with respect to overhead could substantially distort product prices, leading to inaccurate pricing in the market place.

The model implementation methodology was subsequently developed to overcome the outlined deficiencies and is capable of expansion and/ or modification to grow with comp any needs.

The solution which Ingenium will implement, after having gained the necessary skills through a phased training programme for their staff and managers, will seek to allocate costs to products in a way which reflects more accurately a product's consumption of overhead.

This will be achieved through the formulation of cost centres and activity groups, for both factory one and the general overhead. With respect to these overhead groupings there will be cost elements which build up the cost centre and activity grouping cost. Also as an integral part of the cost centre and activity groupings will be the definition of more appropriate methods of cost allocation, and the development of performance measures.

This improved system is seen to provide more accurate cost control in the areas of overhead and for improved management information. This should lead to management decision making on a more informed basis and improved product pricing in the market place.

In conclusion, the project will enable the Romanian enterprise, Ingenium to implement an improved system for overhead control and an improved product pricing system with respect to overhead. The Romanian consultants, Quasaro have gained detailed experience and training with respect to traditional and advanced cost and financial management systems, and have actively participated in the programme, thereby completing the learning experience. This experience could ultimately lead to other Romanian manufacturing enterprises utilising advanced financial and cost management systems.

Nevertheless it must be appreciated that the knowledge and technology transferred to the Romanian consultants and enterprise are the culmination of many years of experience and research, therefore it would be an unreasonable expectation for the Romanian consultants to consider themselves sufficiently qualified to embark on similar assignments of a significant nature without external support, but they must be encouraged to do further, small, containable projects to build up their expertise and competence in the field. Similarly the Romanian enterprise must regard this project as the first step, to be taken at a reasonably slow and controlled pace whilst staff develop competence and confidence. The management of change is mainly an

attitudinal process and to attempt to run before being able to walk expertly in such circumstances is a risky strategy.

Quasaro and Crown Agents
November 1994

Appendices

APPENDIX 1.

List of Quasaro Personnel

1. Mihai Valeanu.

2. Dan Stefanescu

3. Niculae Bohagiar

4. Mihai Enatescu

5. Marian Martazan.

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APPENDIX 2.

Training programme and appropriate objectives for Quasaro Consultants.

Objectives

As a result of the programme selected staff from Quasaro will be able to :-

understand the nature of costs in a manufacturing organisation
recognise ways of identifying non value added wastes
analyse overheads and activity
recognise how resources are consumed in practice
control costs, estimate prices and analyse product contribution
understand a methodology for systematically analysing manufacturing systems
perpetrate a culture of ongoing management excellence
enhance their management training skills
reinforce diagnostic, analytical, planning, HRD and other consultative skills

Initial Training Programme for Local Consultants

Introductions
Communication exercise
Identification of the challenges to throughput
Financial management
Sources and nature of costs
Cost and prices in practice
Estimating and tendering
The Organisation of Manufacturing
The Control and Planning of Inventory
Organisation For Profit Improvement
Activity Based Costing (ABC) And Activity Based Management (ABM)
Management training techniques
Action planning

The programme was designed for Quasaro consultants. The aim was to enable the delegates to put a framework in place which will foster continuing excellence in all aspects of business with particular reference to production costs and overhead analysis.The course was highly participative and was a mixture of informal tutor-led sessions and delegate-led exercises.

APPENDIX 3.

Examples of Procedures produced by Neptun.

PRICING PROCEDURE

1. **Title:** Costs
2. **Object:** Price estimation and costs calculus
3. **Activities related to the procedure:**
   A. Planning budgets and costs (expenses/1000 lei sales): 20%
   B. Designing costs and prices: 30%
   C. Actual costs analysis: 20%
   D. Negotiating prices for finished good and raw-materials: 30%
4. **Identifying inputs and outputs with each activity.**
   A. **Inputs**
      - Number and structure of signed contracts
      - fabrication programme
      - Materials and direct labour consumption
      - Necessary facilities

   A. **Output**
      - Balance of incomes and expenses

   B. **Inputs**
      - Client order
      - Factory memorandum
      - Fabrication technology
      - Materials consumption

   B. **Outputs**
      - Price calculation
      - Issuing order

   C. **Inputs**
      - Post-calculus sheet
      - Computer listing for specific consumption

   C. **Output**
      - Actual costs analysis

   D. **Inputs**
      - Client order
      - Contract appendix
      - Supplier offer
      - List suppliers prices and tariffs
      - Supplier notifications
      - Negotiating notes with the suppliers

   D. **Outputs**
      - Calculation
      - List of prices and tariffs
      - Price offer
      - Negotiating notes
      - Notification

5. **Final output achieving the object**
- Calculus of the actual costs and establishing the selling price for the manufactured goods.

6. **Performance measures for the activities**
A - Completing the job until 31.11.1994
B - Achieving a price margin of 5%
C - Analysis within 30 days from closing the internal work order
D - Negotiating at max _5% from the standard price

7. **Data collecting**
- directly - by getting the data from the factory acceptability.
- automatically - supplied by the computer office.
- from the fabrication technology and the materials consumption designed by the engineering department of the factory.

8. **Documents flowchart**
9. **Documents (forms)** used within the procedure .
10. **Working system for improving the procedure** (computer based)
- issuing computer price calculations

PROCEDURE FOR INTERNAL CONTRACTING

1. **Title:** Contracting in the internal market
2. **Object:** Covering with contracts the company turnover
3. **Activities related to the procedure:**
   A. Contracting in the internal market
   B. Relations with the client
   C. Contract handling until completion
4. **Identifying inputs and outputs with each activity.**
   A. **Inputs**
      - client inquiry
      - client order
      - commercial correspondence related to the contract
      - delivery note for the finished product
   A. **Output**
      - Neptun general offer
      - proper offer (answering the client inquiry)
      - contract
      - contract additional act
      - issuing order for products, services
      - emergency notes to the factory
      - letters asking for delayed delivery terms
      - prices negotiating note
      - note for introducing in the computer the contracted goods

5. **Final output achieving the object**
      - the contract
6. **Performance measures for the activities**

- covering with contracts the annual turnover.
- 25% - until the 30th of September of the present year for the next year
- 50% - until the 30th of December of the present year for the next year
- 75% - until the 30th of March of the planning year
- 100%- until the 30th of June of the planning year

- the feedback time needed to satisfy an inquiry.
2 days - with standard products (without any changes)
7 working days - with standard products with some changes
10 working days - with new products

- the time to answer the client correspondence.
- 2 working days - from the entrance day of the letter at the contracting office
- the time from ordering the completing the contract - 30 days
- the time to answer internal orders (within the company)
- 1 working day

7. **Data collecting**
   - manually
   - automatically
8. **Documents/information flowchart**

9. **Documents (forms)**

10. **Working system for improving the procedure**
- periodic analysis at each 6 months, with internal people involved.

APPENDIX 4.

Initial Activities and performance Measures identified by Neptun.

Purchasing

A. Activities:
1. Drawing-up of the Procurement Plan.
2. Ordering and purchasing materials.
3. Flame cutting thick steel sheets.
4. Collection of recyclable materials (scrap iron, swarf, etc.)

B. PM's:
1. None.
2. As follows:
   i. Fully completion of purchasing rolled iron:
   70% of orders: 45 days before the Agreed Delivery Date (ADD).
   20% of orders: 30 days before the ADD.
   10% of orders: 15 days before the ADD.
   ii. Full completion of purchasing products (bearings, electric motors, etc.)
   80% of orders: Min. 30 days before ADD.
   15% of orders: 15 days before ADD.
   5% of orders: just ADD.
   iii. Full completion of purchasing consumable (oil for HT, materials for foundry, paints, etc.).
   95% of orders: respecting the Minimum Stock Level.
   5% of orders: just ADD.
3 & 4 None

General Stores

A. Activities:
1. Goods-in material reception and stock recording.
2. Handling and storage of supplies.
3. Issuing material and products and stock up-dating.

B. PM's:
1. - Verification of 50% of purchased materials and products in the first day from receiving.
   - Verification of the remaining 50% in a span of three days.
2 & 3 None

Transport

A. Activities:
1. Domestic transport.
2. Maintenance of the transport means.
3. Maintenance, overhauling and repairs of batteries.

B. PM's:
1.& 3 None.
2. Number of transport means failures recorded.

Investments

A. Activities:
1. Compiling the Annual Plan of Investments.
2. Subcontracting the investment tasks.
3. Monitoring the investment contracts.

B. PM's:
1 & 2 None.
3. The ratio Carried out activities Planned activities.

Maintenance

A. Activities:
1. Machines and equipment recording and compiling the Annual Repairs Plan.
2.Recording, monitoring assets life and selling the replaced ones or scrapping.
3. Subcontracting the repairs which cannot be done in Neptun.

B. PM's:
1. 70% of machines/equipment to be repaired at the planned date.
2 & 3 None.

Utilities

A. Activities:
1. Establishing the needs of utilities for one year and deducting the quarterly and monthly rates.
2. Subcontracting the supplying of necessary utilities.
3. Maintenance of installations or equipment used for distributing utilities.

B. PM's:
1. None.
2. Subcontracting all necessary utilities until December 15 for the next year.
3. Completing the overhauls and repairs of installation and equipment until October 30 of the current year.

Quality Assurance
A. Activities:
1. Q.A. activities.
2. Compiling and administration of Quality manuals.
3. Reviewing and authorizing purchase orders for Q.A. requirements.

B. PM's:
1,2 & 3. None

Goods-in verification

A. Activities:
- Receiving inspection and testing of supplies.

B. PM's:
- 62% of scrap notes for purchased materials defects.
- 50% of re-work/ repairs notes for purchased materials defects.

In-process and final inspection and testing

A. Activities:
1. In process inspection and testing.
2. Checking the calibration status of measuring equipment used by the workers.
3. Final inspection with respect to packaging, preserving and storage.

B. PM's:
1 & 3. None.
2. Number of measuring equipment found out of calibration date.

Physical and Mechanical Testing and Metalography Analyses Laboratories

A. Activities:
1. Physical and mechanical properties testing: Brinell, Vickers, Rockwell, tension, resilience, etc.
2. Metalography analyses.
3. Chemical analyses.

B. PM's:
1,2, & 3. None.

Gear Units testing laboratory

A. Activities:
1. Gear units and special tools testing.
2. Surface texture measurements.
3. Calibration of testing equipment before use.

B. PM's:
1,2, & 3. None.

Testing rigs

A. Activities:
1. Gear units trials.
2. Rig maintenance and calibration.

B. PM's:
1. Queue time of trailed units.
2. None.

Legal Metrological Department

A. Activities:

1. Identification, recording, calibrating and adjusting all measuring equipment,
   test equipment and other devices/jigs used for inspection.
2. Overhauling or repairing measuring equipment.

B. PM's:

1. None (see and item IX, B, 2).
2. Number of measuring equipment which cannot be overhauled or repaired
   in Neptun against their whole number (e.g. [717/7729] x 100 = 9%).
3. Number of ranges in which Neptun isn't still approved to perform certain overhauls or repairs against their whole number. (e.g. [9/13] x 100 = 70%).

After Sales Services

A. Activities:

1. Field operation supervision, technical assistance and ascertaining the
   reported defects or failures.
2. Solving up the complaints.
3. Dealing with and spreading up the out of order products sent back in Neptun to be repaired.

B. PM's:

1. - 20 days response time for estimates.
   - 5 days to arrive to the client premises.
2. Three days from calling out to arrive to client premises.
3. Five days from products receiving date to compile and send the estimate.

Sub-contracting

A. Activities:

1. Compiling the Neptun Sub-contracting Plan on a monthly, quarterly, and annual base.
2. Reviewing and concluding the contracts received from the suppliers.
3. Effective provisioning of sub-contracted products.
4. Reviewing the Receiving Notes and Invoices before paying on delivery.

Accounting (BAV)

A. Activities:

1. Fixed assets accounts.
2. General stores accounts.
3. Clients, suppliers, debtors and creditors accounts.
4. Incomes accounts.
5. Salaries accounts (for BAV and Quality).

Cashing invoices

A. Activities:

1. Cashing invoices.

2. Concluding minutes of proceedings for setting off the debts.
3. Prosecuting the debtors who don't want to pay.

B. PM's:
1. 7 days for goods taken away by the client from Neptun.
   30 days for goods delivered to client premises.
2 & 3. None

Cost Department
A. Activities:
1. Budgets and costs planning.
2. Prices and costs building.
3. Actual costs analysis.
4. Negotiating the contract/order prices.

B. PM's:
1 & 3. None.
2. Minimum of 5% margin of profit.
4. +/- 5% against catalogue prices.

Internal contracts
A. Activities:
1. Internal market contracting.
2. Communicating with the client.
3. Internal contracts concluding.

B. PM's:
1. Assuring estimated turnover with contracts, as follows:
   - 25% until 30 Sept. this year, for the next year.
   - 50% until 30 Dec. this year, for the next year.
   - 75% until 30 Mar. of the planned year.
   -100% until 30 Jun. of the planned year.
2. Response time to client inquiries:
   - 2 days for catalogue products.
   - 7 days for catalogue products which need some modifications.
   -10 days for new products.
3. Response time for correspondence: 2 days.
4. Lead time for concluding the contract: 30 days.

Marketing
A. Activities:
1. Market analysis.
2. Marketing forecasts, statistics and planning.
3. Advertising, participating in exhibitions and fairs, etc.

B. PM's: None.

Accounting (under heading Financial control)
A. Activities:
1. Fulfilling accounts for: salaries, taxes, social insurance, unemployment aid contribution, etc.
2. Keeping fixed assets and suitable depreciation accounts.
3. Compiling Quarterly Balance Sheets.

B. PM's: None.

Computing services

Issuing works orders
A. Activities:
1. Compiling and issuing works orders (WO) manually. (for products which are not yet introduced in the computer data base)
2. Issuing WO's via computer to factories.

B. PM's: None.

Data processing
A. Activities:
1. Software engineering.
2. Software testing and implementing.
3. Running computer hardware.

B. PM's: None.

Maintenance of computer hardware
A. Activities:
1. Maintenance of computer hardware on a service contract basis.
2. Monthly overhaul of computer hardware.
3 Trouble-shooting computer failures.

B. PM's: None.

Administration
A. Activities:
1. Secretarial, type-writing, etc.
2. General building maintenance (i.e. house painters, carpenters, etc.).
3. Factory library.
4. Security.
5. Telephone exchange.
6. Health unit.
7. Sports grounds.

B. PM's: None.

Personnel, human relations

A. Activities:

1. Reviewing and evaluating the requirements of skills.
2. Planing, recruiting and selection of necessary work force.
3. Weighting personnel against work performances, promotion and demotion, etc.
4. Establishing the company policy of salary and the payment level for personnel.

B. PM's: None.

Financial

A. Activities:

1. Banking and recording in account books.
2. Currency banking.
3. Cash transactions.
4. Payments accounts.
5. Compiling account books.

B. PM's: None.

External contracts

A. Activities:

1. Receiving the inquiries and sending the offers, price quotations, etc.
2. Receiving the orders, acknowledging them, authorizing their production and compiling the appropriate delivery documents.
3. Performing customs related operations for export - import activities.
4. Compiling and concluding export contracts and assuring external correspondence.

B. PM's: None.

Electrics - Automation Service

A. Activities:

1. Diagnosing and troubleshooting faults of electrical and electronic automation wire - diagrams.
2. Repairing electrical actuators.
3. Faults diagnosing and repairing of medium intricate electrical subassemblies.
4. Numerical control automation equipment diagnose and repairing.
5. Repairing medium power electrical motors.

B. PM's: None.

Distribution (under heading Purchasing - BAV)

A. Activities:

1. Receiving handling and storage finished goods up to delivery.
2. Delivery of finished goods to the customer.
3. Ensuring the appropriate packing / packing cases and packaging for delivering finished goods to the customer.
4. Performing transport arrangements and ensuring the necessary vehicles are available.

B. PM's: None.

APPENDIX 5.

Revised activities, and performance measures.

Purchasing - Activity Centre

A. Activities:
Planning
Purchasing
Flame cutting
Recycling

B. PM's:
Cost per purchase order

General Stores - Activity Centre
A. Activities:
Receiving
Storing
Issuing

B: PM's
Cost per purchase order

Transport - Activity Centre
A. Activities:
Planning
Repairing
Overhauling

Investments - Activity Centre
A. Activities:
Planning
Contracting
Monitoring

B. PM's:
Average Return on investment - Actual

Maintenance
A. Activities:
Planning
Recording
Subcontracting

B. PM's:
Average Breakdown time
No. of breakdowns

Utilities
A. Activities:
Planning
Subcontracting
Maintenance

Quality Assurance
A. Activities:
Co-ordinating
Engineering
Reviewing

Goods-in verification
A. Activities:
Receiving

B:PM's
Cost / Goods receipt

In-process and final inspection and testing
A. Activities:
In - Process Inspection
Calibration status control
Storage Inspection

B. PM's:
No of customer complaints
Type of customer complaint

Physical and Mechanical Testing and Metalography Analyses Laboratories
A. Activities:
Testing
Analysing

B. PM's:
Average cost / Test

Gear Units testing laboratory
A. Activities:
Tool testing
Roughness Measurement
Calibration

B. PM's:
Average Cost / Test

Testing rigs
A. Activities:
Testing
Maintenance

B. PM's:
Average Cost / Test

Legal Metrological Department
A. Activities:
Monitoring and Calibrating
Overhauling and Repairing

After Sales Services
A. Activities:
Field Servicing
Solving Complaints
Solving Failures

B. PM's:
Average Cost / Failure
Average Cost / Complaint.

Sub-contracting
A. Activities:
Programming
Contracting
Provisioning
Reviewing

Accounting (BAV)
A. Activities:
Fixed asset Accounting
General Store Accounting
Debtor and Creditor Accounting
Income Accounting
Salary Accounting

Cashing invoices
A. Activities:
Cashing
Concluding
Prosecuting

Cost Department
A. Activities:
Planning
Quoting
Analysing
Negotiating

Internal contracts
A. Activities:
Contracting
Correspondence
Monitoring

B. PM's:
Average Value of Internal Contracts
No. of Internal contracts.

Marketing
A. Activities:
Market Research
Planning
Advertising

B. PM's: None.
No of Contracts
No. of Internal Contracts
No of External Contracts
Average value of contracts

Accounting (under heading Financial control)
A. Activities:
General Accounting
Depreciation accounting
Balance Sheet accounting

Computing services

Issuing works orders
A. Activities:
Issuing Manual Work orders
Issuing Computer Work orders

Data processing
A. Activities:
Software Engineering
Software Implementation
Software Operation

Maintenance of computer hardware
A. Activities:
Maintenance
Overhauling
Trouble shooting

B. PM's:
Average cost / Work order

Administration
A. Activities:
Secretarial
Buildings
Maintenance
Library
Security
Telephone exchange
Health Unit
Sports Ground

Personnel, human relations
A. Activities:
Evaluating
Planning
Personnel Monitoring
Salary Rating

Financial
A. Activities:
General Banking
Currency Banking
Cash Transactions
Payments Accounts
Compiling Account books

External contracts
A. Activities:
Compiling Tenders
Contracting
Customs preparation
Correspondence

B. PM's:
No of External Contracts
Average Value of External Contracts

Electrics - Automation Service
A. Activities
Maintenance
Repairing

Distribution (under heading Purchasing - BAV)
A. Activities:
Handling and Storage
Delivery
Packaging
Transport

Within each activity centre there there will also be cost elements against which the appropriate resources should be recorded. Examples of the possible cost elements which could be utilised within each activity centre are as follows :

(001) Salaries
(002) Tax
(003) Unemployment
(004) Consumables
(005) Miscellaneous
(006) Depreciation

As with the cost centres and cost elements identified within the factory one overhead, the cost elements identified have codes against which the costs incurred should be recorded. Likewise each activity centre will have an appropriate number.

APPENDIX 6.

Outline Cost Centres, Cost Centre Elements and allocation methods for Factory One Costs.

(F1001) Manufacturing Management - Overhead Grouping

(001) Salaries
(002) Tax
(003) Unemployment - Cost or overhead elements
(004) Consumables
(005) Miscellaneous

The cost centre will be allocated to products on the basis of machine hours.

(F1002) Assembly

(001) Salaries
(002) Tax
(003) Unemployment - Cost or overhead elements
(004) Consumables
(005) Miscellaneous
(006) Tooling
(007) Material
(008) Machine Depreciation

Cost Driver - Number of Direct labour Assembly hours

(F1003) Technical (Production Planning, Production control, and Engineers office)

(001) Salaries
(002) Tax
(003) Unemployment - Cost or overhead elements
(004) Consumables
(005) Miscellaneous
(006) Tooling
(007) Material

Cost drivers - No. of Machine hours

(F1005) Buildings and Utilities

(009) Building Depreciation
(010) Heating
(011) Electric - Cost or overhead elements
(012) Water
(013) Gas

Cost driver - number of machine hours.

(F1006) Administration (accounting, computing, secretarial, administration)

(001) Salaries
(002) Tax
(003) Unemployment - Cost or overhead elements
(004) Consumables
(005) Miscellaneous

Cost Drivers - No of machine hours
No of Direct Labour and Material requisition slips

(F1009) Painting

(001) Salaries
(002) Tax
(003) Unemployment - Cost or overhead elements
(004) Consumables
(005) Miscellaneous
(006) Tooling

Cost driver - Direct labour hours

(F1010) Ancillary Shop

(001) Salaries
(002) Tax
(003) Unemployment - Cost or overhead elements
(004) Consumables
(005) Miscellaneous
(006) Tooling

Cost driver - machine hours

Manufacturing Cost Centres.

All manufacturing cost centres should consist of the following elements

(001) Salaries
(002) Tax
(003) Unemployment - Cost or overhead elements
(004) Consumables
(005) Miscellaneous
(006) Tooling
(007) Materials
(008) Machine Depreciation
(014) Maintenance Materials
(015) Maintenance Labour
(016) Sub-contracted repairs
(017) Set-up labour
(018) Set-up Materials

All cost centres or overhead groupings should have a code as with the support services indicated previously. Although the following list of possible cost centres for

direct manufacturing activities is comprehensive, it will be possible to reduce the number of centres at the start of the project, and have detailed costs only with respect to the machining centres, and CNC machines which consume disproportionate amounts of overhead with respect to conventional machines. The conventional machines could then be grouped under a cost centre of Cases, and shafts and wheels. This indicating the process through which the product flows. As more technologically advanced machines become available within Neptun it will be possible to increase the number of cost centres, as appropriate.

The following manufacturing cost centres were identified on 27/10/94

Shafts & Wheels

Grinding - Large
Grinding - Small/Medium

CNC Lathes

Gear Cutting - Small/Medium
Gear Cutting - Large
Machining Centres
Bevel gear grinding
Worm Grinding
Slotting/Milling Machines
Lathes
Miscellaneous

Cases.

Vertical Lathes
Large Boring/Milling Machine
Medium Boring/Milling Machine
Drilling
Lathes
Flat Grinding
Shaping
Milling
Turning
Machining Centres
Miscellaneous

APPENDIX 7 : LIST OF COST DRIVERS FOR GENERAL NEPTUN OVERHEADS

NO:	NAME OF ACTIVITY	OHD VALUE	PROPOSED COST DRIVERS
1	EXTERNAL CONTRACTS	10442880	External Contract factor Production Factory Cost
2	COMPUTING SERVICES	66409200	No. of Material & Direct Labour Slips No. of Labour slips
3	RECEIVING	41642909	No. of Material Slips
4	PURCHASING	57375341	No. of Material Slips Material Purchasing factor
5	INVESTMENTS	8856480	Production Factory Cost
6	ADMINISTRATION OFFICE	102866468	Production Factory Cost
7	PERSONNEL & HR	39912607	No. of Direct Labour / Factory No. of Direct Labour Hours / Product
8	GENERAL STORES	107199896	No. of Material Slips
9	MAINTENANCE	SEE PT 5	Production Factory Cost No. of Machine hours / Product
10	MARKETING	14421120	Marketing Factor Production Factory Cost
11	INTERNAL CONTRACTS	74944568	Internal Contract Factor Production Factory Cost
12	SOCIAL CHARGES	49135333	No. of Direct Labour / Factory No. of Direct Labour Hours / Product
13	DISTRIBUTION (or sales)	39979813	Production Factory Cost
14	SUBCONTRACTING	19974413	Production Factory Cost
15	UTILITIES	90310019	Production Factory Cost
16	RESEARCH AND DEV.	95421000	Production Factory Cost
17	TRANSPORT	139977992	Material Transport Factor
18	LEGAL METROLOGY	25530106	No. of Measuring Instruments / Factory No. of machine hours
19	QUALITY ASSURANCE	6417302	Production Factory Cost
20	TESTING & ANALYSING	33364708	No. of Material Slips
21	GEAR UNITS TESTING	"	Production Factory Cost

NO:	NAME OF ACTIVITY	OHD VALUE	COST DRIVERS
22	TESTING RIGS	"	Production Factory Cost
23	PROCESS &FINAL TEST	106955027	Number of inspectors/factory No. of direct labour hours / work order
24	AFTER SALES SERVICE	61664848	Production Factory Cost
25	COST DEPT.	22502393	Production Factory Cost
26	CASHING INVOICES		Production Factory Cost
27	FINANCIAL	30982045	Production Factory Cost
28	PURCHASING	25651585	Number of Material Requisition slips Production Factory Cost
29	ELEC - AUTO SERVICES	31350300	Production Factory Cost
30	FINANCIAL ACCOUNTING	28893421	Production Factory Cost
31	MAINTENANCE(STORES)	16465744	Number of Material Requisition slips
32	FOREIGN TRAVEL	53000000	External Contract factor
33	COUNSELLORS	15526542	Production Factory Cost
34	WORK PROTECTION	8303676	Production Factory Cost
35	LEGAL	6064995	Production Factory Cost
36	DIRECTORS	73331953	Production Factory Cost

APPENDIX 8: WORK ORDER INVESTIGATION

W.ORD.NO	QTY	PRODUCTION PLANNING SET UP	PRODUCTION PLANNING ASS	PRODUCTION PLANNING D.LAB	COMPUTER STANDARD SET UP	COMPUTER STANDARD ASS	COMPUTER STANDARD D.LAB	ACTUAL SET UP	ACTUAL ASS	ACTUAL D.LAB
10872	2	24.85	23.34	35.07	2.485	23.34	29.87	24.85	24.12	43.58
10896	20	24.85	233.4	35.07	2.485	23.34	298.7	24.85	24.012	445.61
10873	2	24.28	27.4	41.73	2.428	27.54	37.85	24.28	28.24	49.63
10874	3	27.15	48	71.79	2.715	47.94	72.11	27.15	49.32	94.72
10875	10	28.78	183	289.6	2.878	182.6	286.52	28.78	187.52	348.34
10853	4	27.85	81.2	135.53	2.785	81.64	127.98	27.85	83.6	187.41
10876	1	27.85	20.3	54.18	2.785	20.3	32.105	27.85	20.92	41.19
10854	2	28.93	44.8	83.4	2.893	44.9	80.71	28.93	46.2	141.7
10877	3	28.93	67.2	125.09	2.893	67.35	119.18	28.93	69	174.57
10878	1	28.8	24.5	48.09	2.88	24.7	45.94	28.8	24.5	75.75
10861	6	32.6	113.4	160.5	3.26	115.38	157.44	32.6	118.18	159.3
10883	2	32.6	37.8	53.5	3.26	38.46	52.48	32.6	39.24	49.19
10884	2	31.41	43.2	37.44	3.141	43.67	41.06	31.41	45	73.4
10885	5	15.13	31.5	20.6	1.513	31.7	46.14	15.13	33.53	52.21
10886	8	15.13	54.4	107.84	1.513	58.24	99.9	15.13	57.17	96.34
10890	25	20.42	225	474.55	2.042	223.5	306.7	20.42	245.46	325.2
10864	6	24.32	71.4	105.6	2.442	71.76	111.35	24.42	73.71	128.71
10887	4	24.23	54	75.88	2.423	55.2	84.07	24.23	55.98	97.59
10905	1	24.65	18.5	30.66	2.465	18.48	28.375	24.65	19.96	16.16
10855	4	93.05	859.44	2582.96	9.305	859.44	2196.76	93.05	860.64	2455.08

SET UP = SETTING UP TIME
ASS = ASSEMBLY TIME
D.LAB = DIRECT LABOUR HOURS REQUIRED

APPENDIX 8: WORK ORDER INVESTIGATION.

W.ORD.NO	QTY	COMPUTER M/C HOURS			MATERIAL COSTS	
		SET UP	ASS	D.LAB	PLANNED	ACTUAL
10872	2	2.485	23.34	32.11	224334	305213
10896	20	2.485	233.4	321.1	2243340	2165395
10873	2	2.428	27.4	43.352	378590	345431
10874	3	2.715	47.94	83.025	1174395	681407
10875	10	2.878	182.6	33.6722	6173250	2352300
10853	4	2.785	81.64	147.855	3417800	1817981
10876	1	2.785	20.3	34.985	854450	596043
10854	2	2.893	44.9	90.587	2380976	1148322
10877	3	2.893	67.35	137.327	3571464	1976239
10878	1	2.88	24.7	50.38	2800924	1013121
10861	6	3.26	115.38	181.3	6344196	1663947
10883	2	3.26	38.46	58.26	1455580	540595
10884	2	3.141	43.56	46.359	3866556	1058881
10885	5	1.513	31.7	52.237	420955	334710
10886	8	1.513	53.24	111.527	1087768	774120
10890	25	2.042	223.5	359.96	4816500	2617283
10864	6	2.442	71.76	125.718	3102414	1104609
10887	4	2.423	55.2	94.457	2074008	728780
10905	1	2.465	18.48	30.195	1334685	700310
10855	4	9.305	859.44	2335.64	62155668	42454376

SET UP = SETTING UP TIME
ASS = ASSEMBLY TIME
D.LAB = DIRECT LABOUR HOURS REQUIRED

APPENDIX 9

List of Crown Agents Personnel.

1) Mr Robin Wain, Human Resource Development Director.
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Appendix A4 Report on the Study of Costing and Quotation Systems at Rivulet.

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Manufacturing and Supply Chain Management Centre.

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Report on the study of Costing and Quotation Systems.

at

Rivulet Company (Birmingham).

The objectives of the study were as follows:

1. To assess manufacturing operations and related costing procedures to determine appropriate methods of cost allocation leading to improved contract pricing.

2. To provide the ability to assess and determine appropriate contractual rates for primary machining operations. (Heading, Rolling, Townsend)

3. To provide the ability to assess and determine appropriate piecework and contractual rates for secondary operations.

4. To assess the degree to which Set-Up and Non-Productive time affects product throughput and the subsequent effects on the costing system.

5. To assess throughput times and identify capacity constraints.

Initial Investigation.

In addressing the objectives outlined it was necessary to examine the costing and quotation system and compare the data from the administrative systems to that gained by analysing current manufacturing practice.

The investigation revealed that the way in which costs are incurred in practice is not reflected in the current costing system. In particular it was recognised that the existing costing rates were based on cost data with estimated production volume. Any variation in the order characteristics of those contracts undertaken will distort the costing and quotation rates due to the inherent effect of batch costs.

A comparison of standard costing and time records was severly restricted by a lack of data on the appropriate works orders. It was decided to utilise data collection sheets to obtain information on current production orders and attempt to reflect the order characteristics in any updated costing rates.

It was determined that three separate data collection sheets be utilised to reflect the complexities of the manufacturing operations. The first data collection sheet related to the setting up of machines. To be completed by the setter the form required details of the appropriate work order, machine number and the start time and finish time of the setup. This enabled analysis of setup times to be undertaken for given machines, machining groups and particular works orders.

The second data collection form related to part manufacture. The form was completed by the appropriate operational personnel. It required details of the Work order number, machine number and the start and finish time for the operation, and the production output achieved in the time period. This gave details of the current production output for specific operations. In respect of second operations, the information was subsequently utilised to analyse associated piecework rates.

The final data collection form concerned Non - Productive Time (NPT) which was defined as any period in time when a machine is not being setup or producing parts and work orders are allocated against the particular machine. The form was to be completed by the setter or supervisor and required data regarding the appropriate work order number, machine number, the start and finish time for the Non productive time period and an appropriate non productive code. These were abbreviations of common reasons for limitations on machine utilisation, resource constraint, and increases in throughput time. They encompassed AS (Awaiting Setter), AP (Awaiting Parts or Raw Material), AO (Awaiting Operator), and AT (Awaiting tooling or consumables). This data was seen to provide identification of where advanced manufacturing practices or an increase in resources was required to facilitate increased throughput.

Proposed Systems to Satisfy Project Objectives.

In direct response to the project objectives, and based upon the initial investigation two spreadsheet models have been developed in Microsoft Excel 5.0 to facilitate any future assessment of contract or piecework rates.

System for Assessment of Piecework Rates

The spreadsheet model developed for assessing and determining piecework rates utilises two primary sources of data. Firstly the machining record outlined previously to identify machining hours, works order, and parts produced, and secondly the operator piecework books detailing appropriate piecework rates against work order and operator.

This information is brought together in the spreadsheet in the form of a ratio. In essence it identifies the actual time taken to produce 1000 parts and a benchmark £4.50 per hour labour rate and compares this to the standard piecework rate by utilisation of the piecework ratio.

$$\text{Piecework Ratio} = \frac{\text{Actual Piecework Rate/Hour}}{\text{Benchmark Rate/Hour (£4.50)}}$$

Figure 1.0 shown below outlines the structure of the spreadsheet model utilised for assessing and determining appropriate piecework rates. A piecework ratio of less than 1 is an indicator that the operator has not exceeded the standard production rate for a particular operation. Conversely a piecework ratio in excess of 1 indicates an operator has produced parts at a rate faster than standard. Such a range of scenarios exist and this necessitates the need for a balanced approach to defining piecework rates. Major deviations below standard can result in negative responses from operators, whilst managers should try to avoid piecework rates which are excessive in comparison to the production time expended.

Figure 1.0

Work Order	*Machine Number*	*Quantity Produced*	*No.of Hrs*	*Pwk Rate*	*Rate/Hr*	*Add Hour Rate*	*Total*	*Piecework Ratio*
5413	Drill1	1300	3.25	7.50	3.00	0.45	4.31	**0.96**
5257[1]	Drill1	5250	7.50	7.50	5.25	0.45	7.13	**1.58**
5257[2]	Drill1	1760	2.50	7.50	5.28	0.45	7.16	**1.59**
5257[3]	Drill1	1860	5.75	7.50	2.43	0.45	3.60	**0.80**

As can be seen from figure 1.0 work order numbers 5257[1] and 5257[2] are operations in which the operators have beaten the standard for the process quite dramatically. While work order number 5257[3] has proved to be a difficult operation which required a longer machining time than that anticipated. Such figures are indicative of the results of utilising piecework rates and highlights the complexities of obtaining rates which are contractually and politically (in terms of operator payment) correct.

Figure 2.0 Rivulet Company (Birmingham) Resource Cost allocation

Cost	*Allocation*	*Heading*	*Rolling*	*Townsend*	*Toolroom*	*Sems*	*Drilling*	*Roll/Hroll*	*Slotting*	*Milling*	*+Drilling*	*Tanks*
Wages	%Wages	17.2%	5.2%	13.3%	8.8%	4%	8.6%	1.6%	0.25%	0.12%	0.67%	0.1%
	£'s	2913	881	2252	1490	707	1457	271	43	20	113.5	17
Manuftrg	Mc Hours	1000	365	1600	156	137	179	70	7	3	19	4
Expenses	£'s	1163	425	1861	182	160	208	82	8	3.5	22	4
Motor Expenses	%Alloc	NOTES: Motor Expenses, Quality Control, and Transport costs are allocated to Despatch, Quality Control, and Despatch respectively on a 100% allocation basis.										
QC Costs	% Alloc	Quality Control, Miscellaneous costs, and barreling costs are reallocated to machining operations on the basis of machine hours.										
Transport	%Alloc	Toolroom and Despatch costs are ultimately recovered on the cost of tooling and despatch respectively. In practice these cost will be in addition to the material and carriage charge respectively incurred.										
Mgmt &	Mc Hours	1000	365	1600	156	137	179	70	7	3	19	4
Site Costs	£'s	3437	1254	5499	536	471	615	241	24	11	65	12
Admin	Mc Hours	1000	365	1600	156	137	179	70	7	3	19	4
	£'s	960	350	1536	0	131.49	171.80	67.18	6.58	2.88	18.24	3.36
Machine	% Alloc	40.5%	16.8%	8%	3.8%	4%	1.5%	1.3%	0.09%	0.11%	0.09%	0.23%
Dep.	£'s	8370	3474	1604	785	827	310	269	20	22.50	18.50	47.5
Cost Re-	Mc Hours	1000	365	1600	0	137	179	70	7	3	19	4
Allocate	£'s	1738	634	2781	0	238	311	122	12	5	33	6
Total	£'s	18580	7018	15531	3143	2504	3073	1050	111	65	271	90
(Hours)	Mc Hours	1000	365	1600	156	137	179	70	7	3	19	4
Rate/1000	£'s	N/A	11.47	13.48	N/A	17.85	30.07	15.68	33.23	34.18	24.70	37.50
Rate/Hour	£'s	18.58	19.23	9.71	20.15	18.28	17.17	15.00	15.86	21.67	14.26	22.50

System for the Calculation of Contractual Rates for Primary and Secondary Machining Operations

The spreadsheet model developed for assessing and determining contractual rates for primary and secondary operations utilises two primary sources of data. The first of these is the monthly company accounts which reports the costs incurred. This data is taken from the trading account and schedule of administrative expenses. For the purpose of the model material costs have been ignored. These costs are aggregated into 8 cost areas which are as follows: -

1. Wages
2. Miscellaneous Manufacturing expenses
3. Quality Control
4. Transport and Carriage
5. Management and site costs
6. Motor expenses
7. Miscellaneous administration, and
8. Depreciation of fixed assets.

The second primary source of data are the machining record sheets which provide details of the number of machine hours consumed by a particular group of related machines. This data is supplemented by information regarding wages incurred in the primary machining areas, and an indicative replacement value for the machines.

The resource costs previously outlined are allocated to 15 cost/activity centres within the company. These are as follows: -

1.Heading
2.Rolling
3.Townsends
4.Despatch
5.Quality
6.Toolroom
7.Barreling
8.Sems (2nd Ops)
9. Drilling (2nd Ops)
10. Rolling(2nd Ops)
11. Slotting (2nd Ops)
12. Milling (2nd Ops)
13. Cross Drilling (2nd Ops)
14. Tanks (2nd Ops)
15. Miscellaneous Manufacturing

The resource costs are allocated to the cost/activity centres using 4 distinct methods. Allocation on a machine hour basis is utilised for Miscellaneous Manufacturing expenses, Management and site costs, and Miscellaneous Administration costs. Allocation on a % wage basis is utilised to allocate wage costs, and similarly depreciation of fixed assets is on a % basis reflecting the depreciation of machines in a particular area. All of the fixed assets are depreciated on a yearly basis due to their age and value. Finally quality control costs, transport and carriage, and motor expense costs are allocated using a % apportionment factor.

This method of cost allocation results in a total cost for each of the cost/activity centres rates can then be produced on a machine hour and per 1000 unit basis

utilising an average rate aggregated over the period of the costing system study. The rate per 1000 units can be utilised for primary and secondary machining operations, while an hourly figure can be utilised to cost setting up activity. In the case of toolroom a rate per hour can be determined which can be compared to utilising external facilities. The methods of allocation are shown in figure 2.0 and a summary of results can be seen in figure 3.0

Figure 3.0

Machine Description	*Rate per Hour*	*Rate per 1000 units*
Heading CH5	18.58	10.74
Heading MC 29	18.58	6.19
Heading MC 27	18.58	3.85
Heading MC 8,16,13,15,7	18.58	4.40
Heading MC11,14	18.58	4.93
Heading MC 9,22	18.58	3.97
Heading MC 19,20	18.58	4.55
Rolling	19.23	11.47
Townsend	9.71	13.48
Toolroom	20.15	Not Applicable
Sems (2nd Ops)	18.28	17.85
Drilling (2nd Ops)	17.16	30.07
Roll/H.Roll (2nd Ops)	15	15.68
Slotting (2nd Ops)	16.18	33.23
Milling (2nd Ops)	21.67	34.18
+ Drilling (2nd Ops)	14.21	24.7
Tanks (2nd Ops)	25.71	37.5

Setting Up and Non-Productive Time (NPT): A Discussion.

Assessment of setting up and NPT has identified that particular operations require varying degrees of time. Secondary operations for the most part require a set-up time of 1 to 1.5 hours maximum, while townsends and rolling operations require approximately 2 hours of set-up time. Heading is a indifferent set-up operation with job complexity rather than machine intricacy the predominant factor. This intricacy needs greater long term analysis as certain jobs require 2 hours to set-up while other jobs need in excess of this time period.

A major influence on set-up time is the requirement for resources. Preplanning of set-ups well in advance and kitting up ready for change will enhance the ability of the company to reduce set-up time and increase machine utilisation. The use of set-up kits will also increase the utilisation of setters.

This scenario is confirmed by assessing the causes of NPT. A high Percentage of NPT for heading is caused by machines awaiting a setter to become available (AS). In secondary operations, the primary cause of NPT is awaiting available operators

(AO). This may be due to the supervisor setting the machines a long period of time in advance in certain circumstances. In Sems however the primary cause of NPT is seen to be awaiting parts or raw material (AP).

Conclusion

The utilisation of spreadsheet models, and associated data collection forms, or derivatives will enable Rivulet to assess and determine appropriate contractual rates for the long term. This will provide up to date clarification of the effects that production volume and the manufacturing cost base will have upon costing rates.

It must be recognised that ideally the data should be collected on a long term basis to allow for aggregation and averaging. However by utilising an averaging process it should be realised that current changes will not be as noticeable due to historical data causing distortion of the costing data.

It must be remembered that material is a high percentage of total costs. This will impinge upon the costing and manufacturing control systems. In terms of manufacturing control it is vital that material is issued to the correct works order to avoid situations where there is insufficient material, subsequently affecting Machine utilisation. Similarly from a costing viewpoint differences in material specification and quantity will affect the costs incurred in producing parts. Any major variation against standard for material utilisation will severly affect the profitability of Rivulet.

In the future the introduction of a computerised manufacturing and production control system will enable the company to compare standard and actual manufacturing time and cost and undertake variance analysis. Such a system will ultimately provide a greater level of identification regarding the profitability of each part, and continue the process initiated by this project.

February 1996

Rivulet Set-up Record Week Ending:

W.Order Number	Machine Number	Set-up Information			
		Start Date	Start Time	Finish Date	Finish Time

W.Order Number	Machine Number	Set-up Information			
		Start Date	Start Time	Finish Date	Finish Time

Rivulet **Week Ending:** **Non-Productive Time Record**

W.Order Number	Machine Number	Non-productive Time				Non Prod Code
		Start Date	Start Time	Finish Date	Finish Time	

W.Order Number	Machine Number	Non-productive Time				Non Prod Code
		Start Date	Start Time	Finish Date	Finish Time	

Non productive Codes: AS=Awaiting Setter
AP=Awaiting Parts or Raw Material
AO=Awaiting Operator
AT=Awaiting Tooling or Consumables

Rivulet **Week Ending:** **Machine Record**

W.Order Number	Machine Number	Operation Information				Quantity
		Start Date	Start Time	Finish Date	Finish Time	

W.Order Number	Machine Number	Operation Information				Quantity
		Start Date	Start Time	Finish Date	Finish Time	