THE UNIVERSITY of HULL

A Theoretical and Empirical Study of Performance Measurement: A Challenge for Management Accounting Information Systems

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By

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ABSTRACT

Management accounting information systems (MAISs) play an important role in supporting continuous improvement efforts and management decision-making activities. MAISs provide manufacturing companies with internal financial and some non-financial information required for the three essential functions of planning, controlling and performance measurement. According to Drury (2000), "management accounting systems accumulate, classify, summarize and report information that will assist employees within an organization in their decision-making, planning, control and performance measurement activities".

Performance measurement is one of the most important aspects of MAISs. The development of the concept of performance measurement is the direct result of several dramatic changes in the way today's business environment is structured and how companies employ world class manufacturing (WCM) philosophies or techniques to compete for marketplace advantages. These changes have impacted on the way companies are organised and in skills required to manage, motivate, and empower the workforce to support continuous improvement. Other changes, specially in the Egyptian manufacturing environment, have come from the effect of international agreements, such as General Agreement on Tariffs and Trade (GATT) and World Trade Organisation (WTO), and organisational pressures, such as the ISO 9000 programme.

This thesis presents a theoretical and empirical study to determine 'what', 'why', and 'how' performance measurement systems (PMSs) are changing, as a challenge for MAISs, with the adoption of Just in Time (JIT) and Total Quality Management (TQM) philosophies. A discussion of these questions is presented in Chapter 8. In order to investigate how PMSs can best be used to support the continuous improvement philosophy of JIT and TQM, a model for developing PMSs in a JIT and TQM environment was constructed (see Figure 8.1). This study has used a qualitative method of research. The research findings and the model for developing PMSs in a JIT and TQM environment have been obtained from a literature review and data collected from two Egyptian pharmaceutical companies. The model, as it stands, is exploratory in nature. It proposes a body of ideas that form a new theory formulated for developing PMSs in a JIT and TQM environment. The model could be applicable to manufacturing companies, which have started or plan to implement JIT and TQM philosophies, since it provides a framework for the development and use of PMSs, rather than prescriptive lists of measures and reports that should be used. Norreklit (2000) indicated that models are needed which deepen our understanding of how PMSs are created, and to this end MAISs research has to make its contribution.

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DEDICATION

This thesis is dedicated to the memory of my father, my mother and my family in Egypt. It is also dedicated to my wife, Naglaa Soliman, and my daughters, Esraa, Alaa, and Salma. I could not have completed this work without your love, support, sacrifices, and encouragement over the past four years.

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List of Abbreviations

AAA	American Accounting Association
ABC	Activity Based Costing
AMPCO	Arab Medical Packaging Company
AID	Accounting Information Department
AIS	Accounting Information Systems
AT	Asset Turnover
BPR	Batch Production Record
BPR	Business Process Re-engineering
CAD	Computer-Aided Design
CAIS	Cost Accounting Information System
CAM	Computer-Aided Manufacturing
CBMAIS	Computer-Based Management Accounting Information System
CIM	Computer Integrated Manufacturing
DFM	Design for Manufacturability
DoD	Department of Defense
ED	Electronic Data
FG	Finished Goods
FPA	Flexible Packaging Association
GATT	General Agreement on Tariffs and Trade
GMP	Good Manufacturing Practices
GT	Group Technology
I	Inventory
ISO	International Standard Organisation
JIT	Just In Time
KSFs	Key Success Factors
L.E.	Egyptian Pounds
MAISs	Management Accounting Information Systems
MPR	Master Production Record
MPS	Master Production Schedule

MRP1	Material Requirements Planning
NAA	National Association of Accountants
NODCR	National Organisation for Drug Control and Researches
OE	Operating Expense
PM	Performance Measurement
PMSs	Performance Measurement Systems
QAD	Quality Assurance Department
QMS	Quality Management System
RI	Residual Income
RM	Raw Material
ROA	Return on Assets
ROI	Return on Investment
ROS	Return on Sales
SEDICO	South Egypt Drug Industry Company
SMART	Strategic Measurement and Reporting Technique
SOC	Statistical Operator Control
SPC	Statistical Process Control
T	Throughput
TA	Throughput Accounting
TQM	Total Quality Management
TRIPS	Trade Related Intellectual Property Rights
WCM	World Class Manufacturing
WHO	World Health Organisation
WIP	Work In Process
WTO	World Trade Organisation

Chapter One

Introduction and Research Methodology

1.1 Introduction

Management accounting information systems (MAISs) play an important role in supporting management decision-making activities. MAISs provide manufacturing companies with internal financial and some of the non-financial information required for the three essential functions of planning, controlling and decision-making. According to Drury (2000), "management accounting systems accumulate, classify, summarise and report information that will assist employees within an organisation in their decision-making, planning, control and performance measurement activities." Global competition has caused fundamental changes in the competitive nature of companies' manufacturing environment. This raises a very important question of how the role of MAISs is changing with the change in the manufacturing environment. Innes and Mitchell (1990b) indicated that "little is known about the process of change in management accounting at the level of the firm...The firm-specific origins, the mechanics and the consequences of managerial accounting change are not explored and consequently little understanding is provided of why and how change has come about within a particular firm at a particular point in time." According to Atkinson et al. (1997), at the organisational level, it is now widely accepted that successful manufacturing companies must develop by continuously improving to maintaining a customer focus and reduce response time to customer requests. They also mentioned that these changes will have a profound effect on the way that manufacturing companies collect, process and use the information of management accounting systems. Consequently, the focus of MAISs in manufacturing companies has shifted to reflect the changing role of MAISs in the new manufacturing environment. MAISs in manufacturing companies include many applications such as investment appraisal, cost accounting and performance measurement systems.

One of the most important components of MAISs is performance measurement. According to Globerson (1985a, 1985b), performance measurement is a systematic way of measuring the inputs, such as raw materials, equipment and facility, outputs, such as volume of end items, and the efficiency and effectiveness of performance in

manufacturing and non-manufacturing operations. Performance measurement systems (PMSs) are both a very old and a very new topic of research. Studying the PMSs of manufacturing companies has long been of central interest to both managers and MAISs researchers (Otley, 1999). Every manufacturing company measures its performance; the difference today is in what they are measuring. Financial indicators or measures only show where the company has been. They do not tell the company until it is too late about key changes in, for example, customer demand, manufacturing philosophies/techniques, or information technology. According to Geanuracos and Meiklejohn (1994), financial measures alone do not give a complete picture of performance and may lead to many conflicting sub-optimal decisions. PMSs in the manufacturing companies have become increasingly important because of the increasing manufacturing competition in different markets. Thus, PMSs can offer a distinct competitive advantage. The traditional PMSs are not appropriate for measurement or reporting of competitiveness and do not support new management philosophies to improve competitiveness in today's changing manufacturing environment (Meyer, 1998). According to Forza and Salvador (2000), the pressure for achieving and continuously improving performances leads manufacturing companies to develop their PMSs. Figure 1.1 shows Business Intelligence survey (1992) results which indicates that 89 per cent of respondents were dissatisfied with their companies' range of performance measures, but encouragingly, a similar number stated that they were doing something about it.

Management accountants have long expressed interest in PMSs because of their historical role as providers of the financial information that fed into the firm's performance measurement schemes. However, the conventional tools of PMSs discussed in the traditional management accounting systems literature do not always provide an adequate means of developing and interpreting multiple criteria of performance (see Chapter Three). "As management accountants have assumed a greater role in strategy formulation, they have become increasingly disenchanted with a conventional single criterion performance measure and have recognised the importance of integrating multiple measures of performance based on key success factors for all levels of the organisation" (Kaplan, 1984b). In general, it has been found by management accountants that PMSs based on short-term financial indicators are still used to a great extent (Chenhall and Langfield-Smith, 1998; Durden et al.,

1999; Hassan, 1993). It is suggested that, to compete in the world-class market successfully, more effective measures to induce teamwork, reduce costs, improve productivity, improve production flexibility, and improve quality should be developed and implemented (Forza and Salvador, 2000; Jazayeri and Hopper, 1999). In addition, there is a need for performance reports on the efficiency and effectiveness of teams operations to improve future performance.

Figure 1.1 Business Intelligence Survey

Business Intelligence Survey, November 1992: Business Performance Measurement, Business Intelligence Research, November 1992.

Q: Are you satisfied with your company's performance measures?

Yes: 11% No: 89%

Q: Why not?

Too financially orientated:	63%
Not related to individual performance:	42%
Too short term:	36%
Too vague:	34%

Q: Are you actively redefining your performance measures?

Yes: 89% No: 11%

Source: Geanuracos, John and Meiklejohn, Ian (1994). *Performance Measurement The New Agenda: Using non-financial measures to improve profitability,* London, Business Intelligence.

Global competition, as the result of the General Agreement on Tariffs and Trade (GATT) or World Trade Organisation's (WTO) agreement, has caused fundamental changes in the nature of competition of the Egyptian manufacturing environment. Egyptian manufacturing companies can no longer compete on cost alone, and must now examine the needs and expectations of the customer from a competitive perspective. New manufacturing techniques are affecting markets by raising quality and service levels whilst lowering costs. Competition between manufacturers is intensifying with the ability to provide product diversity, price advantages, lower costs, better delivery and service performance, coupled with increased quality and an ability to respond swiftly to changes in demand. In order to improve their competitive advantage and to be world class manufacturers, some Egyptian manufacturing companies have implemented new manufacturing methods. Those new manufacturing methods are related to new manufacturing philosophies/techniques such as Just-In-

Time (JIT) and Total Quality Management (TQM). According to Johansson *et al.* (1993), the two process philosophies of JIT and TQM constitute one coin of two sides, which can lead to World Class Manufacturing (WCM) performance.

Egyptian manufacturing companies, like other companies, exist to achieve specific goals and objectives. The goals and objectives of these companies are usually expressed in terms of financial and/ or non-financial indicators. These a predetermined indicators, performance measures, can then be effectively used to measure the performance of companies. Well-defined performance measures and reports help workers and their managers perform in the common interest, and also help them act together as a team in pursuit of mutually agreed-upon goals and objectives. Traditional PMSs, which are currently used by many Egyptian manufacturing companies, are insufficient in the new world of 'world class manufacturing'. They often provide inappropriate information, and fail to provide managers and their teams with the depth and structure of information required for them to be truly effective in all aspects of their work. Companies that are implementing, or plan to implement, WCM philosophies/techniques, need a new type of management accounting information system, and a new performance measurement system to succeed in the world markets. If performance measurement systems for Egyptian manufacturing companies are not consistent with the ultimate objectives of management through WCM philosophies/techniques, which they have already implemented or plan to implement, the companies may not succeed in the long run.

There is a significant relationship between changes in the manufacturing environment and management accounting systems (Detoni and Tonchia, 1996; Ghalayini and Noble, 1996), so there are many challenges and opportunities facing management accounting systems in order to aid practitioners in adapting to these changes. Consequently, it is argued that management accounting information systems, especially costing, performance measurement, and investment appraisal systems, have to change when manufacturing philosophies/techniques change (Maskell, 1991).

1.1.1 WCM Philosophies

WCM describes the manufacture of high-quality products reaching customers quickly at low cost to provide high performance and customer satisfaction. According to Todd (1995),WCM means being the best in manufacturing in the world. He said that:

> World-class means being the best in your field in the world. 'Best' can be in terms of:
> - Product design and performance
> - Quality and reliability
> - Least manufacturing cost (so that you can undercut your competitors on price or spend more than they can afford on research and development, or on advertising)
> - The ability to keep introducing innovative designs more quickly than your competitors
> - Shorter lead times and more reliable delivery performance
> - 'Customer service' performance that makes your customers bend over backwards to buy from you rather than from your competitors.

The list is not intended to be exhaustive; it may well be possible to add others. JIT and TQM are techniques of the process which may leading to WCM performance, and they are considered as WCM philosophies or techniques. "World class manufacturing (WCM) techniques have provided the dramatic short term gains in lead time, quality, costs, flexibility and service" (Ralston, 1996).

JIT is a unified philosophy that calls for a total reorganisation of operations activities in order to minimise wasted, 'non-value-adding' activities, and balance operations to demand (Bartezzaghi et al., 1992; Childe, 1997; Goyal and Deshmukh, 1992; Singh and Brar, 1992). Sriparavastu and Gupta (1997) defined JIT as a philosophy of eliminating waste, classified as any activity not adding value to the product. It is used in all departments and processes of the organisation from purchase of materials through production, assembly, packaging and distribution to the customer.

TQM seeks to create an atmosphere in which 'doing it right the first time' becomes the goal, where quality is designed and built into each activity rather than being inspected in after the fact (Johnsson et al, 1993). The focus is on having high-quality, reducing the cost of quality, and it also seeks to instil a continuous improvement process (Carr. 1995; Diallo et al, 1995; Rust. 1995). The Australian

Institute of Total Quality Management (1987) has provided an important definition of TQM:

> Total Quality Management is the management philosophy that seeks continuous improvement in the quality of performance of all the processes, products and services of an organisation. It emphasises the understanding of variation, the importance of measurement, the role of the customer and the involvement of employees at all levels of an organisation in pursuit of such improvement.

According to Sun (2000), TQM provides a generic concept for continuous improvement in quality and other performance measures.

This research is particularly concerned with the impact of world class manufacturing philosophies (JIT and TQM) on PMSs, which challenge the traditional MAIS. The empirical dimension of this research takes the form of an investigation into two Egyptian pharmaceutical companies.

1.1.2 Previous Studies of PMSs

The purpose of this part of the introduction is to highlight the importance of the research topic and the differences between this research and previous studies. There have been several studies that discussed the importance of studying the area of PMSs (Dumond, 1994; Schmenner and Vollmann, 1994; Neely, Gregory, and Platts, 1995; Detoni and Tonchia, 1996; Ghalayini and Noble, 1996; Kaplan and Norton, 1992, 1993, 1996a, 1996b). For example, Neely, Gregory, and Platts (1995), in their studies of PMSs, found that the importance of PMSs has long been recognised by academicians and practitioners from a variety of functional disciplines. They sought to bring together this diverse body of knowledge into a coherent whole, to ensure that the issues were identified, and focused on the process of PMSs design rather than the details of specific measures.

There have been a few studies that examined the relationships between change in the manufacturing environment and PMSs. For example, Detoni and Tonchia (1996), offered some evidence that changes in management philosophies have influenced on PMSs. They used Zanussi-Electrolux, the biggest European producer of domestic appliances, as a case study example. Ghalayini and Noble (1996) examined the changing basis of PMSs. They found that traditional performance measures based

on productivity were no longer appropriate or representative of the information needs of today's competitive global market. They also indicated that the basis of performance measurement is changing and that there are certain characteristics that are necessary in order to produce information that is relevant for improving WCM performance.

Some authors mentioned that when companies are developing or updating their performance measures, they should consider conceptual frameworks to stimulate thought about what should be measured (Vaivio, 1995; Perera, Harrison and Poole, 1997; MacArthur, 1996b; Rangone, 1997; Chenhall, 1997; Daniels and Burns, 1997a). Some companies have made use of the Kaplan and Norton's (1992, 1993, 1996a, 1996b) balanced scorecard, others used the Sink and Tuttle (1989) strategic organisational framework, and the Carl Thor (1991) "family of measures" framework.

Balanced Scorecard Framework

Kaplan and Norton (1992, 1993, 1996a, 1996b) describe the concept of a "balanced scorecard" that includes four categories of organisational measures, financial, customers, internal business processes, and measures of innovation and learning. This framework is intended for the top executives in an organisation as a way to obtain a quick and comprehensive assessment of the organisation in a single report. Using the balanced scorecard requires executives to limit the number of measures to a vital few and allows them to track whether improvement in one area is being achieved at the expense of another area.

Strategic Organisational Framework

Sink and Tuttle (1989) conducted a thorough review of the literature and identified seven criteria for measuring an organisation. Their framework is grounded in a supplier(input)-process(output)-customer(outcome) model. The seven criteria are efficiency (inputs), effectiveness (outcomes), productivity (outcomes/inputs), profitability/budgetability (outcomes/inputs), quality (anywhere in the process model), innovation and quality of worklife. Sink and Tuttle provide a strong focus on linking the organisational performance measures to the strategic planning process.

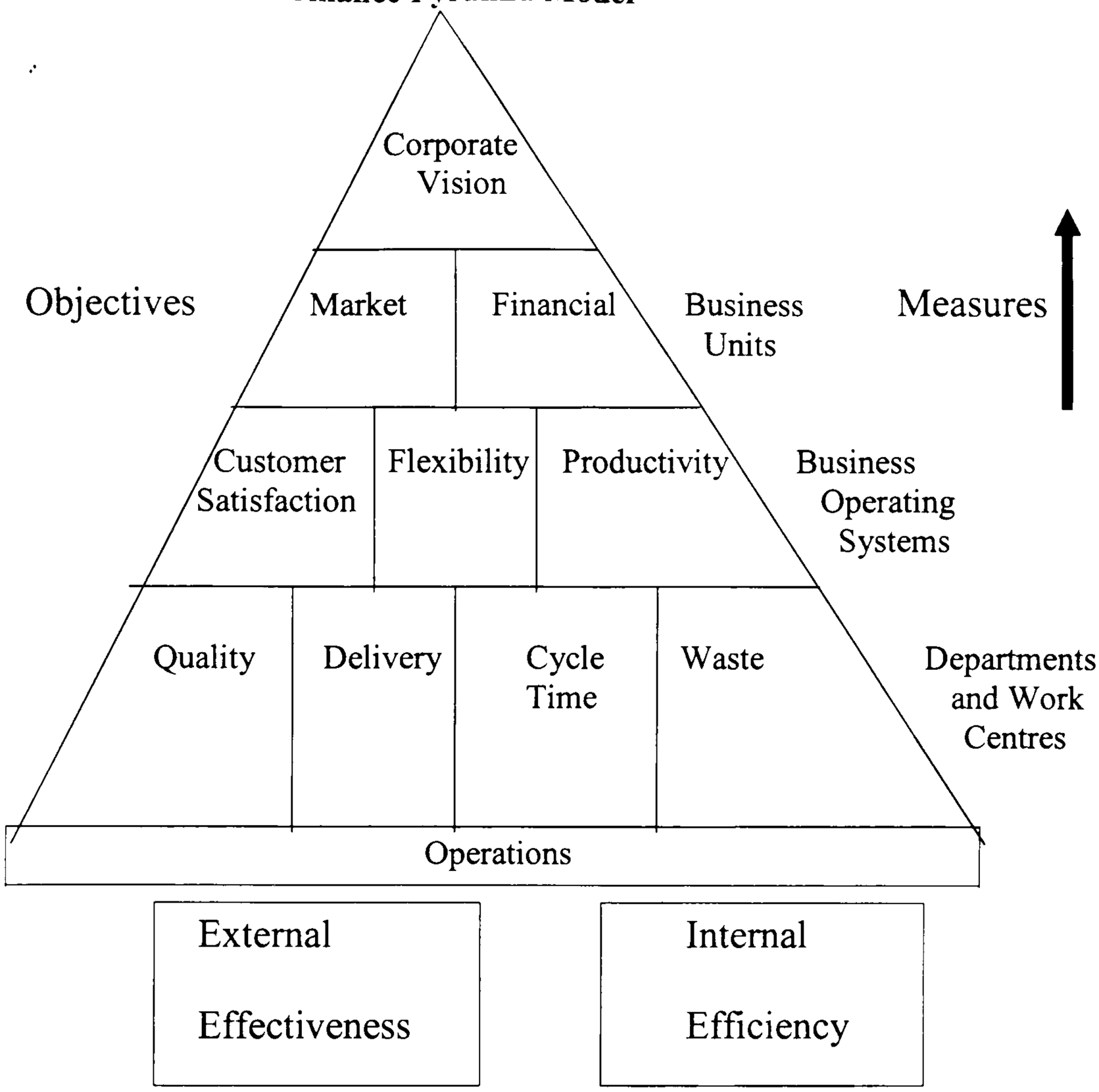
"Family of Measures" Framework

Carl Thor (1991) describes five types of performance measures: profitability, productivity, external quality (customers, "field performance"), internal quality (efficiency, waste), and "other" quality (innovations, safety, organisational culture). Thor emphasises the "family of measures" concept and the alignment of measures across levels of the organisation. Each department in an organisation should have some measures that are unique to it and other measures that are rolled up to a related measure at the next level.

Although the performance reports have the same importance of performance measures, it seems that the majority of the previous studies focused on the types of performance measures that should be used, and did not give any attention to the importance of performance reports. Several authors have identified the types of measures that should be used, and the systems in which the measures should be developed. The most often cited example of a good PMS is that developed by Wang Laboratories in 1989 (Dixon *et al.,* 1990). Wang developed a new approach to PMS, the Strategic Measurement and Reporting Technique (SMART). SMART aims to integrate financial and non-financial measures and reports, link manufacturing to the company's strategic goals, concentrate the performance measures on satisfying customer needs, and develop a system that promotes constant measuring. The SMART hierarchy or 'performance pyramid' is shown in Figure 1.1.2.1.

At the top of the pyramid is the corporate vision, which defines the mission of the company. The vision leads to the definition of the markets the company competes in and its goals in the marketplace, and detailed financial goals. These goals are called strategic business objectives, and lead to the business operating system objectives of customer satisfaction, flexibility, and productivity. Wang recognises that to meet these business operating systems objectives, people must work across functional boundaries, with a horizontal focus on processes. The last level in the hierarchy is departmental and work centre criteria, including quality, delivery, process time, and waste. Wang also recognises that performance measures are imperfect, and will be improved over time to better serve the future requirements of customers.

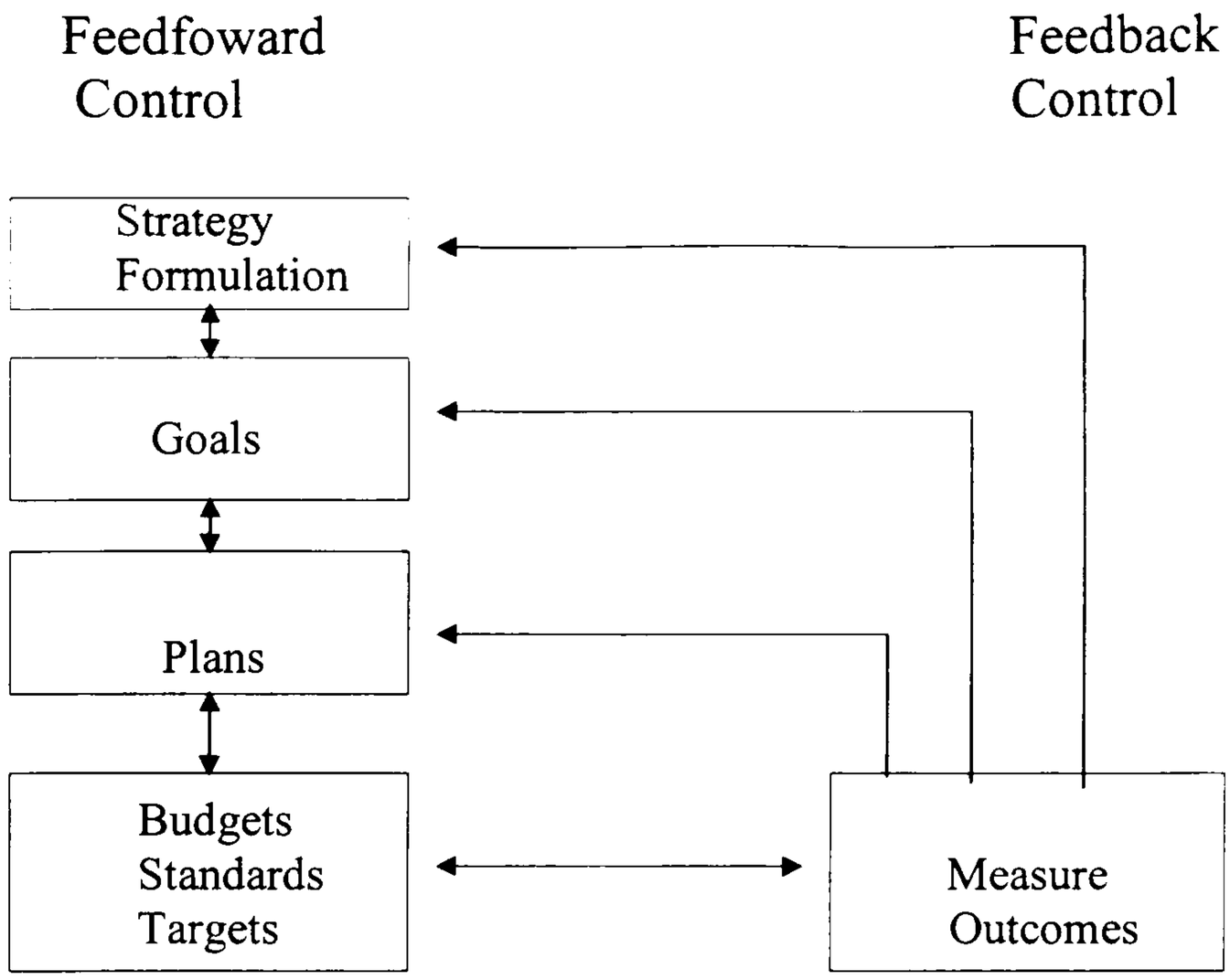
Figure 1.1.2.1 The Performance Pyramid Model



Source: Lynch, R. L. and Cross, K. F., (1991b). *Measure Up! Yardsticks for Continuous Improvement,* Cambridge, Massachusetts, Blackell Publishers.

A second example of a PMS model in the literature is provided by Fitzgerald et al. (1991). Fizgerald et al. developed a PMS model for use in service industries. The model is shown in Figure 1.1.2.2. The core concept of the model is the existence of feedforward control, which is planning and objective setting in their model, and feedback control, which is measuring performance against targets. Fitzgerald et al. also provide a range of measures to be used in different service organisations. As in the SMART hierarchy, performance objectives are derived from strategy.

Figure 1.1.2.2 Feedforward: Feedback Control Model

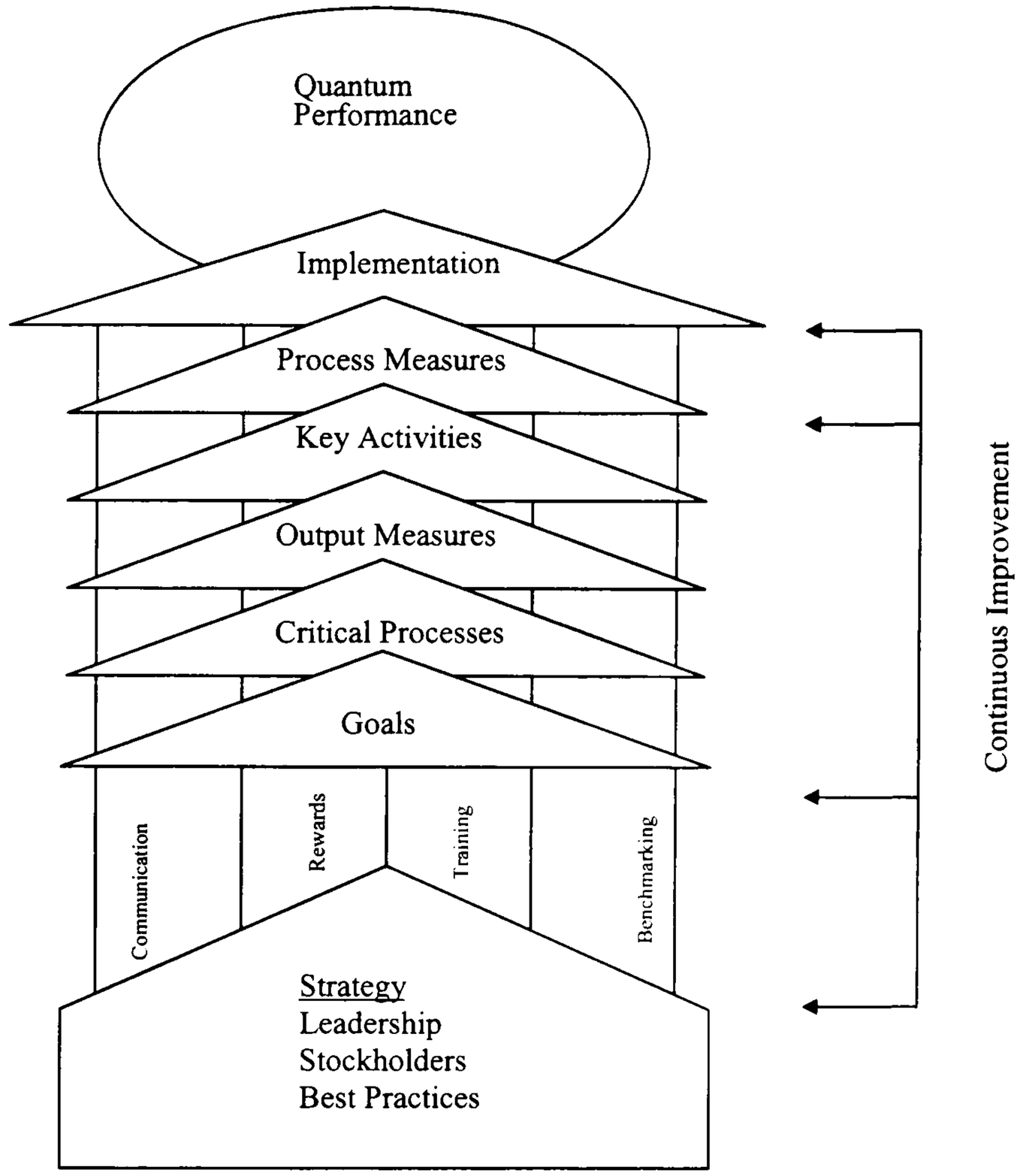


Source: Fitzgerald, L., Johnston, R., Brignall, S., Silvestro, R. and Voss, C., (1991). *Performance Measurement in Services Business,* London, CIMA.

A third example of a PMS model from the literature is the "Quantum Performance Measurement Model" developed by Hronec (1993). The model is shown in Figure 1.1.2.3. Hronec suggests that quantum performance is the result of an integrated planning and control system, the core of which is PMS. Hronec distinguishes between process measures and output measures.

This study looks explicitly at what, why and how performance measurement systems change with the adoption of JIT and TQM philosophies. This is by the building of a model for developing PMSs in a JIT and TQM environment. This topic was not a subject of interest in most of the previous studies. Forza and Salvador (2000), Lockamy (1998) and Neely et al. (1995) conducted a comprehensive review of literature in PMSs area, non of studies included in their review considered questions of 'what', 'why' and 'how' PMSs changed with the implementation of JIT and TQM philosophies. In addition to that, there has been no study that looked at the impact of WCM philosophies on PMSs practices in Egyptian manufacturing companies.

Figure 1.1.2.3 Quantum Performance Measurement Model



Source: Hronec, Steven M. (1993). *Vital Signs: Using Quality, Time, & Cost Performance Measurements to Chart Your Company's Future,* New York, Amacom.

1.1.3 Research Problem

The traditional performance measurement systems, which are currently employed in Egyptian pharmaceutical companies, are no longer suitable or useful for use with JIT and TQM philosophies.

The idea behind this research came from a survey which was carried out by Hassan (1993) in the Egyptian pharmaceutical sector to investigate the technical and behavioural dimensions of accounting performance reports. Hassan, in his survey results, presented many research findings, one of the most important of which is that the majority of Egyptian pharmaceutical companies implemented a traditional PMSs. Those traditional PMSs depend on financial measures and reports provided by the accounting department. Recently, a few Egyptian pharmaceutical companies have started to implement WCM philosophies, and many are planning to do so. According to many authors (Maskell, 1991; Jazayeri and Hopper, 1999; Mia, 2000) traditional PMSs are not appropriate to support the implementing of WCM philosophies.

1.1.4 Research Objectives

A principal aim of this research effort is to identify mechanisms which manufacturing companies can use to develop their PMSs in a JIT and TQM environment. The primary purpose of this study, is to answer the question, 'How PMSs can best be used to support the continuous improvement ideas of JIT and TQM within Egyptian pharmaceutical companies, which have already started to implement, or plan to implement, WCM philosophies?' This question will be studied by building a model for developing PMSs within a JIT and TQM environment.

This research also aims to:

1. study the role of PMSs within MAISs in WCM companies;
2. study the characteristics of JIT and TQM philosophies adopted by two Egyptian pharmaceutical companies;
3. study the types of PMSs currently being employed in the Egyptian pharmaceutical case companies which have already started to implement WCM philosophies;
4. suggest opportunities for Egyptian pharmaceutical companies to develop their performance, through the need of WCM philosophies/techniques;
5. suggest opportunities for future research in PMSs area.

1.2 Background of the Pharmaceutical Industry in Egypt

Since 1991 Egypt has been following an economic reform programme in co-operation with the International Monetary Fund and others. This programme has transformed the economy. The Egyptian currency is now freely convertible, foreign exchange reserves are healthy, overseas debts have been halved, inflation is now well below 10 per cent, most restrictions on imports and exports have been removed and duties reduced (Barclays Bank PLC, 1998). Since January 1995 when the General Agreement on Tariffs and Trade (GATT) was transformed into the World Trade Organisation (WTO), the world economy has witnessed what can be termed as 'globalisation of productivity', due to a free economy in which trade exchange is based on the market mechanism, capital movement and multinational companies. There is no doubt, the Egyptian economy cannot be isolated from regional and international variables, which calls for great flexibility in adaptation and readiness to deal with international economic relations. In January 1996 and at the beginning of the third phase of economic reform, Egypt embarked on a new stage of national enterprise on a sound and clear-cut basis which increased credibility in the Egyptian economy. The sectors in which Egypt has maintained a strong performance are textiles, food and pharmaceutical products. The pharmaceutical industry in Egypt is considered as one of the most important strategic industries in the country. The pharmaceutical industry in Egypt has achieved a good reputation in 1990s. This confidence has been realised through long Egyptian experience, commitment to "Good Manufacturing Practices" (GMP) according to modern international techniques, adherence to the practices of modern international pharmacopoeia and, finally, adoption of modern and accurate methods of analysis (Abouelenein, 1998). One of the important characteristics of the Egyptian pharmaceutical sector is that it brings together all the issues of planning, importation, manufacture, distribution, exportation and research. Hence, the pharmaceutical society is comprised of:

* Pharmaceutical raw materials and chemical companies.
* Medical appliance companies.
* Pharmaceutical packaging companies.
* Pharmaceutical production companies.
* Companies dealing with the marketing of medicines, chemicals and medical appliances.

The pharmaceutical industry in Egypt includes establishments primarily engaged in manufacturing, fabricating, processing and packaging medicinal substances into finished pharmaceuticals for human and veterinary use. Strong and consistent growth is expected in the Egyptian pharmaceutical market over the next few years. Key factors driving this growth include longer life expectancies, strong demographic expansion in older segments of the population, a rising standard of living in Egypt and a large untreated population, such as persons with elevated cholesterol levels. Increases in life expectancies create more health problems. As Egypt's population ages, the demand for pharmaceutical production increases. The elderly are the single largest group of users of prescription drugs.

Egyptian pharmaceutical companies have gained the confidence of multi-national companies to license the manufacture of their products in Egypt. Egyptian pharmaceutical companies export most of their products to various Arab and African countries, and some European countries (Ministry of Information, 1997).

1.2.1 The Impact of the GATT Agreement on the Egyptian Pharmaceutical Industry

The GATT agreement is an economic and political event with serious social and cultural implications. It includes a clause on intellectual property rights that will adversely affect industries in the developing countries in general, but more specifically the pharmaceutical industry which will be worst hit, a matter which led the international community to specify a ten-year period of grace before implementing this agreement in developing countries whose annual income per capita is below $1000.

A quick review of the status of the pharmaceutical industry in Egypt and the effect of the Trade Related Aspects of Intellectual Property Right (TRIPS) agreement helps understand the consequences. The Egyptian pharmaceutical industry provides over 93% of total consumption, with a value in excess of L.E. 2 billion, with prices very much below international norms, due to government control (Abouelenein, 1998). The Egyptian pharmaceutical industry is starting to experience strong competition both locally and internationally due to the easing of import regulations and the entry of giant international multinational companies in the market through the formation of subsidiary companies, totally controlled by the mother company such as Glaxo-Wellcome Egypt branch. These subsidiaries produce numerous products of the

mother company, which they sell at high prices backed up by intense promotion and advertising campaigns using various promotion approaches so that the national industry cannot easily compete.

Current patent rights regulations in Egypt and most developing countries offer protection for inventions, known as intellectual property rights in the GATT agreement, for ten years. Protection applies to the process of manufacture of the active ingredient only and not to the final product. This allows Egyptian companies to produce pharmaceuticals that were previously imported, selling them at much lower prices than their foreign counterparts. This is because the Egyptian company imports active ingredients from foreign companies manufacturing them according to international standard criteria, selling at much lower prices than the patent owning company, perhaps because a different method has been used for manufacturing the ingredient, so intellectual property protection regulations do not apply, or because 10 years have passed since registration, after which the technology falls in the public domain and is no longer protected. The international companies greatly benefited from the intellectual property protection laws in the pre-GATT era and made enormous profits which transformed some companies from being merely small laboratories to major giant multinationals manufacturing, selling and also gaining billions of dollars, recouping any expenses spent in research. Also the pre-GATT regulations allowed Egypt and many developing countries to manufacture their national products through their own R&D without breaching any laws and also to obtain the right to manufacture international products through licence agreements against royalty to be paid annually to the international company as a percentage on yearly net sales, for a certain period of time. In this balanced environment, the pharmaceutical industry in Egypt and many developing countries achieved remarkable progress and used modern technology in manufacturing, research and quality control, utilising up-to-date machinery and equipment. What is the status of the pharmaceutical industry in Egypt following the implementation of the TRIPS agreement? Not only does the agreement protect the process of manufacturing the active ingredient as in the past but it also protects the final product, as well as prolonging the period of protection for the patented technology from ten to twenty years. Doubtless the negative effects of the TRIPS agreement do not only apply to the Egyptian national pharmaceutical industry but also extend to the economic, social and health aspects in the country.

1.2.1.1 The Effect on the Egyptian National Pharmaceutical Industry

The Egyptian pharmaceutical industry is fast growing, providing for 93% of domestic consumption needs while 7% is imported, and the majority of packaging material is made in Egypt. The market value of nationally manufactured pharmaceuticals exceeds 2 billion L.E., but if the same products were imported, the value would jump to 12 billion L.E (Abouelenein, 1998). According to the Pharmaceutical Information Committee in Egypt, the Egyptian pharmaceutical sector includes 11 public sector companies for pharmaceuticals, raw materials and packaging material, 11 companies affiliated to ACDIMA, a holding company, 5 joint Egyptian foreign ventures and 2 private foreign subsidiaries, besides companies producing medical food, veterinary products and other specialised medical appliances. Many other new companies are in the process of establishment. Following the implementation of the TRIPS agreement there will be a dramatic rise in prices of pharmaceutical products, as demonstrated by the Canadian experience following the so-called BILL C-91 (The Canadian Drug Manufacturing Association, 1994). The national Canadian pharmaceutical industry previously provided pharmaceuticals under generic names with prices much lower than similar branded products manufactured by the multinationals. BILL C-91 entailed the following:

1. Retrospective abolition of the compulsory licensing which previously offered national Canadian companies the possibility of manufacturing generic pharmaceutical products (selling at much lower prices) in return for royalty dues paid to the multinationals.
2. Increasing the protection period to at least 20 years. Price competition between manufacturing companies would thereby be abolished and multinationals would monopolise prices leading in the next 7-10 years to generalised price rises. The sole profiting parts of this agreement are the multinational companies, which previously controlled only 10% of the generic products in Canada. The losers are the national Canadian pharmaceutical industry, the national health system and, above all, the Canadian citizen. One study estimated that the total cost of pharmaceuticals in Canada would reach $4 to $7 billion by the year 2010 (The Canadian Drug Manufacturing Association, 1994).

1.2.1.2 Economic, Social and Health Consequences of GATT Agreement

According to the agreement, the multinational companies will accumulate more power, minimising the role of the national Egyptian pharmaceutical industry. It would not be over pessimistic to predict that the national Egyptian pharmaceutical industry will disappear and Egypt will resort to the importation of pharmaceuticals from the multinational companies who monopolise the technology, or to purchasing from their subsidiaries in Egypt, and in both cases with much higher prices. The answer to the claim that signing the agreement will open the door to foreign investment is that the pharmaceutical sector in Egypt, since the very beginning, even during the socialist era during the late fifties and sixties, was open for international companies to manufacture products under licence. There are several international companies partially or totally owned joint venture subsidiaries and their number has lately increased. However, the presence of Egyptian pharmaceutical companies curbs the expected monopoly of prices. It seems that Egypt does not need investment for manufacturing generics, since there is available capacity in the existing factories to double production with minimal investment. What Egypt needs is investment and technology in the following fields:

1. The pharmaceutical raw materials, a heavy pharmaceutical industry involving high technology;.
2. The medical appliances industry (e.g. surgical sutures, machinery and equipment used in diagnosis and therapy).

As for the economic and health consequences, the expected price rises will definitely affect economic aspects and reduce the country's ability to adequately treat its citizens in the national insurance and government hospitals. As previously outlined, Canada which is a rich nation with an annual income per capita exceeding $10000 is suffering from this problem as the price load has increased to $750 million annually in the above mentioned fields (Queen's Health Policy of Canada, 1997). Another problem is the multinational companies' policy of laying off large numbers of employees as has recently occurred in several multinational mergers, such as Glaxo + Burroughs Wellcome and Sandoz + Ciba Geigy, where tens of thousands of employees were laid off (Abouelenein, 1998).

To counter the adverse consequences of the TRIPS under GATT agreement, the following have been suggested by Abouelenein (1998), member of the Board of Directors of Federation of Egyptian Industries and the president of SEDICO Pharmaceutical Co.:

"1. Insisting on the 10 years grace period stated in the GATT before complying with the restrictions of the intellectual property rights agreement. The grace period is from May 1995 to May 2005.

2. Not applying the agreement terms on the pharmaceuticals registered prior to signing agreement.

3. Providing the Egyptian and Arab companies with the right to register the pharmaceuticals with still valid patents and to conduct trial studies to be later handled after the end of the patent period, according to the regulations prevailing prior to the GATT.

4. Limiting the time period for patents in Egypt and the Arab countries to 5 years with no possibility for future extension.

5. Outlining for the Egyptian pharmaceuticals a clearly specified quota of the Arab and African markets through the general system of preferences (GSP), provided that the pharmaceutical lists are fixed for a period not less than 5 years.

6. The TRIPS agreement regulations do not apply retrospectively to products registered prior to implementing the treaty and apply only to patents registered immediately following the implementation of the TRIPS agreement at May 2005.

7. The importance of implementing the world class manufacturing techniques by national Egyptian pharmaceutical companies to bring success especially in competition with others in Egyptian, Arabian and African markets."

According to Ministry of Information (1997), some Egyptian pharmaceutical companies are preparing themselves for the year 2005 when the TRIPS agreement becomes effective in Egypt. The Arab Medical Packaging Company (AMPCO) and South Egypt Drug Industries Company (SEDICO) are two of the most important companies which are preparing themselves for the challenge of the year 2005.

1.2.2 The Importance of Pharmaceutical and Medical Packaging in Egypt

Demand for pharmaceutical and medical packaging in Egypt is increasing and will continue to do so as companies in these two markets come to rely more on packaging to protect and promote their products. Even though pharmaceuticals and medical devices are usually selected by health care practitioners, manufacturers must design their packaging with users in mind. Just as appearance and ease of use are important for consumer products, they are the key to a device's or drug's success, and for over the counter drugs and nutritional supplements, consumer appeal is paramount.

According to the Egyptian Pharmaceutical Society, the pharmaceutical packaging market grew by 3.5% annually from 1990 to 1995, and is expected to increase by 6.5% between 1995 and 2005. The Flexible Packaging Association (FPA) identifies pharmaceutical packaging as one of its fastest growing segments. Packagers in Egypt will be seeking components and materials with superior clarity, static control, and infection-resistant properties.

Information about the Arab Medical Packaging Company (AMPCO), which specialises in flexible packaging products, will be presented in Chapter Five, as the first case of the empirical study.

1.3 Research Methodology

This is an explanatory research effort which is complemented by an exploratory one; therefore, it requires a theoretical and an empirical research methodology. Research has been defined as "an organised, systematic, data-based, critical, objective, scientific inquiry or investigation into a specific problem, undertaken with the objective of finding answers or solutions to it" (Sekaran, 2000). Drew (1980) defined research as "a systematic way of asking questions, a systematic method of enquiry." He also mentioned that the purpose of research is to obtain knowledge or information that pertains to some question. The question may be a very simple one or it may be more complex. Strauss and Corbin (1998a, 1998b) defined methodology as "a way of thinking about studying social reality." From the previous definitions, research methodology can be defined as a way of thinking about studying social reality by the use of a systematic way of asking questions. This research adopts a qualitative research methodology. Many researchers in MAISs area support the use of qualitative research methodology in the area of PMSs. Spicer (1992), Chenhall and Langfield-Smith (1998), and Lillis (1999) suggest the use of the case study approach due to the lack of theoretical framework and the level of detail required to gain understanding in PMSs researches. Kaplan (1984a), in criticising existing PMSs for manufacturing, suggested the need for case study research in the area of performance measurement. According to Strauss and Corbin (1998a, 1998b), qualitative research means "any type of research that produces findings not arrived at by statistical procedures or other means of quantification." Drew (1980), expressing his views on the reasons for conducting research, indicated that research is conducted to solve problems and to expand knowledge. He also pointed out that indulging an investigator's curiosity is a very good reason for conducting research. This research involves investigation of what, why and how PMSs change with the adoption of JIT and TQM philosophies. Those questions are interesting but may have no application at the present time. The goal of this research is to build a model for developing PMSs in a JIT and TQM environment. Research methodology must follow clearly defined and logical rules and procedures, if the findings of the investigation are to be accepted (Strauss and Corbin, 1998a, 1998b). In *The Practice of Social Research,* Babbie (1986) presents a schematic view of the research methodology process. He argues that, ultimately, the research methodology process must be seen as a whole and not simply sequential

parts. Following the statement of the research questions, the variables that will be studied must be defined (conceptualisation), the research approach (es) must be selected, and the group of people or companies that will be observed must be identified (sample). Figure 1.3 contains a flowchart of the necessary research activities of the research methodology process adapted from Babbie's work.

1.3.1 Research Questions

Strauss and Corbin (1998a, 1998b) reported that "the research question in a qualitative study is a statement that identifies the phenomenon to be studied. It tells the readers what the researcher specifically wants to know about this subject." According to Miller (1997), questions in the research methodology process allow qualitative researchers to focus on aspects of the perspectives that are compatible. The perspectives of this study are JIT and TQM philosophies and PMSs. Miller also indicated that questions are procedures for identifying the shortest distance between the aspects of the perspectives.

In other words, Miller said that "questions that address themes that are part of, or implied by, multiple perspectives are useful in guiding qualitative researchers' data collection". At the top of the flowchart of the research process is the research questions. The primary purpose of this thesis is to investigate this basic research question 'How can PMSs best be used to support the continuous improvement idea of JIT and TQM philosophies?' This was accomplished by addressing three more specific research questions:

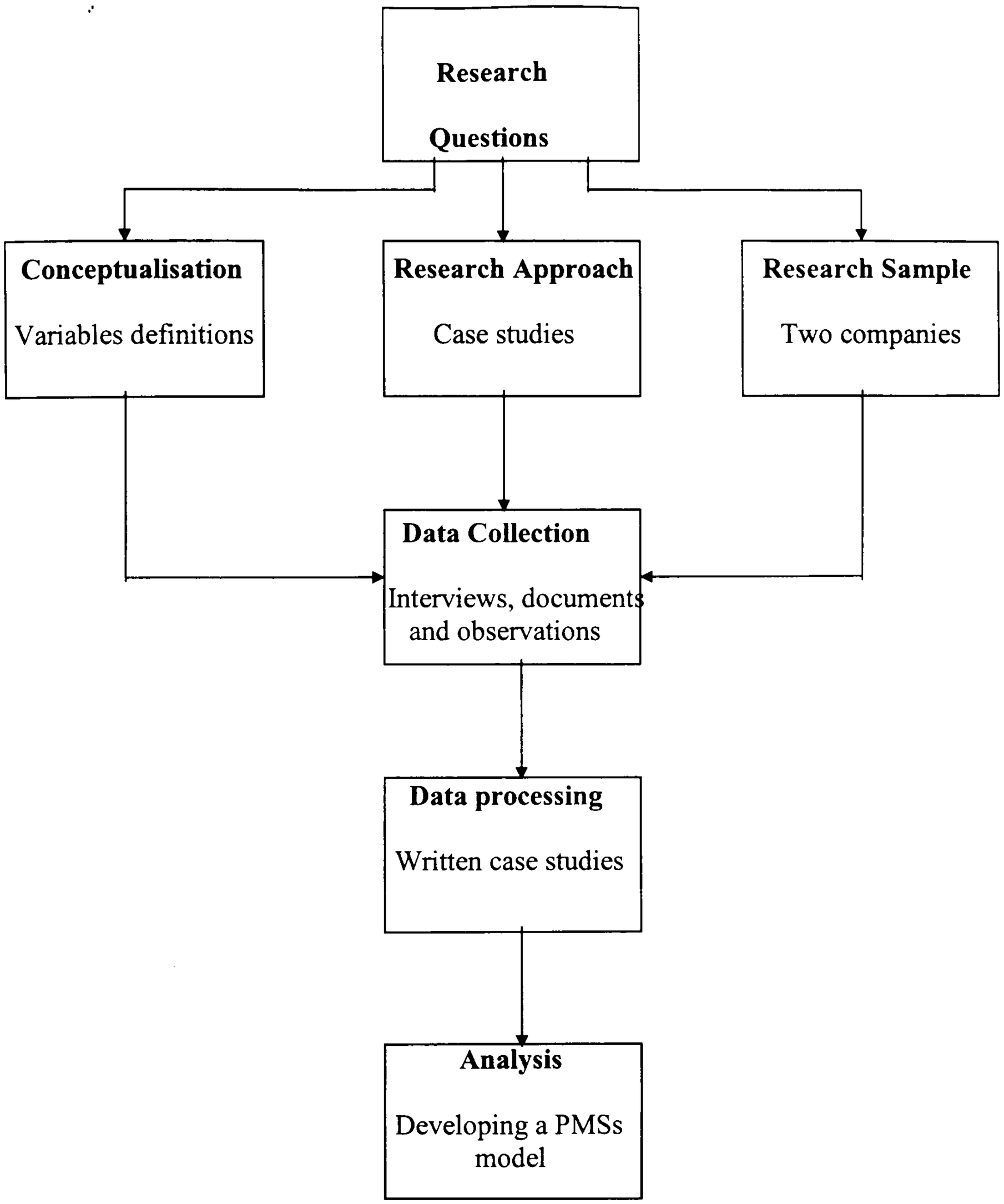
1. What has changed in the performance measurement systems with the adoption of JIT and TQM philosophies?

The 'what' question requires the identification of the performance measurement system changes in the areas of performance measures, performance reports, and the introducing of benchmarking.

2. Why have the performance measurement systems changed with the adoption of JIT and TQM philosophies?

The 'why' question looks at the logical reasons for the process of change in performance measurement systems within the companies.

Figure 1.3 Thesis Research Process



Adapted from: Babbie, Earl (1986). *The Practice of Social Research,* Belmont, California, Wadsworh Publishing Co.

3. How have the performance measurement systems changed with the adoption of a JIT and TQM philosophies?

The 'how' question identifies and reviews the factors observed as responsible for performance measurement systems changes.

Those specific research questions have been supported by the following questions:

a. What are the goals and objectives of WCM companies?

b. What are the key success factors used to measure performance in WCM companies, which have already started to implement JIT and TQM philosophies?

c. How are the key success factors measured?

d. How is the performance information reported and used?

Two types of research were conducted during the investigation; theoretical and empirical. In the theoretical study, a review was carried out of literature related to the role of MAISs in manufacturing companies, traditional PMSs, WCM philosophies (JIT and TQM) and their impact on PMSs, and the new PMSs for a JIT and TQM environment (Chapters Two to Four). The empirical study was based on data collected by unstructured interviews, which was carried out in two Egyptian pharmaceutical companies, which have already begun to implement WCM philosophies (Chapters Five to Seven).

1.3.2 Conceptualisation

Variables are central to the research process (Saunders et al., 2000). Most research is concerned with relationships between variables. For example, is there a relationship between change in the manufacturing environment, one variable, and performance measurement, another variable? A relationship in this case means that companies with different types of manufacturing environment experience different types of performance measurement systems.

An extensive reading of the theoretical and empirical literature was undertaken over the past four years, to build up a knowledge base in the areas of WCM strategy, JIT and TQM philosophies, MAISs, and PMSs. The primary variables of interest in this thesis are PMSs for a JIT and TQM environment in WCM companies. Those variables required definitions of WCM, JIT, TQM and PMSs. Those definitions are developed in chapters two to four and restated in pages 6 to 7. To explain the relationships between those variables empirically, needs an in-depth investigation. According to Feagin et al. (1991) and Saunders et al. (2000) case study is an ideal methodology when an in-depth investigation is needed.

1.3.3 Research Approach

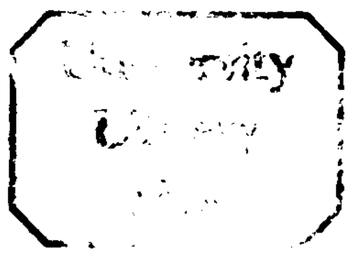
There are many ways or methods of doing accounting research, such as case studies, surveys, experiments, and histories. Case studies have been used in varied investigations in social science researches. According to Otley and Berry (1994), there have been many calls for management accounting information systems researchers to use case study research methods. Recently, there have been a number of published researches which adopted case-based research methods in the management accounting information systems area (Abernethy et al., 1999). Robson (1993), Saunders et al. (2000) and Yin (1994) highlighted that case studies are the best ways of doing the research when "how" or "why" questions are being posed. Yin (1994) reported that "case studies are the preferred strategy when "how" or "why" questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context." Buckley et al. (1976) indicated that empirical research examines what actually happens is best suited for fact finding or seeking reality, and includes case study methodology. Platt (1988) reported that "the revival of interest in qualitative method, and the increase in attempts to systematise it, have once again directed attention to case studies, with most emphasis on methods of data collection." This research is applied case studies as a method or way of doing the investigation. Yin (1994) in his definition of case study reported that "a case study is an empirical inquiry that:

- investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident
- copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result
- relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result
- benefits from the prior development of theoretical propositions to guide data collection and analysis."

Stake (1995) stated that the protocols that are used to ensure accuracy and alternative explanations are called triangulation. The need for triangulation arises from the need to confirm the validity of the processes. This could be done by using multiple sources of data within a case study method (Yin, 1984). According to Denizin (1984), there are four types of triangulation. First, data source triangulation,

when the researcher looks for the data to remain the same in different contexts; second, investigator triangulation, when several investigators examine the same phenomenon; third, theory triangulation, when investigators with different view-points interpret the same results; fourth, methodological triangulation, when one approach is followed by another to increase confidence in the interpretation. In this study, the researcher has adopted data source triangulation, by using multiple data resources. One of the most important suggestions of this study is to investigate the same research problem by using a survey method, which would be consistent with the principle of methodological triangulation.

Brignall (1993) suggests that case studies are needed to investigate the processes whereby companies "have developed their performance measurement systems, and how they link policy to objectives, objectives to strategic plans, and strategic plans to the budgeting system." In researching PMSs, there is a need for in-depth understanding of the companies considered, and the details of what, why and how PMSs are changed (Euske et al, 1993). Duncan (1979) and Babbie (1986) indicated that one of the strengths of the case study method is the in-depth understanding of cases that are permitted. Kaplan (1983) supports the use of case study methodology to study the relationship between new performance measures and manufacturing operations. Platt (1988), in his article, 'What can case studies do?' focused on the reasons for choosing case studies given by some researchers. He mentioned that one of the most important reasons is that " case(s) studies are taken to provide a basis for inference to points not directly demonstrated and with relevance to cases not studied. Many dismissals of case-study method treat this as the only significant cell, and it is certainly the one which raises the most serious intellectual problems." Building a model for developing of PMSs in a JIT and TQM environment in this study requires an in-depth understanding of the JIT and TQM philosophies, and of the PMSs, in each company of the study. Therefore, case study is the primary method selected for this thesis. The case studies in this research tend to be selective, focusing on a few issues that are fundamental to understanding the problem and questions being examined. The case studies in this research are designed to bring out the details of WCM strategy, JIT and TQM philosophies, MAISs and PMSs, from the viewpoint of the participants by using multiple sources of data. Participants have been selected so as to maximise what can be learned in the period of time available for this research.



1.3.4 Research Sample

Mintzberg (1979) and Schendel and Hofer (1979) stated that the number of firms included in an explanatory-exploratory study should be small. They mentioned that the amount of time and resources available to collect the data are usually limited. Therefore, the sample size must be very small. In addition to the concern about the number of companies included in an explanatory-exploratory research project, the type of company included is critical. Schendel and Hofer (1979) stated that site selection is very important in an explanatory-exploratory research effort and should be done "...in a non-random manner, with a preference for either leading or average organisations". The companies which have been selected for this study are at the leading edge of the Egyptian pharmaceutical industry. The criteria for selection of the sample in this research included a dynamic competitive environment, the adoption of JIT and TQM philosophies, PMSs change, and management commitment to an in-depth study. The sample of this study contains two Egyptian pharmaceutical companies which have already started to implement some of WCM philosophies, such as JIT and TQM. Generally, the number of Egyptian companies which have already begun to implement WCM philosophies is very small. Therefore, the sample of companies selected for this study is very small. This study was carried out in two phases.

(1) First phase (Structured interview)

The first phase involved on-site company visits and personal interviews, which were carried out in order to obtain data directly from persons in ten Egyptian pharmaceutical companies that have addressed the problem of PMSs. Prior to the commencement of the empirical study, it was necessary to obtain permission from the General Agency for Public Mobilisation and Statistics, the Ministry of Education, and the presidents of the companies.

The sample in the first phase were included the following companies: Egyptian International Pharmaceutical Industries Co., Arab Pharmaceutical Glass Co., Arab Medical Packaging Co., The Arab Gelatine Pharmaceutical Products Co., Medicinal Plants Arab Co., Arab Co. For Pharmaceutical Raw Materials, South Egypt Drug Industries Co., Arab Medical Food Company, Medical Union Pharmaceuticals Co., and Arab Co. For Medical Appliances.

The interviewees were carried out with the President of the Board of Directors, production managers, and financial managers in each company. The following matters were included in the checklist of discussion during the interviews (see Appendix 1):

- The role of MAISs in the companies;
- Procedures of performance measurement systems;
- Characteristics of performance measures;
- Characteristics of performance reports;
- Manufacturing systems adopted;
- Management philosophies implemented.

The most important findings of this stage were that two companies from the ten have already started to implement JIT and TQM philosophies and their management agreed to the researcher's request to carry out an in-depth study for the second phase.

(2) Second phase (Unstructured interview)

The second phase involved on-site visits and interviews conducted with the board of directors, production managers, junior and senior staff in the manufacturing department, purchasing, marketing, and accounting managers, and junior and senior staff in the accounting department. Because little research has been done in Egypt in the area of PMSs for WCM companies and few Egyptian manufacturing companies have started to implement, or plan to implement, WCM philosophies, the sample in the second phase consisted of two companies. Those two companies are at the leading edge of the Egyptian pharmaceutical sector, have already begun to implement WCM philosophies and have addressed the problems of PMSs in a JIT and TQM environment. The two companies are: Arab Medical Packaging Company (AMPCO) and South Egypt Drug Industries Company (SEDICO).

The purpose of the second phase of the empirical study was to obtain an understanding of the role of MAISs in the two Egyptian pharmaceutical companies, the WCM philosophies which currently being employed, and the types of PMSs currently being employed (see Appendix 2). It was also intended to suggest a model for developing PMSs in a JIT and TQM environment.

1.3.5 Data Collection

The aim of the data collection phase of the research is to collect data in a methodological manner. In 'qualitative methodology', the investigation includes such methods of data collection as "participant observation, unstructured interviewing and the use of documentary methods" (Burgess, 1988). Miller and Glassner (1997), reported that "those of us who aim to understand and document others' understandings choose qualitative interviewing because it provides us with a means for exploring the points of view of our research subjects, while granting these points of view the culturally honoured status of reality." According to Schwab (1999), using the interviews in data collecting allow greater flexibility. He also mentioned that "interviewers can follow up on answers with questions that probe respondents' thinking in greater depth. Interviewers can record responses and interviewee behaviours that are not available as formal questionnaire responses."

Yin (1994) stated that there are six sources of evidence for data collection in the case study method: interviews, direct observation, participant observation, documentation, archival records, and physical artefacts. No single source has a complete advantage over the others; rather, they might be complementary and could be used in tandem. Thus, a case study should use as many sources as are relevant to the study. The researcher in this study used interviews, direct observation and documentation as the data collection resources. Interviews are the most important sources of case study information in this investigation. One of the most important uses of documents in this study is to corroborate evidence gathered from interviews and the researcher's direct observations. The use of multiple sources of data collection is called data resource triangulation (Stake, 1998). Triangulation increases the reliability of the data and the process of gathering.

Two and three-day company visits to each site were scheduled to collect the required data in the first stage, and six-week visits in second stage were scheduled to collect all the information needed. Face-to-face interviews took place at the companies. Face-to-face interviews generally exhibit considerable variation in duration due to their flexibility, ability to clarify questions, and ensuring responses are understood (Sekaran, 1992, 2000). In addition to taking notes during the visits, interviews were recorded after getting permission from the interviewees, to ensure that no data were lost. Interviewees were given a blank copy of the interview schedule to read in order to ensure that they fully comprehended each question. The researcher

provided an explanation of the purpose and nature of the investigation to every interviewee. The researcher used open-ended interviews as recommended by Yin (1984) to expand the depth of data gathering, and to increase the number of sources of information. The interviews were conducted according to the interviewee's schedule and availability, as suggested by Feagin et al. (1991). The researcher followed Yin's (1994) suggestions during his investigation. Yin (1994) suggested that the investigator must possess or acquire the skills of the ability to ask good questions and to interpret the responses, be a good listener, be flexible so as to react to various situations, have a firm grasp of issues being studied, and be unbiased by preconceived notions. Also according to Yin (1989), consideration must be given to construct validity, internal validity, external validity, and reliability in data collection. Yin (1994) suggested using multiple sources of evidence as the way to ensure construct validity. This study used multiple sources of evidence interviews, direct observation, and documentation to ensure construct validity. Yin (1994) also mentioned that the specification of the unit of analysis provides the internal validity. In this study, the unit of analysis is each company included in this research. On that basis, Arab Medical Packaging company (AMPCO), the first case study, is the first unit of analysis and South Egypt Drug Industries Company (SEDICO), the second case study, is the second unit of analysis in this research. External validity is more difficult to attain in a single case study. Yin (1994) indicated that external validity could be achieved from theoretical relationships, and from these generalisations could be made. Reliability can be achieved by the development of a formal case study protocol (Yin, 1994).

1.3.6 Data Processing

Babbie (1986) meant, by data processing, the reporting phase. Yin (1994) proposed that the case study report be planned at the start. Case studies do not have a widely accepted reporting format, hence the experience of the investigator is a key factor (Woods, 1999). Some researchers (Feagin et al., 1991) have used a journal format which was suitable for their work, but not necessarily for other studies. The reason for the absence of a fixed reporting format is that each case study is unique. The research questions, data collection, and indeed the unit of analysis cannot be placed into a fixed model as in experimental research. Indeed, these case studies are not served by such a format. Writing up the case studies and findings from interview data, observation and documents is itself an analytically active enterprise (Woods, 1999). Rather than adhering to the idea of letting the data 'speak for themselves' the researcher has written up the case studies so as to highlight the 'meaning-making process' (Stake, 1998). The goal is to explain in detail how meanings, their linkages and horizons, are constituted both in relation to, and within, the interview environment. The researcher, in the writing up of the case studies, did not just summarise and organise what interview participants said, but also attempted to deconstruct participants' talk to show the importance of the meaning-making process and to find the answers to the research questions.

Following each company visit, a case study was written. Yin (1981) states that "although case studies may often begin with little conceptual framework, the narrative must nevertheless be organised around specific questions or activities". A similar outline was followed for each case study. The cases reflect all data collection methods used, including interview, observation and collected materials. Each person sampled inside every company had an opportunity to review and revise the case study.

1.3.7 Data Analysis

The research questions framed as 'what', 'why', and 'how' determine the relevant strategy to be used. In this study, the nature of the questions (see Appendix 3) led to explanatory-exploratory case studies. The unit of analysis in a case study could be " an individual, a community, an organisation, a nation-state, an empire, or a civilisation" (Sioberq et al., 1991). This study used the case study organisation as the unit of analysis. The linking of the data to the research questions and the criteria for interpretation of the findings are not well developed in case studies. However, they are represented in the data analysis chapter. The data analysis of this study required the building of a model for developing PMSs in a JIT and TQM environment. According to Drew (1980), "a theory or model usually involves a descriptive explanation of why some phenomenon occurs. In such an explanation, certain aspects of the theory are frequently observable or have yet to be observed. Theoretical structures are usually formed by drawing intuitive or logical connection between such aspects. The points and their connective links together become the theory."

It must be emphasised that this is an explanatory-exploratory effort. Hypotheses do not exist. The model developed is, therefore, based on the literature review and data which were collected during the field visits from two case studies in the second stage. The problem which may be raised at this point is whether we can learn from just two case studies and build a model for developing PMSs in a JIT and TQM environment. According to Johnson (1992), "the most appropriate place to learn about business, and to research and develop theories about business is in places of business. If anyone says it is impossible to make scientific generalisations by studying samples of one, tell them that they have much to learn about the concept of "scientific" investigation. Going inside and studying intensely over a long period of time the workings of a real business organisation is certainly the most important research any business professor can do. A socially responsible and enlightened business school will not keep in its employ any business professor who denies the validity-no, the primacy-of field-based research." Upon completing the analysis, analytic generalisations were developed related to this study research questions. A model for developing PMSs was also originated, showing linkages between mission, goals and objectives, strategy, key success factors and performance measurement systems.

1.4 Research Limitations

This research, like any other kind of research, has its limitations. Some limitations are related to the difficulties that were encountered in meeting the participants. Lack of co-operation on the part of some participants and shortage of time allocated for the researcher to apply the interviews were the main limitations in gathering the required data for discussion and analysis of different points of interest to the research in more detail.

Another limitation is related to the applicability of this research's findings. This research focused on PMSs used in two of the Egyptian pharmaceutical companies, which are considered as WCM companies and have implemented JIT and TQM philosophies. Therefore, the results and findings of this study cannot be used to make general statements about PMSs in all manufacturing companies. Such a statement must be reserved for future research.

A final limitation is related to the model for developing PMSs in a JIT and TQM environment. The model for developing PMSs in a JIT and TQM environment, which is generated from this research, will not be verified. Only a few Egyptian manufacturing companies existing today have, so far, started to implement JIT and TQM philosophies. As the number of Egyptian manufacturing companies which expect to implement WCM philosophies increases, additional research will be required to determine whether the PMSs model developed in this study contains all of the related factors, or if additional ones are needed. Accordingly, there is a clearly identified need to investigate the development of PMSs over time, in order to understand better the mechanisms affecting the changing of performance measurement systems.

1.5 Research Structure

The research is presented according to the following structure:

Chapter One: Introduction and Research Methodology

Chapter Two: World Class Manufacturing Philosophies/Techniques

Chapter Three: The Role of Management Accounting Information Systems in WCM Companies

Chapter Four: Performance Measurement Systems for a JIT and TQM Environment

Chapter Five: Arab Medical Packaging Company (AMPCO) Case Study

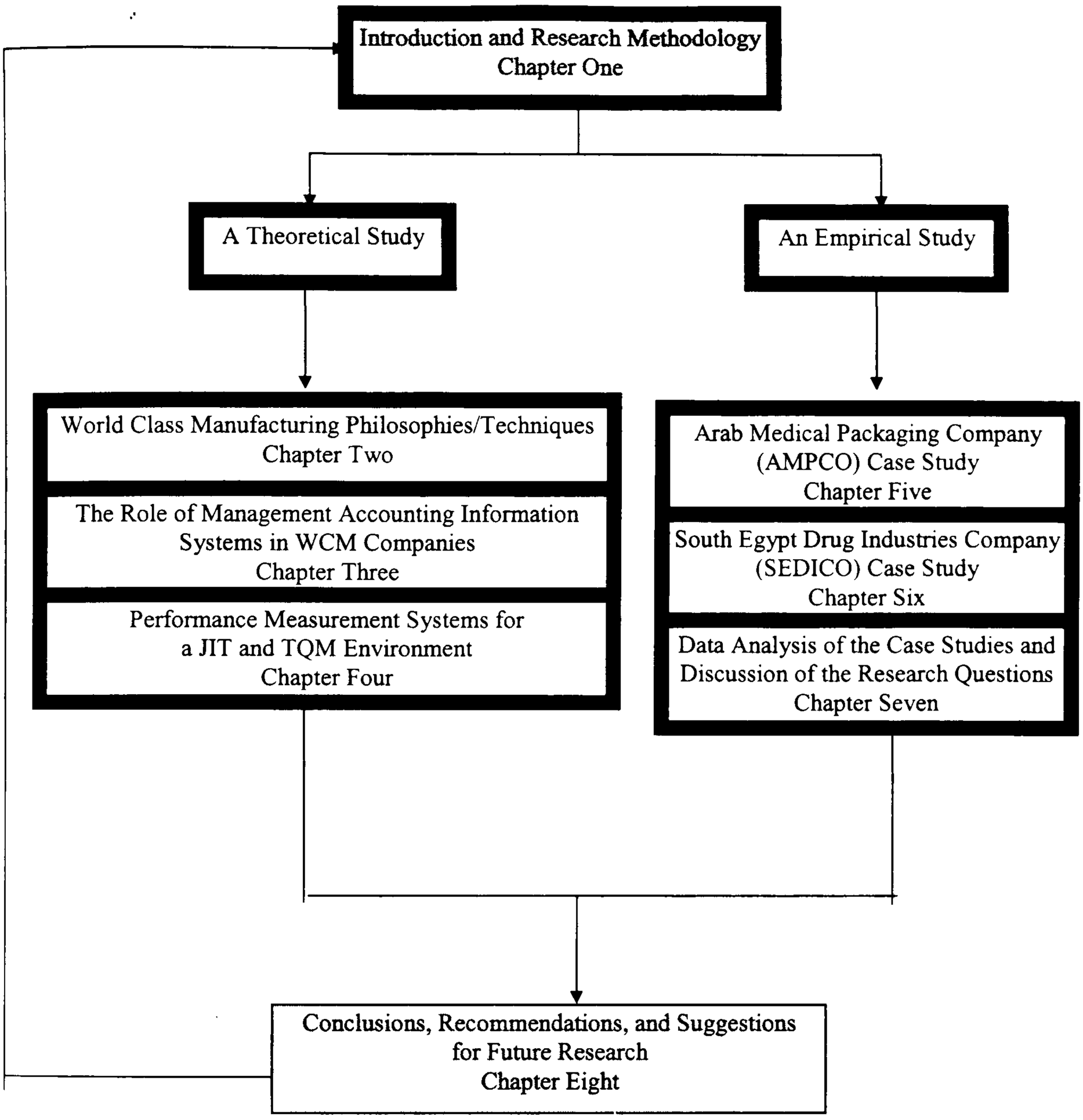
Chapter Six: South Egypt Drug Industries Company (SEDICO) Case Study

Chapter Seven: Data Analysis of the Case Studies and Discussion of the Research Questions

Chapter Eight: Conclusions, Recommendations, and Suggestions for Future Research

The main components of the thesis are related as shown in figure 1.5.

Figure 1.5 The Main Components of the Thesis



Chapter Two

World Class Manufacturing Philosophies/Techniques

2.1 Introduction

Manufacturing is the lifeline of all industrialised societies. Manufacturing is the most important segment in any nation's economy. The standard of living is closely associated with a nation's ability to produce manufactured goods (Evans, 1993). According to Evans, manufacturing operations generally transform some tangible input or raw material into some tangible output. The purpose of manufacturing, at least idealistically, is to enrich society through the production of functionally desirable, aesthetically pleasing, environmentally safe, economically affordable, highly reliable, top-quality products (Muhlemann et al., 1992). A more pragmatic definition of purpose would be to meet customer function, quality, and reliability wishes at minimum cost. Manufacturing is important, technologically, economically, and historically; technologically, manufacturing is one of the most important essential factors that makes technology possible; economically, manufacturing is an important means by which a nation creates material wealth; historically, the importance of manufacturing in the development of civilisation is usually underestimated but throughout history, human cultures that were better at making things were more successful (Groover, 1996). Manufacturing companies operate in a competitive environment, so their customers may be faced with several competing products. In order to make a sale, the manufacturing company must deliver the product as closely as possible to the customer's requirements while keeping production costs low enough to make a profit at a selling price that the customer will accept (Gershwin, 1994).

The 1990s and 2000s were an era of renaissance in manufacturing, born largely from the pressing need of many companies to compete in a growing global marketplace. The term 'World Class Manufacturing (WCM) became the trademark of this movement as many companies began to implement simplified manufacturing methods and new manufacturing philosophies/techniques, such as JIT and TQM, to increase their competitive position (Roehm et al., 1991).

The world of manufacturing has changed dramatically over the past 20 years. Becoming and remaining competitive is no longer easy. Products are now much more sophisticated than they were 20 years ago and the standards of good manufacturing practice have changed dramatically since then. The fact that the leading edge of manufacturing practices have improved so much over recent years makes it more difficult to gain a sustainable comparative advantage. The key issue in manufacturing practices is how to become a world class manufacturer (New, 1992).

2.2 World Class Manufacturing

In the manufacturing world of today, success goes to those who can manage their business more effectively than their competitors, and the competition is now world-wide (Roehm et al., 1991). According to Todd (1995), the world class manufacturing focus on the competitiveness term. Steudel and Desruelle (1992) mentioned that "competitiveness and profitability can only be maintained if manufacturers cut costs by becoming better at what they do and how they do it." Boyd (1992) indicated that the president of Hewlett-Packard defined competitiveness as follows:

> Competitiveness is the degree to which a nation can, under free and fair market conditions, produce goods and services that meet the tests of international markets, while simultaneously maintaining or expanding the real income of its citizens.

This means that any nation can sell anything it wants to sell, to anyone who wants to buy it, anywhere in the world with no restrictions. This is also means that the market is the world, and companies who want to compete successfully are striving to become world class manufacturers. According to the third annual census of manufacturers by Industry Week magazine and Pricewaterhouse Coopers, a number of key differences exist between WCM organisations and other companies (Institute of Industrial Engineers (IIE), 2000). IIE mentioned that, according to the survey, key differences are; first, WCM companies tend to take greater advantage of technology-based systems; second, WCM companies and their suppliers deliver on a JIT basis and their customers participate extensively in new product development; third, quality management programs, ISO 9000 and TQM, are extremely critical for achieving WCM status.

2.2.1 Definitions of World Class Manufacturing

In world class manufacturing, competition levels are rising, significant new competitors are appearing in parts of the world not previously known for manufacturing eminence and, increasingly, manufacturers around the world are thinking and operating with global perspectives. According to Steudel and Desruelle (1992), the definition of WCM focus on the means of being world class in manufacturing. They said that:

> Being world-class in manufacturing means that the company can compete successfully and make a profit in an environment of international competition, not only now, but also in the future. To make a profit, a company must sell its products at a price above its costs and still provide a product to the marketplace that offers better value than the competition's product. This value is typically perceived by customers as a combination of price, quality, availability of the product and service, and the product's performance and capability. In essence, being world-class means being capable of bringing products to the marketplace that offer better value than the competition without going broke.

Hayes, Wheelwright, and Clark (1988), identify the key attributes of world class manufacturers as:

> Becoming the best competitor, growing more rapidly and being more profitable than competitors, hiring and retaining the best people, developing a top-notch engineering staff, being able to respond quickly and decisively to changing market conditions, adopting a product and process engineering approach which maximises the performance of both, and continually improving.

Roth, Giffi, and Seal (1992), in their definition of WCM, focus on manufacturing excellence. They define world class manufacturing as follows:

> A dynamic process that provides unique value, competitive advantage and delight to customers and suppliers through the development of internal operations capabilities that foster continuous improvements in human assets, technology, materials and information flows, that are synergistic with the total business, and that provide a sustainable competitive position in the firm's target markets.

Regardless of the definition chosen, world class manufacturers have a common attribute, namely, that they are able to create high-value products and services, and earn a superior return over the long run through the application of the world class manufacturing philosophies/techniques that win orders in the marketplace. Ralston (1996) mentioned that "today continual and rapid improvement in quality, cost, lead

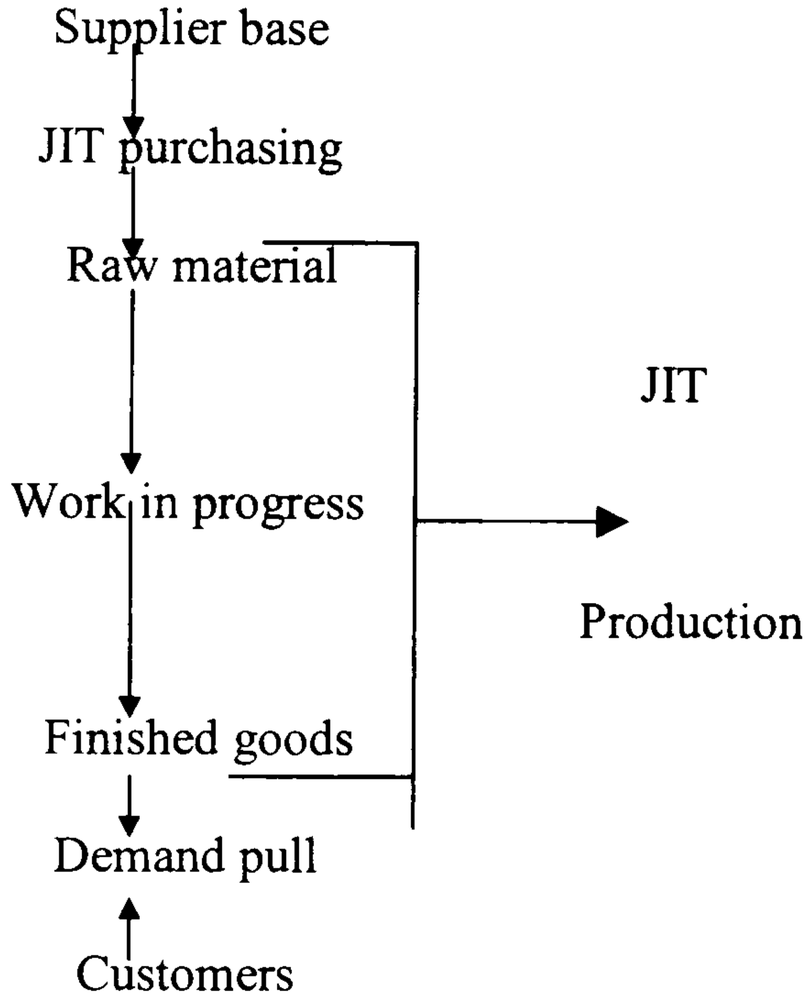
time, customer service and flexibility are accepted as concurrent (rather than opposing) goals by all companies aspiring to be world class manufacturers." According to Todd (1995), it is needed for a new manufacturing management to be a world class manufacturer. The most important things are the keywords associated with the new manufacturing management. Storey (1994) indicated that the keywords associated with the new manufacturing management are "'flexibility', 'quality', 'teamworking', 'Just-in-Time' delivery, 'right-first-time' production, the elimination of waste and non-value-added activity, 'zero-defects' and 'continual improvement'." Less certain is the extent to which it is possible to install individual elements or whether there is a coherent package which, in effect, has to be implemented as a whole. all of the above mentioned keywords of the new manufacturing management can be found inside the two of the world class manufacturing philosophies, which are Just-In-Time and Total Quality Management.

2.3 Just in Time (JIT)Philosophy

Just-In-Time is a manufacturing philosophy which aims to restructure the manufacturing process to bring about more flexible, rapid and cost effective production. "Just-in-Time manufacturing is a Japanese management philosophy applied in manufacturing which involves having the right items of the right quantity and quality in the right place and at the right time"(Cheng and Podolsky, 1993). JIT philosophy includes two sets of activities: JIT purchasing which aims to match the acquisition and receipt of material sufficiently closely with usage that raw material inventory is reduced to near-zero levels, and JIT production which aims to let production takes place only through a pull-system driven by the demand for finished products (Bromwich and Bhimani, 1989). "JIT production's aim is to obtain low cost, high quality, on-time production to order by minimising stock levels between successive processes and therefore idle equipment, facilities and workers" (Bromwich and Bhimani,1989). Figure 2.3 shows the two separate sets of activities of JIT technique: JIT purchasing and production. JIT purchasing has received an increasing amount of attention in the operations management and management accounting literature. According to Horngren, Foster, and Datar (1997), JIT purchasing "is the purchase of goods or materials such that delivery immediately precedes demand or use." Some companies, especially those with high levels of bought out materials, start

implementing JIT purchasing by looking first at the purchasing function (Wheatley, 1992). The shifting of focus, in JIT environment, towards high-quality of parts and make frequent deliveries of the exact quantities specified on a timely basis, these to eliminate non-value-adding costs (Cheng and Podolsky, 1993: Horngren, Foster, and Datar, 1997).

Figure 2.3 JIT Purchasing and Production Technique



Source: Moyes, J. (1988). 'The Dangers of JIT', *Management Accounting (UK),* February, p.22.

Table 2.3 is a summary of comparing purchasing activities under the traditional purchasing and JIT purchasing systems. Effective use of JIT purchasing system can reduce the inventory investment and hence the costs of carrying inventories (Goyal and Deshmukh, 1992). JIT purchasing approach is aim to build strong and enduring relationships with a limited number of suppliers. This involves a long term view of the buyer/supplier relationship (Wong, 2000). The closer the supplier is to the buyer's plant, the easier it is to make more frequent deliveries of smaller lots. Ideally, this may allow the supplier to initiate JIT production in his/her own plant and so link up with the buyer's JIT production system (Bierman and Hilton, 1990).

Table 2.3 Comparative Analysis of Purchasing Practices

Purchasing activity	**JIT purchasing**	**Traditional purchasing**
Purchase lot size	Purchase in small lots with frequent deliveries	Purchase in large batch size with less frequent deliveries
Selecting supplier	Single source of supply for a given part in nearby geographical area with a long-term contract	Rely on multiple sources of supply for a given part and short-term contracts
Evaluating supplier	Emphasis is placed on product quality, delivery performance, and price, but no percentage of reject from supplier is acceptable	Emphasis is placed on product quality, delivery performance and price but about 2% reject from supplier is acceptable
Receiving inspection	Counting and receiving inspection of incoming parts is reduced and eventually eliminated	Buyer is responsible for receiving, counting, and inspecting all incoming parts
Negotiating and bidding process	Primary objective is to achieve product quality through a long-term contract and fair price	Primary objective is to get the lowest possible price
Determining mode of transportation	Concern for both inbound and outbound freight, and on-time delivery. Delivery schedule left to the buyer	Concern for outbound freight and lower outbound costs. Delivery schedule left to the supplier
Product specification	'Loose' specification. The buyer relies more on performance specifications than on product design and the supplier is encouraged to be more innovative	'Rigid' specifications. The buyer relies more on design specifications than on product performance and suppliers have less freedom in design specifications
Paperwork	Less formal paperwork. Delivery time and quality level can be changed by telephone calls	Requires great deal of time and formal paperwork. Changes in delivery date and quality require purchase orders
Packaging	Small standard containers used to hold exact quantity and to specify the precise specification	Regular packaging for every part type and part number with no clear specifications on product content

Source: Lee, S. M. and Ansari, A. (1987). 'Comparing Japanese and Traditional Purchasing', in C. A. Voss, *International Trends in Manufacturing Technology: Just-in-Time Manufacture*, UK, IFS Publications Ltd.

2.3.1 Definitions of JIT

JIT had its beginnings as a method of reducing inventory levels within Japanese shipyards (Goddard, 1986). Today, JIT has evolved into a management philosophy containing a body of knowledge and encompassing a comprehensive set of manufacturing principles. JIT is a manufacturing technique based upon the principles of simplicity and basic manufacturing excellence. According to Wong (2000), for a manufacturing company to achieve business excellence, its customers have to be satisfied with the performance of the company. JIT manufacturing has the capacity, when properly adapted to the organisation, to strengthen the organisation's competitiveness in the marketplace substantially by reducing wastes and improving product quality and efficiency of production to satisfy customer.

JIT is a philosophy of eliminating waste, classified as any activity not adding value to the product. It is used in all departments and processes of the organisation right from purchase of materials through production, assembly, packaging and distribution to the customer. It was originated in Japan around 20 years ago, and within the past decade western companies have begun to show a keen interest in the benefits it could provide (Monden, 1998). Without the efforts of Taiichi Ohno, the father of the Toyota Production System and former vice president of the Toyota company, and Shigeo Shingo, the man who served a very important role as a consultant during JIT's formative period, Japan's manufacturing industries would not have developed as they have, and Japanese products such as automobiles and home electronics would not be as widely used by people throughout the world as they are today (Majima, 1992; Monden, 1988). Majima said that:

> Taiichi Ohno originated the just-in-time production concept of 'supply the market with what is needed when it is needed and in the exact quantities needed'. We are indebted to him because the actual result of his work not only turned Toyota into a colossal super company, but also turned Japan into a world class manufacturing power.

In practice it is difficult to find a definition that covers all the important aspects of JIT. One of the reasons for the difficulty in defining JIT could be that awareness of its applications has changed along with its development. JIT, at first, was considered as inventory management, later becoming a waste-elimination and quality control method. According to Goyal and Deshmukh (1992), JIT has been described as many different things by leading authors. Schniederjans (1993) mentioned that three of the

most common descriptions of JIT are: a methodology to achieve manufacturing excellence, a philosophy to guide everyday work activities, or a strategy for the marketplace.

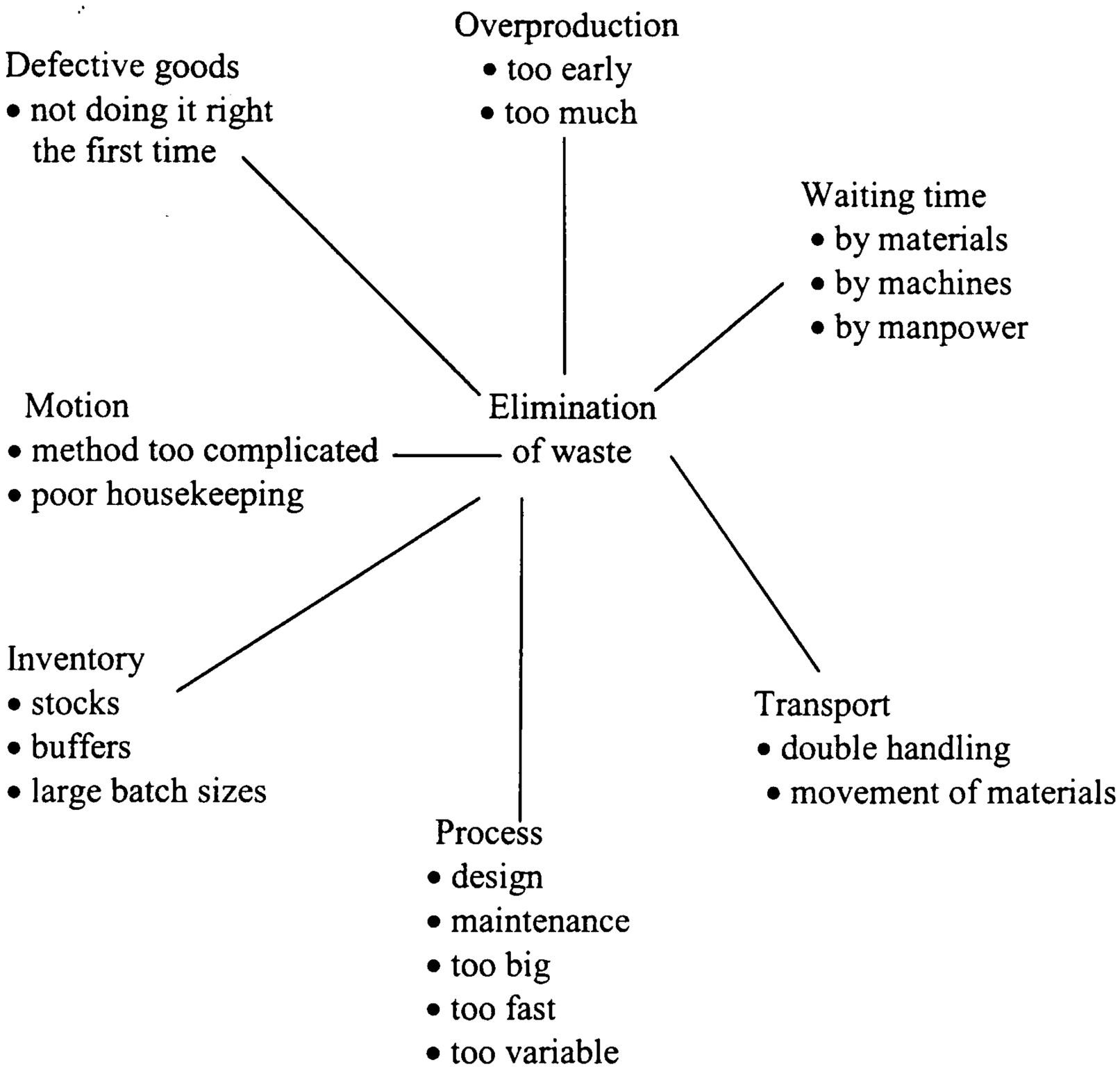
A selection of definitions by leading authors for JIT are given below. One of the most important definitions of JIT as a philosophy is provided by Power and Sohal (2000). They said that:

> Just-In-Time is a philosophy aimed at minimising total costs through the pursuit of continuous improvement, the application of specific manufacturing and purchasing techniques, a commitment to total quality and the unlocking of the full potential of an organisation's human resources.

A simple definition that adequately describes the overall goal of JIT manufacturing is by Voss (1988). He summarises it as: "An approach that ensures that the right quantities are purchased and made at the right time and quality, and that there is no waste." Suzaki (1987), Hay (1988), Harrison (1992), and Schniederjans (1993) identified seven types of waste. Figure 2.3.1.1 illustrates and summarises these seven types of waste. In general, if an action does not directly add value to marketable product, the action is wasteful. According to Maskell (1986), the continuous elimination of waste focus on every aspect of the manufacturing process. He said that:

> The continuous elimination of waste is brought about by changes to every aspect of the manufacturing process, notably:
> • elimination of raw materials inventories by the suppliers delivering direct to the shopfloor just in time for use;
> • elimination of WIP by reducing batch sizes (ideally to one);
> • elimination of finished goods inventories by reducing lead times so that all products are made to order;
> • elimination of scrap and rework by an emphasis on total quality control of design, of the process and of the materials;
> • elimination of material handling costs by re-design of the shopfloor so that goods move directly between adjacent work centres.

Figure 2.3.1.1 Elimination of Waste



Source: Harrison, Alan (1992). *Just-in-time Manufacturing in Perspective,* London, Prentice Hall.

The predominant objective of JIT system is the elimination of waste throughout manufacturing process. Hay(1988) in his definition of JIT focuses on the previous objective. He said that:

> Just In Time is a manufacturing philosophy, a philosophy of eliminating waste in the total manufacturing process, from purchasing through distribution. If this philosophy is properly implemented, JIT enables a company to develop manufacturing into a strategic weapon.

Vonderembse and White (1991) have defined Just-In-Time as:

> A philosophy of operation that seeks to maximise efficiency and eliminate waste in any form, influencing all parts of a company, including purchasing, engineering, marketing, personnel, and quality control, and even determining the relationships among the company, its suppliers, and its customers.

According to Keller and Kazaki (1993), Schonberger has offered several definitions for JIT. They mentioned that his first definition is in simple terms of what happens and the second is more general definition. The first definition is:

> Produce and deliver finished goods just in time to be sold, sub-assemblies just in time to be assembled into finished goods, fabricated parts just in time to go into the sub-assemblies and purchased materials just in time to be transformed into fabricated parts.

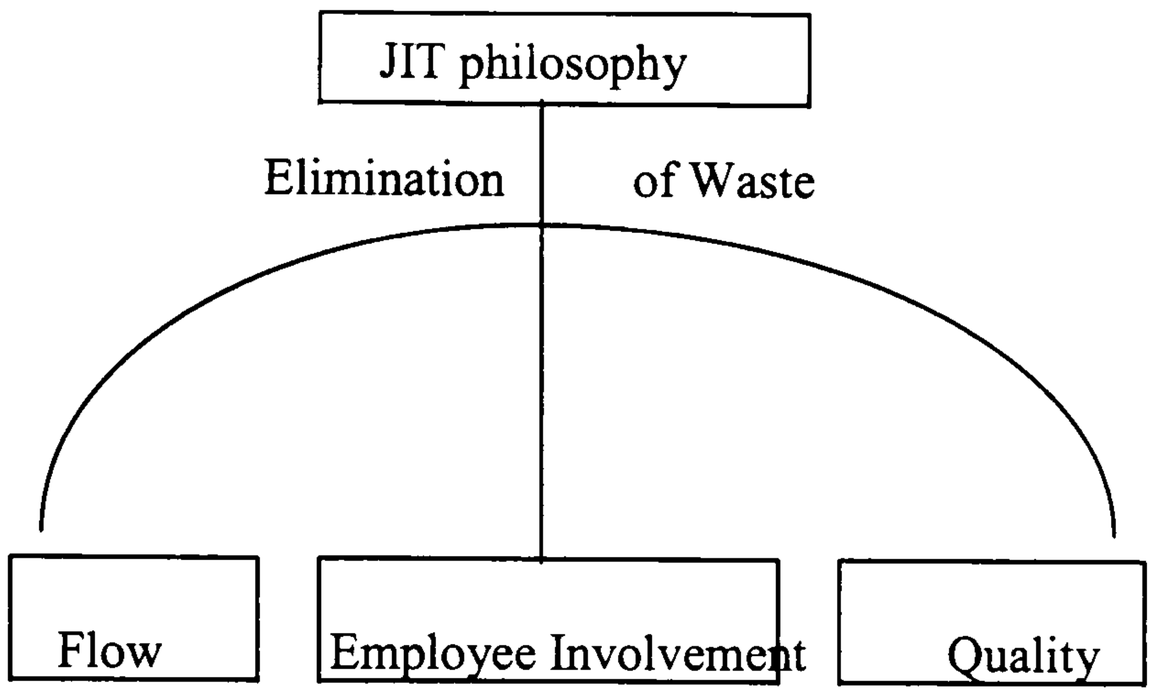
The second definition is: "Strategy or guiding philosophy whose goal it is to seek manufacturing excellence." Bicheno (1991) also indicated that the American Production and Inventory Control Society (APICS) defined JIT in two ways. He said that

> In the broad sense, an approach to achieving excellence in a manufacturing company based on the continuing elimination of waste....In the narrow sense, just-in-time refers to the movement of material at the necessary place at the necessary time.

JIT is a manufacturing philosophy/technique which have a few basic assumptions, about the right way to manufacture and the right way to conduct business with suppliers and customers, that lead to efficient and productive manufacturing (Toffler, 1989; Cheng and Podolsky, 1993). According to Schonberger (1986, 1996), and Hay (1988), the means with the JIT philosophy tackles this is by concentrating on the flow of materials through the supply chain, employee involvement in pushing forward to accomplish the strict demands placed by the JIT philosophy and finally through quality in every level of operations (See figure 2.3.1.2).

The basic diagram in figure 2.3.1.2 provides a starting point from which to describe the JIT philosophy and how it focuses on elimination of waste. There are three basic and equally important components for eliminating waste in a JIT environment. The first component in JIT philosophy is flow in the manufacturing process. The second component is quality, the idea of doing it 'right the first time, every time'. The third component is employee involvement.

Figure 2.3.1.2 The JIT Philosophy



Uniform plant load
Reduced setup time
Overlapping operations
Pull system(linking operations)
JIT purchasing

Source: Hay, Edward J. (1988). *The Just-In-Time Breakthrough: Implementing the New Manufacturing Basics,* New York, John Wiley& Sons.

2.3.2 The Implementing of JIT

The use of JIT philosophy/technique has resulted in reduction of inventory, increases in quality, productivity and efficiency, improved communication and decreases in costs and wastes (Samson, 1991). The potential of gaining these benefits has made many organisations consider this approach to manufacturing, as a means to achieve world class status (Todd, 1995).

Walleigh (1986) draws on his experience at Hewlett-Packard to argue:

> JIT is not just a better way to reduce inventory in order to get a better return on assets, it is a means of solving the problems that block the building of an excellent manufacturing organisation.

Walleigh points out that JIT involves problem solving throughout the value-adding chain in an organisation and that JIT is a demand-pull system, producing only what is necessary to satisfy the demand of the succeeding operation. JIT is a fast-cycle reaction system, pulling material towards the end of the process only as it is needed. A pull system means that materials are viewed as being pulled from preceding work centres only when needed by the subsequent ones (Singh and Brar, 1992). JIT uses a pull system to move parts and materials. Instead of pushing materials through

processing based on a pre-planned schedule, a pull system moves materials based on actual needs at successive work centres (Steudel and Desruelle, 1991). Within a JIT technique, one of the best methods to pull materials and parts is a method developed by Toyota based on *Kanban,* as they are called in Japan (Monden, 1998). The role of *Kanban* is to ensure a continuous flow of materials to the right places at the right time at the right quantities (Schniederjans, 1993). Williams (1994) explained the *Kanban* and how it is used in a JIT environment. He said that:

> In JIT a 'Kanban' is an order card attached to a container of parts. Such cards take two forms; a 'conveyance Kanban' which is carried when going from one process to the preceding process, and a 'production Kanban' which is used to order the production of the parts used by the subsequent process. When the contents of a container of parts begin to be used the conveyance Kanban is removed from the container and taken to the stock point of the preceding process and attached to the container held there. This container holds the production Kanban, and this is removed and used to trigger the production of parts to replace those withdrawn. These are produced as soon as possible. The processes in the line are therefore linked to the preceding processes or external subcontractors. By attention to the variables governing the Kanban movement, the operation of the plant is driven towards that of an indexing conveyor.

The Toyota motor company has developed a Kanban as a powerful technique in JIT environment (Monden, 1998). Samson (1991) highlighted how some of JIT techniques link together. He said that:

> By reducing set-up times, often dramatically, JIT procedures lead to linkages between manufacture, assembly and delivery that were previously not possible, lower work-in-progress and space requirements as well as reduced shrinkage. The linkages that can be established once set-up times are shorter lead to shorter lead times, better equipment utilisation and better quality, through having a more actively committed work group.

Successful setup time reduction requires a close knowledge of the processes used, as well as how they can be modified to permit rapid changeovers between batches of different parts (Steudel and Desruelle, 1991).

It is certainly true that not all attempts to implement JIT have been successful in manufacturing companies. In studying how JIT can be adapted to fit Western manufacturing organisations, Rehder (1988) argues that:

> Just-in-time is a production-smoothing system that sharply reduces the impact of product-line diversity on production cost. It induces team pride in performance by giving individuals a sense of control and a sense of responsibility to the next step in the process. The effect of JIT on factory performance through reducing material handling, batch sizes, and inventory levels is most attractive to American managers. However, they often fail to see JIT will only produce high performance levels within a company-wide quality control system.

According to Hay (1988), JIT implementation associated with two kind of issues; technological and managerial. He said that:

> The issues associated with JIT can be seen as falling into two main categories. First, there are technological issues: how to level the load, set up work cells, and reduce machine set-up time. Second, there are numerous management issues: the greatest being how to foster a climate within the corporation under which a successful change to a JIT environment can take place.

To do this, all management levels inside a company must understand the benefits JIT can have to their organisation. Hay has worked with all kinds of companies to implement JIT philosophy. Figure 2.3.2 shows some of the more tangible results of JIT implementation and the elimination of waste. The figures represent ranges of improvement gained by Hay's clients in a number of different industries. Some of these improvements convert directly to dollars, while others are more obviously improvement in service to customers.

Horngren, Foster, and Datar (1997) in their book divided the benefits of implementing JIT technique into two categories: financial benefits and product-costing benefits. They said that:

> JIT can provide many financial benefits, including
> 1- Lower investment in inventories.
> 2- Reductions in carrying and handling costs of inventories.
> 3- Reductions in risk of obsolescence of inventories.
> 4- Lower investment in plant space for inventories and production.
> 5- Reductions in setup costs and total manufacturing costs.
> 6- Reduction in costs of waste and spoilage as a result of improved quality.
> 7- Higher revenues as a result of responding faster to customers.
> 8- Reductions in paperwork.

Figure 2.3.2 JIT Opportunities

	Range of Improvement(%)
Lead-time reduction	83-92
Productivity increase	
Direct labour	5-50
Indirect labour	21-60
Cost of quality reduction	26-63
Purchased material price reduction	6-45
Inventory reduction	
Purchased material	35-73
Work in process	70-89
Finished goods	0-90
Setup reduction	75-94
Space reduction	39-80

Source: Hay, Edward J. (1988). *The Just-In-Time Breakthrough: Implementing the New Manufacturing Basics,* New York, John Wiley& Sons.

In addition to the above mentioned financial benefits of JIT, Horngren, Foster, and Datar also presented the product-costing benefits of JIT. They said that:

> In reducing the need for material handling, warehousing, inspection of supplies, and other activities, JIT systems reduce overhead costs. JIT systems also facilitate the direct tracing of some that were formerly classified as overhead. For example, the use of manufacturing cells makes it easy to trace materials handling and machine operating costs to specific products or product families made in specific cells. These costs then become direct costs of those products. Also, the use of multiskilled workers in these cells allows the costs of setup, minor maintenance, and quality inspection to become easily traced, direct costs.

According to Voss and Harrison (1988),there are four aspects which need to change, in order to obtain a successful implementation of JIT philosophy. They said that:

> There are many things embodied in the traditional way of manufacturing which conflict with the requirements of JIT.....There are four areas where a company must change: measures of performance, flexibility in the organisation, a focus on the doer, continuous improvement.

Cheng and Podolsky (1993) indicated that performance measurement systems for JIT serve two purposes: "providing the basis for monitoring implementation activities,

monitoring or tracking the progress of work; and providing a standard for improvement activities." Using traditional performance measurement systems alone, will militate against successful JIT implementation. Cheng and Podolsky highlighted this, by saying that:

> Although an organisation is likely to have measurement systems in place prior to JIT implementation, these traditional measurements are not likely to reflect JIT organisational requirements. JIT measurement systems differ from traditional measurement systems on three levels: they must relate to organisational strategic objective, provide information which reflects the organisational direction and relate the organisation's performance in terms of improvement.

In JIT environment, effective performance measures and reports must be accurately defined and continually updated to ensure they are measuring what is actually meant to be measured and to support continuous improvement effort. The traditional focus of manufacturing management has been problem solving. However, once a problem is solved, companies tend to leave well alone. In a JIT environment, the focus changes to continuous improvement. When a problem is solved, the company must seek to improve still further; it must seek for further ways to eliminate waste and continuously improve performance. TQM is very close to JIT, and at the same time helps manufacturing companies to focus on the continuous improvement philosophy.

An essential partner in a JIT environment is TQM. JIT and TQM are two sides of the same coin (Toffler, 1989). Sandras (1989) considers that: "Just-in-Time and Total Quality Control are two sides of the same coin... Just-in-Time is going to force you to practice Total Quality Control." If all waste is to be removed, a tool is required to deal with the problems which will appear when the slack, safety stock and safety lead time, are removed. TQM plays this role of solving problems.

2.4 Total Quality Management (TQM) Philosophy

Quality is the one major factor which underpins the success or failure of a company wishing to compete in a global manufacturing market. Across the world, manufacturing is undergoing substantial changes necessitated by fierce competition in an expanding global market. Manufacturing companies around the world are under increasing pressure to lower costs, increase efficiency, increase effectiveness, and improve quality because of growing global competition.

During the last decade, quality management and improvement have become a fundamental strategy for many manufacturing companies (Stitt, 1989). The developments in the management and improvement of quality during the 1990s led increasingly to the international adoption of the principle of business improvement through TQM. A number of American quality gurus have been advising manufacturing companies on how they should manage and implement quality. Deming, Juran, Crosby and other internationally known quality experts or gurus strongly encourage all organisations to adopt continuous improvement in support of the goal of TQM (Harrington, 1987). It is difficult to decide which of the 'gurus' of TQM to follow. When adopting the teachings of one of the masters of TQM, the question of ability to sustain the quality improvement process should be considered. The best approach to TQM has to be the most practical approach (Early, 1995).

Many manufacturing companies adopted and started implementing TQM to improve their products and processes, to satisfy customer (Sirvanci and Durmaz, 1994). "Companies adopting TQM often have customer satisfaction as an objective of their operations" (Wong, 2000). Eklof and Westlund (1998) point out the usefulness of customer satisfaction to TQM. They stated that:

> Customer satisfaction studies have traditionally been seen as merely a tool for market analysis. However, it should be appreciated that continuous monitoring of customer satisfaction constitutes an invaluable source for all strategic business analysis and management. Thus, it should play a central role in the company's TQM.

TQM has been presented as a new and coherent philosophy of organisation and management, which looks holistically at organisations (Sinclair and Collins, 1994). TQM philosophy provides the overall concept that fosters continuous improvement in an organisation with involving everyone and everything. This philosophy focuses primarily on total satisfaction of both the internal and external customers, use of all people, usually in multi-functional teams, and seeks continuous improvement of all systems and processes. According to Ho, Cheng and Fong (2000), the basic principles of TQM philosophy are customer focus, continuous improvement and teamwork. If TQM philosophy is understood, the operators, the management and the company's manufacturing standing will all benefit.

2.4.1 Definitions of TQM

TQM is a way of managing business processes to ensure complete customer satisfaction at every stage, internally and externally. Agus et al. (2000) said that:

> TQM is a management philosophy under which an organisation operates which seeks to improve quality and increase customer satisfaction. The philosophy is holistic, applying to everything (total). Its aim is to satisfy all customers, internal and external.

Using quality as a strategic weapon is meant to help an organisation to achieve its overall objective by improving the organisation's customer impact, reducing its cost structure, increasing its competitive market share and maximising its employee productivity (Oakland, 1999). According to Davidson *et al.* (2000), for TQM to operate flawlessly, quality must exist at every stage from design to customer post-purchase satisfaction.

There are many definitions of TQM. TQM may be defined as an organisation-wide activity for improving business performance that has to reach every individual within an organisation. Oakland (1993), has propounded this viewpoint by defining TQM as follows:

> Total Quality Management (TQM) is an approach to improving the effectiveness and flexibility of business as a whole. It is essentially a way of organising and involving the whole organisation; every department, every single person at every level.

TQM may be defined as a management philosophy which is rich with practical guidelines for the management practitioner who attempts to improve the quality level

of products and services. According to McCarthy and Elshennawy (1991), the Department of Defense (DoD) at U.S.A defines TQM in this way:

> TQM is both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organisation. TQM is the application of quantitative methods and human resources to improve the material and services supplied to an organisation, and the degree to which the needs of the customer are met, now and in the future. TQM integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach focused on continuous improvement.

TQM has been based on the quest for progress and continual improvement in the areas of cost, reliability, quality, innovative efficiency and business effectiveness (Fisher, 1992; Lakhe and Mohanty, 1994; Zaire and Simintiras, 1991).

TQM is best defined as: "A strategy for improving business performance through the commitment of all employees to fully satisfying agreed customer requirements at the lowest overall cost through the continuous improvement of products and services, business processes and the people involved" (Jones, 1992).

According to the above mentioned definitions, there are seven key principles of TQM philosophy. TQM philosophy is a *management philosophy*, seeks *continuous improvement* in all processes, products, and services, requires the *understanding of variation*, emphasises the *importance of measurement,* requires an understanding of the *role of the customer,* emphasises the *involvement of employees* at all levels, and recognises that *management plays the key role* (Fisher, 1992).

Thus, TQM in an organisation brings all the people together to ensure and improve product-process quality, the work environment and working culture (Barron and Gjerde, 1996; Tobin, 1990; Whicher, 1990). It means that TQM is concerned with looking at organisation as total systems of inter-linked activities contributing in different ways to creating added value to products and services destined for the customer (Pfau, 1989; Saylor, 1992).

2.4.2 The Relationship Between ISO 9000 and TQM

Deming, Juran, and Crosby recommend tools and techniques such as Statistical Process Control (SPC) which bring the reality of quality improvement to all levels of the company and particularly the shop-floor. SPC is an approach using statistical techniques for assisting operators, supervisors, and managers to manage quality and to eliminate special causes of variability in a process (Oakland, 1986). According to Early (1995), "if TQM is not transmitted throughout the organisation in practical terms, accessible to all staff, the likelihood of early demise will be so much greater...In this respect many companies choose to implement a Quality Management System (QMS) registered to ISO 9000 before embarking on a TQM process."

It is widely accepted that product quality to customer requirements is of paramount importance and that maintaining standards requires the use of a suitable quality system. This system should permeate the business in all areas and at all levels and would fundamentally ensure the quality of incoming parts and outgoing products through sound planning and process control. Quality is meeting and, if possible , exceeding the customer's expectations. In a building this can only be realised by the systematic management of clearly defined customer requirements. The international ISO 9000 series of standards offers guidance for establishing and maintaining a quality system for many company providing a product (Ho, 1994).

Some customers require their suppliers to hold a certification of ISO 9000 approval before they will award any business, and this makes approval essential. It always debatable whether it is better to implement TQM or ISO 9000 first. However, if one sees ISO 9000 as a route to TQM, they are complementary to one other. Companies who are already on TQM, installing ISO 9000 is relatively straightforward. On the other hand, if companies are planning towards TQM, they can use ISO 9000 as a vehicle. Companies can use ISO 9000 as a structural framework for the implementation of TQM. According to Ho (1994), companies can use ISO 9000 as a route to implementing TQM. He said advised:

> Try to develop a Quality Manual for ISO 9000 that is suitable for your company and its customers. Fully implement it and then go for continuous improvement. This will lead your company towards TQM in a systematic way...Even with ISO 9000 certification in hand, it would not guarantee that the products and services are of high quality.

In order to produce quality products and services, the system needs TQM to lift it up to expectations.

Certification to ISO 9000 is an objective process of confirmation that a supplier is able to meet customer requirements. As meeting customer requirements is the basis of TQM, the implementation and registration of ISO 9000 is a logical first step towards TQM. It is a first step which enables independent recognition of ability in quality management. ISO 9000 certification can provide an important motivate for quality improvement and success in TQM (Early, 1995). A comparison of the key features of an ISO 9000 registered Quality Management System (QMS) and TQM is given in Table 2.4.2

Table 2.4.2 Distinctions Between TQM and the Systematic Approach to Quality Management of ISO 9000

Total Quality Management	**Quality Management System**
A philosophical approach to quality management	A systems approach to quality management
Operates through personnel taking individual responsibility for their actions	Operates through documented procedures
Primary focus on continuous satisfaction of customers through quality improvement	Primary focus on continuous satisfaction of customers through compliance with specifications
Secondary focus on the reduction of quality related costs	
Company-wide approach covering all departments	Product and service orientated
Emphasis on culture change enhancing personnel commitment	Personnel are trained for involvement
Involvement of all personnel is encouraged	Requires only the involvement of personnel concerned with the product or service
Recognition of achievement through performance and confidence of customers	International recognition of achievement through registration to ISO 9000
Self-motivated through quality improvement and quality cost reduction	Driven by routine surveillance by the certification body
Company-wide high visibility is stressed	Often low visibility throughout the company

Source: Early, Ralph (1995). *Guide to Quality Management Systems for the Food Industry,* London, Chapman & Hall.

2.4.3 The Implementing of TQM

The implementing of TQM is a major task. Sink (1991) has suggested the following approach to the design, development and implementation of TQM:

Stage 0: understanding the organisational system.
Stage 1: developing a strategic plan for the TQM effort.
Stage 2: planning assumptions.
Stage 3: specifying strategic objectives.
Stage 4: specifying tactical objectives.
Stage 5: implementation planning.
Stage 6: project management.
Stage 7: measurement and evaluation.
Stage 8: evaluation, accountability, follow through, ensuring effective implementation.

According to Oakland (1991, 1993), the task of implementing TQM can be daunting; the first decision is where to begin. He indicated that responsibility for quality control should be on the shopfloor, all employees should be involved, control instructions should be given, preventative/feedforward measures should be used when possible, action must be taken promptly in the event of a problem, all equipment should be checked for adequacy, suppliers should be developed, training should be given, continuous improvements should be made, performance should be measured. However, implementation of TQM is not an easy task as it requires a total change in organisational culture, and continuous participation of all employees in the quality improvement process. Table 2.4.3 outlines the framework for implementing TQM in an organisation. The improvement of such TQM-based frameworks is important given the increasing use of self-assessment by organisations (Black and porter, 1996; Ahire, Golhar, and Waller, 1996). Cullen (1991), writing about TQM in the Rover Group, recognises five conditions to be necessary and sufficient for taking a company towards TQM:

1. Leadership from the top.
2. Effective management of the cost of quality.
3. Focus on customer satisfaction.
4. Continuous improvement in all aspects of all operations.
5. Complete involvement of everyone in quality improvement.

Table 2.4.3 Framework for Implementing TQM

1.	Identify the degree of commitment and key interests and list the long-term changes required
2.	Define the objectives of TQM
3.	Identify resources available and develop understanding of organisational system with quality system
4.	Specify top management commitment through quality policies, procedures and processes
5.	Create company-wide awareness and participate work environment by emphasising customer-oriented values. Encourage quality commitment
6.	Design action plans and develop specifics about future
7.	Identify key issues and constraints on implementation and develop strategies for implementation
8.	Identify and allocate resources, execute plans and build momentum for change
9.	Implement and monitor
10.	Measure benefits in terms of increased customer satisfaction
11.	Review and reward

Source: Lakhe, R. R., and Mohanty, R. P.(1994). 'Total Quality Management: Concepts, Evolution and Acceptability in Developing Economies', *International Journal of Quality & Reliability Management,* Vol. 11, No 9, pp. 9-33.

The key message from Cullen's list is that the manufacture of quality products is not just the responsibility of direct line operators. Everybody working within a company has an influence on quality and, hence, profitability. It can clearly be seen from this list that effective management can have a considerable influence. Management have the responsibility for providing adequate systems and procedures to allow line operators to produce quality products. Therefore, the true sign of TQM may be the continuous pursuit of quality in every area of company.

Successful implementation of TQM requires that "measures be taken to consider ramifications and to plan more for the long term when it comes to capital improvement expenditures" (Pitman, 1994). The company must maintain a customer focus and involve the customer in the product design phase. Employees must also be empowered to act immediately when serious quality problems are identified. They must be trained on the TQM practices. Seen in this way, TQM is about continuous performance improvement. According to Kanji (1996), to improve performance, people need to know what to do and how to do it, to have the right tools to do it, to be

able to measure performance and to receive feedback on current levels of achievement, performance measurement systems. Ho, Cheng and Fong (2000) said that: "Successful implementation of TQM requires all members of an organisation to focus on the needs of internal and external customers and work as teams to improve quality continuously using a set of tools and techniques."

The benefits from implementing TQM in companies include lower long-run costs, higher resulting profits, less rework, more satisfied customers and greater market share (Ross, 1993; Talley, 1989; Forker *et al.* 1996). TQM has been shown to contribute to greater market share and return on investments (United States General Accounting Office, 1994; Cole, 1992), as well as lower manufacturing costs in the long run and improved productivity (Garvin, 1983). Reed *et al.* (1996) considers TQM in relation to firm orientation and identifies market advantage, product design efficiency, process efficiency, and product reliability as the key features of its content, which lead to performance expectations for TQM, in the form of increased revenues, reduced costs and their time lags.

According to Youssef *et al.* (1996), reported TQM benefits include: better quality, faster organisational learning, promoting continuous improvement, increasing firm's flexibility, and enhancing firm's responsiveness. They present three main arguments. First, they argue that 'these benefits may not be realised immediately.' Second, they argue that 'TQM in and by itself cannot succeed unless it is integrated with other time-based philosophies such as just-in-time (JIT), design for manufacturability (DFM) and group technology (GT).' Finally, they argue that 'a holistic view of TQM must prevail throughout the organisation and that a major part of the organisation must have been converted to using TQM tools and activities.' Therefor, there are three essential variables for the successful of TQM, time, organisational transformation to TQM culture and the integration of TQM with time-based philosophies, such as JIT. According Agus *et al.* (2000), the organisation's TQM culture "is defined by and supports the constant attainment of customer satisfaction." It is argued that TQM technique can achieve its full potential by the integration of TQM and other performance improvement techniques, such as JIT (Ho, Cheng and Fong, 2000).

2.5 The Relationship Between JIT and TQM

JIT and TQM philosophies are part of many organisational change initiatives or generally accepted 'good' management practices (Davidson *et al.,* 2000). JIT philosophy focuses on waste elimination (non value-added), inventories, throughput, and the reduction of time to market. TQM philosophy focuses on quality and getting things right first time, every time.

JIT and TQM have received enormous attention from organisations all around the world as useful strategies to improve their competitiveness (Sriparavastu and Gupta, 1997; Vuppalapati *et. al.* 1995). Japanese companies that excel in manufacturing, and thus have been referenced for competitive benchmarking, reveals that their outstanding operations have followed a more eclectic approach, by the adoption of JIT and TQM philosophies (Miyake *et al.,* 1995). The Japanese concept of JIT production is often cited in the quality literature and several researchers use the philosophies of JIT to discuss the correlation between product quality and market success (Monden, 1993). For example, Schonberger (1982) argues that the JIT system leads to less scrap, better quality and higher productivity. The important part of the JIT production system is to attain a high-quality product the first time. This is by implementing TQM philosophy. Since, by definition, a JIT producer uses small lot sizes, a zero defects plan is needed, leading to higher overall quality levels, less scrap, and consequently greater productivity. Producing at higher levels of quality, by implementing TQM, also means less buffer inventory is needed to keep downstream processes fed with materials.

Improving quality is made possible through TQM. Employees in manufacturing companies which espouse the principles of TQM are required to possess a full understanding of job requirements, prevent quality problems, understand the impact of quality costs and seek to reduce of eliminate the costs of poor quality. Maintaining and improving quality is an integral part of JIT (Harrison, 1992). According to Harrison, it is difficult to speak about one without mention of the other. JIT and TQM have in common the basic idea that the manufacturing systems' overall performance results not only from front-line operators' direct work, but also from the interaction of a whole set of concatenated activities that must be fulfilled by employees allocated at diverse functional spheres, internal or external to manufacturing systems (Miyake *et. al.,* 1995). Davidson *et al.* (2000) highlighted that JIT facilitates TQM in that it has a

flexible manufacturing process and it allows for little or no finished goods inventory. They also mentioned that JIT could only work efficiently if TQM is present.

The foregoing discussion on JIT and TQM philosophies shows that manufacturing companies have three options to design strategies for improvements in their operational performance. These options are: "(1) implement JIT manufacturing systems; (2) implement TQM philosophy alone; or (3) implement a synthesised whole of JIT manufacturing systems and TQM philosophy throughout the organisation" (Vauppalapati *et al.,* 1995). According to Vauppalati *et al.,* operational performance of manufacturing companies which implementing both JIT and TQM concurrently is better than manufacturing companies implementing JIT or TQM alone. The significance of the concurrent application of JIT and TQM philosophies for manufacturing systems performance improvement gains momentum, not only by providing a more comprehensive approach, but also because the magnitude of the resulting boost in overall performance can be larger (Miyake *et al.,* 1995; Sriparavastu and Gupta, 1997).

Flynn *et al.* (1995) established that there is a relationship between TQM and JIT practices and performance. They show that, although TQM and JIT function effectively in isolation, their combination yields synergies that lead to further performance improvement. They propose that the use of TQM philosophy will improve JIT performance through process variance reduction. Reduction in variances permits safety stock inventory reduction and yields shorter cycle times, both standard measures of JIT performance, through elimination of rework. They also propose that the use of JIT philosophy will improve TQM performance through its effect on quality performance by reducing lot sizes, which reduces potential scrap and rework resulting from process failure. They used data of 42 plants in three US industries and found that common infrastructure practices formed a strong foundation for both types of performance. In addition, they demonstrated that TQM and JIT practices interacted. Sriparavastu and Gupta (1997) in their research, "An Empirical Study of Just-in-Time and Total Quality Management Principles Implementation in Manufacturing Firms in the USA", concluded that a joint implementation of JIT and TQM techniques resulted in continuous improvement of higher performance than the results of implementing either one.

2.6 Summary

Traditional manufacturing thinking has been to reduce cost with the greatest possible efficiency and utilisation of both equipment and labour. In such environments, product and processes did not flow. Inventory was built in large quantities and stored for later manufacturing use. Another objective was to maximise the output or efficiency of each manufacturing operation as the order was processed.

These traditional objectives in manufacturing are being challenged today as manufacturing professionals are questioning the value of large inventories, multilevel manufacturing processes with long lead times, and long setup times. This is especially so in WCM environment. The concept of 'world class' manufacturing is closely aligned with development in manufacturing strategy (Hill, 1993; Voss, 1992; Schroeder et al., 1986). Number of authors have developed this concept, often basing their models of world class performance on Japanese companies (Schonberger, 1986 and 1996; Todd, 1995). According to Hayes et al. (1988), key attributes of WCM are:

- becoming the best competitor;
- growing more rapidly and being more profitable than competitors;
- hiring and retaining the best people;
- being able to respond quickly and decisively to changing market conditions;
- continually improving, this is considered to be the 'ultimate test of a world class organisation.

This emphasis on continuous improvement is developer by Schonberger (1986). He said that: "Today there is wide agreement that continual improvement in quality, cost, lead time and customer service is possible, realistic and necessary...one more primary goal, improved flexibility, is also part of the package...with agreement on the goals, the management challenge is reduced to speeding up the pace of improvement." However, many would argue that Schonberger (1986 and 1996) was the originator of the term WCM and he discusses two "dominant WCM precepts": JIT and TQM. One of the fundamental approaches on which the Japanese built their JIT philosophy was to understand and simplify every step in the manufacturing process (Monden, 1993). They 're-engineered' the manufacturing processes of the West to capitalise on their strengths and reduce the impact of their weaknesses (Monden, 1998). JIT is a philosophy whose main objective is to achieve excellence in a process based on the continuing elimination of waste and reducing batch sizes to the ultimate of one. This

reduction highlights manufacturing issues such as product quality, set up times, inventory management, and etc. Waste is things that do not add value to the product. A cornerstone of JIT is TQM (Sandars, 1989; Toffler, 1989). JIT identifies waste, and TQM provides the problem-solving mechanisms to eliminate waste (Davidson et al., 2000). TQM is a philosophy whose main objective is to meet or exceed the needs of internal and external customers. The main elements conforming TQM are customer focus, prevention of problems, continuous improvement and a teamwork approach. JIT and TQM philosophies focus, therefore, on continuous improvement.

It seems that the continuous improvement idea of WCM companies focuses on process (Schonberger, 1996). A process is a set of linked activities that take an input, transform it, and create an output (Hill and Jones, 1998). Ideally, the transformation that occurs in a process should add value to the input and create an output that is more useful to and effective for the recipient. A process with a broad scope is likely to cross a number of functions or departments (Thompson, 1997). Processes are horizontal while functions are vertical, processes cut across functions and functional activity feeds processes (Hill and Jones, 1998). Process-based multi-functional teams come together to provide a solution to customer requirements. Identifying and understanding processes is not as simple as it might at first seem. In examining organisational processes, Russell and Taylor III (1995), Shafer and Meredith (1997), and Waters (1996) classify a basic set of high-level, which they believe apply to all organisations. These processes are:

- Strategic processes, which are those processes by which the organisation plans for and develops its future, included strategy planning, product development and new process development.
- Operational processes, which are those by which the organisation carries out its regular day-to-day functions, such as 'winning' the customer, satisfying the customer, supporting the customer, cash and treasury management, financial reporting.
- Enabling processes, which are those enable strategic and operational processes to be carried out, such as human resource management, management accounting and information systems management.

These three types of organisational processes can thus be broken down into more detailed sets of processes. These processes in turn can also be broken down into further level of detail and so on until reach the level of the individual task.

According to Todd (1995), in a WCM environment, a JIT and TQM environment, processes can become integrated not fragmented, decision making can become distributed, organisational boundaries can become flexible and the team rather than the hierarchy become vital and people are empowered rather than disenfranchised. Guimaraes and Bond (1996), mentioned that WCM companies should includes the following goals and objectives:

> Increase competitiveness by improving quality, reducing costs, and shortening product development, emphasise the value-added element at every activity, use time as a competitive weapon, focus on end results and objectives, apply the right innovative technology, check quality at its source, build consensus on making changes, set aggressive business process goals, redesign end-to-end processes important to the company's success, consider process improvements based on the capabilities of information technology, reduce costs and production times, and operate across organisational units.

Most of the previous goals and objectives can be obtained by the implementation of JIT and TQM philosophies. Therefore, JIT and TQM can be consider as an environment which leading to world class performance. According to Jazayeri and Hopper (1999), traditional accounting and performance measurement systems are inappropriate in a JIT and TQM environment. Further evidence comes from Johansson et al. (1993), who said that:

> Information systems on top of functional thinking and traditional accounting and performance measures often move the wrong information faster, and fail to provide employees with the depth and structure of information required for them to be truly effective in all aspects of their work.

According to Childe (1997), in a JIT and TQM environment, there is a need for good performance measurement to show a company how its continuous improvement is working. He said that:

> Total quality approaches provide techniques to ensure conformance to requirements and to eliminate variations... Another element of TQ which is very relevant to JIT is the establishment of a system of performance measures which can show the company how its improvements are working. This is important to retain the commitment of both management and employees to continuous improvement.

In the next chapter, the role of Management accounting information systems in WCM companies will be presented, while in the next but one performance measurement systems for a JIT and TQM environment will be discussed.

Chapter Three

The Role of Management Accounting Information Systems in WCM Companies

3.1 Introduction

When investigating the literature regarding management accounting systems, it is apparent that many authors address the shortcomings of traditional cost accounting and performance measurement systems (see for example, Barad, 1998; Barnes et al., 1998; Burns and Scapens, 2000; Bjornenak and Olson, 1999; Chalos, 1992; Ferrara, 1990; Innes and Mitchell, 1990b; Johnson and Kaplan, 1991; Suwignjo et al., 1998; and Vaivio, 1999). Few authors have investigated the role of management accounting systems in WCM companies (see for example, Garrison and Noreen, 2000; Jazayeri and Hopper, 1999; Maskell, 1991). Management accounting information systems (MAISs) play an important role in manufacturing companies. As summarised by Usry, Hammer, and Matz (1988), the major roles of MAISs are:

1. Creating and executing plans and budgets for operating under expected competitive and economic conditions.
2. Establishing costing methods and procedures that permit control and, if possible, reductions or improvements of costs.
3. Creating inventory values for costing and pricing purposes and, at times, controlling physical quantities.
4. Determining company costs and profit for an annual accounting period or a shorter period.
5. Choosing from among two or more alternatives which might increase revenues or decrease costs.

Those five major roles of MAISs provide necessary tools for planning, controlling, and decision-making activities inside manufacturing companies. Information provided by the MAISs help manufacturing companies' management to set the company's goals, establish departmental objectives, evaluate the effectiveness and efficiency of activities, pinpoint successes or failures in terms of specific responsibilities, and analyse and decide on adjustments and improvements to keep the entire company moving toward established goals and objectives (Drury, 1996). For a long time, the ability of traditional management accounting to achieve its objectives of providing manufacturing companies' managers and their teams with suitable information for planning, controlling and decision-making has been challenged (Jazayeri and Hopper,

1999). The original objective of traditional management accounting was to facilitate preparation of financial reports. Traditionally, management accounting has focused on periodic, historical, and aggregated data, primarily in the form of financial statements (Burns and Scapens, 2000).

Traditional management accounting is considered as one of the many major obstacles hampering the implementation of WCM philosophies (Jazayeri and Hopper, 1999; Kaplan, 1984a). According to Johnson (1992) and Kaplan (1984b), traditional management accounting is outdated and has lost its relevance to the changing nature of today's manufacturing environment, because manufacturing has changed rapidly but management accounting has not changed correspondingly. As the manufacturing environment changed, product cost information, inventory valuation, profitability calculation, and performance measurements provided by traditional management accounting systems became increasingly unreliable (Shields, 1997; Atkinson et al., 1997).

As shown in Chapter Two, the manufacturing environment has changed rapidly over time. WCM philosophies, JIT and TQM philosophies, emerged and were adopted by some manufacturing companies to continuously improve companies' performance and respond to international competitors. Johnson and Kaplan (1991) highlighted the importance of redesign of management accounting information systems as the result of the change in the manufacturing environment. They pointed out that "today's management accounting information driven by the procedures and cycle of the organisation's financial reporting system, is too late, too aggregated, and too distorted to be relevant for managers' planning and control decisions." In addition, traditional management accounting systems are designed to support the more traditional goal of cost control (Kaplan and Cooper, 1992). Traditional systems use the cost assignment methods that are required for external reporting. They provide reports on items such as price and usage variances for materials, labour and overhead costs. While this information may be useful, it should be supplemented with information that provides support for the continuous improvement goal. In the continuous improvement setting, information is used as a tool to promote managers' and their teams' understanding and participation in the company's continuous improvement effort (Kerrin, 1999). MAISs should provide information which will

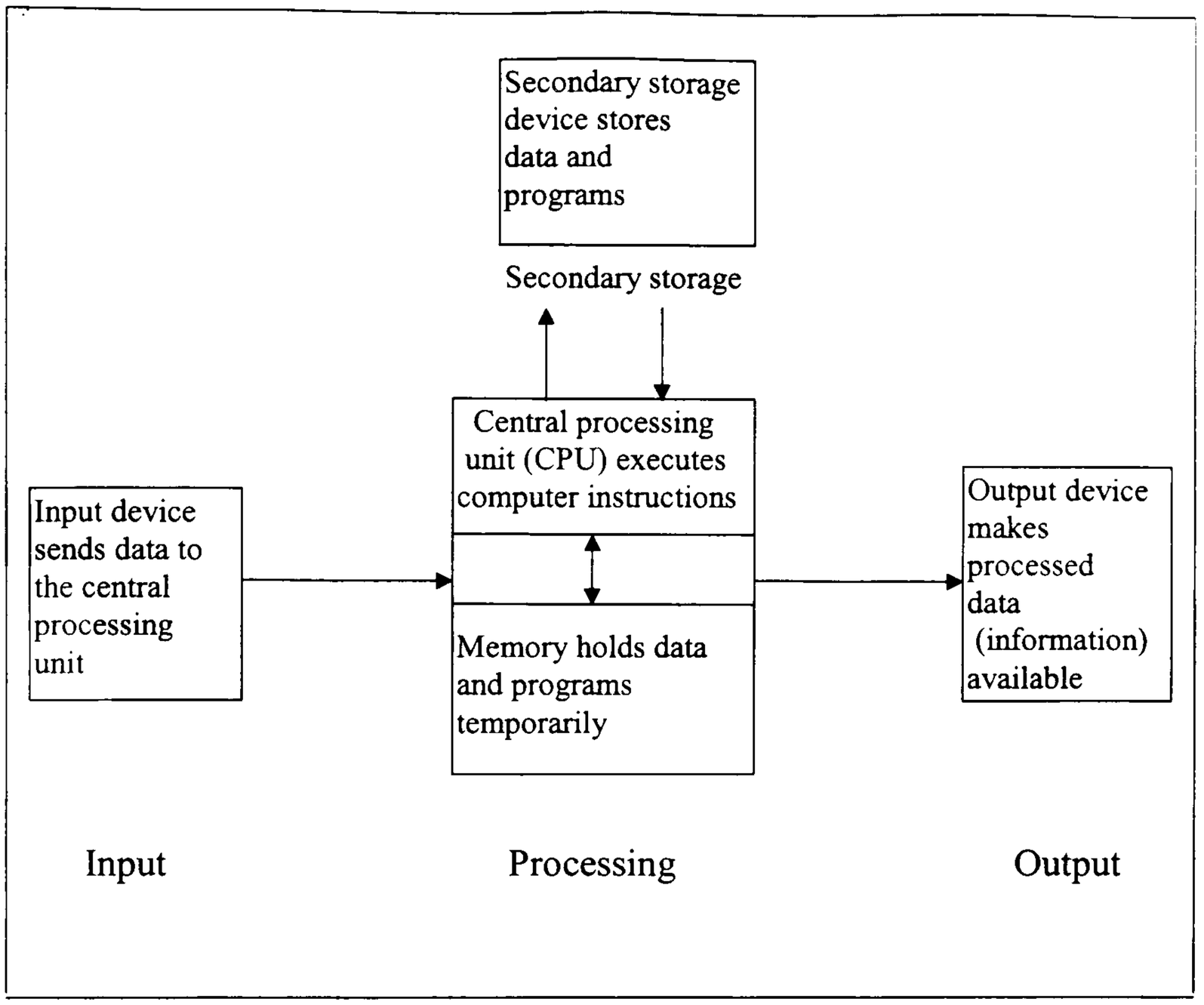
enable managers and their teams to support the continuous improvement philosophy. According to Burns and Scapens (2000), MAISs change has become a topic of much argument in recent years. Jazayeri and Hopper (1999) mentioned that "WCM with its emphasis on non-financial measures, continuous improvement, computerised information systems, and changed management structures and roles is likely to impact upon the role of management accounting."

In this chapter, the researcher will present the changes that are made in the role of MAISs when continuous improvement philosophy of WCM techniques is adopted. This will be presented through the following points: A computer-based management accounting information systems, cost accounting information system and its new ideas, and performance measurement systems to support the continuous improvement philosophy of a JIT and TQM environment.

3.2 A Computer-Based Management Accounting Information Systems

A computer is "a machine that can be programmed to accept data *(input),* process it into useful information *(output),* and store it away (in a *secondary storage* device) for safekeeping or later reuse. The *processing* of input to output is directed by the software but performed by the hardware" (Capron, 1998). Capron indicated that, to function, a computer system requires four main aspects of data handling: input, processing, output, and storage (Figure 3.2.1). One of the advantages of using a computer to produce accounting information is that all the dull, time-consuming parts, entering transactions, adding columns of figures, sorting expenses by type and so on, are taken care of by the machine (Mauldin and Ruchala, 1999). This will free the user, accountant, to concentrate on the important part, which is the result.

Figure 3.2.1 Four Primary Components of a Computer System



Source: Capron, H. L. (1997). *Computers: Tools for an Information Age (fifth edition),* Reading, Massachusetts, Addison-Wesley.

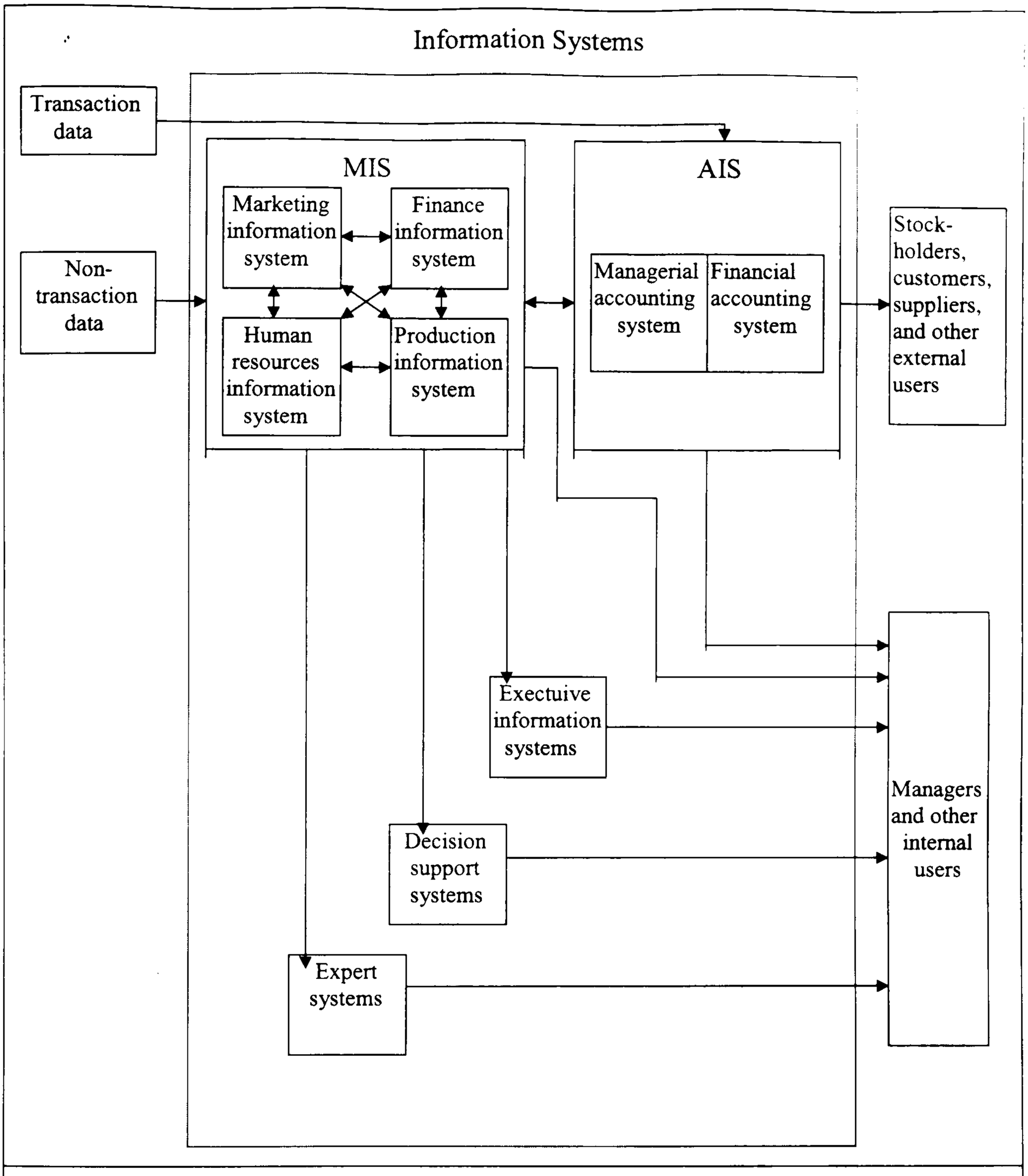
According to Bonder et al. (1993), "accounting, as an information system, identifies, collects, processes, and communicates economic information about an entity to a wide variety of people. Information is useful data organised such that correct decisions can be based on it. A system is a collection of resources related such that certain objectives can be achieved." WCM companies depend on information systems in general, and MAISs in particular in order to stay competitive. Computers provide effective and efficient ways of processing accounting data, and they are a necessary part of MAISs. Computers made MAISs faster, less expensive, and more accurate (Choe, 1998). MAISs involve much more than just computers. The successful applications of MAISs requires an understanding of the business process, activity, and its environment to support management decision-making by providing information that managers and their teams can use to plan and control the activities of WCM companies (Jonsson, 1998). MAISs collect, process, store, analyse, and provide

required information for planning, controlling, and decision making (Gelinas et al., 1993).

A computer-based management accounting information system (CBMAIS) is a MAIS that uses computer technology to perform some or all of its intended tasks (Capron, 1998). According to Mauldin and Ruchala (1999) "technology is a pervasive and growing component of accounting tasks and has been shown to change work processes". Computer technology is playing the role of a facilitator for MAISs' activities and processes. That role will become more important as time passes. Mauldin and Ruchala (1999) mentioned that as computer technology grows more advanced, MAISs are recognised as fundamentally changing task processes and providing complex decision support, as opposed to simply increasing the speed and accuracy of traditional accounting tasks. According to Bjornenak and Olson (1999), "today the use of modern database technology makes it possible to link many data sources together, including external and non-financial data. This development has diluted the one system thinking of management accounting.

Thus, the technological development has made it difficult to define a management accounting system per se". While definitions of MAISs abound, the researcher follows the Institute of Management Accountant's (1997) draft definition, according to which "Management accounting is a value adding, continuous improvement process of planning, designing, measuring, and operating non-financial and financial information systems that guides management action, motivates behaviour, and supports and creates the cultural values necessary to achieve an organisation's strategic, tactical and operating objectives". Figure 3.2.2 shows how different information systems are linked together. The figure also views the information systems as a link between data sources and information users. Information systems are responsible for converting data into information useful for decisions. Data become useful information once they are processed into a form that can be used by decisions makers (Capron, 1998). Computer technology will be the key enabling accounting information to become accessible on a real-time basis for decision makers (Sutton, 1999). The changes occurring in manufacturing companies as a result of the gains in information technology and the implementation of WCM philosophies provide a multitude of challenges to MAISs (Sutton, 1999).

Figure 3.2.2 The Component Information Systems Within a Company



Source: Wilkinson, Joseph W. and Cerullo, Michael J. (1997). *Accounting Information Systems: Essential Concepts and Applications (third edition)*, New York, John Wiley & Sons, Inc.

According to Jazayeri and Hopper (1999), as the result of WCM philosophies' implementation, cost accounting information systems change to have a greater focus on actual costs and trends, continuous cost reduction, non-financial performance measures, and advanced technology to collect cost data.

3.3 Cost Accounting Information System

According to Howell and Roucy (1988), the "classical cost accounting model still being taught by accounting faculty and used by many companies is seriously deficient for the new manufacturing environment. It encourages inappropriate behaviour and fails to provide information that management need to make sound decisions and be truly competitive". In the classical or traditional accounting model, there are three primary uses for cost accounting information, inventory valuation, product costing, and cost management and control. For example, inventory valuation is the usual driver of financial information in the traditional cost accounting model. The model typically uses either a job order or process system, standard costs, and overhead allocation methods, usually based on direct labour hours or cost, for the valuation of inventory under generally accepted accounting principles (Anthony, 1989).

The traditional cost accounting system was designed for an era when direct labour and materials were the predominant factors of production, technology was stable, overhead activities supported the production process, and there was a limited range of products (Bakke and Hellberg, 1991; Kaplan, 1991; Horngren, 1989). The main objective of traditional cost accounting systems is to cost products and to promote efficiency in the use of labour and materials (Shillinglaw, 1989). Full costing and variable costing are two methods used in traditional cost accounting system to determine product cost (Drury, 1996). Full costing, also referred to as absorption costing or conventional costing, charges units of product with both direct manufacturing costs, direct labour and raw materials, and all indirect manufacturing costs, both variable and fixed (Horngren and Foster, 1991). However, costs such as R&D, design, marketing, and administrative costs are not part of product costs and are expensed in the same period in which they are incurred. Variable costing, also referred to as marginal costing, charges units of product with only those variable direct and indirect manufacturing costs. The fixed manufacturing costs are excluded from product cost and are treated as period costs. Traditional cost accounting system has been reported to distort product cost (Drury, 2000).

As shown in Chapter Two, the implementation of JIT and TQM philosophies inside WCM companies has brought fundamental changes. These changes include

shifts in cost behaviour, lower inventories, reduced production lead times, shortened product life cycle, and an emphasis on product delivery, flexibility and quality (Horngren, Foster and Datar, 2000). These production trends result in changes in manufacturing cost characteristics. The changes in manufacturing cost characteristics include decreased direct labour costs, increased factory overhead, high capital investment and recovery decisions, and the need for better traceability of cost to product, activity, and process. Failure to recognise the new production trends, as the result of JIT and TQM implementation, and their impact on management accounting systems may result in neglect of the information of those systems, especially cost information.

The objective of cost accounting information system (CAIS) inside WCM companies is to provide information for decision making for the planning and controlling of manufacturing and non-manufacturing operations. CAIS also provide information for process value analysis for competitive advantage. Competitive advantage is gained by the cost accounting information system's emphasis on real-time, operational decision making, quality, flexibility, time, price, and market scope. Process value analysis focus on both cost reduction of manufacturing and non-manufacturing activities, and process improvement (Stemsrudhagen, 1997). Recognition of problems with traditional cost accounting system grew during the 1980s (Hiromoto, 1991). Management accountants began to recognise the deficiencies of existing cost accounting system and to devote efforts to develop remedies. Bjomenak and Olson (1999) said that:

> Traditional management accounting has primarily functioned as one integrated co-ordinating system....new ideas have expanded the co-ordinating role, but also exploited the roles of supporting operational and strategic processes. This development shows that management accounting has adapted to the idea that different organisational contexts have different criteria of information relevance, and thus has changed the view of how management accounting systems are being used.

Some new MAISs techniques, approaches or ideas such as activity based costing (ABC), throughput accounting (TA) and cost of quality have been introduced recently to overcome the deficiencies of exiting cost accounting system (Scarlett, 1996; Bjornenak and Olson, 1999).

3.3.1 Activity Based Costing (ABC)

A traditional cost accounting system assumes that products cause costs to be incurred whereas activity based costing (ABC) assumes that products incur costs according to the activities that they require (Borden, 1990). In 1984 two accounting professors, Robert Kaplan of Carnegie-Mellon University and Tom Johnson of Portland State University began to expound the shortcomings of traditional MAISs (Mitchell and Innes, 1990). Concurrently, Robin Cooper of the Harvard Business School developed a new type of cost system that allocated costs on activity. This method was called activity based costing (ABC), and began to gain attention.

"ABC is a technique which focuses primarily on overhead costs" (Darlington et al., 1992). According to Turney (1991), ABC is a new approach to product cost. He indicated that ABC identifies activities performed, traces the cost of resources used to the activities, and traces the cost of activities to the products that consume the activities. According to Needy et al. (2000), ABC "is a cost management method that addresses shortcomings inherent in traditional costing methods, for the handling of indirect costs (or overhead)". The basic concept behind product costing in ABC is that the cost of a product equals the cost of raw materials plus the sum of the cost of all activities required to produce a product (Beaujon and Singhal, 1990). One of the most important characteristics of ABC is the availability of PC-based software to perform the calculations involved in handling multiple activities and cost drivers in combination with numerous products (Troxel and Weber, 1990). Turney defined ABC as information system. He said that:

> Activity-based costing is an information system that maintains and processes data on firm's activities and products. An activity-based cost system identifies the activities performed, traces cost to these activities, and then uses various cost drivers to trace the cost of activities to products. These cost drivers (such as the number of different parts used or the effort expended by product) reflect the consumption of activities by the products.

A major contribution derived from ABC accounting is the development of procedures for detailed analysis of overhead cost to identify the real cost-drivers (Innes and Mitchell, 1990a). This implies the sharing of overhead in costs related to activities and costs related to volume. The activity based overhead costs and the volume based overhead costs are allocated to products. All direct and indirect costs are possible candidates for inclusion in product costs (Cooper, 1990). These led to improve

information about the cost of activities and products, and at the same time more accurate product costs reporting (Richardson, 2000). According to Turney (1991), improved information can led to continuous improvement in cost reduction. He said that:

> Improved information about the cost of activities and products facilitates the cost reduction objectives of continuous improvement by allowing managers to simulate the cost consequences of decisions that change the performance or use of activities.

Troxel and Weber (1990) pointed out that there are some advantages from ABC implementation. They mentioned that ABC provides an important perspective on product costs, in establishing the cost of activities performed, and in identifying key cost drivers. One of the most important aims of WCM companies is to eliminate activities that consume resources but add little or no value (Beaujon and Singhal, 1990). According to Eiler and Campi (1990), traditional cost accounting is not helpful in managing activities. ABC can make a significant contribution in managing activities as well as in determining product costing (Beaujon and Singhal, 1990). According to Borden (1990) and Turney (1991), in WCM companies, ABC helps managers and their teams to make better decisions about product design, pricing, marketing, mix and encourages continuous improvement. Troxel and Weber (1990) indicated that ABC should be used as a tool for decision making rather than as stand in for an existing cost accounting system.

Although ABC provides more accurate product costs and improved product line profitability analysis, it requires a large amount of data, that usually requires a powerful computer to collect economically (Brimson, 1991). Innes and Mitchell (1990a) indicated that ABC produces historic cost information which has only an indirect relevance to managerial decisions. Cobb et al. (1992) in their study, 'Activity Based Costing: Problems in Practice', indicated that there are top five ABC problems in practice. These problems which have been identified by accounting respondents are:

> (1) the great deal of resource required;
> (2) accurate data collection (especially gathering data on cost drivers);
> (3) coping with the fact that activities cross existing departmental boundaries and areas of responsibility;
> (4) the fact that other changes were given a higher priority within the organisation;
> (5) the heavy demands made by ABC design and implementation on accountants' time.

Cobb et al. also mentioned that these problems have caused some manufacturing companies to reject ABC, but others have overcome these problems to implement that approach, which they consider valuable and successful in the assessment of its costs and benefits. In WCM companies, ABC offers an approach which has the potential to overcome many of the problems and shortcomings of traditional cost accounting system (Innes and Mitchell, 1990a; Kennedy and Bull, 2000; Richardson, 2000).

3.3.2 Throughput Accounting (TA)

Throughput accounting (TA) advocates that only direct materials are included in product cost and all other costs are fixed and not identifiable with products (Goldratt and Cox, 1984). The earliest reference of TA can be traced to a series of articles written by Galloway and Waldron (1988) and Waldron and Galloway (1988, 1989a, 1989b). "TA is a technique in which overhead and labour costs are taken as given and the focus is on the flow of production through the factory" (Darlington et al., 1992). According to Balderstone and Keef (1999), TA is based around three performance measures: throughput, inventory and operating expenses.

Throughput (T)

According to Goldratt and Cox (1993), throughput is "the rate at which the system generates money through sales". In throughput accounting, all costs except material costs are considered as fixed and excluded from product costs. This means that only the material costs should be included in the product cost and that labour costs and overheads are considered to be part of operating expenses (Miller and Vollmann, 1985).

Inventory (I)

Goldratt and Cox (1993) indicated that inventory is "all the money the system invests in purchasing things the system could, or intends to, sell". This is the total amount of investment in the system, including such things as buildings, equipment, vehicles and raw materials inventory.

Operating Expense (OE)

Operating Expense is "all the money the system spends in turning inventory into throughput" (Goldrattt and Cox, 1993). This is all the money constantly poured into the system to keep it operating, such as expenses for labour, supplies, maintenance, advertising, etc.

Balderstone and Keff (1999) mentioned that Goldratt claims that manufacturing companies should first focus their efforts on increasing throughput, second on decreasing inventory and lastly on decreasing operating expenses. Throughput accounting focuses on increasing throughput as well as balancing cost cutting and inventory reduction (Dugdale and Jones, 1997; Graves and Gurd, 1998). According to Dugdale and Jones (1996a, 1996b), although there are differences between Goldratt's and Waldron-Galloway's throughput accounting, TA is a new tool that has been developed to support the objectives of WCM companies of making more money and profit now and in future. The philosophy of TA in WCM companies is that making money and profit are functions of manufacturing response time and that the long-term objective of companies must be to maximise profit (Dugdale and Jones, 1997). According to Dugdale and Jones (1996a, 1996b, 1997), in WCM companies, JIT and TQM philosophies encourage throughput. They mentioned that successful implementation of JIT and TQM philosophies led to continuous improvement in throughput.

It is difficult to say which is the better technique for manufacturing companies to adopt, ABC or TA (Corbett, 1999). Scarlett (1996) highlighted that the thrust of these techniques is that they seek to deploy a more sophisticated understanding of cost information than that found in traditional cost accounting system. According to MacArthur (1996b), in a JIT and TQM environment, management accountants should be flexible enough to choose a suitable cost accounting system to satisfy changing information needs of managers and their teams. Darlington et al. (1992) mentioned that the management accountants of UK manufacturer Garrett Automotive Ltd. (GAL) rejected the use of ABC, because it did not emphasise selling price, sales volume, and material cost, all of which were the most sensitive variables in relation the company's profitability. At the same time, the management accountants decided to adapt TA, which has helped the company to double its profits without any reduction in its number of employees. MacArthur (1996a) indicated that the management accountants of one USA growing manufacturing company, Bertch

Cabinet Manufacturing Inc., decided to change from ABC to TA to serve their internal customers better in a cost-beneficial way. MacArthur also said that:

> As the recent experience of Betch demonstrates, an accounting change to meet user needs better can be a move to a simpler costing model. Greater complexity is not necessarily better because a more complicated costing system might be neither cost beneficial not timely. It is clear that costing systems should be dynamic and able to respond quickly to the changing needs of managers, subject to cost-benefit considerations.

Variable costs are the only relevant costs for product decisions because the fixed costs have already been incurred, or committed to be incurred, and cannot be changed (Drury, 2000). Wousters (1994) suggested that ABC should be used to make short-term decisions as well as long-term decisions because it is difficult to distinguish between variable and fixed costs and the uncertainty involved in decision making. Bakke and Hellburg (1991) investigated traditional cost accounting system, ABC, and TA for both short and long-term product mix decisions theoretically. They reported that neither TA nor ABC has a relevance to all product mix decisions. Their relevance is highly dependent on the manufacturing environment. For example, TA performs well in short-term product mix decisions but may result in incorrect long-term product mix decisions.

3.3.3 Cost of Quality

In WCM companies, quality is considered as one of the most important factors to success. So, giving information about quality costs is challenging the role of cost accounting information system. Quality costs include all the costs incurred in the quality related activities such as prevention, appraisal, and correction of internal and external failures (Rust, 1995). Typical activities include quality engineering, system audits, inspection, rework, analysis of defects and failures, product replacement or repair (Carr, 1995). Cost of quality information, which is providing by CAIS, is seen as a vital ingredient for companies pursuing TQM and JIT philosophies. According to Rust (1995), a quality cost system needs to be implemented to support continuous improvement efforts of quality. He also mentioned that the goal of quality cost system should be to use quality improvement efforts that will led to opportunities for cost reduction. Continuous improvement in cost reduction is considered as one of the most

important aims of JIT and TQM environment. Atkinson et al. (1991), highlighted the importance of applying the cost of quality information. They mentioned that "understanding the cost of quality is the beginning of the journey toward a total quality management philosophy. Isolating the root causes of the cost of quality allows a company to focus on the source of the problem, not just the symptoms, and work toward achieving higher quality and lower costs." They also pointed out some of the benefits from applying cost of quality information, which are:

- Quality becomes a measurable and manageable process.
- The cost of quality assessment demonstrates the linkage between the performance measures of the shop floor and the performance measures of top management.
- The strategic goals of the company and the sources of competitive advantage are linked with day-to-day company activities.
- Financial and non-financial performance measures crucial to both long and short term success are identified.
- A comprehensive framework of complementary performance measures can be designed to guide the daily activities of the company.
- The timing and sequence of quality improvements can be determined.
- The achievements of benefits can be measured.

Banker, Potter and Schroeder (1993) investigated the JIT/TQM practice of providing lower level workers with quality and productivity information. In addition, the impact of the provision of the information on employee empowerment and job satisfaction was examined. Data were collected by a questionnaire survey. The respondents were 362 line workers from 40 USA manufacturing companies. The three dependent variables investigated were quality information, productivity information, and worker job satisfaction. The independent variables used were JIT, TQM, decentralisation and teamwork. Regression results of this study showed that each of dependent variables was positively related to the independent variables. It can be highlighted from the results of this study that manufacturing companies that are involved with WCM philosophies provide quality information to lower level workers and that has a positive impact on job satisfaction. The role of CAIS in this case is to provide information about cost of quality.

According to Guilding *et al.* (2000), cost of quality information and reports are produced for the purpose of directing manufacturing companies' management attention to prioritise quality problems. Rolstadas (1998) mentioned that the strong Japanese focus on quality as a competitive factor has led the most manufacturing companies to focus on customer satisfaction. He also indicated that this means excellence in all respects, which involves zero defects, on time delivery, and low costs, amongst others. These raise a very important question of how manufacturing companies measure the improvement of the abovementioned performance factors.

One of the most important aspects of MAISs is performance measurement. Performance measurement is considered as one of the most challenging areas for MAISs researchers in the 1990s and may be in 2000s. Performance measurement plays an important role in supporting the continuous improvement ideas of JIT and TQM philosophies. Berliner and Brimson (1988) indicated that:

> A key factor in ensuring the successful implementation of a company's strategic plan is performance measurement, which measures business and plant performance in relation to the goals and objectives developed in the planning process; provides timely information for identifying and eliminating activities that add no value; and provides timely information on causal factors that may lead to manufacturing improvements.

A brief review of traditional performance measurement systems will be presented in the next section, and a detailed discussion of PMSs in a JIT and TQM environment will be presented in the next chapter.

3.4 Traditional Performance Measurement Systems

Performance measurement continues to receive attention today, as it has for the past five decades (Marchant, 1998; Norreklit, 2000). Performance measurement is viewed as "complex information processing tasks that are conducted in a social environment" (Wood and Mitchell, 1981). Traditionally, cost and profit have been cited as the most important criterion or key success factors for assessing good performance (Drury, 2000). Organisation theorists and management accountants have suggested that, while profit making is an important factor to ensure a company's survival, other financial and non-financial factors are also critical (Kaplan and Norton, 1992, 1993, 1996a,

1996b; Thompson, 1997; Hill and Jones, 1998). For example, two equally profitable companies, both providing equal rates of return on their assets, may not, in fact, be equal in those factors which ensure long-run profitability. For most WCM companies, success depends on a number of key factors beyond financial results (Jazayeri and Hopper, 1999).

Financial measures are deficient not only because they can be abused but also because they purport that financial health is the only goal of the organisation, a focus which results in management's myopic pursuit of short-run profit maximisation (Perrin, 1998). According to Marchant (1998), financial performance measures are increasingly criticised because over-emphasis on short-term financial results can led manufacturing companies to focus on quick fixes and ignore the need to create long term value. Kaplan (1984), while admitting that financial measures are important, has stated that:

> Other measures, such as product innovation, product leadership, employee skills and morale, or customer loyalty, may be much better indicators of future profitability than annual profits. It unlikely that any single measure can both summarise the economic events affecting a firm or division during a period and serve as a basis for motivating and evaluating managers.

Kaplan's message is clear; a single measure cannot be used for multiple purposes. However, the traditional performance measurement systems discussed in the management accounting literature do not always provide an adequate means of developing and interpreting multiple performance measures (Kaplan and Norton, 1996b; Neely, 1998, 1999; Perrin, 1998). Horngren (1993) said that:

> The way performance is measured and evaluated affects individuals' behaviour. Measuring performance in areas such as quality and productivity causes employees to direct attention to those areas. The more rewards are tied to performance measures, the more incentive there is to improve the measures. Measures of performance must be carefully thought out for their behavioural effects. Improving the measures should improve organisational performance toward achieving its goals.

Traditional PMSs report what happened in the past without indicating how managers and their teams can improve performance in the future (Hussain, 1996). Downe and Pastoria (1997) mentioned that the Institute of Management Accountants issued

Statement on Management Accounting 4U (1995), concerning the development of comprehensive PMSs. The Statement reads:

> Unfortunately, many firms' performance measurement systems have not been sufficiently redesigned to meet the needs of today's environment. Many systems primarily focus on measuring historical performance of internal operations, expressed in financial terms, using as a basis of measurement a set of budgeted figures against which actual results are compared. In addition to the traditional, historical, internal financial measures that give the 'score', performance measurement systems must focus on the future, on external relationships, and on nonfinancial as well as financial measures.

As management accountants have assumed a greater role in strategy formulation, they have become increasingly disenchanted the importance of integrating multiple measures of performance based on key success factors for all levels of the organisation (Kaplan and Norton, 1996a). Traditional PMSs are not useful with the implementing of JIT and TQM philosophies. Handy (1996) mentioned that traditional PMSs are "conditioned by the philosophy of the audit to count only what they can put their finger on and cross their heart about". According to Perrin (1998), this results in more attention to efficiency than effectiveness and to lack of attention to what is really important, key success factors, such as customer satisfaction, quality and on time delivery, and how it is positioned to respond to the future, continuous improvement philosophy. White and Liu (1998) mentioned that efficiency-based performance measures are ratios and include profits as a percentage of sales, return on sales (ROS), fixed assets, return on assets (ROA), and return on investment (ROI). Perrin also pointed out the limitations of traditional PMSs. He mentioned that traditional performance measurement "does not provide value for money, does not provide meaningful accountability, and does not as a rule provide accurate outcome information about what is most important. PM is not appropriate for making resource allocation decisions, and generally results in cynicism and resistance to a focus on outcome, effectiveness, and program improvement". For more details of the limitations and shortcomings of traditional PMSs, see for example (Allen, 1993; Crandall, 1993; Perrin, 1998). According to Tatikanda et al. (1998), more competitive environment, such as WCM environment, requires PMSs that are current and relevant. They also indicated that traditional PMSs are "criticised for being absolute, irrelevant to managerial decision making, unrelated to strategic objectives, too late,

too aggregated, and detrimental to organisational improvement". Table 3.4 shows the shortcomings of traditional PMSs.

Table 3.4 Shortcomings of Traditional PMSs

Unrelated to strategic goals
Irrelevant to managerial decision making
Add little or no value to business or customer
Too late
Clog the information systems
Send false positive signals
Create barriers to improvements
Send wrong messages

Source: Tatikonda, Lakshmi U., CMA, and Tatikonda, Rao J. (1998). 'We Need Dynamic Performance Measures', *Management Accounting (USA),* Sept., pp. 49-53.

According to Jazayeri and Hopper (1999), in a WCM environment, traditional PMSs are not suitable or useful. WCM companies need new PMSs to support the continuous improvement idea of JIT and TQM philosophies. These poses the challenge of determining the key issues in that relationship. It seems that determining a company's key success factors is the key issue. Winston (1999) said that:

> PM systems need to be assessed, across a range of programs and organisational settings, to determine which factors are likely to (a) facilitate the achievement of expected results; (b) lead to unintended outcomes; and (c) act as barriers to effective implementation.

In recent years there is increasing mindfulness of the importance of linking performance measurement systems to company's key success factors (Norreklit, 2000). In the next chapter, the researcher will present how performance measurement systems are linked to the company's key success factors in a JIT and TQM environment. This is considered as a challenge for MAISs. According to Waggoner, Neely and Kennerley (1999), the development of an effective, efficient and balanced set of financial and non-financial performance measures for a company is one of the principal challenges confronting manufacturing companies today.

3.5 Summary

According to Drury (1996), there are many definitions of accounting, one of which is the definition formulated by the American Accounting Association (AAA). He mentioned that it describe accounting as:

> The process of identifying, measuring and communicating economic information to permit informed judgements and decisions by users of the information.

Accounting information is most valuable to decision makers when it provides support for company's current goals, objectives and continuous improvement effort (Kaplan and Cooper, 1992). The more traditional MAISs are designed to support the more traditional goal of cost control. For example, a traditional CAIS uses the cost assignment methods that are required for external reporting. It provides reports on items such as price and usage variances for raw materials, labour and overheads. While this information may be is useful in the continuous improvement setting, it should be supplemented with information that provides support for the achievement of the company's improvement goals. The purpose of MAISs in WCM companies is to provide relevant information for decision making under various manufacturing environments. Irrelevant information or inappropriate information might be provided when the MAISs cannot properly represent the manufacturing processes and environments, decisions based on such information may led to poor system performance. For example, the practice of using volume sensitive drivers in a traditional cost accounting system to attach overhead costs to products may satisfy statutory and regulatory accounting requirements, but is not suitable in today's competitive and dynamic environment, such as a WCM environment (Kennedy and Bull, 2000). Therefore, MAISs approaches, techniques or ideas such as ABC and TA, should mirror the manufacturing process and environment. Different MAISs approaches have different assumptions and characteristics that have to be taken carefully into consideration with the characteristics of manufacturing processes and environments (Innes and Mitchell, 1990b). For example, a labour based overhead allocation rate should not be used for a company that has a low labour content when traditional costing is used. This is because the labour based overhead allocation rate is a poor measure of the manufacturing characteristics and processes. Product cost assumption used in TA does not properly mirror the manufacturing process and environment that has high overheads with a relatively low raw material and labour

content. In a manufacturing company with a low raw material content, it may not be suitable to use the TA approach. For the same reason, a manufacturing company with a low overhead content may not find the ABC approach suitable. "Whether it is ABC or other developments, the successful implementation of accounting innovation is important for the future of management accounting in many organisations with rapidly changing internal and external environments" (Cobb et al., 1992). Therefore, a carefully selected MAIS approach that can properly mirror the manufacturing processes and environments will result in better decisions and lead to better performance. Every new MAIS technique, approach or idea has its own objectives, assumptions, strengths, weaknesses and implementation requirements. Therefore, the major concern of manufacturing companies is how to select an appropriate MAISs idea which will provide suitable information for decision making and at the same time support the continuous improvement philosophy of a given manufacturing environment, such as JIT and TQM. In a JIT and TQM environment, continuous improvement efforts to identify and measure quality costs will lead to reduction of many direct and indirect costs and that can satisfy customers while increasing profits (Rust, 1995). In this regard, MAISs should recognise what information, financial and non-financial, is needed by managers and their teams, why it is needed, and how to provide it in the best possible form for understandability and usefulness in decision-making. Performance measurement information plays an important role in supporting managers and their teams in decision-making.

It has been mentioned that performance measurement is one of the most important components of MAISs. Brancato (1995) in his study found that traditional PMSs were thought to be more useful for meeting reporting requirements rather than measuring performance. He also found that non-financial measures were being added to financial measures to attempt to achieve better PMSs. In WCM companies, measuring performance in terms of high quality, on time delivery, customer satisfaction, reduction lead time and costs has the advantage of directing managers and their teams toward these improvement objectives. According to Kaplan and Norton (1996b), managers and their teams focus on improving the outcomes that a company measures. In the next chapter, PMSs in a JIT and TQM environment will be presented.

Chapter Four

Performance Measurement Systems for a JIT and TQM environment

4.1 Introduction

In Chapter Two, WCM philosophies, JIT and TQM, have been discussed. The common themes of these philosophies are to make the manufacturing company, its products, and its processes better and to lower costs to provide better value to customers (Institute of Industrial Engineers, 2000). Then in Chapter Three, the role of MAISs in WCM has been discussed, and it was mentioned that PMS is one of the most important aspects of MAISs. It also mentioned that traditional PMSs are no longer suitable or appropriate in the changed manufacturing environment (Chenhall and Langfield-Smith, 1998). According to Neely (1999), many authors comment in passing that traditional PMSs need to be changed in the light of evolving circumstances, such as changing markets, strategies and environments. It seems that the new manufacturing environment, such as a JIT and TQM environment, needs new PMSs. This is because traditional PMSs often do not support the continuous improvement effort of this new manufacturing environment. They are financial in nature, encourage short-term rather than long-term objectives, and they do not encourage the basic principles of JIT and TQM philosophies: focus on continuous improvement, customer satisfaction and elimination of waste (Hendricks, 1994; Marchant, 1998). According to Chenhall (1997), a challenge for MAISs has been to ensure that PMSs are relevant to this new environment of implementing WCM philosophies (Chenhall, 1997).

The challenge of MAISs also is to devise performance measures and reports that support strategic objectives and continuous improvement, and are consistent with the new environment (Here, 1996). According to Maskell (1991), the new PMSs can be introduced before, at the same time, or after the introduction of WCM philosophies/techniques.

The issue of PMSs is not new. What is new is the recognition that improved performance is necessary for many companies who have already started to implement, or have a plan to implement, WCM philosophies. If performance is to be improved, it must first be measured (Crandall, 1993). Vokurka and Fliedner (1995) mentioned that PMSs need to provide information on activities with respect to meeting customer expectations and objectives. However, according to Crandall, designing and developing PMSs that satisfy all of the concerned parties are difficult objectives. What are the key elements in any new PMSs is a question that needs to be answered. Smith (1993), an independent consultant, offers a view of what any system will have to include. He comments that PMSs in the future:

- will be multi-factor based covering all aspects and relationships of the business;
- will focus on results drivers as well as the results themselves;
- will be judged relative to world class companies and plans to improve;
- will assess non-financial as well as financial criteria;
- will be profitability and cash flow based (the investor satisfaction factors);
- will cover customer satisfaction factors;
- will assess quality of management;
- will have information systems to support and monitor the management decision processes and not just be used to keep records of activity and results.

It seems that JIT and TQM philosophies are changing the way companies do business, and are forcing companies to make complementary changes in their performance measurement systems (McNair and Mosconi, 1987). In this chapter, the impact of WCM philosophies on PMSs, PMSs components and new performance measures and reports for a JIT and TQM environment will be presented.

4.2 The Impact of WCM Philosophies on PMSs

According to Schonberger (1986, 1996), WCM companies strive to make continual and rapid improvements in areas where the company seeks advantages over the competition. Thus, the company's move toward manufacturing excellence is driven by a set of strategic objectives which guide all continual improvement activities. Authors such as Schonberger (1982, 1986, 1996), Ohmae (1983), Kaplan (1983), and Goldratt and Cox (1986) have collectively identified some 'key success factors' or strategic objectives as being critical to the attainment to WCM capabilities. These factors are lower cost, better quality, shorter lead time, on-time delivery, increased process/product innovation, increased process/product flexibility and more responsive field service. WCM companies, in order to ensure achievement of their goals and objectives, use PMSs to measure, control and improve performance processes (Ghalayini and Noble, 1996). PMSs offer a means for communicating objectives and achievements throughout the organisation, as well as ensuring that the company is concentrating its efforts and using its resources in the most effective manner (The Economist Intelligence Unit, 1995).

The impact of WCM philosophies, JIT and TQM, on PMSs determine the new performance measures and new performance reports needed in this relationship. An important concern in the implementation of JIT and TQM philosophies is the extent to which JIT and TQM should be developed together with new PMSs employing measures and reports for manufacturing and non-manufacturing processes (Chenhall, 1997). According to Hendricks (1994), for JIT and TQM philosophies to be implemented successfully, PMSs must support the continuous improvement idea of those philosophies.

It is realised that, the first step in a JIT and TQM environment is to determine company's mission and goals or objectives. The mission statement is a relatively short document which succinctly outlines the company's purpose (Thompson, 1997). According to Thompson, it should specify senior managers' long-term view about the strategic aim of the company, which businesses, markets and products it will operate in, and the way in which it will operate in them. In the matter of company's goals, Eli Goldratt (1989) states that the most important goal of any manufacturing

company is to make more money now and in the future. He said that "the goal of a manufacturing organisation is to make money, all the other goals or objectives in the company enable the company to make money. But they are not goals themselves, they are just the means of achieving the goal." The goal theory as developed by Latham and Locke (1979), states that motivation and performance are higher when managers and their teams are set specific goals, when the goals are difficult but accepted, when there is feedback or reports on performance. Participation in goal-setting is important as a means of securing agreement to the setting of higher goals (Hill and Jones, 1998). Difficult goals must be agreed and achieving them must be helped by guidance and advice.

The second step in a JIT and TQM environment is to determine the key success factors for company's mission and goals or objectives. The process of identifying key success factors is a business-led process in determining the relationship between a manufacturing environment and PMSs (Abair, 1993; Allen, 1993; Ghalayini et al., 1997). The third step is to tie PMSs to key success factors. The exercise starts with the clarification of the company's mission, followed by a definition of current business objectives or goals. The next step is to determine the limited number of key areas of the business, key success factors, on which managers should focus to ensure that the company meets these goals. Once these have been identified, the company needs to find the means of measuring and monitoring performance in these key areas of the business, by designing new PMSs. Thus, PMSs must measure the key success factors in the manufacturing company and the MAISs' function must reflect this performance. Most manufacturers realise that a well-designed PMSs is an essential part of any WCM strategy (Vitale, Mavrinac and Hauser, 1994). According to Green (1993), and Lee et al. (1995), a well-designed PMS is the strongest tool for controlling business objectives.

In a JIT and TQM environment, the focus is on continuous improvement philosophy (Crandall, 1993; Ghalayini and Noble, 1996). PMSs in place should therefore activate improvements. According to Lynch and Cross (1995), and Tarr (1995), the purpose of PMSs is to motivate behaviour leading to continuous improvement in identified key success factors. Allem (1993) argued that one of the moat important key characteristics that differentiates successful manufacturing company from the 'also rans', is their ability to recognise and focus on the most

important aspects of the business. He also suggests that identifying the company's key success factors, according to the company's mission and goals related to the WCM strategies, will help in establishing performance measures and reports to measure and monitor those factors, and then using those measures and reports to run the business seems like a 'fairly straightforward process'.

In a JIT and TQM environment, it seems that PMS is necessarily tied to key success factors; key success factors must tied to the company's strategy; the company's strategy must be tied to the company's goals or objectives and the company's goals or objectives must tied to its mission. It is important to note that designing and developing PMSs should focus attention on measuring, monitoring and improving company's performance relative to key success factors. Therefore, if the company's goals change, according JIT and TQM implementation, key success factors and PMSs must be changed to match.

According to Hussain (1996), it is now a widely held view that in order to be successful in a competitive world market, manufacturing companies must perform well on a number of key success factors such as market share, cost, customer satisfaction, quality, and delivery time. In a JIT and TQM environment, there are three categories of key success factors: JIT key success factors, TQM key success factors, and general key success factors. Figures 4.2.1, 4.2.2 and 4.2.3 show those key success factors.

Figure 4.2.1 JIT Key Success Factors

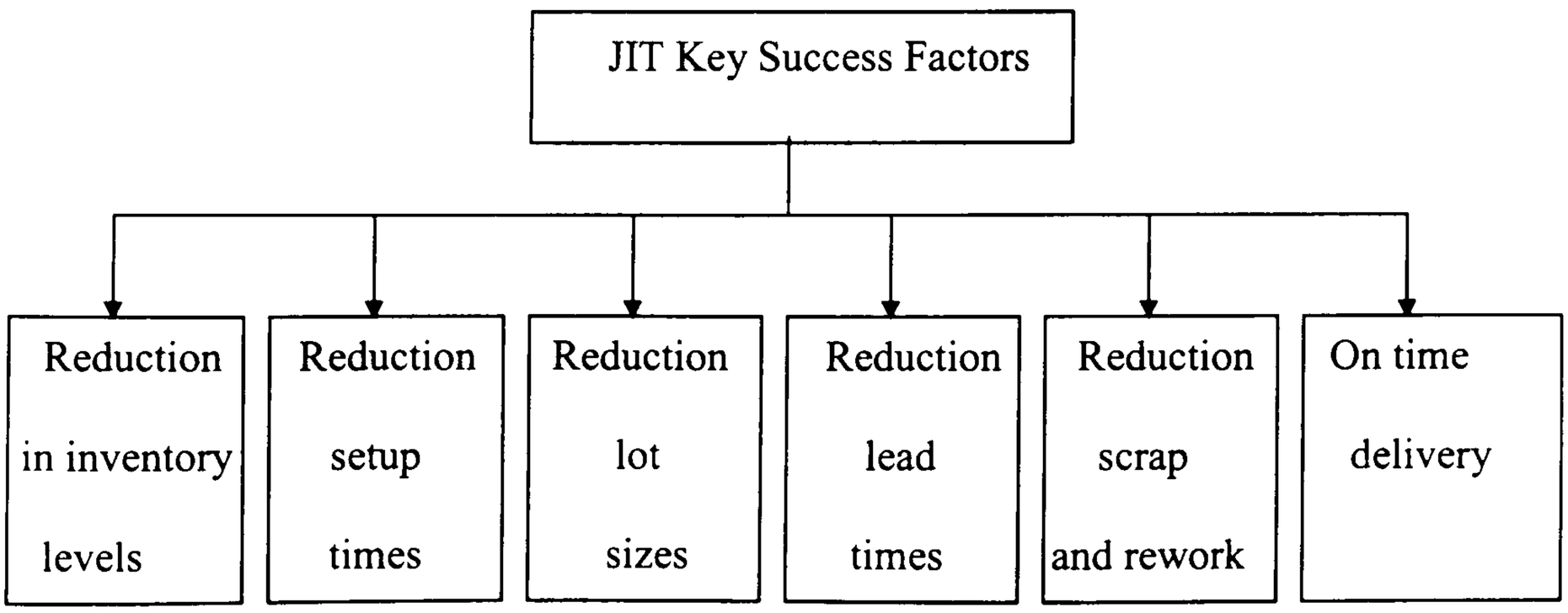


Figure 4.2.2 TQM Key Success Factors

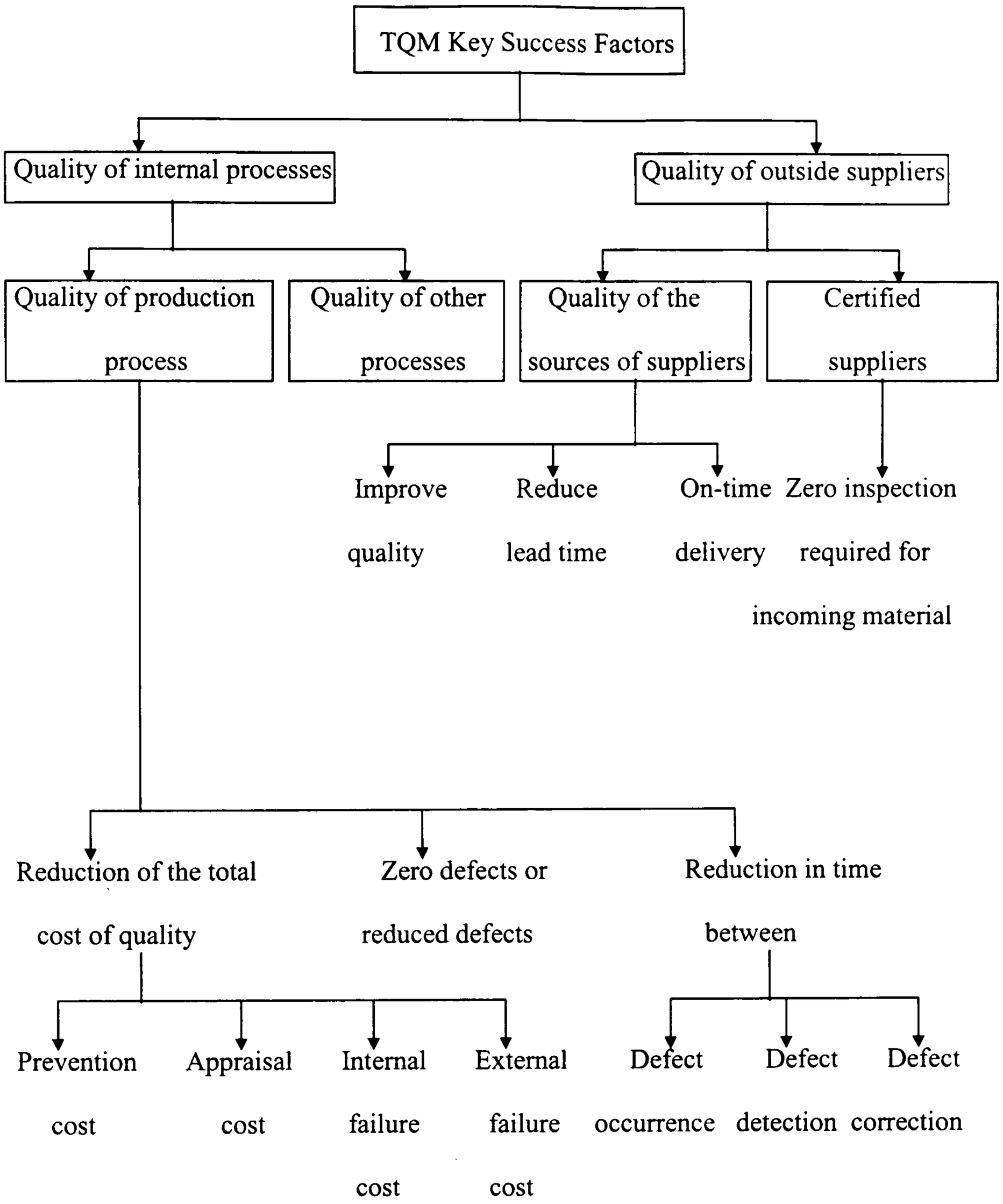
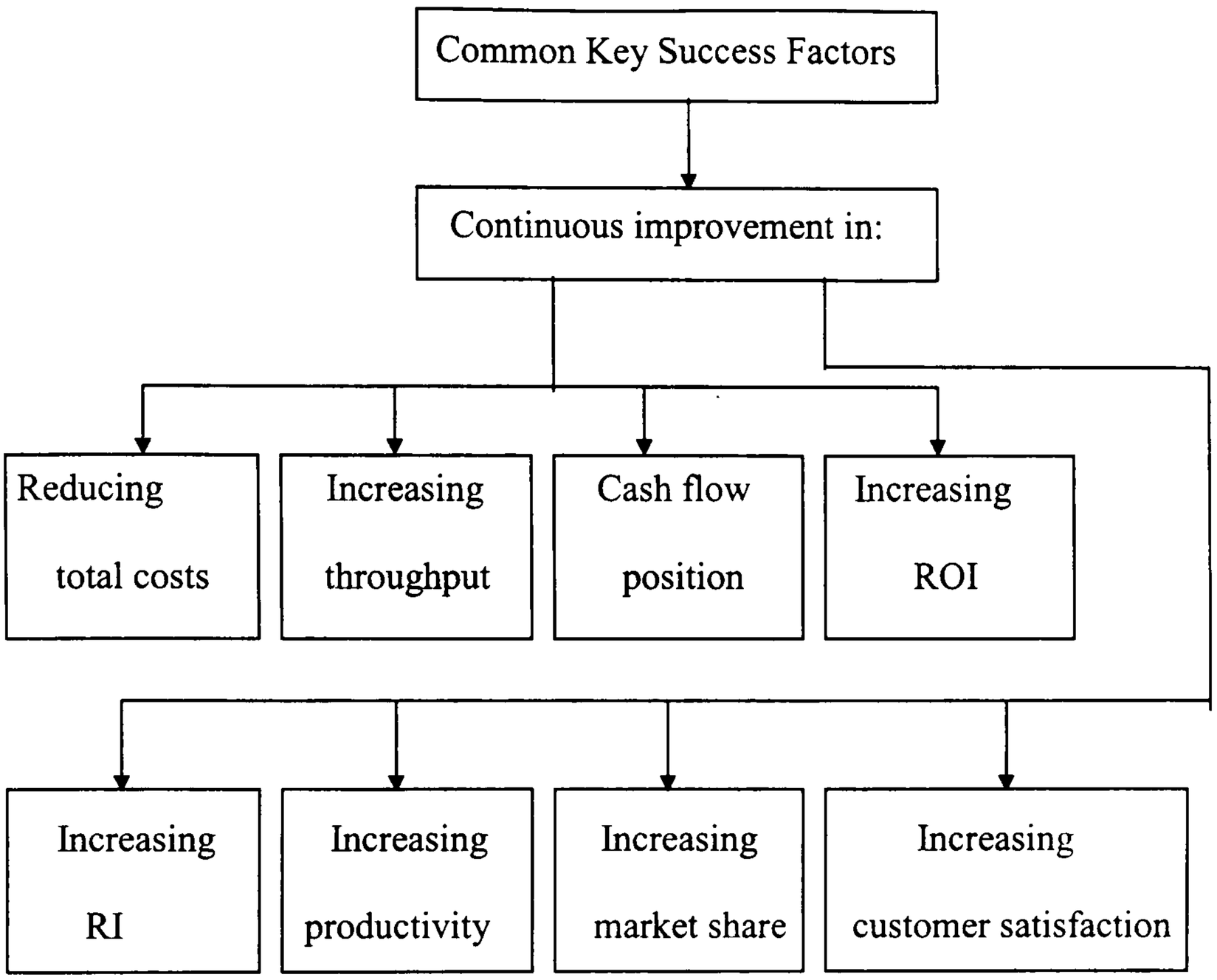


Figure 4.2.3 Common Key Success Factors



According to Neely (1998) general or business key success factors include continuous improvement in:

- Reducing total costs
- Increasing throughput
- Cash flow position
- Increasing return on investment(ROI)
- Increasing residual income(RI)
- Increasing productivity
- Increasing market share
- Increasing customer satisfaction

When a company begins to move in the direction of implementing JIT and TQM philosophies, a new PMS is required to measure business and plant performance in relation to identify key success factors, along with providing timely information, performance reports, to support the continuous improvement philosophy (Brimson and Berliner, 1988; Burcher and Stevens, 1996; Neely, 1998; Olorunniwo, 1997).

In a JIT and TQM environment, implementing good PMSs enables managers to communicate expectations to their teams, identify performance gaps and make positive changes to support continuous improvement objective (Helmes, 1995). In a JIT and TQM environment, PMSs will be in place to measure the company's or activity's performance in terms of its key success factors and provide feedback on performance with which control can be achieved, changes can be made, and performance rewarded, thereby ensuring the achievement of the organisation's objectives. In a JIT and TQM environment, performance must be measured, improvements made and the performance measured again. Performance measurement should be like a cycle of measurement and improvement and measurement again. In a JIT and TQM environment, PMSs are a systematic way of measuring the performance in manufacturing and non-manufacturing operations (Lockamy III and Cox III, 1994).

4.3 PMSs Components in a JIT and TQM Environment

In general, a PMS is the set of people, methods, and tools for generating, analysing, portraying, discriminating, and measuring data and information about multiple dimensions of performance (Hayes et al., 1995). Forza and Salvador (2000) indicated that a primary function of PMS "is to provide employees with information on their past performance, allowing them to assess the outcomes of their actions, and therefore if they are meeting or not the objectives they are given". They also mentioned that the pressure for achieving and continuously improving performances leads companies to develop their PMSs, to play the role of supporting continuous improvement. According to Drongelen and Bilderbeek (1999), performance measurement can be defined as "the acquisition and analysis of information about the actual attainment of company objectives and plans, and about factors that may influence this attainment".

In a JIT and TQM environment, PMSs are composed of performance key success factors or criteria, measures and reports that allow a manufacturing company for planning, scheduling and controlling of resources to satisfy customers' needs and to support the continuous improvement effort (Lockamy III and Cox III, 1994).

Crawford, Cox and Blackstone (1988) employed the following definitions of a PMS, criterion or key success factors, and measure in studying selected JIT operations:

- performance measurement system: A systematic way of measuring the inputs, such as raw material, equipment, facility, outputs, such as end item, and transformation in a manufacturing or non-manufacturing operations. The system includes performance criteria, measures and reports. PMS is a way of ensuring that a manufacturing company is using its resources in the most effective manner (Here, 1996). Hussain (1996) in his definition of PMS presented the same meaning. He said that: "It is a way of communicating objectives and achievements within an organisation and of ensuring that the firm is using its resources in the most effective manner".
- performance criterion or key success factors: The relative element used to measure macro and micro, long-term and short-term, functional, such as accounting, marketing, and manufacturing, and overall performance.
- planned performance measure: The accepted satisfactory level of performance.
- actual performance measure: The actual value of the performance criterion.

To explain the difference between PMS components, suppose that a manufacturing company produces a product with a quoted lead time of ten weeks, the industry average. Lead time is one of the most important key success factors in this company, which can be defined as the amount of time between the customer's placing an order and receiving the order. Suppose that the four biggest customers of this company indicate that this company would be the preferred supplier if the quoted lead time was eight weeks. From this example, the performance key success factor or criteria is lead time, the planned performance measure is eight weeks, and the current performance measure for this factor is ten weeks. Assume that if the plan is achieved, then annual sales to these four customers alone would increase. In this case, the company needs to reduce lead time, the competitive advantage factor, which can be done by using appropriate JIT techniques, like setup time reduction, small lot production and so on. It is essential for JIT and TQM companies to establish performance criteria or key success factors and measures in areas where continual improvement is required for competitive advantage (Ghalayini and Noble, 1996).

In a JIT and TQM manufacturing company, it becomes necessary to develop a PMS which drive the company towards the goal of supporting continuous improvement to become a 'world class manufacturer' (Daniels and Burns, 1997a). According to Lockamy III (1998), sustainable world class performance will not occur if there is a misalignment between a company's objectives and actual market requirements. PMSs facilitate consistent organisational actions toward objective achievement, and linkage between the company's objectives and customers' requirements and expectations through key success factors (Lockamy III and Cox, 1994). Jonsson and Lesshammar (1999) mentioned that it is very important to identify the key success factors in a PMS, 'what to measure', and the optimum approach for measuring, 'how to measure'. They also mentioned that evaluation of the actual performance measures against planned performance measures for the identified key success factors is the first step toward a more 'comprehensive and effective approach' for PMS. The second step is to suggest improvements to the existing performance.

In the next section, a discussion of some of performance measures in a JIT and TQM environment will be presented. It must be understood that the above mentioned key success factors and the following performance measures are not all of the key success factors and performance measures related to a JIT and TQM environment. They are given to show some kinds of the key success factors and related performance measures that make sense in a JIT and TQM environment.

4.4 Performance Measures in a JIT and TQM Environment

A few authors have discussed the design of performance measures in a JIT and TQM environment (Dixon et al., 1990, Crawford and Cox, 1990, Maskell, 1991). Neely et al. (1997), summarises recommendations for designing good performance measures, which are made in ten different papers and books on PMSs. They explain that these papers and books were not chosen at random, but identified following an extensive review of the PMSs literature, which was published by Neely, Gregory and Platts in 1995. These recommendations and their references are:

1. Performance measures should be derived from strategy (Dixon, et al. 1990, Kaplan and Norton, 1992, 1996, Golberson, 1985a, Goold, 1991).
2. Performance measures should be simple to understand (Lea and Parker, 1989, Lynch and Cross, 1991b, Goold and Quinn, 1990).
3. Performance measures should provide timely and accurate feedback (Dixon, et al. 1990, Globerson, 1985b, Fortuin, 1988).
4. Performance measures should be based on quantities that can be influenced, or controlled, by the user alone or in co-operation with others (Globerson, 1985a, Lynch and Cross, 1991a, Fortuin, 1988).
5. Performance measures should reflect the "business process", i.e. both the supplier and customer should be involved in the definition of the measure (Globerson, 1985a, Lynch and Cross, 1991a, Fortuin, 1988).
6. Performance measures should relate to specific goals (Globerson,1985b, Fortuin, 1988, Goold and Quinn, 1990).
7. Performance measures should be relevant (Lynch and Cross, 1991b, Fortuin, 1988, Azzone, Masella and Bertele, 1991).
8. Performance measures should be part of a closed management loop (Kaplan and Norton, 1992, Globerson, 1985b).
9. Performance measures should be clearly defined (Globerson,1985b, Fortuin, 1988).
10. Performance measures should have visual impact (Lea and Parker, 1989, Fortuin, 1988).
11. Performance measures should focus on improvement (Lea and Parker, 1989, Lynch and Cross, 1991a).
12. Performance measures should provide fast feedback (Fortuin, 1988, Maskell, 1991)
13. Performance measures should employ ratios rather than absolute numbers (Globerson, 1985b).
14. Performance measures should use data which are automatically collected as part of a process whenever possible (Globerson, 1985a).
15. Performance measures should be reported in a simple consistent format (Lynch and Cross, 1991a).
16. Performance measures should be objective-not based on opinion (Fortuin, 1988).

The previous recommendations are general recommendations which together constitute a "good" design of performance measures (Neely, et al. 1997).

According to Geanuracos and Meiklejohn (1993), changes in performance measures can be a powerful driver of change in the way companies both function internally and perform in the marketplace. Dixon, Nanni and Vollman (1990), said that:

> Existing measures must be replaced with new measures for the following reasons:
> 1. Dissatisfaction with traditional measurement systems is growing.
> 2. Measurement approaches must support ever-increasing excellence.
> 3. Managerial effectiveness is achieved by integrating strategies, actions, and measures.
> 4. A major failure of existing measurement systems is their inability to focus managerial attention on overhead cost and the deployment of overhead personnel.

Today's competitive environment, in which JIT and TQM philosophies, are being implemented requires good PMSs that incorporate non-financial as well as financial measures (Vitale, et al. 1994). JIT and TQM focus on non-financial performance measures. Non-financial measures "rely on data outside of a conventional financial or cost system, such as on-time delivery, manufacturing cycle time, set-up time, productivity for the total work force and various measures of quality" (Santori, 1987). According to the National Association of Accountants (1986), in NAA's statement on management accounting 4D, non-financial measures have two distinct advantages over financial performance measures:

> • Non-financial indicators directly measure an entity's performance in the activities that create shareholder wealth, such as manufacturing and delivering quality goods and services and providing service for the customer.
> • Because they measure productive activity directly, non-financial measures may better predict the direction of future cash flows. For example, the long-term financial viability of some industries rests largely on their ability to keep promises of improved product quality at a competitive price.

Kaplan and Norton (1992, 1996a), and Vaivio (1995) argued that more dynamic environments, such as a JIT and TQM environment, require financial measures, as well as various types of non-financial measures to capture company's performance. Kaplan and Norton (1996b) also argued that managers and their teams should not have to choose between financial and non-financial measures of performance. Clark (1997), in his study about Irish management, mentioned that managers and their teams want a balanced presentation of both financial and non-financial measures

which provides a relevant information about company's performance. According to Scott and Tiessen (1999), financial and non-financial performance measures are complementary and together form a system of comprehensive PMSs. Perera et al. (1997) and Vaivio (1995) in their study provide empirical evidence of the increased use of non-financial performance measures by manufacturing companies pursuing a new approaches to manufacturing management such as JIT and TQM. According to Maskell (1992), new world-class manufacturing performance measures must directly relate to manufacturing strategy, use primarily non-financial as well as financial performance measures, vary between locations, change over time as company needs change, be simple and easy to use, provide fast feedback to operators and managers, and foster improvement rather than just monitoring. New style performance measures should support the organisation's mission, objectives or goals, strategies and key success factors of the business (Tadkinen and Smeds, 1999). According to MacArthur (1996b), new performance measures should be used to measure an organisation's success in continuously improving of manufacturing and non-manufacturing performance. New performance measures should be developed for the important activities and processes in the manufacturing company as well as for business units and the company as a whole. In the manufacturing company, there are a large number of activities performed, so it is difficult to determine which ones to measure. The most important thing is to establish performance measures for key activities, such as production activities, to minimise the amount of time spent on value added activities such as machining and assembly operations and to eliminate or reduce the time spent on non-value added activities such as setup time, material handling and inspection. In a JIT and TQM environment, new performance measures should support the continuous improvement philosophy.

As mentioned previously, key success factors are very important to many JIT and TQM manufacturing companies. They include, for example, quality, lead times, setup times, productivity and general key success factors. Each performance measure should relate to and support a key success factor. It must be understood that the new performance measures will change as time goes by and as the concept of continuous improvement becomes a daily reality (Tarr, 1995). The following are some of the appropriate performance measures for the aforementioned key success factors.

4.4.1 JIT Performance Measures

The idea of JIT philosophy is centralised around the elimination of waste. The continuous elimination of waste brings about changes in every aspect of the activities of the manufacturing company (Olorunniwo, 1997). Olorunniwo indicated that these include eliminating raw material inventories as suppliers deliver direct to the shopfloor just in time to be incorporated in manufacture and elimination of material handling costs by redesigning the shopfloor so that materials flow directly between adjacent work stations. These changes also include eliminating work-in-process by reducing lot size, eliminating finished goods inventories by reducing lead times such that all products are made to order and eliminating scrap by emphasising TQM philosophy (Harrison, 1992; Withers et al., 1997). According to Barfield, Raiborn and Kinney (1994), JIT philosophy attempts to acquire components and produce units only as they are needed, minimise product defects, and reduce lead/setup times for acquisition and production. They also mentioned that the three primary goals of JIT philosophy are elimination of any production process which does not add value to the product, continuous improvement in production performance and reduction in the total cost of production, with an increase of quality. The following are some of the JIT performance measures which can tie the goals of JIT philosophy to their key success factors.

- **Inventory Levels**

In manufacturing companies, the term inventory is used to refer to raw materials (RM), work- in-process (WIP) and finished goods (FG) inventory (Olorunniwo, 1997). Reducing inventory levels has always been a concern of production managers mainly because reducing inventory levels decreases the burden of financing the inventories. Burch (1994), mentioned that with a JIT technique, there may not be any RM inventory or FG inventory; instead, RM go directly to WIP, and the FG is shipped from WIP directly to the customer. One of the most important goals of JIT philosophy is to have zero-inventory production systems, or eliminate inventory levels (Barfield, Raiborn and Kinney, 1994). Horngren, Foster and Datar (1997), mentioned the important benefits of lower carrying costs of inventory. They said that "an important benefit of lower inventories is the heightened emphasis on eliminating the root causes of rework, scrap, and waste and on reducing the manufacturing lead time of their products." The percent reduction in inventory levels is a continuous

improvement measure which it can be use for measuring the key success factor of inventory levels.

- **Setup Times**

Most of manufacturing companies are aware that reduction of setup times is a cornerstone of the JIT manufacturing philosophy (Steudel and Desruelle, 1992). Steudel and Desruelle defined setup times as "the time spent between the production of the last part of one lot and the production of the first good part of the next lot: The time during which no good part or product comes out of the equipment." The percentage reduction in setup times or changeover of the equipment or production line is an important measure of continuous improvement. The percentage reduction in setup times measure can be displayed on a trend line or cell daily, weekly or monthly, depending on the current frequency of changeover.

- **Lot Size**

Reducing the size of production orders, lot size or batch size, not only reduces production lead time, which increases manufacturing flexibility, but also reduces the costs associated with large lot sizes (Wheatley, 1992). The percentage reduction in lot size is one of the most important measures in JIT philosophy, and it can be displayed on a trend cell or line weekly or monthly as average lot size by production process. It is usually agreed that reducing lot sizes leads to smaller inventories and decreased production lead times (Bartezzaghi et al., 1992).

- **Lead Time**

Reducing lead times includes manufacturing lead time and procurement lead time (Schniederjans, 1993). The percentage reduction in lead times are the measures which can be used. Miller, Meyer and Nakane (1992), presented an important definition of lead times. They said that manufacturing lead time is "the cumulative time from the beginning of the production cycle until an item is finally finished. Time spent in inventory as work in process, setup times, move times, inspection, and order preparation time are included." They also said that procurement lead time is " the cumulative time from the beginning of the procurement order cycle, order commitment, until the produced item is delivered. Includes vendor lead time, transportation, and receiving and inspection time." According to Horngren, Foster and Datar (1997), an important effect of reducing manufacturing lead time is reducing setup time. It is realised that lead time includes many non-value times, like

setup time, move time, and inspection time. The role of the percentage reduction in lead times measure is to focus the attention of management on the concept of continuous improvement in the elimination of non-value activities. The percentage reduction in manufacturing lead time measure can be displayed in trend cells daily, weekly or monthly, according to the time taken for the item to be finished.

•Throughput Time

In a JIT environment, manufacturing lead time is called throughput time. Reducing the total throughput time is one of the aims of JIT philosophy. The percentage reduction in total throughput time is a measure which can be used here. According to Cooper and Kaplan (1991), the total throughput time for a product can be represented as follows:

$$throughput\ \ time = proces\sin g\ time + inspection\ time + movement\ time + waiting\ /\ storage\ time$$

According to JIT philosophy, processing time is considered as value added time, and all the remaining time, inspection, movement, and waiting time as non-value added time. JIT philosophy aims to eliminate waste or non-value added time or activity, so in an ideal JIT technique, the throughput time for a part just equals its processing time (Cooper and Kaplan, 1991). The percentage reduction in total throughput time measure can be displayed in trend cells daily, weekly or monthly, according to the lot size of production.

• Delivery performance

Delivery performance is one of the most important key performance measures in a JIT environment. This is because delivering products to customers on time is the essence of a JIT manufacturing system (Maskell, 1991). On-time deliveries is a non-financial performance measure which can be use to evaluate delivery performance activities. According to Maskell, there are many factors that affect the on-time deliveries measure. These include correct scheduling, ensuring high quality, on-time deliveries of raw materials and components from suppliers, manufacturing at the right time in the right quantity and shipping the finished product when it is needed.

4.4.2 TQM Performance Measures

According to figure 4.2.2 TQM key success factors are concerned not only with the production process, but with every activity within the company, including marketing, purchasing, accounting, and after sales services. According to Cupello (1994), TQM represents a new paradigm for manufacturing companies in which continuous improvement and customer focus lead to enhanced process performance. Quality needs to be built into every process of the manufacturing company. In terms of the importance of product quality, measures of quality of production process will be presented. To achieve a high quality of production process, incoming raw materials and parts must be of an appropriate quality standard. In a TQM environment, if a manufacturing company is achieving a production standard, this does not mean that the company should simply accept that, but it must practise continuous improvement (Boaden, 1996; Born, 1994). The performance of the supplier can be measured in terms of zero inspection, on time delivery, and high quality of incoming raw materials (Wong, 2000). Incoming raw materials, therefore, must be measured against a standard. The standard will be in relation to the required standard needed in the production process and of the finished product. The measure of continuous improvement in percentage of good units produced to total number actually produced is one measure which can be used.

4.4.2.1 Quality Measures of Production Process

- **Percentage reduction in total cost of quality**

The reduction in total cost of quality would be measured on a weekly or monthly basis and can be displayed in graph format. The elements of total costs of quality are internal failure, external failure, prevention and appraisal costs (Krishnan et al., 2000). These four elements can be measured weekly or monthly as a percentage of sales. Table 4.4.2.1 highlights these costs. The percentage reduction in total costs of quality and in every element of it, is one of the most important measures which can be used in TQM philosophy.

- **Percentage reduction in defects**

The reduction in defects is measured in parts per million. The measure is defects per unit relative to the number of opportunities for defects to occur. The reduction in defects can be measured daily, weekly and monthly, and it can be displayed on a trend chart. TQM aims at 'doing it right first time, every time', so zero defects is one

of the most important aims of TQM philosophy. Slack et al. (1998) argued that zero defects standard is perhaps never achievable in practice but it does allow an operation to calibrate itself against a theoretical limit. The percentage reduction in defects measure is one of the most important measures to make sure that company pursues continuous improvement.

Table 4.4.2.1 Classification of quality costs

Failure costs. Costs required to evaluate, dispose of , and either correct or replace a defective or deficient product. • Internal failure costs. Failure costs discovered before the product is delivered to customers. Examples: - Rework costs - Net cost of scrap - Disposal of defective products - Downtime due to quality problems • External failure costs. Failure costs discovered after the product is delivered to customers. Examples: -Complaint investigation and processing - Warranty claims - Cost of lost sales - Product recalls
Appraisal costs. Costs of monitoring and inspecting products in terms of specified standards before the products are released to customers. Examples: -Measurement equipment -Inspection and tests - Product quality audits - Process control monitoring - Test equipment expense
Prevention costs. Investments in machinery, technology, and education programs designed to reduce the number of defective products during production. Examples: -Customer surveys -Research of customer needs - Field trials -Quality education and training programmes - Supplier reviews - Investment in improved production equipment - Quality engineering - Quality circles

Source: Pasewark, W. R. (1991). 'The Evolution of Quality Control Costs in American Manufacturing', *Journal of Cost Management for the Manufacturing Industry,* Spring.

- **Percentage reduction in time between defect occurrence, detection and correction**

There are actually three measures here: defect occurrence, defect detection and defect correction. These could be measured by way of a chart located in each work area, with time horizontally displayed and defects vertically displayed. Operators would record time of occurrence, detection and correction. The results of those measures can be summarised daily, weekly and monthly.

4.4.2.2 Quality Measures of Outside Suppliers

In a TQM environment, manufacturing companies are collaborating with their suppliers in the efforts to improve quality (Barron, 1996). They recognise that quality problems often result from the delivery of supplies and raw material that do not meet process specifications (Lawler lll et al., 1995). The following two measures are some of the TQM measures related to the quality of suppliers.

- **Percentage of certified suppliers**

Certified suppliers requires that the supplier's process has been certified to the point that there is no incoming material inspection required (Wheatley, 1992). The data on this measure should be displayed on a trend line and reviewed weekly or monthly according to process and appropriate actions should be taken. According to the concept of 'doing it right first time, every time', zero inspection for incoming material is one of the most important aims of TQM philosophy.

- **Percentage reduction in supplier base**

This measure is utilised to review improvements in quality of source of supplier. The supplier base is typically reduced by rewarding those sources that continuously improve quality, reduce lead time and improve on-time delivery performance. This measure can be display monthly as a trend line.

4.4.3 General Performance Measures

Planned measures can be used with most general performance measures. A planned measure is a numerical value set by management or customers and can also be derived from benchmarking. Appropriate performance measures indicate how well the company is meeting or exceeding its plan (Burch, 1994). Setting ongoing plans is essential to implementing continuous improvement. Continuous improvement is a

never-ending journey. When certain plans are reached, it is time to look at changing activities that can take performance to a new plateau.

- **Activity Costs (Total)**
  - * Production Activities Costs
    - – Direct Material Costs
    - – Direct labour and Overhead Costs (operation costs)
  - * Purchasing Activities Costs
  - * Marketing Activities Costs
  - * Financial Activities Costs

The percentage reduction in total costs, in costs for every functional process and in different categories of costs inside every function, are measures which can be used to measure the key success factor of continuous improvement in the reduction of activities' costs. For example, the percentage reduction of direct material and operating expense are some of measures which can be used here. According to the throughput philosophy operating expenses are 'all non-material costs, including direct and indirect labour' (Dugdale and Jones, 1997).

- **Throughput**

In a JIT and TQM environment, throughput is a new financial measure. Goldratt and Cox (1993), provided an important definition of throughput. They said that "throughput is the rate at which the system generates money through sales." This definition support the primary goal of any manufacturing company, which is to 'make more money now and in future', and the perfect way to achieve this goal is to increase throughput. Westra et al. (1996) argued that when the linkage is made between financial and non-financial measures, managers and their teams can see exactly how much money they are making for their company. They also said that "today's emphasis on throughput enables managers to compress significantly the time it takes to manufacture and collect payment." The following is the throughput measure:

$$Throughput = Sales\ revenue - Direct\ material$$

Dugdale and Jones (1996a) mentioned that the successful implementation of JIT and TQM support the continuous improvement of throughput. They said that "JIT leads to smaller batch sizes, improved response to customer demand and, hence, improved throughput. TQM emphasises product quality and customer satisfaction, thus leading

to improved throughput." Martin (1997) mentioned that JIT and TQM philosophies aims to improve manufacturing performance such as cycle time, response time, quality, productivity, on-time delivery, etc. He also mentioned that if such improvements do not result in increases in throughput, they cannot be regarded as improvements, only operational changes. The percentage increase in throughput is one of the most important measures which can be used to measure the key success factor of throughput to make sure that the company is pursuing the continuous improvement.

- **Return on Investment (ROI)**

ROI is the most popular approach to incorporating the investment base into a performance measure in traditional performance measurement systems. ROI can provide more insight into performance when it is divided into the following components:

$$ROI = \frac{\text{Revenues}}{Investment} X \frac{Income}{\text{Revenues}}$$

This approach is know as the *DuPont method of profitability* analysis (Horngreen, Foster and Datar, 1997). In the new style of performance measurement, ROI should be used in conjunction with other financial and non-financial measures. In a JIT and TQM environment, the percentage increase in ROI is a measure which can be used to support the continuous improvement idea. According to Dugdale and Jones (1996a, 1996b, 1997), any manufacturing company that uses the concept of throughput world with JIT and TQM world and cost world can easily use the following familiar relationships:

$$Net\ profit = Throughput - Operational\ \text{exp}enses$$

$$ROI = \frac{Throughput - Operational\ \text{exp}enses}{Investment(assets)}$$

Tucker and Tucci (1994) mentioned that the financial success or failure of most of manufacturing companies depends on their ability to generate profits from their normal ongoing core businesses.

According to Goldratt and Cox (1993) and Dugdale and Jones (1996a, 1996b), throughput world emphasises increasing throughput through more sales, JIT world concentrates on reducing inventory and all non-value added activities, TQM world encourages the term of doing it right first time every time, 'cost world thinking' emphasises cost cutting and more cost cutting. percentage increases in ROI and net

profit are two measures which can be used to make sure that the manufacturing company is following the continuous improvement concept.

- **Residual Income (RI)**

RI is income minus a required return on the investment (Horngren, Foster and Datar 1997).

$$RI = Income - (\text{Re}quired\ rate\ of\ return\ X\ Investment)$$

Percentage increase in RI is a measure which can be used for the key success factor of continuous improvement in residual income.

- **Productivity**

Productivity measure ascertains the amount of outputs produced by inputs. Productivity is normally measured using ratios, such as the following:

$$\text{Pr}oductivity = \frac{Outputs\ produced}{Inputs\ consumed}$$

A WCM company must continue to improve its output of products in relation to the inputs. Percentage increase in productivity is a measure which can be used to make sure that the manufacturing company is following the continuous improvement.

- **Customer Satisfaction**

According to VanDeven (1993), customer satisfaction would best be achieved by simultaneously making products 'faster', 'better' and 'less expensive'. He said that "the comparative form of these three modifiers was selected because it demonstrates an anticipation of the ever increasing expectations of customers, and it further suggests that a continuous improvement concept will be employed to satisfy them." Therefore, the principle of 'faster' encourages the economy of time and the avoidance of queues, and is measured by the Cycle time from the first to the last production operation. The principle of 'better' generates two separate behaviours and measures. One, that addresses giving the customer what is needed by doing it right the first time every time, is Quality, which is considered as one of the most important measures of the TQM philosophy. The other is getting it when it is needed, i.e. On Time Delivery, which is considered as one of the most important measures of the JIT philosophy. Similarly, 'less expensive' yields two behaviours and measures, the first is to build only what is needed, which means an Inventory Levels measure. The second is to build it at the lowest possible cost by eliminating non-value added activities, which means a Total Cost measure. Those measures, Cycle Time, Quality,

On Time Delivery, Inventory Levels and Total Cost, would not only serve to foster customer satisfaction but would also support the strategy of growth by promoting the types of changes that led to competitive advantage and the associated acquisition of greater market share. Olorunniwo (1997) mentioned that a manufacturing company should foster a performance atmosphere of continuous improvement to satisfy the customer's changing demand for variety and quality in order to remain competitive advantage. Chenhall (1997), in his study, indicated the factors which can be used to measure customer satisfaction. He said that:

> customer satisfaction is measured by quality of final products, on-time delivery, responsiveness to customer needs, and various aspects of the value chain associated with quality production such as materials throughput time, defect free production, minimum inventories, vendor quality and reliability, high productivity and low cost.

Those customer satisfaction measures, cycle time, quality, on time delivery, inventory levels and total cost, can provide a wealth of detail for benchmarking purposes. It can tell manufacturing companies who their major competitors are, who is best of breed in a particular process or activity, and how they rate against both these competitors and best practice leaders. According to Barfield, Raiborn and Kinney (1994), it seems reasonable that manufacturing companies which are not satisfying customers will most likely lose market share. Horngren, Foster and Datar (1997), mentioned that Conner Peripherals, a manufacturer of hard disk drives, identifies market share, customer response time, on-time performance, and product reliability as customer satisfaction measures.

4.5 Performance Reports in a JIT and TQM Environment

Most studies in PMSs emphasise performance measures, and little attention has been given to performance reports. Performance reports are at least as important and possibly more so than performance measures. It is basic to managers and their teams in manufacturing companies to share information about business performance, which is included in performance reports. Without that information, it is difficult for individuals, teams and managers to understand how well the business is doing and make meaningful contributions to its success, and it is likely to have little sense of what it must do to be competitive (Lawler III et al. 1995). Lawler et al. found in many cases, with the absence of performance reports, that it is impossible for individuals and teams to make good suggestions about how products and services

can be improved and about how work processes in their area can be done more effectively. In a JIT and TQM environment, the goal of performance reports is to improve the quality of performance of managers and their teams by providing a clear picture of the activities and accomplishments of the company. In a JIT and TQM environment, performance reports do not simply describe what has happened, they must influence what will happen, as they provide information for decision making and having a positive impact on behaviour. This role of performance reports can be fulfilled by providing them in the proper form, at the right time and preparing them according to what the managers and their teams perceive to be most suitable. According to Drury (2000), it is essential that the managers and their teams should be heavily involved in discussions with the management accountants as to what performance information should be reported to them. He also indicated that when the nature of the required performance information has been determined, some thought must be given to the frequency of reporting the information, the amount of detail to be presented, and the format. Burch (1994), mentioned that many world class manufacturers display the performance reports throughout the day on boards, charts, or graphs located adjacent to production cells. He also mentioned that such direct reporting methods can be useful motivations because shop floor teamwork is able to monitor their own performance on a continuous basis and the results are displayed for all members to see. On time reports permit managers and their teams to understand their work and to resolve problems quickly when they arise.

Barfield, Raiborn and Kinney (1994) mentioned that the continuous improvement concept recognises the value of eliminating non-value added activities to reduce lead time, making products with zero defects, reducing product costs on an ongoing basis, and simplifying products and processes. Armstrong (1997), mentioned that feedback or performance reports are vital in maintaining motivation, particularly towards the achievement of the key success factors of the business. In a JIT and TQM environment, performance reports may help in changing managers' and their teams' behaviour to support continuous improvement effort. The traditional performance reports, namely financial reports, might not encourage such a change. One of the most important behavioural changes that many manufacturing companies are currently encouraging is ongoing motivation of continuous improvement, which relates on enhancing teamwork task performance and the level of product quality (Barfield, Raiborn and Kinney, 1994).

4.5.1 Behavioural Impact of Performance Reports

Management accounting information has had not only a decision making but also a behavioural focus (Drury, 2000). As Ferrara (1990) indicated, accounting research of a behavioural nature has long been observed in management accounting information literature. Horngren (1989) has increasingly emphasised the motivational effects of the choices of accounting systems since the 1970s. However, there has been an overemphasis on a decision making focus. As Horngren noted, motivation was mentioned, but the emphasis was on which accounting quantifications would led toward wiser economic decisions. At this point, management accountants need to change their focus in designing performance measurement systems from an information-for-decisions to an information-for-decisions and to a behaviour-influencing focus (Hiromoto, 1991). The information-for-decisions approach was apparently stressed because management accountants wanted to recommend the optimal decisions, even though the final choice always rested with the operating managers. The primary concern of the behaviour-influencing approach is to design a system to influence managers and their teams to do the desired things to allow them to be creative and resourceful (Daniels and Burns, 1997b; Forza and Salvador, 2000). Kaplan and Norton (1992) mentioned that performance reports strongly affects the behaviour of managers and their teams.

PMSs have a fundamental effect upon the behaviour of individuals, teams and managers inside any manufacturing company (Hanna and Burns, 1997). According to Marchant (1998), the PMSs of a manufacturing company have a strong impact on the behaviour of people within that company: "what gets measured gets managed". The majority of studies in the behavioural impact of PMSs focus on the behavioural consequences of performance measures, and little attention has been given to the behavioural impact of performance reports. For example, Jaworski (1992), Tarr (1995), Daniels and Burns (1997b) and Hanna and Burns (1997), mentioned that performance measures clearly do influence behaviour. Hanna and Burns in their study found that poor behaviours closely correlated with badly designed performance measures. They said that "poor behaviours were felt to be a response to inappropriate or badly designed performance measures....However, it is important to note that the power of the measure not only comes from its definition but also from its

application." They also found that teams wanted their managers to provide feedback and performance reports, and to recognise achievement.

According to Barfield, Raiborn and Kinney (1994), positive feedback or performance reporting motivates teams to future successes by encouraging them to continue favourable behaviour. They also mentioned that that teams receive negative performance reports are made aware of problems relating to this negative performance and can attempt to change their behaviours in the future. It is realised, from the above point, that the most important effect of performance reports is the motivational effect. "Motivation is the concept we use when we describe the forces acting on or within teamwork to initiate and direct behaviour. We use the concept to explain differences in the intensity of behaviour, regarding more intense behaviours as the result of higher levels of motivation, and also to indicate the direction of behaviour" (Gibson, Ivancevich and Donnelly, 1997).

Management accountants must always be cautious in making motivational inferences by the preparation of performance reports according to what the managers and their teams perceive to be most suitable. One reason why the understanding of motivation is important is that high levels of motivation are significant contributors to exceptional performance (Jones et al., 1972). Manufacturing companies prefer highly motivated teams because they strive to find the best way to perform their work. According to Gibson, Ivancevich and Donnelly (1997), motivated teams are interested in producing high quality products or services, and more likely to be productive than are non-motivated teams. On the other hand, it is quite likely that performance reports in a JIT and TQM environment may provide a manufacturing company with the means to motivate managers and their teams to change, to adopt new practices, and to improve (Flynn et al., 1995). This is the essential argument of the continuous improvement based management philosophies associated with Japanese management practices such as JIT and TQM (Euske et al., 1993). There is another important point which is related to motivation and performance reports, and that is reward.

4.5.2 Performance Rewards

Rewards can be related to manufacturing company performance by means of 'gain-sharing' (Kelly and Monks, 1998). Some authors in team contributions mentioned that the aims of relating rewards to company performance through performance reports are to enable managers and their teams to share in the success of company, to increase the identification of teamwork to share in the success of the company and to focus teams' attention on what they can contribute to company success (Mabey et al., 1998; Marchington and Wilkinson, 1997). Gain-sharing is a 'formula-based' company or 'factory-wide' bonus plan which provides for a team to share in the financial gains made by a company as a result of its improved performance (Marchington and Wilkinson, 1997). The formula determines the share by reference to a performance measure such as throughput or another financial measure like residual income (RI) which is shown in performance reports (Mabey et al., 1998). Mabey mentioned that in some schemes the formula also incorporates performance measures relating to quality, on-time delivery, setup times, customer satisfaction, or cost reduction. Gain-sharing aims to relate its pay-outs more specifically to performance improvements which are shown in performance reports information (Kelly and Monks, 1998).

Fundamentally, the aim of gain-sharing is to improve company performance by creating a motivated and committed workforce who want to be part of a successful company. Gain-sharing plans are always based on key success factors and the performance measures related to those factors. Companies therefore need to ensure that every team involved knows exactly what is happening in these performance areas, why it is happening and what can be done about it. Performance reports as a part of the communication process can play this role. Otley (1997) suggests that the establishment of a balance between financial and no-financial performance measures and performance reports mechanisms is a powerful means of managing performance in tomorrow's company. Benchmarking is one of the most important tools of PMSs to manage and improve performance of JIT and TQM companies. According to Chakrabatti (1996), "benchmarking is the process of finding out the performance and practices of market leaders for comparing with its own performance".

4.6 Benchmarking

Benchmarking is playing an important role in supporting the continuous improvement philosophy of a JIT and TQM environment. Benchmarking is a process of continuously comparing and measuring a company against the best in practices (Simpson and Kondouli, 2000). Perhaps the easiest and simplest type of benchmarking to implement is internal (Chakrabatti, 1996). Chakrabatti mentioned that external benchmarking is more difficult to accomplish, but equally valuable. Best practices are those breakthrough techniques the best companies have adopted to achieve superior results (Zairi and Ahmed, 1999). Daniels (1996), stated that:

> Benchmarking is the process of comparison of a particular organisation, plant or process with its 'peers', i.e. an attempt to find out whether performance is good or bad when compared to others carrying out the same activities. It also attempts, from the various competitors, to identify 'best practice' and to use that as the basis of improvement.

It seem that for some manufacturing companies, it is difficult to make the identification of the 'peers' and to get permission to obtain data in sufficient detail on which to base an effective comparison, especially when the companies are competitors to each other. Benchmarking has been widely recognised as a technique that can dramatically improve company performance to best practice performance (Zairi and Hutton, 1995). Drysdale (1997) mentioned that benchmarking is a technique for learning based on empirical data. He said that:

> Benchmarking is not just information-gathering, comparing yourself to a competitor, or 'cherry picking' other organisation's good practices. It is a structured approach to learning, based on empirical data. To benchmark effectively you have to have an organisation that can not only observe and analyse as a planned process, but also has a framework that allows it to learn and develop.

It seems that JIT and TQM manufacturing companies can gain many benefits from using of benchmarking. They can understand the factors that make a successful organisation. They can identify their problem areas. They can see where they need to improve. Benchmarking, for instance, can be of extreme value in assessing the manufacturing company's gaps and in defining potential areas for strategic advantage (Pereira and Aspinwall, 1997). According to Drysdale (1997), benchmarking involves the following:

- Identifying a service, product or process within your organisation;
- Specifying its key performance criteria, e.g. time, cost or failure rate;

- Selecting 'partners' against which the performance of the product/process is to be measured. These could be other departments in your organisation, or other organisations, whether similar to yours or not;
- Collecting data on the key performance criteria from your organisation and your partner, and making comparisons;
- Where there are performance gaps, analysing their cause and assessing whether there are improvements which can be incorporated into your organisation's practices.

According to Malcolm (1996), benchmarking has provided several JIT and TQM manufacturing companies with valuable insights into ways of achieving best practices. Zairi and Ahmed (1999) mentioned that Hewlert Packard reported a wide range of benefits from the adoption and usage of best practices, including financial and non-financial benefits. These benefits are:

- reduction in time to market;
- reduction in costs;
- innovative use of existing products;
- revolutionary product ideas;
- decrease in employee turnover;
- increase in customer satisfaction.

Ruchala (1995) suggests that benchmarking can help identify areas for improvement and suggest magnitudes of improvement a manufacturing company needs to become a best practices. He also mentioned that benchmarking may be must useful when manufacturing companies set their sights on incremental, continuous improvement, before comparing their performance to WCM best practices. This can be done by a well designed PMS. In a JIT and TQM environment, benchmarking may be considered as one of the most important tools for PMSs. In a JIT and TQM environment, the primary purpose of PMSs under MAISs is to bring about improvement and make the manufacturing company successful (Drury, 2000). According to Burch (1994), a well designed PMS can be used to encourage day-to-day operations that improve suppliers' performance, reduce lead times, reduce setup times, increase throughput, improve quality and satisfy customers. This is a great challenge to MAISs. Burch also mentioned that perhaps the best way to continuous improvement is to measure the key success factors of the company. Miller (1997) mentioned that the real challenge of MAISs is to get all managers and their teams in a manufacturing company to accept ownership of their activity's PMS, by making sure they are involved in designing, developing and tracking PMSs.

4.7 Summary

Increasing globalisation and stiffening competition have imposed new customer requirements, including broader product lines, higher quality, on time delivery, and lower prices (Kald and Nilsson, 2000). With these changes in the manufacturing environment, a number of new philosophies or techniques for organising and managing manufacturing companies have been introduced (Dent, 1996). According to Kald and Nilsson (2000), two of the best known are JIT and TQM. The goal of those philosophies is continuous improvement, with all employees learning to do things better and to do better things (Nanni et al., 1992; Sriparavastu and Gupta, 1997; Kald and Nilsson, 2000). This raises a very important question of how PMSs can best be used to support the continuous improvement idea of a JIT and TQM environment.

The objective of PMSs has changed over the past few decades. Clark (1997) argued that traditional PMSs are important but they have limitations. Traditional PMSs based on financial measures and information are no longer appropriate or representative of information needs for the implementation of JIT and TQM philosophies. Traditional PMSs are an incomplete and inadequate means of understanding current or future WCM performance. Ghalayini and Noble (1996) mentioned that the implementation of JIT and TQM philosophies revealed that traditional PMSs have many limitations and the development of new PMSs is required for success. According to Keegan et al. (1989), one of the most important limitations of traditional PMSs, is that they often include too many different measures, which makes it difficult to understand the 'big picture'. Alternative PMSs focus in the integration of variety of performance measures, financial and non-financial. According to Jonsson and Lesshammar (1999), integration between measures is often problematic, and many studies have emphasised that manufacturing companies do not have effective PMS that cover all necessary performance key success factors (e.g. Caplice and Sheffi, 1995; Ghalayini and Noble, 1996; Makell, 1991; Schemenner and Vollmann, 1994; Srikanth and Robertson, 1995). For example, Schmenner and Vollmann (1994) showed in their empirical study that most firms studied needed to seriously consider changing their PMSs. Review and analysis of the limitations of traditional PMSs, as well as the emerging trends in PMSs development, reveals that the basis of PMSs in a JIT and

TQM environment must be changed and that there are certain characteristics that are necessary in order to produce information that is relevant for improving WCM performance.

In a WCM environment, a JIT and TQM environment, it seems that key success factors are the answer to some of today's needs to measure both financial and non-financial results, to build flexibility into PMSs, and to gain acceptance by all levels of management. New PMSs must usually be developed in conjunction with the key success factors of JIT and TQM philosophies. Some authors referred to the importance of linking PMSs to strategies, through key success factors (Haas and Kleingeld, 1999; Kaplan and Norton, 1996b).

In summary, Taylor and Convey (1993), and Rangone (1997) believed that there are three key rules essential to successful PMS: identify key success factor, link performance measures to key success factors and focus on continuous improvement. Taylor and Convey also suggested that any PMS will be organisation specific, since every manufacturing company is different. Martin (1997) mentioned that no system will be perfect, but through continuous improvement the 'best' PMS can be achieved and refined. In this regard, PMS, by itself, does not show which actions are to be taken in order to improve performance (Kueng, 2000). The aim of a PMS is to support the continuous improvement philosophy (Forza and Salvador, 2000). A clear understanding of the behavioural consequences of performance measures and reports is necessary to implement a successful PMS (Daniels and Burns, 1997b). Finally, any PMS must remain fluid and changing with the ever changing needs of manufacturing environment to motivate managers and their teams to achieve the company's mission, goals or objectives, strategies, and key success factors (Daniels and Burns, 1997a). Marchant (1998) said that: "If companies are to succeed in the emerging knowledge economy they must create measurement systems that focus on their mission and strategies". This mean that a new PMS cannot be implemented and forgotten. Hendricks et al. (1996) indicate that in today's dynamic environment, strategies, goals and objectives and key success factors are subject to change. Therefore, PMSs must be reviewed periodically and changed as necessary (Waggoner et al., 1999). This relationship between the changing manufacturing environment, company's goals and objectives, key success factors and changing in PMSs can be summarised in a conceptual model.

4.7.1 Conceptual Model

Although every manufacturing company wanting to introduce PMS should create its own version to suit its needs, it is useful to have a conceptual model or a theoretical framework within which appropriate processes can be developed and operated. Sekaran (2000) in the very important book, *Research Methods for Business: A Skill-Building Approach,* provided an important definition of a theoretical framework. She said that "a theoretical framework is a conceptual model of how one theorises the relationships among the several factors that have been identified as important to the problem." Sekaran also mentioned that after conducting the interviews, completing a literature review, and defining the problem, one is ready to develop a conceptual model. In this study, the conceptual model will help in deciding the PMS approach to be adopted and, when the decision has been made, it will provide guidance to managers and their teams on what performance measurement activities they will be expected to carry out. The conceptual model or theoretical framework of this study consists of the following factors.

1. JIT and TQM environment

2. Company's mission, goals and objectives

- company's mission;
- company's goals;
- company's objectives

3. Company's strategy

- world class manufacturing strategy;
- definition of JIT philosophy/technique
- definition of TQM philosophy/technique

4. Key success factors

- JIT key success factors;
- TQM key success factors;
- general or common key success factors;

5. Performance Measurement Systems

- definition of performance measurement systems;
- JIT performance measures;
- TQM performance measures;
- general performance measures;

- the link between company's key success factors and performance measures;
- performance reports or feedback;
- benchmarking process.

6. Continuous improvement concept

A manufacturing company should foster a performance atmosphere of continuous improvement. Continuous improvement, in a JIT and TQM environment, adopts an approach to improving performance which assumes more and smaller incremental improvement steps (Sriparavastu and Gupta, 1997). Slack et al. (1998) mentioned that in continuous improvement it is not the *rate* of improvement which is important, it is the *momentum* of improvement. They also mentioned that it does not matter if successive improvements are small; what does matter is that every month or week, or quarter, or whatever period is appropriate, some kind of improvement has actually taken place. It seems that this concept has a direct effect on the designing of PMSs, especially in determining performance key success factors and measures. According to Turban, McLean, and Wetherbe (1999), "the process of continuous improvement relies on performance measurement to detect deficiencies and determine root causes by careful selection and timely tracking of critical performance measures". According to Sekaran (1992 and 2000), a good detailed discussions of a conceptual model or theoretical framework depends on a literature review and data collect from empirical study.

The empirical study of this research will be conducted in two of Egyptian pharmaceutical companies. In the next chapter, information about Arab Medical Packaging Company (AMPCO), which specialises in flexible packaging products, will be presented as the first case of the empirical study.

Chapter Five

Arab Medical Packaging Company (AMPCO) Case Study

FLEXIPACK

5.1 Introduction

A decade ago, packaging was often an afterthought for many companies, viewed as merely the final step in manufacturing. But now, food, drug and medical device makers are considering packaging earlier during development. Medical device manufacturers are devising packages that can not only withstand shipping and handling and sterilisation, but also are easy to use in critical situations like surgery and hold a variety of instruments. Pharmaceutical and nutritional product makers are using packaging and labelling as mediums to promote their products and increase patient compliance with drug regimens. Packaging for pharmaceuticals and medical devices must meet domestic and international regulations regarding labelling language, waste reduction or reuse, barrier needs, and a host of other concerns.

Both drug and device makers are experiencing the cost restraints of managed care, so both are looking for ways to keep manufacturing and packaging costs down. Manufacturers turn to specialist packaging suppliers for assistance, not only with requests for more economical materials and components, but for help with package quality, development and ongoing technical support. These suppliers are responding with innovative materials that cost less and are stronger, have more barrier, and are more attractive than their predecessors. They are also providing equipment that can thermoform, mould, extrude, fill, wrap, seal, or label packages at high rates, helping manufacturers get their products to market more quickly.

Arab Medical Packaging Company (AMPCO) is one of the most important flexible packaging companies in Egypt. Initial contact with AMPCO was made by a company visit in July 1997. This company was identified through various channels, i.e. suggestions by the faculty of commerce and business administration staff members at Helwan University (Egypt), and by the pharmaceutical information committee of the Egyptian Ministry of Health. During the initial visit and discussion with the President of the Board of the Directors of the company, the aims and

objectives of the case study were outlined. After obtaining permission for the study, extended interviews were conducted with the President of the Board of Directors and his vice-president, and production, quality, and financial managers. This was done by structured interview (see Appendix 1). The purpose of the structured interviews was to take the pulse of the company. This was the first phase of on-site company visits.

In the second phase of on-site visits, research data were collected from unstructured interviews (see Appendix 2). The design of the interview questions was open-ended to encourage dialogue with interviewees for more detailed information and understanding of interrelationship between WCM strategy, JIT and TQM philosophies, and the PMSs changes. These field interviews started in June 1998 and lasted three months. The interview schedule helped to focus the investigation and ensured a consistent enquiry procedure was followed. During 24 visits, two days a week, to the company over a period of three months, extended unstructured interviews were conducted with the company's employees from the President of the Board of Directors of the company to shop floor employees. Thirty people were interviewed in the company, including the President of the Board of Directors and his vice-president, production manager, sales and marketing manager, financial manager, quality control manager, management accountants, production and shift supervisors, and various personnel in the production area, during plant tours, amounting to approximately 90 hours of interviewing. In addition to the interviews, tours of the factory, offices, and stores were conducted. Some of the company documentation was provided by the company. In addition, the researcher spent time in the AMPCO library where he found useful information about packaging in general and flexible packaging in particular. The information gathered from the AMPCO was written up as a case study, beginning with the company background.

5.2 The Company Background

AMPCO was established on the 29th September 1983, according to law No. 43 of 1974 concerning Arab & Foreign Investments, amended by the law No. 132 of 1977 & 230 of 1989. AMPCO is a member of the Flexible Packaging Association (FPA). FPA has served as the voice of the flexible packaging industry since the association was formed in 1950. Its headquarters are in Washington, D.C. Members represent all facets of the industry from the manufacturers, converters, and suppliers of flexible packaging materials and products to the trade press and packaging schools. FPA works on behalf of the industry and consumers. It ultimately serves, through its public outreach, government relations, technical, educational, and statistical programmes.

AMPCO, based in Cairo, includes six plants in which pharmaceutical packaging and other packaging products are manufactured. The company's customer base is 100% make-to-order. On the Thursday of each week, Manufacturing, Marketing, Purchasing, Accounting, and Scheduling managers review the master schedule and customers' orders. Based on this review, the overall daily production rates for the following week are calculated and specific product mix schedules are developed. The product mix schedules are distributed to the purchasing and manufacturing managers. In addition to this weekly meeting, there is a monthly meeting between the President of the Board of Directors, production, marketing and sales, purchasing, quality, and financial managers to review the company's activities. Based on this monthly review, plans for the company's activities for the next month are developed.

AMPCO developed a new manufacturing strategy, aiming to achieve WCM performance. AMPCO began the journey of the becoming a world class manufacturer in October 1995. The process of change of the company to be a world class manufacturer will be presented in the section 5.3.1 changing story of AMPCO. The people in AMPCO believed that the route to success in achieving world class performance is by the following compatible three ways, product leadership in the flexible packaging products, manufacturing excellence, and customer satisfaction. The people in AMPCO also believed that customer satisfaction would be the critical success factor. They interpret customer satisfaction as meaning utilising the intimate knowledge of customers' needs and requirements to provide quality products, and on

time delivery, at suitable prices, to their world wide customer base. To do so, AMPCO has already started to implement WCM philosophies, associated with JIT and TQM philosophies. The JIT and TQM programmes were started in June 1996. Included in the current JIT operation are all parts, products, work centres, and employees at all levels. AMPCO considers quality as the most important part of JIT techniques. As a result of this new environment of the implementing of WCM philosophies, AMPCO is altering its aim from competitive costs to competitive costs, quality, and time-responsiveness. AMPCO is using a new PMS introduced in 1998 to measure and report its performance. This is because the traditional PMS, which AMPCO used to operate, is no longer suitable or useful with the implementing of WCM philosophies. AMPCO supports its WCM strategies with a new PMS, which supplements the traditional PMS. AMPCO's activities, capacity, products, mission, goals and objectives, are outlined below.

5.2.1 Activities

AMPCO has specialised in the production of flexible packages, coated and laminated foils for pharmaceuticals and food stuff packages (dairy products, biscuits, chocolate, meat and poultry), cosmetics, seeds, and some chemicals. The President of the Board of Directors mentioned that "good things come in less packaging", and flexible packaging is used by virtually every industry in the world to protect and preserve its products. He also mentioned that flexible packaging is strong, versatile, lightweight and sophisticated, and consists of less material than other forms of packaging. This source reduction means there is less material to recycle or discard and that fewer natural resources are consumed in the first place.

5.2.2 Production Capacity

AMPCO's production capacity is 75000 tonnes (packaging & wrapping materials) yearly. In view of the fast development of automatic packaging and the requirement to provide the necessary protection for the packed product, AMPCO uses flexible packaging on a large scale for packaging numerous and varied pharmaceuticals, food stuff, and chemical products in all their different forms: liquid, powder, tablets, paste and granules, in order to facilitate handling and consumption rationalisation.

5.2.3 Products

AMPCO produces the following:

1. Opaline, sulphite and Kraft paper coated with polyethylene.
2. Paper laminated with aluminium and coated with polyethylene.
3. Aluminium foil coated with heat sealed lacquer.
4. Polypropylene coated with polyethylene.
5. Polyester coated with polyethylene.
6. Cellophane laminated with aluminium and coated with polyethylene.
7. Cellophane laminated with paper.
8. Aluminium foil laminated with paper.
9. Polyamide laminated with polyethylene.
10. Polyester laminated with aluminium foil and coated with polyethylene and other coated and laminated foils for different purposes.

All these types of laminates are printed with the most up-to-date technology to meet the customers' requirements.

5.2.4 Mission, Goals, and Objectives

AMPCO has a new mission, goals, objectives statement, which was distributed to all management levels in October 1995, when the company started to implement a world class manufacturing strategy. This statement of mission, goals and objectives is written in Arabic; the following is a translation of its contents.

The company's mission is to become a world class manufacturer of flexible packaging products in Egypt, Middle East, Arabian, and African markets. This can be done by providing the best flexible packaging products of high-quality, according to customers requirement, in the right quantity, in the right place, at the right time, and at competitive prices.

The company's goal is continuous improvement in the rate of return on investment (ROI), by making more sales now and in the future, making more money now and in the future, and making more profit now and in the future. According to the President of the Board of Directors, the ultimate strategic goals of AMPCO are:

1. Providing the highest quality levels of the flexible packaging products.
2. Make more businesses now and in the future.
3. Make more money now and in the future.
4. Make more profit now and in the future

The company's objectives are:

1. Continuing to develop world class manufacturing capabilities at the company facility.
2. Continuing to develop the company's capabilities for faster and more accurate customer responses in all of its markets.
3. Continuing to satisfy customers by providing high quality product, on time delivery with competitive prices.
4. Continuing to improve sales revenue.
5. Continuing to improve contribution margin (throughput).
6. Continuing to improve the reduction of total costs.
7. Continuing to improve the reduction of inventories costs.
8. Continuing to improve the reduction of set-up and lead times.
9. Continuing to improve the elimination of all types of manufacturing and non-manufacturing wastes.

According to the President of the Board of Directors, reducing cost, improving quality, increasing customer satisfaction, improving profit and increasing speed to market are AMPCO's main objectives.

5.3 World Class Manufacturing Strategy at AMPCO

The President of the Board of Directors and his Vice-president mentioned that the company now is working to be world-class manufacturer, because of the new systems of the world organisations, such as ISO 9000 and world-wide GATT or WTO agreement. They indicated that they will almost certainly have to find ways of doing things better than they have ever done them before, not just in manufacturing but in every aspects of the company's business. They also mentioned that a new WCM strategy, to support this new way of working, has been proposed and the likely benefits identified. They also mentioned that a well-managed company, according to WCM strategy, recognises the need for continuous improvement. The production manager indicated that WCM at AMPCO has been defined as a management philosophy that focuses on continuous improvement.

The primary goal of continuous improvement in AMPCO is customer satisfaction. It also aims to satisfy such cross-functional goals as quality, cost, cycle time and on-time delivery. The President of the Board of Directors mentioned that every department at AMPCO accepted the premise that customer satisfaction is the only way to succeed as a world class manufacturer in the new environment. The marketing and sales manager said that: 'The company has become increasingly exposed to competition and not just at home, but in many of its traditional export markets too because of the growth of international trade. The company's customers have woken up to the fact that they can demand more improvements in an ever shorter time, and if the company does not satisfy their demands, someone else probably will.'

According to the production manager, AMPCO until 1995 used a very traditional manufacturing processes based on engineering driven standards. The philosophy was that engineering could design anything, any way, without giving much thought to manufacturability, and it was the plant's job to figure out how to make it. But now, as the result of implementing the WCM strategy, AMPCO focuses on the plant's processes and the environment in which the company personnel perform. Plans have been set to raise the productivity and profitability of the factory while meeting or exceeding customer expectations. Two of the most significant practices of the change are the development of internal factory capabilities through teams to design vertically integrated work cells and the cultural change from

traditional division of labour to self-managing, customer focused work teams. AMPCO started in the beginning of 1996 to train the workers in world class manufacturing strategy. Approximately 70 percent of the workers, by June 1998. were trained in elements of WCM and given full empowerment to change any process, layout, or flow in the sequence of events from customer order to product delivery. These changes were implemented over a period of years by continual education and training, management participation in all activities, empowerment of the employees, and recognition of their efforts.

In the words of Gamal Galie, the President of the Board of Directors of AMPCO, the company is looking for world class performance. He said 'world class performance is much more than an exercise in meeting due dates, it is an unprecedented effort to work in harmony across functional boundaries, together with the customers, in order to simplify the process of planning, controlling and delivering our products on high quality, on time delivery, and at a competitive price'. He also mentioned that business logistics, as the result of the WCM strategy, is very important to AMPCO. By business logistics, he meant, he said 'the process of planning, implementing, and controlling the efficient, effective flow and storage of raw materials and products and related information from point of origin to point of consumption to meet customer requirements.' He also said that AMPCO put this very simply, saying, 'it's the process of getting the right product to the right customer at the right time at the right price.' He mentioned that AMPCO's objectives are the best products at the lowest cost, enabling the customers to make the most profit from the company's operations with the least involvement. AMPCO uses logistics to add value by getting this lowest cost product to the customer at a rate lower than he can negotiate. AMPCO works with outside suppliers in the same fashion: negotiate, negotiate, and negotiate. Survival is not a requirement in AMPCO, it is a privilege. Galie mentioned that AMPCO started to change in 1996, and until now it has only seen the beginning of the change. He also said that the rate of change will increase at a tremendous rate up to 2005 and the best way to enter the 21st century will be to create a competitive advantage through the use of improved technology and WCM philosophies. As the result of the implementation of WCM strategy, new concepts have been adopted at AMPCO, such as teamwork and

marketing reviews. But before the discussion of those concepts, a brief discussion of the changing story and the process of change at AMPCO will be presented.

5.3.1 Changing Story of AMPCO

People in AMPCO mentioned that the flexible packaging industry is undergoing a sea change, as a result of a dramatic shift in customers' priorities and expectations. Where once AMPCO competed upon price alone, customers now place much greater priority on quality and delivery time. The production manager mentioned that customers demand superior, reliable flexible packaging products that are made to their specification and are environmentally friendly, and they want on time delivery. The President of the Board of Directors indicated that the AMPCO was responding to these changed circumstances by exhibiting flexibility and a thorough understanding of the customer.

In the monthly meeting of October 1995, the Board of Directors of the company decided to change its business processes to be ready for the year of 2005. It was mentioned that there are many reasons for the change inside the company but the main reason for the change is the result of the pressure of the GATT or WTO agreement, which has been signed by the Egyptian Government in May 1995. Egypt like any developing countries has 10 years grace period before fully implementing the agreement. AMPCO decided to change because of the expectation of increasing competition in local and international markets as the result of the agreement.

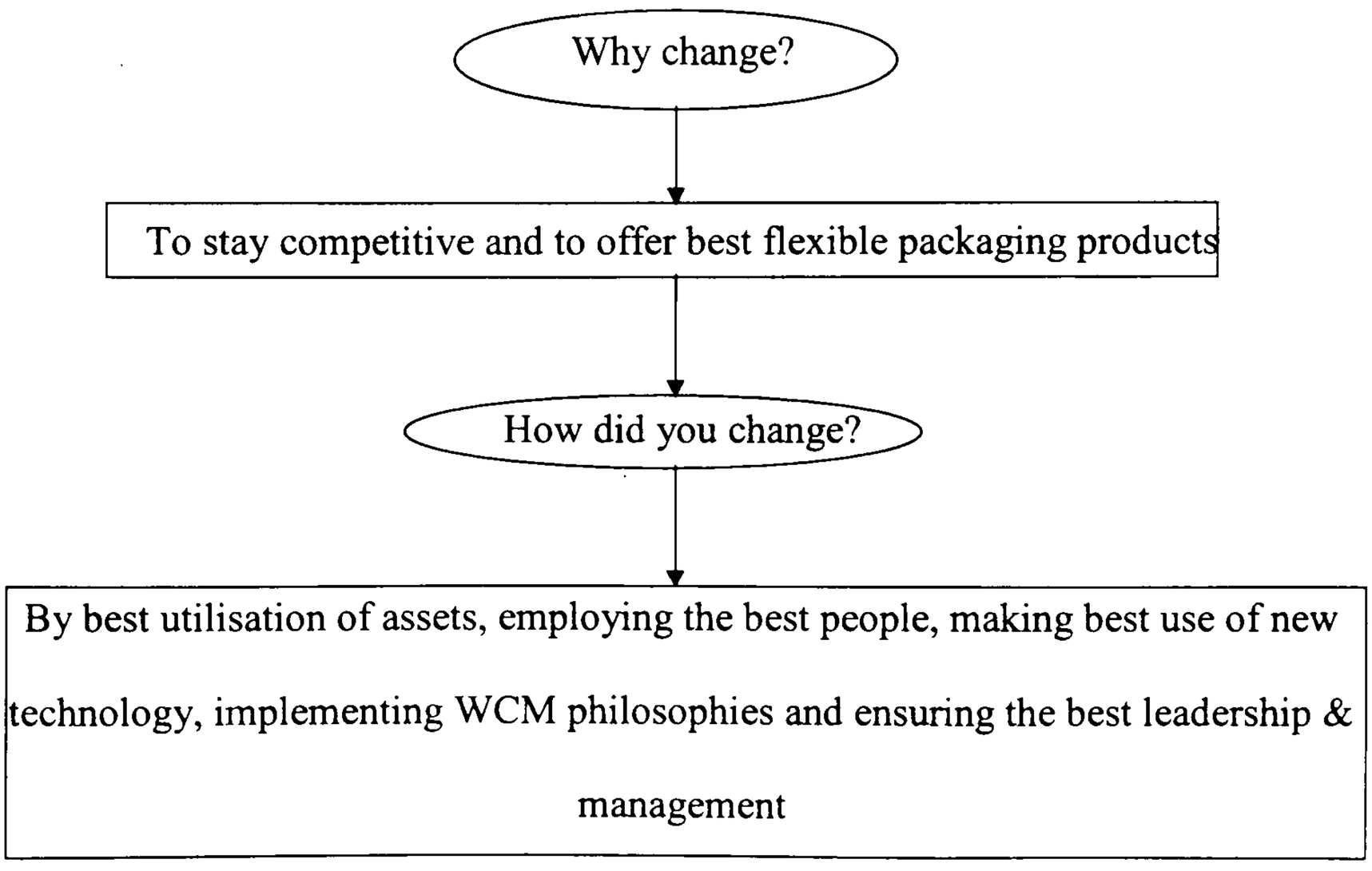
The period from October 1995 to December 1995 was the period of ideas, thinking, putting plans and discussing between the Board of Directors members, and at the same time connecting the experts. In January 1996, the Board of Directors of the company started the process of change with the establishment of the mission statement, which not exist before, and determined the goals and objectives which will enable the company to achieve that mission (see point 5.2.4). The Board of Directors of the company has also chosen WCM strategy as the way to achieve the company's goals and objectives. The company decided to implement JIT and TQM philosophies under WCM strategy as the way to continuous improvement of the performance. The choice of WCM strategy, JIT and TQM philosophies was a matter of manufacturing wisdom, which the company got from the successful international

companies inside Egyptian market such as General Motors, Toyota, and Glaxo-Wellcome Egyptian branches.

The period from January 1996 to June 1996 was the period of training and education of the manufacturing team, changing the layout of machines to U-shape systems and improving the company relationships to its suppliers, customers and employees. In June 1996, the company started to implement JIT philosophies. As the result of starting the change in AMPCO, the company developed an extensive training programme before the JIT implementation, which was started in June 1996. This will be presented in the JIT philosophy section. The details of the change from June 1996 to August 1998 will be presented in the JIT, TQM, and PMSs sections.

According to the President of the Board of Directors, the aims of the change are to do business better than before, to improve the performance of the company dramatically and to be a world class manufacturer of flexible packaging products. He acknowledged that "to improve performance dramatically takes a long time; we know it is not something that can be done overnight, because there is so much to do to make it happen." AMPCO is changing its ways of working to stay competitive and survive into the twenty-first century. Figure 5.3.1 shows the answers of the President of the Board of Directors on Why and How AMPCO made its change.

Figure 5.3.1 Why and How did AMPCO change?



AMPCO's relationships and interactions with suppliers of inputs and equipment and customers of output were instrumental in influencing decisions to make changes in technology and adapt product characteristics to the requirements and expectations of customers. For example, the requirement of some pharmaceutical companies in Six October City (industrial city) to receive their pharmaceutical packaging on a daily basis, direct to their shop floor has forced AMPCO to build a new factory in that city with high technology and a view to meeting quality requirements of those customers.

AMPCO has been also developed by investment in upgrading technology of the old factory. The investment involved technological improvements of equipment and establishing quality control facilities. In this regard, the main problem which has faced AMPCO is the human resource requirements to cope with technological upgrading and adoption of new philosophies of JIT and TQM. AMPCO decided that the only way to solve this problem is through formal and other forms of education and training.

One of the benefits of changing in AMPCO is the change of employment policy, starting from 1997, especially for the new factory of six October City, which will start its manufacturing in 2000. This is because the traditional policy of manufacturing workers was focused on the ability of reading only. For example, it is mentioned in the new policy that some skills are basic and required for manufacturing workers at all levels. Those skills are:

1. Literacy: Which means that employees must be able to read and understand factors related to their jobs, act on that information and communicate effectively in writing.
2. Numeracy: Which means that all workers require an ability to do basic mathematical operations, and at least some ability in geometry, computers and statistics. More advanced capabilities are required for positions involving engineering, programming and statistical quality control.
3. Technical knowledge: Which means that prior familiarity with manufacturing processes or equipment is highly valued.
4. Analytical skills: Which means that workers need to be able to solve problems effectively. They must be able to reason, draw conclusions based on available information and act upon their decisions.
5. Responsibility and learning skills: Which means that workers have to be able to take on responsibility for problem solving.

6. Interpersonal skills: Which means that employees must be able to work co-operatively and productively as team members and to communicate their ideas effectively.

The President of the Board of Directors mentioned that employees are playing a broader, more responsible and more thoughtful role in AMPCO than ever before. He indicated that the manufacturing workforce, for example, as a whole, will shift away from unskilled labour, towards skilled and semi-skilled positions. He also mentioned that one of the most important benefits of the implementation of the new employment policy has brought the concept of teamwork into AMPCO.

5.3.2 Teamwork

With the implementing of WCM philosophies, especially JIT, AMPCO realises that teamwork is important to the success of the company, and it has made working in teams a part of the company's values. According to the Vice-President of the company, each team has a clearly defined objective; the members understand what is required of them, and they know when and how they will be evaluated. He also mentioned that every team establishes specific, challenging, and concrete performance expectations. The other two most important aspects of the structure of the team are establishing ground rules and determining the teams' decision making process. AMPCO reports that the members of each team understand each other well, are able to respond to each other's needs, understand and design tasks based on individual knowledge, skill, competence, and characteristics, and come together and function as a team.

5.3.3 Marketing Reviews

The purpose of market reviews in AMPCO is to identify opportunities for increased market share, revenue, throughput and profit. The sales and marketing manager mentioned that market reviews identify and analyse the top customers based on items such as sales volume, products sold to those customers, top competitors and their approach to selling, main reasons for winning and losing orders, lead time versus competition, market share, and delivery performance. Market reviews in AMPCO also identify new or replacement products that should be added to the company's portfolio. The sales and marketing manager also mentioned that new product introduction has to be co-ordinated with sales training, customer notification, and

advertisement programmes. AMPCO conducts marketing review meetings for each of its four major market factors: customers, competition, industry requirements, and distribution, four times a year. These involve the President of the Board of Directors, sales and marketing, manufacturing, purchasing, and accounting managers. Their task is to plan the introduction of new products and to co-ordinate all activities to ensure a successful product introduction. One of the benefits of the 1997 marketing review was the establishment of a new customer service section under the sales and marketing department at the beginning of 1998.

The goal of customer service is to support the AMPCO plan in satisfying customer needs. Customer service personnel enter customer orders into the order entry system, which is linked by a computer network to the production, purchasing and accounting systems. Customer service also co-ordinates with the production supervisors and raw material control to change manufacturing priorities to meet particular order dates. Another area of involvement is in assisting the marketing function in the administration of special pricing agreements. Customer orders can be placed in several ways, via fax, telex, mail or phone calls. Two individuals in the customer service area enter orders, but AMPCO is studying the use of electronic data (ED), i.e. the direct computer-to-computer exchange of standard business documents (customer orders, purchase orders, trade and freight invoice, bills of lading, etc.) between companies, for this purpose. Key areas of performance for the customer service section are customer shipments and service levels in finished products, which are examined on a daily basis. Also, invoice errors are measured and causes ranked. A new measure for the customer service area is the elapsed time between when an order is received and when it is placed in the order system.

The President of the Board of Directors indicated that achieving incremental improvement in performance will set the company on the path to becoming world-class, but only a well-organised continuous improvement programme, involving the whole workforce, will enable the company to remain world-class in the longer term. One of the most important philosophies, which has been implemented at AMPCO as the result of following the continuous improvement programme, is JIT philosophy.

5.4 Just-in-Time Philosophy at AMPCO

The President of the Board of Directors and production manager of AMPCO mentioned that the aims of JIT philosophy are to provide a fast, reliable and flexible response to customer's requirements, eliminate waste of resources, and minimise dependence on inventory. They also mentioned that implementing JIT philosophy requires a long-term commitment. The first step, which the company decided to follow in its process of change to implement JIT philosophy is to build a good education and training programme.

5.4.1 Education and Training at AMPCO

In January 1996, AMPCO started to formulate its long-term plan for education and training. Training in AMPCO has taken various forms in-house training, training in specialized local institutions and training in other countries. The company has found from the experiences of other companies that training in other countries is very beneficial, but causes a financial problem at the same time. The problem of depending on training in other countries for AMPCO is that overseas training is expensive and has therefore largely been confined to a few managerial and specialized technical and professional skills. Local training in technical and professional institutions had catered for the majority of staff. The major problem, for AMPCO, is the shortage of specialist institutions for technical skills in flexible packaging. Lower-level skills were acquired through in-house training inside the company. All direct employees and supervisors in the manufacturing department were required to attend in-house training session, a three weeks, 8 hours per day, that included economics, supply and demand, AMPCO's markets, JIT and quality techniques. All direct employees were trained in the skills required to understand a process and thereby influence the quality improvement over time.

Top management who had previous experience tended to accumulate learning faster. Their visits abroad were an eye opener when such visits were targeted. In this regard, the benefits of change are coming from the interactions with foreign partners, who are responsible for delivering new and upgrading technological equipment, which were found to have enhanced managerial and technological capabilities but only under certain conditions.

The emphasis of JIT philosophy in AMPCO focuses on continuous improvement towards lower production costs, better quality and reliability of products, achievement of promised delivery times of finished goods, and close relationships between customers, suppliers and workforce. It seems that the techniques of JIT are becoming very well known for both the purchasing and the production function teams of AMPCO. When top management were questioned about the reason for switching to JIT techniques, it was stated that those techniques focus on reducing all kinds of waste and costs, improving the quality and reliability of incoming materials and finished products and satisfying customer demand. JIT in AMPCO has yielded and continues to yield substantial benefits, including reduction in total cost, reduction in inventory levels and costs, and improvement in delivery schedules (see for example, tables 5.7.3.5.2 and 5.7.3.6.7). Now, the top management are hoping to transfer these improvements to all functional teams before starting the production of the new branch in the Six October City on 1.1.2000.

5.4.2 Suppliers' Relationships

The major elements of the JIT inventory system in AMPCO are to provide only the necessary material at the right place, at the correct time, to eliminate waste, and to accomplish operations at minimum cost. AMPCO started in January 1996 to re-build its relationship with suppliers. The change of those relationships has taken four months. This is done by building long term relationships with suppliers and assurance that the suppliers are able to deliver superior quality materials in small lots with frequent deliveries. AMPCO is reducing the number of the suppliers and forming partnerships with the remaining vendors; 90% of the suppliers are on annual agreements. The benefits of the reduction in the number of suppliers have resulted in reduced prices and better delivery performance. Vendors are expected to deliver high quality raw materials. The vendor partnerships have resulted in quality improvements and shortened procurement lead times. Incoming inspection of raw materials has therefore been largely eliminated. The majority of materials received from ship-to-stock vendors are directly placed in the stockroom without inspection. These are materials imported from international outside companies. There are about six certified ship-to-stock suppliers. The main problem of reducing the number of outside suppliers is related to the risks if the suppliers fail to deliver the raw material on time. AMPCO also has three local JIT suppliers of raw materials. These materials,

however, still require inspection. The purchasing manager believes that quality, product innovation, delivery and cost are the most important objectives on which the department competes. He mentioned that key measures used in evaluating suppliers' performance are quality, on time delivery and prices. He also mentioned that the company has a plan to continuously improve its relationships with the suppliers.

5.4.3 Cellular Manufacturing

One of the most important JIT elements that have been implemented at AMPCO is cellular manufacturing. Prior to the implementation, a process layout existed. The workstation layout divided the factory into machine centers that group machines of a similar type together. Job orders were processed through the factory by moving the semi-completed material from one machine center to another according to the production routing for the product. This approach required that the product be moved a considerable distance during the production process as it was transferred from one work center to another. The problems of this approach were high inventory investment, long production cycle times, some material damage and wasteful materials movement.

AMPCO started in March 1996 to change its workstation to work cells and it finished this change in May 1996. The workstation area is now divided into six work cells, each containing all the equipment required to manufacture and test an assigned group of packaging products. In addition to the equipment, a supervisor, production line engineer, test engineer, production control planner, and preventive maintenance employee are assigned to the cell. The benefits of the change to this new approach are minimisation of the movement of materials, tooling, and employees. In each cell, completed parts are automatically moved to the next machine to reduce material handling. The problems of the change to cell approach were related to two periods, before and after the change. Before the change, the problems related to over production to cover the non-production period during the change and the inventory investment of that over production which included rent of the storage place outside the company. After the change, the problems were related to some employees mistakes in the beginning of the production with the new approach which led to materials damage as the result of the non-familiarity of some employees with that change.

The most important benefit related to the employees in workstation is that a cross-training programme has been implemented. The purpose of the programme is to increase flexibility within the work cells by training employees to operate various machines in the work cells. A preventive maintenance programme has also been implemented. Each work cell has assigned to it a technician who is responsible for maintaining the cell's equipment. Approximately 26 workers are assigned to each work cell in three shifts. This small number of employees in the work cells allows continuous discussion of work cell problems. To ensure that employees have the skills required to identify and solve problems, they have attended detailed quality and JIT training sessions. Manufacturing employees at AMPCO are quite flexible and can assist in other work cells when needed. The production manager mentioned that the workforce in AMPCO are multi-skilled, cross trained, employees.

5.4.4 Set-up Time Reduction

The process of set-up time change started in January 1996 by studying the set-up processes, through discussion of set-up with the employees who do the tasks and by analyzed the activities step-by-step.

As a result of JIT implementation, according to the production manager, set-up times for the cells' machines have been reduced by approximately 20%. To achieve this, manufacturing engineering, production, and machine maintenance were studied, and set-up times were reduced by changing processes, redesigning products, modifying machines, and improving work methods.

5.4.5 Master Production Schedule (MPS)

The planning and scheduling team under the manufacturing department plans the material requirements and schedules customer orders for the manufacturing cells. The team receives from the marketing department details of packaging products needed, including quantities, delivery times etc. The production manager has the responsibility of ensuring that the manufacturing cells' teams are aware of any changes in material or process specifications for all customer orders. The customer orders are then matched against production capacity, loaded into the master production schedule, which includes all necessary tasks for completing every order, manufacturing teams' responsibilities and time tables for task completion, and exploded by the Material Requirement Planning (MRPI) into requirements utilising super bills of material. The requirements generate material demands for the purchasing department, which is responsible for stock checking and contacting suppliers for the necessary amount of materials to support the production. A daily production meeting is held to develop daily production schedules and to discuss performance against the weekly manufacturing plans for each manufacturing cell.

The manufacturing cells at AMPCO are undergoing a JIT conversion process, which is having a major impact on the planning and scheduling function. The elimination of the semi-finished products area has allowed the manufacturing department to drop a temporary planning step. The benefit of the reduction in manufacturing cells' cycle time as the result of JIT implementation inside AMPCO has made the manufacturing environment more dynamic and allowed for customers' orders to be scheduled within a shorter time and on a daily basis if required.

As the result of JIT implementation at AMPCO and to build a good MPS, the quality control department is currently conducting training sessions for design engineers, marketing and manufacturing teams on how to perform a customer interview. The skills acquired in these training sessions will be used in product design meetings with all customers, especially new ones, and in field application workshops devised to avoid the miss-application of the product by the customer. Customer interviews are conducted by design engineers, marketing and manufacturing personnel to determine their needs prior to the design and manufacturing phase. Customer interviews during field application workshops are

designed to discover whether the packaging product is performing in a satisfactory manner. Follow-up interviews with customers are also conducted to monitor customer satisfaction levels.

It seems that, as a result of JIT implementation at AMPCO, one of the most important benefits of the change is that the engineering and manufacturing teams work together very closely on getting new flexible packaging products into the workstations, and solving manufacturing problems within the production process. At the same time, the marketing and manufacturing interface has become very important. Work issues such as plant loading, raw material inventory stocking policies and manufacturing cycle times used to be discussed between the two functional teams. The new challenge to AMPCO under JIT philosophy implementation is tearing down traditional functional boundaries.

According to the production manager, it is very important to AMPCO to have very good quality with the implementing of JIT philosophy. All manufacturing cell teams are responsible for producing quality packaging products. They should inspect their work and not deliver defective products. If a defect or problem is detected, the operator notifies the supervisor, who then determines how the problem will be solved. The production manager also mentioned that AMPCO has chosen TQM philosophy to be implemented alongside the JIT philosophy.

5.5 Total Quality Management Philosophy at AMPCO

The AMPCO company defines quality as "continuous improvement activities, processes and functions to reduce waste, defects, and variability in everything the company does, while striving to meet customers' expectations". The President of the Board of Directors and Production Manager mentioned that the TQM philosophy is based on defect prevention. They also indicated that the objective of this philosophy is to meet the needs of internal and external customers by creating an organisational culture inside AMPCO in which everyone, at every stage of creating the products and every level of management, is committed to quality and clearly understands its importance. They expressed the belief that achieving world class performance means developing a 'quality creation' culture, in which every member of the workforce takes personal responsibility for the quality of his or her own work, and where it is accepted by all that the goal of 'right first time, every time' applies to every employee and to every aspect of the company's operations, not just to manufacturing process. In this respect, the quality control department plays an important role in AMPCO's ability to achieve its quality objectives by ensuring that all product designs, materials and process of the product are of the highest quality. At the same time, the quality control function at AMPCO serves as the focal point for the development of TQM philosophy.

5.5.1 Quality Control Department

The quality control department at AMPCO consists of a quality manager, three quality engineers and several process auditors. The process auditors are former quality inspectors who are responsible for discovering any quality problems in the manufacturing process. According to the quality manager, quality inspectors will no longer be used in the AMPCO plants when the company fully implements TQM philosophy. The quality engineers are responsible for all incoming inspections of purchased materials from a quality perspective. At this point, one of the benefits of change is that AMPCO is reducing the need for inspection of incoming materials by JIT implementation and improving relationships with the suppliers. The quality engineers are also involved in the day-to-day problem solving activities in the manufacturing area, and co-ordinating how each manufacturing cell supports the product from a quality perspective. The quality manager is the person responsible for

overall product quality. He is viewed almost as an internal consultant. He provides long-range direction to the company in the area of quality, as well as guidance in the area of quality education and training. In support of the company's mission of customer satisfaction, the quality manager has been actively involved in developing a means for keeping AMPCO abreast of customer needs. Recently, he has taken the initiative to communicate with all teams on a regular basis the idea that quality is the single most important driving force in the packaging business. When the quality manager speaks of quality, he does not limit it to products, but speaks of a total quality commitment which starts with design and ends with satisfied customers. The quality manager believes that continuous quality improvement can only occur through the continual education of the whole workforce on the principles of TQM philosophy.

The quality function at AMPCO uses two primary techniques to analyse quality data: first, check sheets which are used to ensure that quality control data is collected carefully and accurately; second, cause and effect diagrams which are used to identify relationships between potential causes of quality problems and their effect on product quality. One of the most important roles which the quality control department plays in AMPCO is to support the manufacturing department in assessing the type and level of manufacturing technology required to improve product quality, reduce direct and indirect cost, reduce manufacturing lead times, and enhance overall customer satisfaction. The President of the Board of Directors, quality and production managers all mentioned that ISO 9000 requirements, which were adopted in June 1998, are the key to insuring good implementation of TQM philosophy and satisfying customers at the same time. As they saw it, ISO 9000 is sweeping the world, and is rapidly becoming the most important quality standard. Many Egyptian pharmaceutical companies have already adopted it and many more are in the process of doing so. When they were asked, "why ISO 9000?" they said, because it improves quality; it saves money; customers expect and ask for it, and the majority of competitors use it. The marketing and sales manager said that 'Customers are demanding and competitors are driving AMPCO towards the implementation of ISO 9000 requirements.' Becoming ISO 9000 registered, in order to comply with external regulatory forces, meet customer demands, and gain a competitive advantage, was very important to AMPCO.

5.5.2 ISO 9000 Requirements and TQM philosophy

AMPCO receives advice on upgrading its management systems to meet the requirements of world class performance, from the Centerior organisation in Nasr City, Cairo, Egypt. Centerior was established in Toledo Ohio USA, for handling non-regulated business operations. The parent company, Centerior Energy Corporation, was formed in April 1986 upon the merger of the Cleveland Electric Illuminating Company and the Toledo Edison Company. With assets close to $11 billion, Centerior Energy Corporation is one of the largest electric utility systems in the United States. According to Eng. Amin Kasim, Manager, Quality Consultancy Division in Centerior, "Centerior is committed to providing lifelong services for the Clients. Our mission is to be the source of continually exceeding customer expectations with uncompromising quality service. Our dedication to customer satisfaction has been a tradition with Centerior and its predecessors for a long time. Our main strategies are to become the client's partner in quality and provide a service that is informative, insightful and pleasant and to assist our clients in making their growth, quality and profit soar."

During interviews with people from Centerior it was mentioned that in today's fiercely competitive environment, concepts such as zero defects, Just In Time, Total Quality Management, and continuous improvement,....are a must if AMPCO wants to achieve world class performance to reach total customer satisfaction. They emphasised that becoming world class was not just a matter of investing in the latest equipment and technologies but that the core elements of WCM strategy include JIT techniques, ISO 9000, TQM, and continuous improvement and closely linked to these are concepts like cycle time reduction, quick changeover, elimination of non value added activity, and the development of supplier certification programmes, and demand chain management strategies. The Centerior experts concur that world class is a moving target, that it demands continuous improvement, a constant striving to get better.

Centerior is assisting AMPCO to reach this target through the following services:

1. Providing assistance in setting up and implementing the management system to meet ISO 9000 and ISO 14000 Standards.
2. Assisting with the preparation of procedures and manuals.
3. Assisting with the implementation of system requirements within the business activity.

4. On site appreciation training.

5. Pre-registration assessment of the recent upgraded management system.

6. Assisting during the Certifying Body's assessment of the system.

7. Provision for maintaining the AMPCO quality management system.

8. Assisting with the implementation of TQM techniques.

Training was provided by the Centerior experts in management systems to help AMPCO. The Centerior experts mentioned that "by combining capabilities in advisory services for the management of quality and quality management training, Centerior achieves a better standard of training because its staff is constantly in touch with the real-life situation and problems which face AMPCO, which is attempting to improve its commitment to quality. Our courses are customised, where necessary, to meet specific needs." Esmat Doss, the leader of the Centerior team, explained how ISO 9000 works as follows:

1. A company decides that it needs to develop a quality system that meets the ISO 9000 standards. The company may choose to follow this path because it feels the need to control or improve the quality of its products and services, to reduce the costs associated with poor quality, or to become more competitive, or it may choose this path simply because its customers expect it to do so or for all the previous reasons.

2. It then requires to develop a quality system that meets the quality requirements specified by ISO 9001. In the course of doing so, it also considers ISO's many guidelines.

3. Once the company's quality system has been fully developed and implemented, it invites an accredited external auditor, the registrar, to evaluate its effectiveness. If its auditors like what they see, they will certify that the quality system has met all of ISO's requirements. They will then issue an official certificate to the company and they will record its achievement in their registry. The company can then announce to the world that the quality of its products and services is managed, controlled, and assured by a registered ISO 9000 quality system.

4. However, the company need not be registered. ISO does not require formal registration or certification. The company can be in compliance without being registered by an accredited auditor. Nevertheless, its customers are more likely to believe that it has an effective quality system if an independent external auditor says so.

The following is the Diagnostic Audit Report of Centerior for AMPCO's case:

DIAGNOSTIC AUDIT REPORT FOR

ARAB MEDICAL PACKAGING CO.

1. Introduction

This audit was performed within the framework of Centerior, to evaluate the effectiveness of client's quality programme for compliance to ISO 9002. This is considered as first step to make sure that the implementing of TQM in AMPCO will be successful.

2. Audit Team

- Esmat Doss — Team Leader
- Amin Kasim — Team Member
- Nagwa Bahgat — Observer
- Ibraheim Abd El Razek — Observer
- Mohie Mohamed — Observer

3. Checklists References

The ISO 9002-1994 Standard.

4. Audit Methodology

- Adequate Audit → by desk study of client's documents and forms.
- Compliance Audit → by on site audit, questions, verifying the activities, processes and operations implemented.

5. Report Methodology

- Presenting the ISO 9002-94 standard requirements.
- Stating the status and findings of the existing management system.
- Recommendations for improvements.

6. Purpose of the audit

Determination of the required efforts needed to upgrade the client's quality management system to meet the requirements of the applicable standard, as a basis for preparing a long term action plan for implementing TQM philosophy.

7. Conclusions

Currently, AMPCO requires to review its structure and activities to meet the requirements of ISO 9002-94 standard. Also, it needs to develop a structural documentation system that incorporates all activities. The Centerior auditing team mentioned in the last sentence of the report that achieving world class performance

for AMPCO means doing a lot of things right, and also means creating a strong team environment.

There are many points which have been audited by Centerior. Each point has its requirements, the company status and recommendations for the future. The following are those points:

1. Management Responsibility
    - 1.1 Quality Policy
    - 1.2 Organisation Responsibility and Authority
    - 1.3 Organisation Resources
    - 1.4 Management Representative
    - 1.5 Management Review
2. Quality System
    - 2.1 Quality System Procedures
    - 2.2 Quality Planning
3. Contract Review
    - 3.1 General
    - 3.2 Review
    - 3.3 Amendment to Contract
    - 3.4 Records
4. Design Control
    - 4.1 General
    - 4.2 Design and Development Planning
    - 4.3 Organisational and Technical Interfaces
    - 4.4 Design Input
    - 4.5 Design Output
    - 4.6 Design Review
    - 4.7 Design Verification
    - 4.8 Design Validation
5. Document and Data Control
    - 5.1 General
    - 5.2 Document and Data Approval and Issue
    - 5.3 Document and Data Changes
6. Purchasing
    - 6.1 General

6.2 Evaluation of subcontractors

6.3 Purchasing Data

6.4 Supplier Verification at Subcontractor's Premises

6.5 Customer Verification Subcontracted Product

7. Control of Customer-Supplied Product

8. Product Identification and Tractability

9. Process Control

10. Inspection and Testing

10.1 General

10.2 Receiving Inspection and Testing

10.3 In-process Inspection and Testing

10.4 Final Inspection and Testing

10.5 Inspection and Testing Records

11. Control of Inspection, Measuring and Test Equipment

11.1 General

11.2 Control Procedure

12. Inspection and Test Status

13. Control of Non-conforming Product

13.1 General

13.2 Review and Disposition of Non-conforming Product

14. Corrective and Preventive Action

14.1 General

14.2 Corrective Action

14.3 Preventive Action

15. Handling, Storage, Packaging, Preservation and Delivery

15.1 General

15.2 Handling

15.3 Storage

15.4 Packaging

15.5 Preservation

15.6 Delivery

16. Control of Quality Records

16.1 Internal Quality Audits

17. Training

18. Servicing

19. Statistical Techniques

    19.1 Identification of Need

    19.2 Procedures

The Centerior experts mentioned that application of ISO 9000 requirements is the first step for the successful implementing of TQM philosophy. According to the Centerior experts, AMPCO can have a competitive advantage, larger market share, lower costs, and several other impressive benefits by realising superior customer satisfaction. They also mentioned that this can be done by developing and implementing TQM practices in all functions of AMPCO, with the aim of attaining greater customer satisfaction.

The Centerior Team started its auditing in December 1997 and finished in May 1998. AMPCO applied all the recommendations of Centerior by June 1998, and it has a plan with Centerior to complete the mission to set-up the company with TQM requirements by December 1998. This is to make the company ready, when it starts production in its Six October City factory in 2000, for full implementation of the JIT and TQM philosophies.

5.5.3 The Benefits and Problems of JIT and TQM Implementation

Many good things have come out of the struggle of AMPCO to achieve WCM competitiveness by implementing of JIT and TQM philosophies. The introduction of JIT and TQM in 1996 presents a big challenge inside the company and required a long time to lead to effective results and benefits. The emphasis were on JIT manufacturing, quality, customer satisfaction, flexibility, and changing management style of dealing with first line people.

One of the most important benefits of the change towards JIT and TQM philosophies is that the company started in 1997 to study the customer continuously. Now, the company's entire process, internal as well as external, is directed towards the customer. AMPCO's people believed that by serving the customer, the company will gain increasing market share and corporate health. For example, by serving SEDICO, which considered as one of the most important customers to the company, AMPCO gained 75% of SEDICO's packaging requirement.

The introduction of JIT serves as one of the most important drivers of continuous process improvement. With low levels of inventory, quality is a critical factor for all inventory items. The JIT environment inside the company allows for the minimisation of raw and packaging materials inventory as well as scrap and rework expenses (see table 5.7.3.6.7). The introduction of TQM led the company to define quality in terms of customer needs. Now, "close to the customer" is the all-pervasive basis of doing business at AMPCO. Despite the problems that the company has faced with TQM implementation, the key to finding out what the customer perceives as 'quality' was to create occasions and opportunities for customers to tell the company what they think about the company's products and then to listen to the customers carefully.

There are also some financial benefits, which the company gained, partially at least, as the result of JIT and TQM implementation. The following are some of those benefits:

1. There is increased sales revenue by 12.87% in 1997 and 10.21% in 1998 (see table 5.7.3.6.3).
2. There is increased throughput by 26.96% in 1997 and 22.56% in 1998 (see table 5.7.3.6.3).
3. There is increased ROI from period to period. ROI was 13.07% in 1995, 18.24% in 1996, 20.97% in 1997, and 23.84% in 1998 (see table 5.7.3.6.4).

One of the benefits of the change inside the company is that this change has given the Board of Directors impetus to create a learning organization and introduced a drive to develop and transfer knowledge constantly. These are the results of the education and learning programme inside the company and also the changes in the accounting department, especially the beginning of the change in PMSs.

Changes towards JIT and TQM philosophies required a radical shift to a new management style which caused tension with the first line employees. AMPCO moved towards a culture of continuous improvement by introducing an extensive training programme that challenged the intellectual skills of employees and giving them the tools and encouragement needed to improve their performance. The role of manufacturing management was to create an environment where employees were empowered to take matters into their own hands and create change. The new management style required a radical modification in working procedures which manufacturing workers were reluctant to embrace. Essentially this was because, in the past, manufacturing management used to treat operators as suppliers of labour, not as individual human beings with something to contribute. This traditional style led to mutual distrust and poor relationships between manufacturing operators and management. It is scarcely surprising that difficulties were encountered when new working procedures were introduced. Now, AMPCO is endeavoring to make full use of the work force's first hand knowledge of how to make the production better, faster, and safer. To be successful trust must be established between management and operatives. AMPCO accepted that it takes time and experience to develop trusting relationships between operators and management, which is why AMPCO dedicated a great deal of time and money to training and educating its employees. The distrust between operators and managers must be overcome to begin to realise the advantages of change. Training and education alone will not change operators' and managers' behaviours, but training in the new skills was the first step toward the change. Nevertheless considerable advances were made in working practices.

At this time an external event had a significant adverse influence. The problem related to the new Egyptian government policy of privatisation, which was a direct consequence of pressure from the WTO agreement. In late 1996 the Egyptian government started to sell some of the publicly owned companies and at the same

time introduced a policy of retirement for some employees to ease the transition. The government aim was to improve the financial results of publicly owned companies before privatisation to maximise the sale price.

This policy change indirectly affected the behaviour and motivation of operational staff. AMPCO's operators knew that the Egyptian government owned a share in the company. Therefore, they assumed that, as happened in some of the public companies, they might be dismissed or be given early retirement. In late 1997, AMPCO started to implement statistical operator control (SOC) techniques as a precursor to TQM philosophy. This programme provided statistical training for all employees to enable measuring the quality of their own output. The quality manager of the company was made responsible for undertaking this training programme, which started in October 1997 and lasted for three months. At the end of the programme, the quality manager ran a test to evaluate the operators understanding of the technique. The feedback showed a very low level of understanding. Further informal questioning revealed that a significant factor was that employees were de-motivated by the fear of redundancy. Even though managers explained to the operators that because AMPCO was not in the category of full public ownership, and therefore ownership was not about to alter, staff were still not convinced that redundancies would not take place. Examination of the circumstances by the researcher revealed that additional factors were also important:

1. Training did not extend to the implementation phase.
2. A lack of overall TQM philosophy.
3. Senior managers did not show any significant interest.
4. Training omitted to mention benefits from other similar experiences.

It seems that there was difficulty in convincing operators about management's commitment. Though management was committed to adopting SOC and TQM, operators in the company expressed their doubts about management's intention. This was due to the long time emphasis on production and profitability. Suddenly, however, operators were finding increased insistence by management to improve quality, and this they found difficult to digest. But management did not make it clear that this shift towards quality was primarily because of increased competition and also to open up export opportunities not to create favourable circumstances for selling the company. The issues, therefore, were to create stability as a prelude to growth. In this regard, it was observed that senior management of the company were

involved in other issues, leaving the job of implementing TQM solely to the quality manager. After the initial training programme introduced updating the quality manuals, further initiatives were undertaken: hiring an outside consultant, forming work improvement teams, and sending managers abroad for training. The senior managers did not realize that in addition strong personal participation was required for TQM to be successful.

Management neglected to convince everyone that it did not expect employees to work harder but wanted them to adopt the TQM philosophy as a way of life. Management did not explain either the tangible or intangible benefits that operators would receive. After a period of analysis and deliberation, AMPCO asked the US firm of Centerior consultants to help the company in the implementation of ISO 9000 and SOC but also to devise a programme aimed in building the trust between the operators and management. The Centerior experts started this training programme in late 1998. As a result the SOC technique was successfully implemented.

The role of Centerior experts was to develop quality procedures and techniques to ensure that the packaging products were produced correctly according to specification. The old techniques used in AMPCO were an expensive approach to quality control in terms of wasted raw materials, excessive operator time and equipment resources. Finally, more operators and equipment were used to filter out the scrap generated by inspecting all products. Filtering processes tended not to be 100 per cent efficient, which meant that customers on occasions received poor quality packaging, even after inspection.

Centerior experts from the outset aimed to involve all operators in the improvement process. Therefore it was important that a good relation between Centerior team, management and operators was developed. Operators were given opportunities to determine their own targets, gather quality information and develop improvement plans. Indeed, trust was an essential ingredient in introducing and implementing SOC technique. Training was a key part of the Centerior approach. Initially two teams from designated cells received training to kick-start the quality improvement process.

During the training session, operators learned about the company's competitive position and where the sources of immediate competitive threats lay. The concept of empowerment and its importance was explained. Time was allowed for operators to develop their own schemes of improvement so they could contribute more effectively

to their company's success. Centerior team allocated two hours a day for two month for all operators in determined cells. They also explained the principles of SOC and its tools. The benefits of SOC were explained and some tools, such as quality charts, were introduced. These tools enabled operators to control process variation which causes inconsistencies within the product. Also they created a framework for continually improving performance. After two months operators were armed with an understanding of SOC technique and quality charts. Greater process stability meant more consistent output. By progressively reducing variation over time to improve the capability of the process, the level of defects declined and productivity increased. The successful implementation of SOC technique in two manufacturing cells was a good advertisement for the technique and enabled a wide range of operators in other manufacturing cells to understand the benefits of SOC on the factory floor.

The Centerior experts helped the company to implement a more proactive approach to quality. SOC helped to prevent problems within the process. The output could then be sample-tested because the standard of quality from the manufacturing cell no longer necessitated 100 per cent inspection. The findings of the sample tests were fedback to the team operators responsible for the process so preventative measures could be taken. In this regard, product quality costs were therefore reduced because of savings in materials, labour and equipment processing time. The Centerior experts helped the company to present quality data on a continuous basis using control charts.

Control charts showed performance of a process over time in graphical format to emphasise the process variation. Control charts were used to manage product quality. Control charts are a neutral tool for identifying and describing a situation objectively. Centerior consultants found that placing control charts on the shop floor next to the operator, where the work was being done and the measurements were being made, served to make operators aware of how the process was doing and given them quick feedback about the effects of changes. This led operators and managers alike to be much more alert to problems and more responsive to fixing and eliminating them, whether the problem was caused by a faulty machine, lower quality materials, or human error.

Critique of the Relationship with SEDICO

Prior to 1998 SEDICO were treated as a standard customer. After negotiations in 1998 SEDICO gave AMPCO preferred supplier status. According to this new supplier/customer relationship, AMPCO signed an agreement to provide 75% of the packaging requirement. Although this relationship provided some benefits to AMPCO, it also entailed some risks in terms of manufacturing capability, marketing and openness.

The risk of manufacturing capability concerns the investment made by AMPCO in a new factory built in Six October City after the relationship was signed. These investments would be wasted if SEDICO did not maintain its orders. The risk of marketing might occur because of the tight relationship with SEDICO might adversely influence relationships other competitors of SEDICO who might be very conscious of the tight relationship between AMPCO and SEDICO. They might hold AMPCO responsible for their possible loss of market share and therefore no longer deal with the company.

The risk of openness concerns the change in the negotiation process with SEDICO. AMPCO sales people were relatively free to set prices for certain designs. Because complicated designs could be sold at relatively high prices, there was an incentive to customize designs. The number of colors in a design was an important element in the buying-selling negotiating process. The risk to AMPCO is that openness in this relationship might lead to a more rational way of buying and selling. AMPCO might lose some commercial leverage in selling to SEDICO. The negotiation process in which sales can be manipulated by using different product features and prices might be replaced by a rational calculation on the basis of what the product should be like and what should be an appropriate price. This might lead to cheaper products and therefore a decrease in sales value. From the above arguments it can be concluded that AMPCO might take more risks, but also that the company had a better opportunity to expand the supplier/customer project findings to other customers.

5.6 Management Accounting Information Systems at AMPCO

Management accountants at AMPCO have traditionally provided financially oriented information for internal users. In recent times, as the result of the implementation of WCM philosophies, management accountants at AMPCO have continued to perform this information processing and interpreting role, in addition to providing non-financial information.

The financial manager mentioned that AMPCO are adopting new management philosophies in response to increasing global competition and rapidly advancing technology. These new management philosophies includes an emphasis on high quality production to meet customers' needs and the elimination of all kinds of wastes. He also mentioned that the accounting information systems, especially MAIS, of AMPCO had reflected and supported these new management philosophies. The emphasis of MAIS in AMPCO is changing from providing financial information to providing both financial and non-financial information.

The AMPCO accounting information systems procedures have been changed by using electronic data processing. This is done by the implementation of a modern computer system which offers an excellent opportunity to re-examine manual and paper intensive systems in the accounting information department. The financial manager mentioned that as the result of the implementing of JIT ideas, such as waste elimination, the accounting systems within AMPCO have been extended to accomplish corresponding objectives by eliminating accounting wastes such as unnecessary transaction processing, excessive paper handling, unnecessary reports, outdated controls and procedures, and excessive historical analysis. He also indicated that accounting sections, financial and cost and management information systems, were serving AMPCO with fewer resources than before.

The President of the Board of Directors, production manager, purchasing manager, and sales and marketing manager of AMPCO indicated that they want to control and improve performance by measuring it, so that they can find out what is actually happening at present and how can they improve the performance in the future. They also mentioned that the implementation of WCM philosophies required

a fundamental change in the way in which manufacturing and non-manufacturing activities are managed. They also indicated that, as a result of implementing JIT and TQM philosophies, the traditional performance measurement systems which have been used by AMPCO for a long time are no longer suitable or useful.

The following is a brief discussion of the accounting information systems at AMPCO, the financial accounting systems, also called the financial accounting information section, and the cost and management accounting systems, also called the cost and management accounting information section.

5.6.1 Financial Accounting Information System

The function of the financial accounting system is to represent the relationships between AMPCO and the outside world. The financial accountants in AMPCO systematically record all business transactions that affect a change in assets, liabilities or owners' equity. This then allows them to determine the financial position of a firm as of a given point in time, i.e., what AMPCO owns in the form of various assets, and what it owes to its creditors. The difference between these two represents the equity position of AMPCO owners. These three aspects are summarised in the balance sheet. Furthermore, financial accountants record in detail how this equity position changes over time, usually over a 12 months period, in the form of financial statements. As the result of implementing the WCM strategy, AMPCO also prepared financial statements every three months. These give rise to a profit and loss statement and balance sheet. The balance sheet and the profit and loss statement allow current and potential investors in the AMPCO to assess how well their investment is doing. Producing these two documents is also a legal requirement in Egypt for all companies, for assessment of taxes as well as for the protection of creditors of the companies. These are the main purposes of the financial accounting system in AMPCO.

5.6.2 Cost and Management Accounting Information Systems

The Cost and management accounting information section, also called the management accounting information systems (MAISs), at AMPCO has the purpose of providing financial and non-financial information to the internal users of the company. According to the financial manager, the MAISs aid in planning and controlling decisions of various operations and activities of AMPCO. The financial manager mentioned that as the result of the implementation of WCM philosophies, management accountants at AMPCO used the MAISs to develop the information for the company's managers and teams. In doing so, they were guided primarily by the information needed by the different managers and teams.

Cost accounting information plays an important role at AMPCO. According to the financial manager, the major purposes of cost information are to support day-to-day operations and to support decision making by internal decision makers. Cost accountants in AMPCO classify costs by product type into direct costs and overhead costs. The cost accountants mentioned that direct costs are those directly identifiable with a specific end product. This includes the purchase costs of raw materials used in the production process only. The operating costs or overhead costs cover the cost of all support activities that are not directly attributable to a particular product or are shared by all of the products. Examples of overheads are the cost of salaries and fringe benefits of executives, managers, supervisors and various support staff, like maintenance, personnel and other administrative services. The operating costs also include labour costs, which are difficult for accountants in AMPCO to allocate directly to a specific product, as was apparent in AMPCO's performance reports.

According to the financial manager, one of the most important components of the cost and management accounting systems at AMPCO, which have been affected by the implementing of WCM philosophies, is performance measurement.

5.7 Performance Measurement Systems at AMPCO

The financial manager indicated that in support of the WCM philosophies, JIT and TQM, and continuous improvement efforts within the company, it is necessary to have a good PMS, which checks, monitors and determines the opportunities to improve the performance. This is in order to verify changes and the effect of improvement actions, to understand the variability of the processes and to make effective decisions. The following is the process of change in AMPCO's performance measurement systems.

5.7.1 The Process of Change in PMSs

The financial manager mentioned that the process of change in PMSs started informally in 1996 and formally in January 1998. The financial manager and his team, especially the cost and management accounting team, started in 1996 to put forward ideas of how to improve the accounting information to support the efforts of the company to change and improve. They highlighted that the first step is by education and learning

The financial manager is a highly-educated person, he got his master and Ph.D. degrees in accounting from USA. He started in 1996 to collect and read information about WCM strategy, JIT and TQM philosophies, and the new challenge of accounting information in such environments through books and academic and practical journals. At the same time, he asked the staff of cost and management accounting team to attend special courses, which were provided by some faculty of commerce inside Egyptian Universities in advanced management accounting, to be financed by the company.

According to the financial manager, 1996 and the early part of 1997 were a period of education and learning for the accounting department team without making any change in the information which the department provided. In the monthly meeting of the Board of Directors at March 1997, the financial manager started to present some new information, such as throughput information, the rate of achievement and improvement for some financial factors, beside the traditional accounting information which he used to present. In September 1997, the financial manager presented some benchmarking information, which included the company's sales price of some products, delivery time, quality and ROI compared with the same

factors in Vaassen Flexible Packaging Company in Netherlands. This information was provided because that Netherlands Company is considered as one of the most important competitors to the company in some Arab countries markets. The idea behind the providing of new along with traditional information was to make the Board of Directors familiar with the new information and to get their acceptance, and to get co-operation from the different departments of the company. The process of providing the new information alongside the traditional reports occupied the period from March 1997 to December 1997.

In the monthly meeting of January 1998, the financial manager highlighted among the rest of Board of Directors members the need to fundamentally change the company's PMSs for competitive advantage. In that meeting the Board of Directors decided to change the company's PMSs to support their effort in the continuous improvement of the company's performance. They decided that accounting department was responsible for that change. This was a matter of power, which the financial manager has as the result of being one of the most important members of the Board of Directors. The management accounting information systems sections (MAISs) inside the company divided the change of PMSs into two types; business PMS and departments PMS, such as manufacturing PMS, sales and marketing PMS, and purchasing PMS. MAISs started to change the business PMS first as recommended by the Board of Directors in their monthly meeting of January 1998. In the period from February 1998 to July 1998, the financial manager and his team were providing some new information such as the rates of achievement and improvement in throughput, order delivery time, and defect rate. These were beside some traditional information such as order cost and sales revenue. In August 1998, the accounting department provided the first new performance report as the result of the change in PMS (see point 5.7.3.4).

The MAISs section defined the new PMS at AMPCO as a management tool used to measure and support the improvement of the work performed and results achieved. According to the financial manager, measuring performance in AMPCO means setting performance expectations, comparing actual performance with planned data and continuously improving activities and processes. He also mentioned that all teams in AMPCO want to excel. The PMS helps the teams to focus on what is important. Comparing actual with expected result enables the teams to measure progress towards the company's goals and objectives. The differences or gaps

between the expected performance and actual performance represents room for improvement. The chief of management accountants at AMPCO mentioned that the new PMS offers the company a chance to aim for the top and provide ideas on what it needs to do to get there.

The President of the Board of Directors said that "any company that succeeds and makes money constantly assesses itself and improves in all activities of its business. Good PMSs are the cornerstone of its assessment and the foundation for any company's improvement, and in fact we are looking for that." He also mentioned that, as the result of implementing JIT and TQM philosophies, AMPCO had tried and was still trying to develop the PMSs to cover customers, internal work processes, suppliers, finance and employees. According to the management accountants in the MAISs section, the change in PMS included changing performance measures, performance reports, and benchmarking process.

5.7.2 Performance Measures or Indicators

The new performance measures, which have been used since implementing of the JIT and TQM philosophies, play an important role in AMPCO. The company set organisational improvement objectives in terms of specific key success factors, such as increasing ROI, customer satisfaction, high quality product, on time delivery and reducing cost, translated to specific performance measures, and measures the improvement levels achieved. Those performance measures shows the rate of achievement of objectives and the rate of improvement for every criterion or key success factor of performance, to managers and their teams. The following equations show how the MAISs in AMPCO calculates the rate of achievement and improvement in every key success factor:

$$The\ Rate\ of\ Achievement\ of\ Objective = \frac{The\ Actual\ Performance}{The\ Planned\ Performance} X\ 100$$

The rate of the objective achievement is considered as a positive rate for cost measures and non-financial measures such as quality and times measures when it equals 100% or less, and 100% or more for other financial measures such as sales, throughput, net profit and return on investment. The following rates are examples:

$$The\ rate\ of\ achievement\ of\ raw\ material\ cost\ objective\ of\ 1997 = \frac{\$86,650,850}{\$91,640,000} \times 100 = 94.56\%$$

$$The\ rate\ of\ achievement\ of\ throughput\ objective\ of\ 1997 = \frac{\$70,896,150}{\$66,360000} \times 100 = 106.84\%$$

$$The\ Rate\ of\ The\ Improvement = \frac{\left(The\ Actual\ Current\ Performance - The\ Actual\ Previous\ Performance\right)}{The\ Actual\ Previous\ Performance} X100$$

The rate of the improvement is considered as a positive rate for cost measures and non-financial measures such as quality and times measures, when it is -, and for other financial measure when it is +. The following rates are examples of that:

$$The\ rate\ of\ improvement\ of\ raw\ material\ cost\ of\ 97 = \frac{(\$86,650,850 - \$83,755,200)}{\$83,755,200} \times 100 = 3.46\%$$

$$The\ rate\ of\ improvement\ of\ throughput\ of\ 97 = \frac{(\$70,896,150 - \$55,839,800)}{\$55,839,800} \times 100 = 26.96\%$$

The financial manager indicated that AMPCO's new performance measures, which have been implemented since implementing WCM philosophies, are good performance measures for many reasons. First, they are meaningful because they are significantly and directly linked to the company's mission, goals, and objectives. Second, they are responsibility linked, because they are matched to the teams responsible for achieving the measure. Third, they are accepted by all of the company's teams. Fourth, they have a customer focus, because the majority of measures reflect the point of view of the customers and shareholders. Fifth, they are comprehensive, because they include all of the key success factors of the company's performance. Sixth, they are "balanced", because they include financial and non-financial performance information. Seventh, they are timely, because they are used and reported at a suitable time. Eight, they are credible, because they are based on accurate and reliable data.

The new goal of AMPCO is continuous improvement in increasing ROI. According to the company's policy, this can be done by making more business, money, and profit now and in the future. The company used to adopt ROI as the financial performance measure, but after implementing the JIT and TQM philosophies it started to use the ROI as one of the most important performance measures within a new perspective.

5.7.2.1 Return On Investment (ROI)

One of the most important financial performance measures used by AMPCO to measure the efficiency and effectiveness of the company in achieving its ultimate goals is ROI. The AMPCO Board of Directors takes decisions to balance the revenues, costs, and investment of the company's activities to achieve the planned ROI. The cost and management accounting information systems department uses the Du Pont formula to calculate the ROI. The Du Pont formula breaks ROI into two ratios, return on sales and assets turnover:

$$ROI = \text{Re}turn\ on\ sales(ROS) \times Assets\ turnover(AT)$$

$$= \frac{Net\ profit}{Total\ sales} \times \frac{Total\ sales}{Total\ assets}$$

Return on sales is a financial performance measure of how efficiently the company generates profit, while assets turnover is a financial performance measure of how effectively the company uses its assets. AMPCO plans to have high ROS and AT to achieve high ROI. Figure 5.7.2.1 shows all the factors related to ROI. AMPCO plans to increase sales, net profit and working capital now and in the future, and to reduce all types of waste and costs.

There are two measures at AMPCO for measuring the ability of the company to have high ROI. Those measures are the rate of achievement of ROI objective, and the rate of improvement of ROI.

$$The\ rate\ of\ achievement\ of\ ROI\ objecitve\ of\ 97 = \frac{The\ actual\ ROI\ 97}{The\ planned\ ROI\ 97} \times 100$$

$$The\ actual\ ROI\ of\ 1997 = 20.97\%$$

$$The\ planned\ ROI\ of\ 1997 = 20\%$$

$$The\ rate\ of\ achievement\ of\ ROI\ objective\ of\ 97 = \frac{20.97\%}{20\%} \times 100 = 104.85\%$$

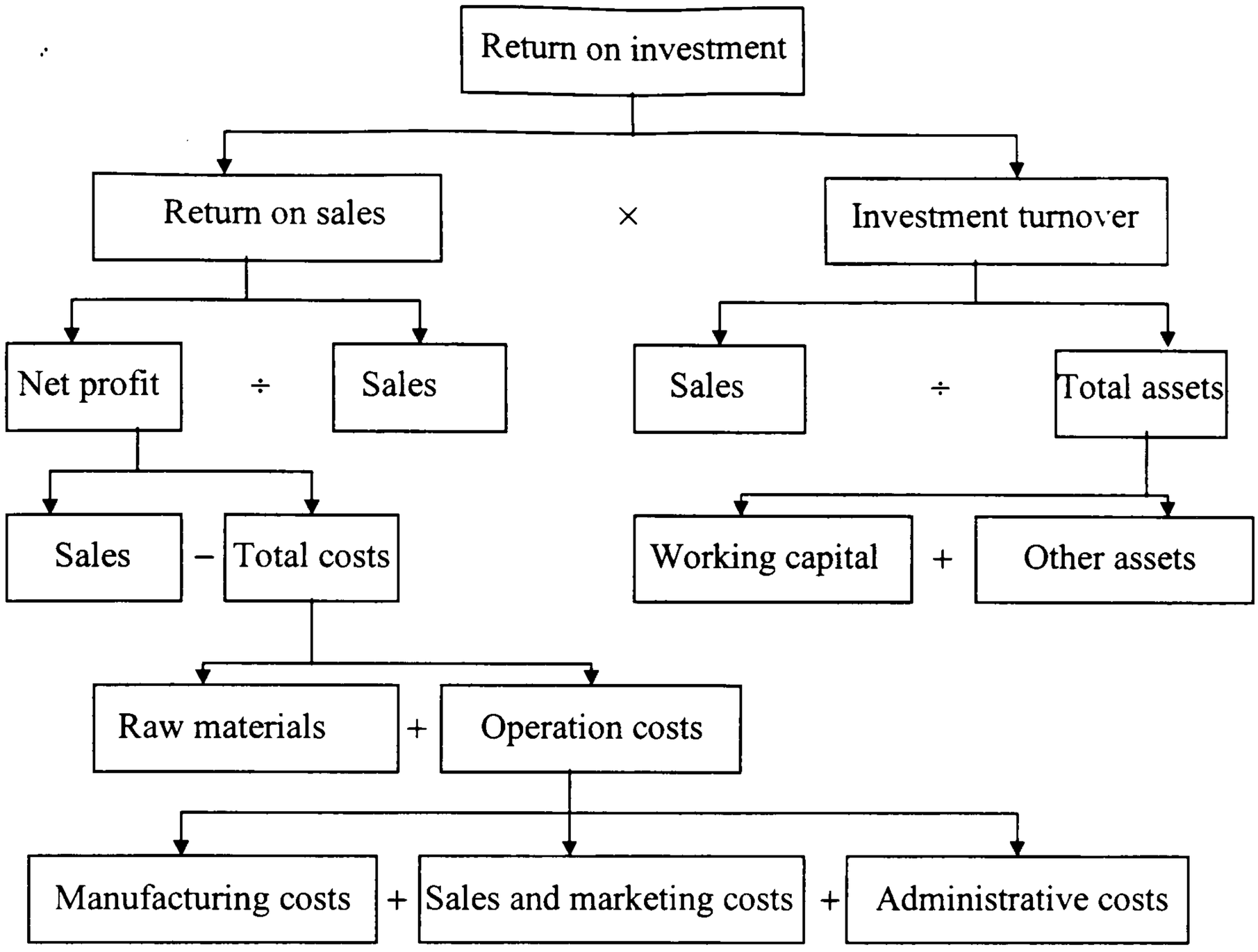
The previous rate is considered as positive when it is equal to 100% or more.

$$The\ improvement\ rate\ of\ ROI\ 97 = \frac{(The\ actual\ ROI\ 97 - The\ actual\ ROI\ 96)}{The\ actual\ ROI\ 96} \times 100$$

$$The\ improvement\ rate\ of\ ROI\ 97 = \frac{(20.97\% - 18.24\%)}{18.24\%} \times 100 = 14.97\%$$

This rate is considered as positive when the result is a plus rate.

Figure 5.7.2.1 AMPCO's ROI factors



According to the financial manager, developing good performance measures is an evolving process that improves with time. He mentioned that measures will need to be reviewed on an ongoing basis and changed as necessary, based on changes in AMPCO's key success factors. One of the most important new performance measures at AMPCO is customer satisfaction.

5.7.2.2 Customer Satisfaction

According to the President of the Board of Directors, customer satisfaction is the most important key success factor of AMPCO's business relationships. Accordingly, customer satisfaction is not just a slogan at AMPCO, it is a consummate objective that is continually monitored, managed, and achieved. AMPCO's traditional approach to measuring customer satisfaction, product prices, was limited. This is because customer satisfaction is related to many factors such as quality, delivery, price and service. The traditional approach was not designed to have a direct impact on the bottom line or even to give AMPCO's management some clues to aid in continuous improvement efforts. The new commitment of AMPCO, since

implementing the JIT and TQM philosophies, to customer satisfaction, affects everything it does, from extending technology boundaries to meeting or exceeding flexible packaging quality standards, to delivering competitively-priced products on time. The sales and marketing manager mentioned that the company's commitment to products begins with listening to what the customers tell them and taking action on customers' comments. He also mentioned that AMPCO is committed to 'delighting' its customers by exceeding their expectations. The sales and marketing manager indicated that the continuous improvement in customer satisfaction in AMPCO depends on continuous learning of how to satisfy customers and communication with them. He also said that 'by remaining flexible and responsive to the customers' changing needs, AMPCO delivers excellence in products through customer vistas.' AMPCO's marketing team visit regular customers to acquire an in depth understanding of their unique requirements and to open lines of communication and build the trust necessary to establish and cement long-term relationships.

According to the President of the Board of Directors, the most important component of customer satisfaction to AMPCO is the focus on building strong and long-term relationships with its customers by offering them high quality products and support that rank among the best in the flexible packaging industry. The new performance measures of customer satisfaction which have been implemented in AMPCO since the beginning of 1998 are quality, on time delivery, and total costs which have a strong impact on product prices.

5.7.2.3 Performance Measures of Customer Orders

The financial manager mentioned that rapid response has become a prerequisite to success in the business today. AMPCO has recognised the advantages of time-based competition and has set new performance measures, especially for the different customer orders. The majority of performance measures now applied to orders did not exist before the implementing of the JIT and TQM philosophies. The only measure which existed was a cost measure. The following are the customer order performance measures which have been used by AMPCO since the beginning of August 1998:

5.7.2.3.1 Order Cost Measure

The cost measure is used for each customer order and each item produced for this order. It focuses on all the costs of resources used to produce item(s) for each order such as, raw materials and operating costs. The aim of the company in measuring of the cost of each order is to strive for continuous improvement in reducing every order cost and each item needed for the order. This is for regular customers. For example, AMPCO has a long relationship with PHARCO pharmaceuticals company. Every 25 days it orders approximately 50 tons of opaline, sulphite and Kraft paper coated with polyethylene, 50 tons of paper laminated with aluminium and coated with polyethylene, and 50 tons of polypropylene coated with polyethylene. The aims of AMPCO in measuring the cost of PHARCO's order are to determine a competitive price for each item in the order, and to maintain continuous improvement in reducing of the cost of its order and the cost of each item in the order, without affecting the quality of each item.

5.7.2.3.2 Quality Measure

One of the most important new measures, which has been implemented as the result of applying the JIT and TQM philosophies in AMPCO, for measuring customer order performance, is quality. Quality in AMPCO is measured by two measures: defect rate and yield rate. Defect rate for every order is the rate of defective production of each item of the customer order. Yield rate is the rate of zero-defect production of each item(s) of the customer order. The aims of the company in measuring of quality are to keep improving the quality of each product, and to achieve zero defect rate for every customer order and each item of the order.

5.7.2.3.3 Time Measures

Time measures have also been implemented as the result of implementing the JIT and TQM philosophies in AMPCO. There are three measures of time: cycle time, lead time, and delivery time. 'Cycle time' is the time from when the item(s) of the customer order start(s) production until the order is completed. 'Lead time' is the time from receipt of the order until it starts production. 'Delivery time' is the time from receipt of the order until delivery. This is for measuring on-time delivery. The aims of AMPCO in applying time measures are to achieve continuous improvement

in reducing cycle time and lead time, and to deliver finished orders at the time promised, which is on-time delivery.

The financial manager said that 'for each performance measure of the customer orders, comparing actual performance with proposed performance level, and reporting the results is a very important aspect of continuous improvement efforts at AMPCO. Any changes will be analysed, and subsequent actions will be planned.' Measuring actual performance and reporting results compared to performance expectations is an important way, at AMPCO, to measure progress toward the company's goals and objectives. The chief of management accountants said that 'the whole point of reporting on AMPCO's performance is to enable management to see that progress is being made towards achieving the goals and objectives that they have set, and to identify where improvements are feasible or necessary.' This means that management accountants at AMPCO need to introduce new methods of performance reporting which satisfy these management requirements, and at the same time they need to review existing performance measures to ensure that those that are irrelevant or counter productive are, as far as possible, either modified or removed. This indicates the importance of performance reports at AMPCO.

5.7.3 Performance Reports

The process of displaying the results of control and the measuring of performance presents the real image of the company's operations. Those results are shown at all the management levels within AMPCO in the form of reports. The reports are seen as a medium of communication inside AMPCO. The financial manager mentioned that the reports are the natural medium through which to communicate and exchange data and information related to the different aspects of activities, to the different management levels. This process enables them to be aware of what is happening in the company, and take timely decisions, as needed, to avoid faults.

According to the financial manager, performance reports play a feedback role. They are intended to help the managers and their teams to accomplish their tasks, namely, planning, controlling and measuring performance. He also said that 'It is one of the management accountants' duties to seek the different factors that secure the success of the performance reports, whether technical or behavioural, to reach its goals.' As the result of the JIT and TQM implementation at AMPCO, many issues

related to the performance reports have changed, as explained in the following paragraphs.

5.7.3.1 The Role of AMPCO's Accounting Information Systems in the Preparation and Deployment of Performance Reports

The financial manager mentioned that the accounting function at AMPCO is no longer limited to registering data historically and summarising and displaying it in the form of financial statements and balance sheets. The accounting function at AMPCO has developed in the last few years, as the result of the implementation of WCM philosophies, to become a full system of information. This system presents the necessary information to the different parties, whether inside the company, to help in the planning operations, controlling and measuring performance and decision making, or outside the company to help in evaluating the company's investment. The accounting information system at AMPCO is comprised of the financial accounting information and cost and management accounting information systems.

5.7.3.1.1 The Role of Financial Accounting Information System

The financial accounting system at AMPCO is concentrated on a group of records, lists and financial statements that present data capable of serving the aims of the company's financial accounting, namely, to determining the result of the company's activities of gain and loss for a given period of time and providing the financial position. This financial accounting system aims at producing financial information that comes as a result of the accounting measurement of historical financial events. The information provided by financial accounting at AMPCO is characterised by specific features and the system is directed by certain rules and principles. The financial accounting system at AMPCO is based on historical records and avoids prediction of expected events. It is also committed to objectivity of measurement. It concentrates on financial transactions between the company and others, but is not concerned to follow and record money-movement inside the company. For this reason, financial accounting at AMPCO is characterised as overall accounting, that is to say, it is interested in showing the overall results of the company, without details or analysis. Financial accounting is interested in recording operations at the company level, without going into the details of these operations at departmental levels. It can be observed from the above that AMPCO's financial accounting system presents data

and overall financial information that helps in preparing and activating performance reports for the company as a whole. The net profit that is shown in the financial statement report, is considered as one of the most important financial measures in the company. For this reason, the financial accounting system at AMPCO is not helpful in presenting functional performance reports such as manufacturing performance reports, purchasing performance reports and sales and marketing performance reports. This system presents information which helps in preparation of performance reports for the President of the Board of Directors and his management team at each financial year and, now, every three months. So, the financial accounting information system at AMPCO plays a role in preparing the performance reports for the company as a whole and for top management.

5.7.3.1.2 The Role of Cost and Management Accounting Information Systems

Cost and management accounting systems at AMPCO are based on a group of records, lists, documents and statements that present financial and non-financial information to meet the needs and aims of cost and management accounting. Those aims are measuring costs, controlling the elements of costs, providing the necessary data to prepare budgets, providing financial and non-financial information on the measurement and control of the performance of the company's activities, and providing necessary data to help management in setting policies and taking decisions.

The chief of cost accountants at AMPCO indicated that the cost accounting system is considered as an analytical tool governed by a group of principles and scientific basis which cost accountants put into practice in order to follow, record, and analyse the different factors of costs, such as raw materials, labour and services and relate them to the activities' centres and the units of production or services, in order to measure, and reduce costs. It supports management in making decisions among alternatives so that the company can achieve the maximum rate of efficiency and effectiveness of performance. The cost accounting system at AMPCO was concerned, before the implementation of WCM philosophies, with determining the production cost and proposing prices for every product, to achieve the ultimate goal of increasing the ROI. But with the change in AMPCO's environment, as the result of the implementation of JIT and TQM philosophies, and the development of other goals and objectives of the company, the role of cost accounting has been extended

to take into consideration environmental and behavioural variables which are expected to affect performance.

The role which the cost accounting information system plays in preparing the performance reports appears clearly in the stages of measurement and control of costs inside AMPCO. Those stages are as follows:

1. Setting cost plans. This includes carrying out 'scientific studies' at the beginning of the control period to determine the planned costs according to the following:

A. The objectives to be achieved, such as the volume of planned production, the expected net profit, levels of raw material availability, and other general and sub objectives.

B. Setting a time-scale for achieving those objectives, through defining needed resources, planning production, setting purchasing and inventory policies, and preparing sales plans.

C. Preparing budgets and setting performance measures.

2. Measuring the differences between actual and planned costs.

3. Analysing the variances in term of :

- Components of variances.
- The reasons for variances.
- The activity team responsible for each variance.

4. Providing costing information to management accountants to help them in preparing performance reports for teams, e.g. manufacturing team, purchasing team, sales and marketing team, and other teams of AMPCO. This information is provided according to the responsibility accounting concept, which has been implemented at AMPCO as the result of the implementation of WCM philosophies, to show the efficiency and effectiveness of every team and to help the company in its effort of continuous improvement in reducing activities' costs and total costs.

It is clear from the above that the cost accounting information system at AMPCO plays an important role in providing needed information to prepare and activate the performance reports directed to the different teams according to the responsibility accounting concept. The concept of responsibility accounting at AMPCO plays an increasing role in controlling performance in key success factors, whether financial or non-financial, and in preparing performance reports. This is done by providing performance information related to the different teams at

AMPCO, including planned and actual performance of every team, and achievement and improvement rate of their performance. The concept of responsibility accounting inside AMPCO is a way of implementing decentralisation in decision making and measuring performance.

The majority of AMPCO's accountants indicated that the management accounting information system at the company is the only system which is able to prepare and deploy the performance reports depending on financial and costing accounting information, in addition to other sources of information inside and outside the company. Most of the additional information is non-financial information, such as suppliers' information, competitors' information and customers' information.

The management accounting information system at AMPCO prepares and present a complete series of performance reports, or responsibility reports as management accountants call them. These reports are prepared and presented at the needed times, weekly, monthly, quarterly and yearly, according to the content of those reports and the team or management level, to which they are presented. The details of the information that is included in the performance reports differ from one management level to another. When a performance report is to be given to the top management level, it includes more activities done under their supervision, with less details, but when it is presented to the first line management level, it includes fewer activities done under their supervision, described in more detail. There are three management levels at AMPCO which receive performance reports from the cost and management accounting information systems.

5.7.3.2 The Management Levels at AMPCO Which Receive the Performance Reports

The performance reports are presented from the cost and management accounting information systems to the different teams and management levels at AMPCO. According to the financial manager, the efficiency and effectiveness of those reports are based on taking into consideration the information needs at each levels. The content, components, degree of coverage and details of those performance reports depend on the management levels that they are presented to. The performance reports within the company are presented according to the following management levels:

1. The top management level

This level includes the general managers, the Board of Directors and the President of the Board of Directors. The top management level is considered as the highest authority in the company. It is responsible for the whole company, and for the various departmental activities of the company. It traces the general plan of the company's activities, and it sets performance control methods. It also links the different activities of AMPCO together. For this reason, the team at top management level has multiple goals. The cost and management accounting information systems at AMPCO present brief and complete performance reports to this management level, on a comparative basis, so they can identify weaknesses and short-comings and the level of performance, just by looking at the reports. Two kinds of performance reports are presented to this management level:

- General or summary performance reports: Those reports are related to all activities of the company in general. They are presented monthly, quarterly and yearly.
- Detailed performance reports: They are reports given to every director or manager about the activities of his/her team and the related departments, such as the manufacturing performance report, purchasing performance report, and sales and marketing performance report.

2. The middle-management level

The middle management is the administrative authority which executes the policies of the higher management. This level of mid-responsibility is a bridge between the higher and the executive management within the company. This level includes the administrative directors or managers and heads of departments. The reports which are presented from cost and management accounting information systems to this level aim to measure the efficiency and effectiveness of its performance, and every manager is responsible for the activity of his/her team. The reports presented to the production manager and his team, for example, include the quality, quantity, costs and wastes of each order and each item of the order and the increase or decrease of actual quantity and costs compared to planned. The aims of those reports are to explore short-comings and wastes in order to avoid them and to identify strong points, to encourage them.

3. The first line management level

This level includes the departments and the levels that carry out the actual execution of the performance. In every department, a supervisor or controller or head of

workers is responsible to control, through continuous supervision, the execution of production or the carrying out of services inside the company. The reports presented from the cost and management accounting information systems to this level include in detail the actual and planned performance for each factor, whether financial or non-financial, to promote the efficient and effective performance of every team in the company.

There are some new technical factors, which AMPCO's management accountants take into consideration, related to the preparation and deployment of the performance reports.

5.7.3.3 Technical Considerations in Preparation and Deployment of Performance Reports

The performance reports at AMPCO are seen as important channels of communication within the company in transmission of information to the different teams. At the same time, the performance reports are considered as one of the most important components of the cost and management accounting information systems, because they are the final result of AMPCO's performance measurement system. Management accountants at AMPCO take into consideration some technical factors, when they are preparing and deploying the performance reports. Those factors consist of two groups: general technical factors, related to the all reports of the cost and management accounting information systems, and special technical factors, related to the reports of the performance measurement system. The following are some of the most important general and special technical factors related to preparing and deploying the performance reports.

5.7.3.3.1 General Technical Considerations

First: The participation of every team at different management levels in designing the MAIS's reports.

The MAIS's reports at AMPCO are considered as the most important communication channel between the management accountants and the different teams. The financial manager said that "Due to the fact that the MAIS's reports are mainly directed to the managers and their teams who use them, not those who prepare them, their users participate in designing them and defining their contents, which could facilitate their understanding and emphasise their importance to them." He also mentioned that

some managers and their teams prefer the reports in graphical form and others prefer them in the form of tables. Management accountants at AMPCO indicated that the MAIS's reports would lose a great part of their value if prepared without the participation of users. The chief of the cost and management accounting information systems department mentioned that participation in the design of the MAIS's reports makes the participants aware of their importance and that the top management appreciate them. He also mentioned that participation could increase the morale of the report users, which could result in positive effects. Management accountants mentioned that the process of participation was carefully planned, because participation without organisation and control could lead to some behavioural problems.

Second: Simplicity and clarity in preparing and deploying the MAIS's reports.

One of the most important of the general technical considerations which management accountants stressed when preparing and deploying the MAIS's reports is simplicity and clarity. The chief of the cost and management accounting information systems mentioned that easy and simple reports are beneficial, so that management accountants selected suitable forms of reports for different teams and write them in simple language. He saw this as a key factor in the success of those reports. Clarity in this respect means presenting financial and non-financial information clearly, so that they cover all the facts related to a specific situation, in generally-known terminology. The following are some of the considerations related to the simplification factor in the MAIS's reports:

(a) The use of specific, clear, and consistent definitions of technical terms.

(b) The use of main titles and sub-titles in preparing the reports.

(c) Showing the most important points clearly.

(d) Matching the method of presenting information with the team using it.

(e) Presenting the information coherently.

(f) Avoiding unnecessary information.

Third: The compromise between speed and precision when preparing the MAIS's reports.

The chief of the cost and management accounting information systems department mentioned that the management accountants prepare the reports in a very precise yet rapid way in order to help different management levels to take the right decisions at the right time. He also indicated that in the past, before the implementation of WCM

philosophies, it was known that there was contradiction in many cases between the factors of rapidity and precision. He also said that "the user of the report cannot achieve any benefit from even the most precise information if it is late, so the report becomes useless and management accountants waste the time and effort spent in preparing and writing it, because the information which it contains has no value to the user."

Management accountants at AMPCO in the past used to face many problems in choosing whether to present incomplete information about a process or activity at the right time, or to wait in order to make sure of the exactness and completeness of the information, which could result in information not being available when needed for decision-making.

As the result of the implementation of the computer network at AMPCO, after the implementation of WCM philosophies, it is becoming easier for management accountants to combine precision with speed. The financial manager mentioned that providing the management levels with the information needed with the necessary speed and accuracy is considered as a vital factor that could affect the performance of the company. For this reason, management accountants at AMPCO have deployed computers, to help in achieving high levels of precision, speed, quality and analysis at on economic cost.

Fourth: Consistency in the method of preparing and deploying the MAIS's reports.

The financial manager mentioned that management accountants prepare the MAIS's reports according to consistent accounting principles and rules, in terms of methods of displaying and analysing information. He also mentioned that this consistency in the presentation and analysis of accounting information in successive periods is necessary for purposes of comparison. This applies not only to the accounting principles and basis used in preparing and designing the reports, but also to the form of the reports.

Consistency in the way of preparing, deploying and designing the reports facilitates exploration of information, whereas changing it from time to time would makes the task of users more difficult, and the report in this way would become a waste of time and effort. The financial manager said that "the consistency in the preparing, designing and deploying of the MAIS's reports is very important and necessary. Changes are accepted but only after their importance has been considered."

5.7.3.3.2 Special Technical Considerations

According to the management accountants at AMPCO, the above technical considerations are seen as general considerations for all the MAIS's reports. To these general characteristics, other specific considerations are added, which apply to certain kinds of reports produced by the system. The following are the most important technical considerations related to the performance reports.

First factor: Format

The performance reports are used at AMPCO as a tool to transmit information related to the process of measuring the performance of the team. The management accountants prepare and design the performance reports in any format suitable to the management levels, in order to enable them to understand their contents easily and rapidly. Management accountants use three forms of reports: table or schedule, chart, and text.

(A) Tables

Management accountants at AMPCO mentioned that the schedule reports, which display information in numerical form, are seen as the easiest way of displaying data and information, presuming that the user can understand the figures which are considered as the language of accounting. The chief of the MAIS department indicated that the schedule performance reports are prepared on the basis of comparison between the planned and actual performance (see for example, Table 5.7.3.6.3). This is to show the efficiency and effectiveness of the activities' performance in achieving the company's goals and objectives and to present the capability of the company to achieve continuous improvement in the performance. Those reports are directed to the different management levels in the company, from the first line team to the top level team. The management accountants at AMPCO take into account the following technical considerations when they prepare and deploy the schedule performance reports:

(1) The content of the table must be organised in a logical way, generally, in accordance with the relative importance of the data and information.

(2) The management accountants use papers with specific characteristics, special methods and a consistent table format for the different periods and for the reports provided to the different management levels. This facilitates their collection,

coherence and preservation. The management accountants mentioned that the consistency in methods of writing and printing the reports made them more acceptable and so beneficial to the users.

(3) Clear and short titles are used for the rows and columns. Titles are chosen to be suitable for the needs of the users.

(B) Charts

The management accountants at AMPCO mentioned that financial and non-financial statistics are not always sufficient for displaying performance information in a clear and precise way. For this reason, the main rationale for introducing charts in the performance reports is to help to transmit the meaning of the performance information to the users rapidly and clearly (see for example, Charts of Table 5.7.3.6.3). The chief of the cost and management accounting information systems department mentioned that sometimes the users of the performance reports, especially top management, find that statistical data takes a lot of time to understand, compare, and explain. He also mentioned that the presentation of statistics in the form of a chart makes it easy to compare and analyse the data in the desired way. The management accountants mentioned that the only justification for using charts is to support, facilitate, and show the different relationships of the numbers.

According to the financial manager, there are many characteristics of the use of charts in the performance reports at AMPCO. They show clearly, at a glance, similarities and differences in performance information. They save time and space by presenting a great amount of information in a short way. They are clear, simple, quickly assimilated, and attractive to users. The top management level at AMPCO uses this type of reports in addition to tables because they save the time and effort needed for understanding the figures in table reports.

The following technical factors are taken into consideration, by the management accountants, in preparing and designing charts:

(1) Avoiding complexity

The management accountants mentioned that the forms and charts used in the performance reports are as free as possible from any complexities. They include only the information relevant to the process of measuring performance. The chief of the cost and management accounting information systems mentioned that adding

information to charts without any reason makes the user's comprehension of reports more difficult.

(2) Explanation of symbols used

Symbols are used to limit, if possible, the text on the charts and to simplify their presentation. The management accountants mentioned that an explanation is given of every symbol, to ensure it is understood by the users. They do not presume users' familiarity with, or understanding of symbols.

(3) Taking into consideration the cultural and intellectual level of the users

The management accountants indicated that charts differ in their complexity and presentation of information. For this reason, it is necessary to take into consideration the cultural and intellectual level of the report users. The chief of the cost and management accounting information section indicated that the accountants presented charts in a way that is easy and understandable to the users. He also mentioned that there is no real need for presenting simple information in a complex forms or charts.

(4) The minimal use of numbers

According to the management accountants, effort is made to limit the use of numbers when preparing charts to present performance measurement information, since the charts are intended to be as expressive as possible of numbers.

(5) Showing the real and true image of the performance measuring process

According to the management accountants, the main aims of the using of charts in the AMPCO performance reports are facilitating the task of showing information and simplifying the written reports and showing the real image of the process of measuring the performance.

The chief of the cost and management accounting information section mentioned that the previous technical factors are respected by management accountants when they use charts in preparing and designing performance reports. He also indicated that the use of charts in the performance reports attracted the users' interest and helped in the explaining and clarifying the information included in the reports.

(C) Narrative

The third form, which is used at AMPCO, for preparing and designing performance reports, is narrative form. This form is used at AMPCO to transmit information that is not amenable to financial and quantitative measurement and in explaining the deviations that result from comparing the actual and planned performance. According to the chief of the cost and management accounting information section, this form is used in general to write the introduction and conclusion to the tabular and graphical reports. He also mentioned that this form is used in explaining variances, commenting on them and offering solutions to solve them. The management accountants take into considerations the following technical aspects in preparing the narrative parts of the performance reports:

(1) Appropriate language

Management accountants at AMPCO aim to use easy and widely-known words, because some words do not mean the same thing to different people in the culture. For this reason, management accountants avoid the use of technical terminology in reports directed to ordinary team members who may not perceive the meaning intended.

(2) Objectivity in the writing

Objectivity at AMPCO means tackling facts in a neutral and detached way. So management accountants presenting the aspects of performance measurement completely and explain the data and information related to the measuring results on the logical basis that the information suggests.

(3) The style of the writing

The management accountants mentioned that they presented the narrative part of the report in a good linguistic style. The right presentation of the information necessitates careful use of language. The chief of the cost and management accounting information section mentioned that the language is as important as the content of the report.

(4) The coherent relationship between the different parts of the report

Coherence at AMPCO means relating the words, sentences, paragraphs and ideas of the report together, so that the report represents a coherent idea.

It can be realised from the above presentation that the performance report at AMPCO is composed of three main parts. The first part is the introduction of the

report, where the narrative form is used; the second part is the subject of the report. where tables and/or charts are used; the third part is an explanation and commentary on differences between actual and planned performance and draws conclusions and in this regard, the narrative form is used.

The second factor: Frequency

According to the financial manager, it is judged at AMPCO as important to prepare and deploy the performance reports and present them to their users at the right time. For example, there is a monthly meeting of the Board of Directors to discuss the company's performance for the last month. The management accountants therefore prepare performance reports for the company as whole and for every department, one day before the meeting, so they can be presented at the meeting day, to help decision-makers to take the right decisions at the right time. The management accountants mentioned that any delay in presenting reports or information might cause delay in the decision-making to solve a problem, and this could undermine efforts to control performance.

The frequency of the report at AMPCO is one of the most important factors in the success of the feedback or performance measurement system. Management accountants mentioned that the performance reports are prepared and forwarded to the specific team at the right time to enable them to use the information as efficiently as possible. The cost and management accounting information systems at AMPCO present two types of performance reports. The first type, are the regulatory reports which are provided daily, weekly, monthly, quarterly and yearly. The second type, are the exceptional reports which are prepared on the basis of the concept of 'management by exception', which means that they are provided to a specific team as and when needed for a rapid decision. According to the management accountants, there are three factors which influence the frequency of the performance reports at AMPCO:

Rapidity: This means the extent of rapidity needed to prepare the report for performance measurement purposes.

Regularity: This means the time the report needs to reach management level concerned, which means organising the hour and day that the report reaches the specific management level.

Cost: This means the costs related to prepare the reports; not only the direct costs but also the effort and time spent by the management accountant, which represent indirect costs.

The financial manager mentioned that the two types of performance reports. regular and exceptional, have their importance in the process of performance measurement and shedding light on the differences when comparing planned and actual performance.

The third factor: Content and method of presentation

(1) Content

According to the management accountants, the performance report includes the list of the activities and elements of the performance measurement of the specific team, distinguishing between those elements controlled by the team those not. In this matter, the responsibility of the team is based on the factors under their control. The report also includes the list of actual and planned performance elements and variances. The chief of the cost and management accounting information section mentioned that as far as variances are concerned, the content of the report shows not only the size and kind of variance, but also information that could help the team to take decisions at the right time with regard to the nature of variances. The management accountants mentioned, with regard to the variances, that three types of information are included in the performance report:

(A) Identifying and isolating variances, by comparing planned and actual performance or comparing actual and planned averages. The management accountants indicated that there are two variables that influence the production of variances: the actual and planned performance, so that the variances are attributable to lack of precision in the planning or inappropriate or inefficient execution. According to the financial manager, the lack of precision in planning could be caused by not following the necessary precision in the planned averages of the performance criteria or key success factors. It could also be caused by the varying circumstances or conditions during the execution of the plan even when following the needed precision in putting the planned averages of the company's activities elements. For this reason, before analysing the variances, the management accountants make a re-evaluation of the planned averages to make sure of their continuity and validity to

measure the efficiency of actual performance. The management accountants mentioned that if the evaluation proves that the factors and circumstances have changed during the time of execution from the time of planning, there is a possibility of changing the averages, limiting the variances and knowing the real reasons for their occurrence, which is in this case caused by the changing conditions, not by the actual performance. The management accountants mentioned that the second variable which causes variances from planned performance is the lack of efficiency in execution of the company's activities. They also mentioned the need, in this case, to analyse the variances from different perspectives to know the reasons for them and allocate responsibility.

(B) The prediction of the impact of a certain variances on future results. The management accountants indicated that the opportunity of repetition of a variance differs from one period to another. They also indicated that due to the fact that AMPCO's performance reports cover a short period, their relevance as a source of information is increased when they present to the team predictions of variances in future results.

(C) Explaining the reasons for variances of differences and suggesting methods or behaviour to cure them. The management accountants mentioned that the traditional performance measurement systems at AMPCO necessitated a search for the source of a variance if it exceeded a certain level with respect to a criterion determined on the basis of the experience and judgement of the responsible person. They also mentioned that with the implementation of waste reduction techniques under JIT and TQM philosophies, it has become important to explain the reasons for all variances, whatever their magnitude. This is because the non-existence of explanations for variances could lead to misapprehension which could have a negative influence on future performance.

(2) Method of presentation

The chief of the cost and management accounting information section mentioned that the method of presenting the performance report is related directly to the content of the report. He also mentioned that the method of the presentation is tailored to the management level who receives the performance report. Moreover, the performance reports directed to the different management levels are complementary. The management accountants indicated that the information of the performance reports is related, but the degree of detail differs according to the management level. Thus, the major differences between the performance reports which provided to the AMPCO management levels are the level of detail and the reporting frequencies associated with each measure.

As a result of the implementing WCM philosophies, JIT and TQM, AMPCO's accounting information systems review the data and information prepared regularly in order to avoid redundancy and adapt to changing conditions. The financial manager mentioned that presenting certain data and information on a regulatory basis could lead to recipients losing interest, so if it is seen at any time that any information in the performance report is not beneficial, preparation, content, timing etc. will be reviewed.

The performance reports play an important role inside AMPCO. Most performance reports are provided by the cost and management accounting information systems and are termed performance measurement reports by management accountants. The only product quality reports are provided by the Quality Assurance Department (QAD), but there is co-operation between AIS and QAD in this matter. For example, when MAIS prepare the monthly report, especially for the order information section, QAD give MAIS the defect rate for each product. With the support of the President of the Board of Directors, the MAIS team at AMPCO have applied new techniques to many of their processes, especially in relation to performance reporting. According to the MAIS team at AMPCO, the new performance reports are used to monitor performance trends and to uncover improvement opportunities. The following are examples of monthly, quarterly and annual performance reports provided to the top management team at AMPCO:

5.7.3.4 Example of a Monthly Performance Report

Arab Medical Packaging Company

Accounting Information Department

Cost and Management Accounting Systems Section

Performance Report of the Company's Activities during August 1998

Introduction

The following is the report of the company's activities during August 1998. This report includes the following:

1. The planned achievement rate for production quantity, sales revenue, raw material cost, contribution margin or throughput, other costs or operation costs, and net profit.
2. The rate of improvement in increasing production quantity, sales revenue, and throughput, and decreasing raw materials costs.
3. Information about the monthly finished orders such as:

A. Defect rate, cycle time, lead time, delivery time for each product in the specific order.

B. Order total costs, revenue and net profit.

C. The planned achievement rate of the order defect rate, cycle time, lead time, delivery time, total costs, revenue and net profit.

Table 5.7.3.4.1 The Improvement of Production Amount and the Rate of Achieving the Plan

Items	August 98 (A)	July 98 (A)	Change amount	Change rate %	August 97 (A)	Change amount	August 98 (P)	Achie-vement rate %
Produc-tion amount								

A: actual P: planned

Table 5.7.3.4.2 The Improvement of Production Amount for Every Product

Items	August 98 (A)	July 98 (A)	Change amount	Change rate %	August 98 (P)	Achievem-ent rate %
P. No. 1						
P. No. 2						
P. No. 3						
P. No. 4						
P. No. 5						
P. No. 6						
P. No. 7						
P. No. 8						

P. No. 9						
P. No. 10						
Other						

Table 5.7.3.4.3 The Improvement of Sales Revenue, Raw Materials Cost, Contribution Margin, Other Costs, and Net Profit

Items	August 98 (A)	July 98 (A)	Change amount	Change rate %	August 98 (P)	Achievem-ent rate %
Sales Revenue						
Raw materials						
Contributi on margin						
Other costs						
Net profit						

Table 5.7.3.4.4 Information of Finished Orders During the Month

Items	Order 1	Order 2	Order 3	Order 4	Order 5
Defect rate					
Cycle time					
Lead time					
Delivery					
Order cost					
Order revenue					
Order profit					

Such reports did not exist before the implementation of JIT and TQM philosophies. The report of August 98 was the first formal-monthly report; non-formal reports existed before. According to the financial manager, the non-formal report was presented in the monthly meeting of the President of the Board of Directors, production manager, purchasing manager, and financial manager, as a basis for discussion of the monthly activities of the company. This non-formal report included financial information only, but since implementing JIT and TQM philosophies, the monthly report includes financial and non-financial information. No data are given for the month of August because the review of the company was finished by 18 of August 98. The format of Tables 1,2, and 3 is fixed, but that of Table 4 will be changed according to the finished orders each month.

5.7.3.5 Example of a Quarterly Performance Report

Arab Medical Packaging Company

Accounting Information Department

Cost and Management Accounting Systems Section

Performance Report of the Company's Activities

during the period from 1/1/1998 to 31/3/1998

Introduction

This is the quarterly report of the company's activities during the period from 1.1.98 to 31.3.98. The performance report of this period includes the following information:

1. Information about different sources of revenue and their achievement and improvement rates.

2. Information about the period sales revenue, raw materials costs, other costs or operation costs, throughput, and net profit.

Table 5.7.3.5.1 Revenue Resources of the Current Activities (numbers by thousand)

Achievem-ent for the period	Planned for the period	Achievem-ent from 1/10/97 to 31/12/97	Achievem-ent from 1/1/97 to 31/3/97	Items	Objectiv-es achievem-ent rate%	Improve-ment rate %
$39253	$39500	$39000	$34964	Actual sales	99.37%	.65% and 12.27%
$152	----------	---------	----------	Other sources	----------	----------
---------	$38	----------	$50	Other revenue	----------	----------
$39405	$39538	$39000	$35014	Total sources	99.66%	1.1% and 12.54%

From the table, it can be seen that:

1. Achievement rate decreased through the period, reaching 99.37%. This was attributable to MUVCO company, because its order was 200 tons of aluminum foil laminated with paper, and it asked for another 100 tons, which means the delivery date will be 8/4/1998. The sales revenue of MUVCO's order, which is $3,000,000, will be included in total sales revenue of April 98. AMPCO recognises sales revenue as at the date of delivery of product(s).

2. The improvement rate shows that the company is still following the continuous improvement concept from year to year and from period to period. This is considered as one of the most important strategies of the company.

Table 5.7.3.5.2 The Operating Costs During the Period From 1/1/1998 to 31/3/1998

Items	Actual costs	Planned costs	Previous period costs
Labour	$3996000	$3975000	$3365000
Services	$1264000	$1282000	$1862000
Deprecations	$999000	$1238000	$1238000
Banks interest	$28000	$108000	$375000
Rent	$328000	$328000	$325000
Other costs	$141000	$167000	$150000
Total costs	$6756000	$7098000	$7315000

From the previous table it was realised the following

1. As the result of implementing of JIT and TQM philosophies, the company succeeded in decreasing total operating costs of this period from the last period, 1/10/97 to 31/12/97, by $559000, a 7.64% reduction. This means that the rate of improvement of total operating costs this period is 7.64%.
2. The company also succeeded in decreasing the actual operating costs of this period compared with planned costs for the same period by $342000. This means that the rate of achievement of total operating costs objective equals 95.18%.
3. The increase of labour cost over the pervious period and over planned cost is attributable to increase of production.

Table 5.7.3.5.3 The Development of Production, Sales, Contribution Margin or Throughput and Profit

Items	1/1/98 to 31/3/98 (A)	1/1/98 to 31/3/98 (P)	1/10/97 to 31/12/97 (A)	Rate of achievement	Rate of improvement
Production	$41253000	$39500000	$39000000	104.44%	5.78%
Sales	$39253000	$39500000	$39000000	99.37%	.65%
Raw M.	$21044000	$21922000	$21854000	96%	-3.71%
Throughput	$18209000	$17578000	$17146000	103.59%	6.20%
Operation C.	$6756000	$7098000	$7122000	95.18%	-5.14%
Net profit	$11453000	$10480000	$10024000	109.28%	14.26%

From the previous table, the following were realised:

1. The company succeeded in achieving its production, sales and throughput objectives and also succeeded in reducing actual raw material cost from the planned cost by 4%.

2. As the result of implementing of JIT and TQM philosophies, the company succeeded in continuous improvement of production, sales, throughput and reduction of raw material and operation costs from period to period.

3. The actual sales revenue of this period = $39253000 (period sales) + $2000000 (part of MUVCO order) = $41253000. This means that the actual achievement rate = $41253000/39500000 % = 104.44%

Table 5.7.3.5.4 Information on Customers' Orders Which Have Been Finished

Items	Order 1	Order 2	Order 3	Order 4	Order 5	Order 6	Order 7	Order 8	Order 9
Defect rate									
Cycle time									
Lead time									
Delivery time									
Order cost									
Order revenue									
Order profit									

Formal information about the finished orders during the period such as the order defect rate, cycle time, lead time, delivery time, total cost, revenue, and net profit did not exist during this period. According to the management accountants, this information would be available from August 1998. The above form of table 4 is that which will be used from August 98, but the number of orders finished during the current period was nine.

5.7.3.6 Example of a Yearly Performance Report

Arab Medical Packaging Company

Accounting Information Department

Cost and Management Accounting Systems Section

Performance Report for the Year 1997

Introduction

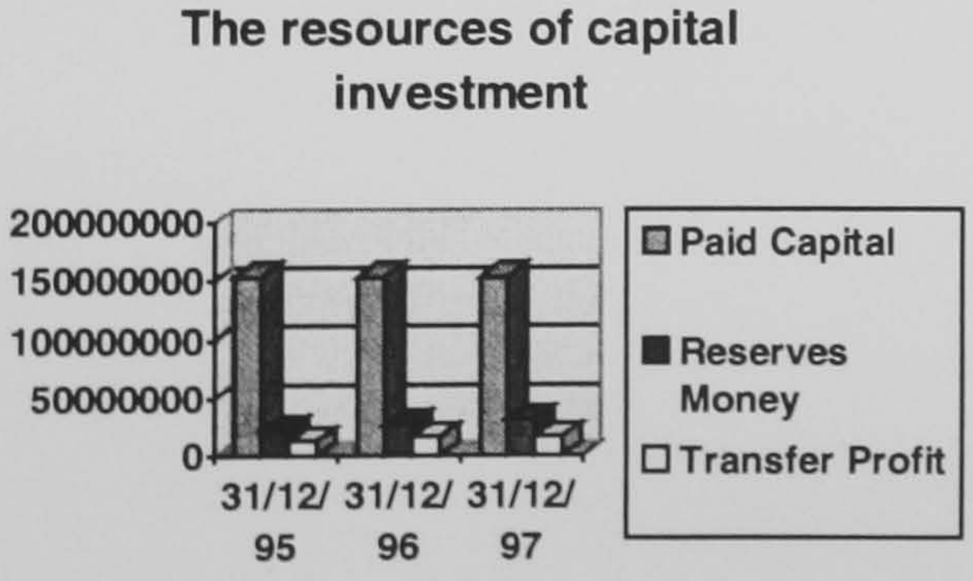
This is the annual performance report of the company's activities for the year ended in 31/12/1997, it shows the results of the company's activities for the period from January to December 1997. The company succeeded in achieving its aims and objectives and the results show continuous improvement from year to year, despite increased in internal and external competition as the result of the GATT or WTO agreement. The following are the results of the company's activities compared with the plan and the achievement of the previous year 1996.

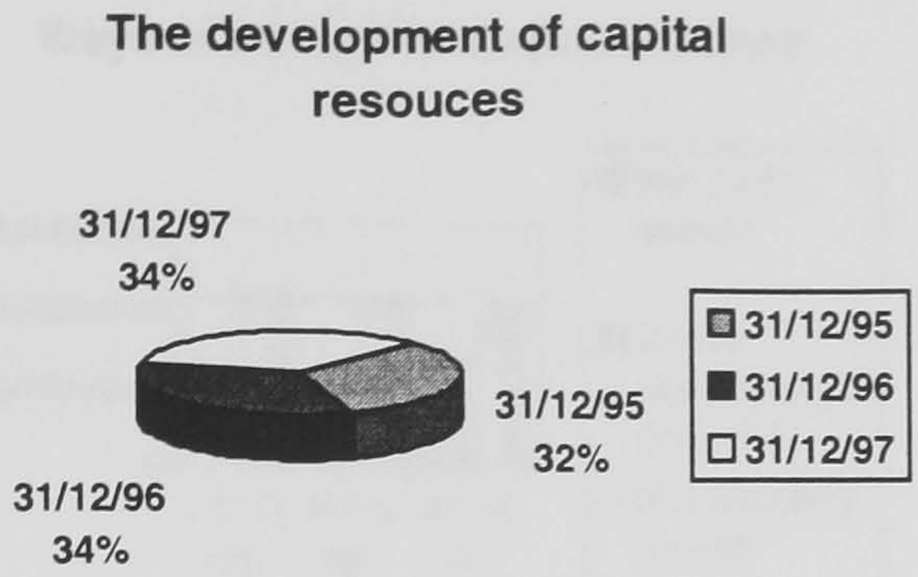
First: Capital and Investment Money

The capital issued and paid up to 31/12/1997 was $ 154623800, distributed to 1546238 shares and of $10. The following tables and figures show the capital resources and the way the company's money was used.

Table 5.7.3.6.1 The Resources of Capital Investment

Items	31/12/95	31/12/96	31/12/97
Paid Capital	$154623800	$154623800	$154623800
Reserves Money	$23540000	$27070000	$31020000
Transfer Profit	$13280000	$16630000	$16630000
Total	$191443800	$198323800	$202273800

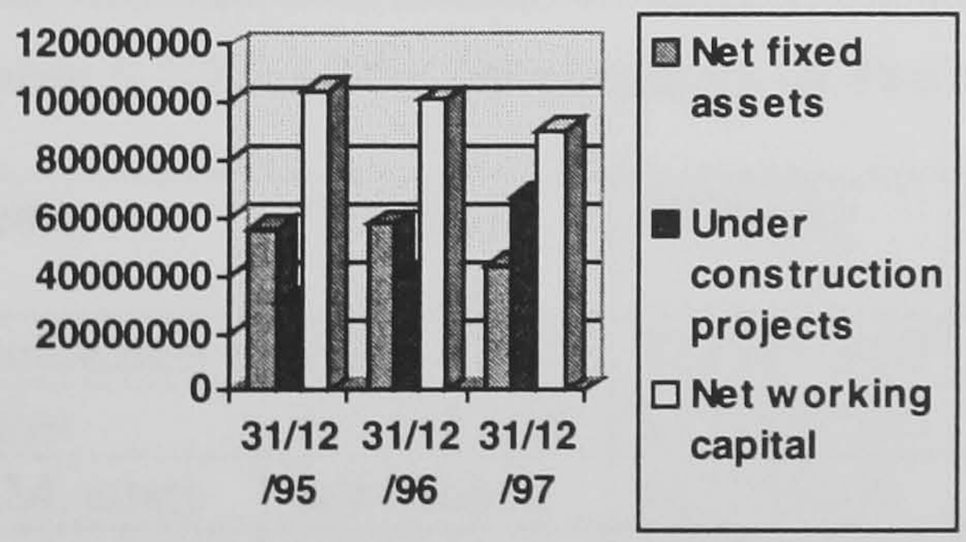


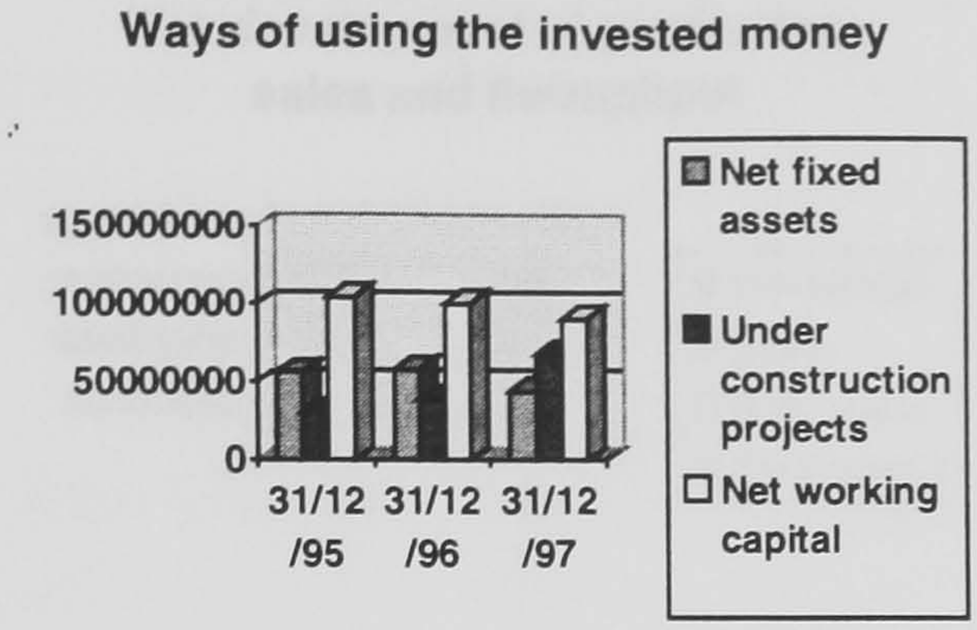


It was realised from previous table and charts that there was an increase in capital resources from year to year, especially with the resources which depend on the company's activities.

Table 5.7.3.6.2 Ways of Using the Invested Money

Items	31/12/95	31/12/96	31/12/97
Net fixed assets	$56230000	$57980000	$43920000
Projects under construction	$30970000	$39390000	$67860000
Net working capital	$104243800	$100953800	$90493800
Total	$191443800	$198323800	$202273800





From the previous table and charts, the following were realised:

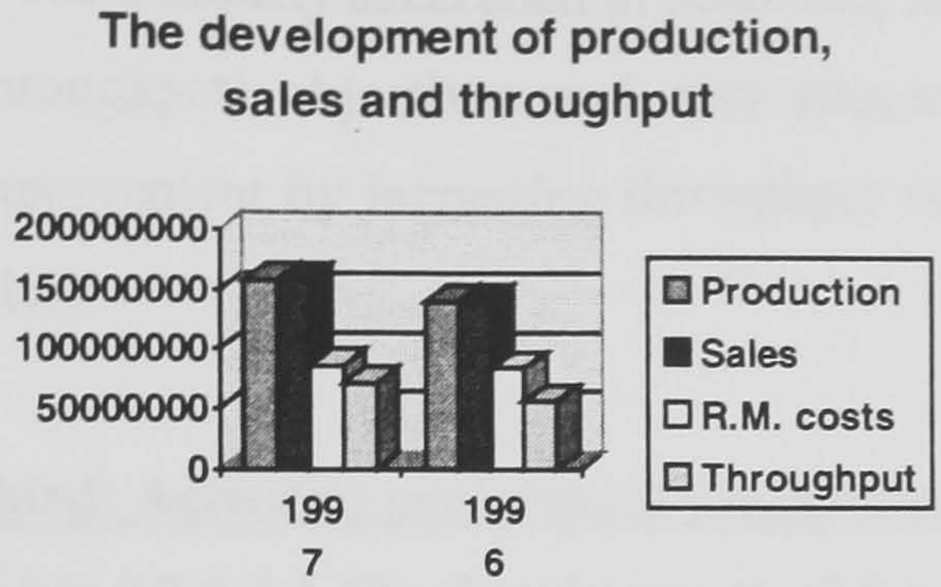
1. The cost of net fixed assets equals $43920000 from total cost of $143250000, which means that net fixed assets equal 31% of costs. This means that the book value of 69% of capacity is finished and it needs renewal and development or complete replacement with advanced technology to be competitive in the new environment of world class manufacturing. This means that the company needs to increase throughput amount, net profit and reserves.

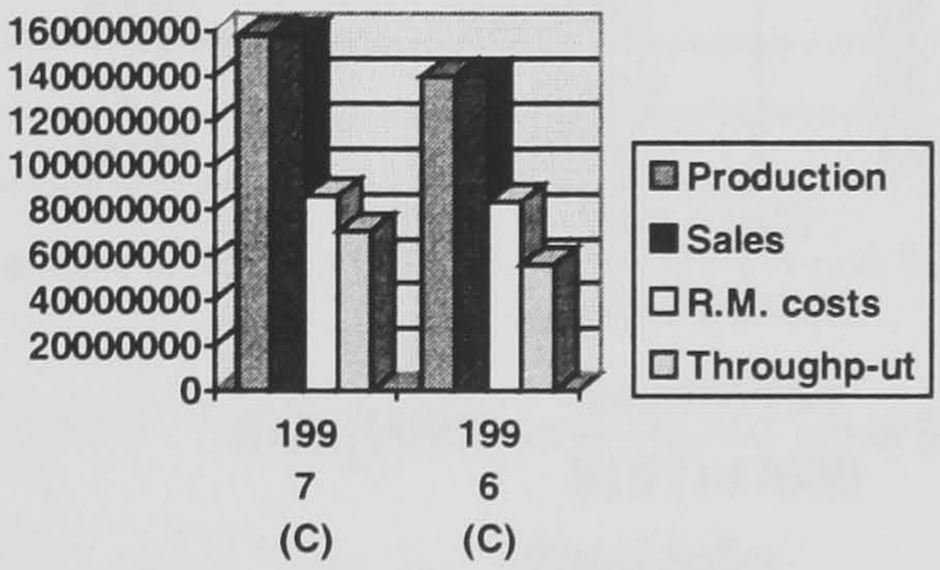
2. The cost of the new factory which is to be located in Sixth October City is $67860000, including the projects under construction account, and it was $32450000 last year, which means that the cost of this year, 97, was $35410000.

Second: The Development of Production, Sales and Throughput

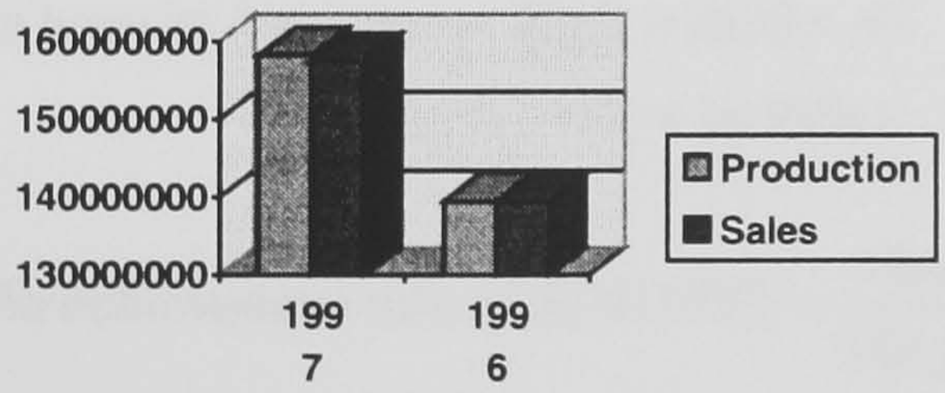
Table 5.7.3.6.3 The Development of Production, Sales and Throughput

Items	1997 (A)	1996 (A)	Change amount	Change rate	1997 (P)	Achieve-ment rate
Production	$158147000	$139631000	$18516000	13.26%	$158000000	100.09%
Sales	$157547000	$139592000	$17955000	12.87%	$158000000	99.71%
R.M. costs	$86650850	$83755200	$2895650	3.46%	$91640000	94.56%
Throughput	$70896150	$55839800	$15056350	26.96%	$66360000	106.84%





The development of production and sales



Raw materials and throughput indictors

	1997 (A)	1996 (A)	1997 (P)	1998 (P)
Rate of raw materials/Sales =	55%	60%	58%	53%
Rate of throughput/Sales =	45%	40%	42%	48%

The following were realised from previous table, charts and indictors:

1. The company was successful in achieving its production and sales objectives, and at the same time there were increases in production and sales rate by 13.26% and 12.87% over 1996.

2. The company succeeded in achieving its production, sales and contribution margin (throughput) objectives and also succeeded in achieving its aim of continuous improvement by increasing throughput rate and decreasing rate of raw materials to sales.

Third: Activities performance measures

Table 5.7.3.6.4 The Development of the Return on Investment

Items	1995	1996	1997	1998 (P)
ROS	20.11%	24.32%	26.99%	30%
AT	.65 times	.75 times	.78 times	.85 times
ROI	13.07%	18.24%	20.97%	25.5%

$$\text{Return On Sales}(ROS) = \frac{Net\ profit}{Total\ Assets} \times 100$$

$$ROS(1997) = \frac{\$42408150}{\$157147000} \times 100 = 26.99\%$$

$$Assets\ Turnover(AT) = \frac{Total\ Sales}{Total\ Assets}$$

$$AT(1997) = \frac{\$157147000}{\$202273800} = \cdot 78\ Times$$

$$\text{Return On Investment}(ROI) = ROS \times AT$$

$$ROI(1997) = 26.99\% \times \cdot 78\ times = 20.97\%$$

$$The\ achievement\ rate\ of\ ROI(1997) = \frac{The\ actual\ ROI(97)}{The\ planned\ ROI(97)} \times 100$$

$$The\ achievement\ rate\ of\ ROI(1997) = \frac{20.97\%}{20\%} \times 100 = 104.85\%$$

$$The\ improvement\ rate\ of\ ROI(1997) = \frac{The\ actual\ ROI(97) - The\ actual\ ROI(96)}{The\ actual\ ROI(96)} \times 100$$

$$The\ improvement\ rate\ of\ ROI(1997) = \frac{20.97 - 18.24}{18.24} \times 100 = 14.97\%$$

The previous table and equations show that the company succeeded in achieving its goal, which is continuous improvement of ROI. At the same time, there were increases in ROS and AT from year to year, which also led to increase of ROI.

The Development of Profit

The following indicators show the continuous improvement year after year in the profit of the company, which confirms the successful policy of the company and its power to develop and improve. Although the company faces a new challenge in this industry, because of the increase in internal and external competition. those indictors show the ability of the company to improve continuously.

	1994	1995	1996	1997	98(P)
The rate of the net profit before tax/paid capital	36%	41%	51%	64%	80%
The rate of the net profit before tax/owners equity	30%	33%	40%	49%	60%
The rate of the net profit after tax/paid capital	32%	33%	40%	46%	58%
The rate of the net profit after tax/owners' equity	26%	27%	32%	36%	50%
The distribution of the shares/paid capital	22%	25%	30%	37%	47%

Table 5.7.3.6.5 Liquidity Indicators

Indicators	1995	1996	1997
Current ratio = Current assets/Current liabilities	3/2= 1.5	5/3= 1.6	2/1= 2
Quick payment ratio = Cash/Current liabilities	1/8= .125	1/3= .33	1/2= .50

The previous table shows that the ability of the company to pay its regular duties is improving from year to year. The current ratio in 1997 indicated that if the creditors demand payment, there is enough cover from the current assets. The liquidity indicators show a clear improvement in liquidity as a result of profit improvement. The balance of credit banks in 1997 reached $10630000, and it was $156580000 in 1996. The balance of debit banks in 1997 was $65020000, and it was $29400000 in 1996, which means that the company has the ability to pay its short-term liabilities such as creditors' and distribution liabilities.

Table 5.7.3.6.6 Loans and Facilities

Items	1997	1996	The change	The change Rate %
Banks	$10630000	$15658000	$-5028000	(32.11%)
Creditors facilities	$50825000	$25600000	$25225000	98.54%
Total	$61455000	$41258000	$20197000	%48%

It is important to indicate that the decrease of banks' facilities is due to the increased internal resources of the company, quicker turnover of working capital and the increase of creditors' facilities. It is also important to mention that the company used part of creditors' facilities to increase of debtors' facilities to support sales and avoid reducing the sales price commensurate with reduction raw materials prices which led to decreased financing costs and increased of profits. The success of the company in doing so is attributable to the following:

1. The development of purchasing and storing policy.
2. Implementation of JIT philosophy in purchasing and storing.
3. Speed in collecting notes receivable and payment of the credit balances of banks, which reduced bank expenses and interest by $1890000.

Table 5.7.3.6.7 The Inventory

Items	1997	1996	1995
Raw materials costs	$10501000	$12802000	$27961000
Packaging materials	$87000	$165000	$240000
Finished products	$679000	$337000	$347000

The inventories of raw materials and packaging materials are the minimum limit for achieving of a good operating cycle, which does not burden cost and at the same time does not lead to stops in production

It was realised from the above table that has been a reduction in raw materials and packaging materials inventories. This is a result of implementing JIT and TQM philosophies. The cost of finished product is part of the cost of EPICO's order for 30th and 31st December. The order will be delivered on 7.1.1998. The cost of keeping inventory of finished product is becoming zero as the result of JIT philosophy. The following shows the improvement rates in the reduction of raw materials and packaging materials inventories.

	1997	1996	1995
The improvement rate in raw materials inventory	(17.97%)	(54.21%)	(5.34%)
The improvement rate in packaging materials inventory	(47.28%)	(31.25%)	(9.5%)

The quantity of raw materials is enough for 42 days work, and that of packaging materials, for 5 days.

Fourth: The future project

The budget of 1998 includes the following investment in the new project of the Sixth October City factory.

Table 5.7.3.6.8 The Future Project

The new project	Finished until 31/12/1997	Planning for the year of 1998	Total in 31/12/98
1. Land	$5640000	----------	$5640000
2. Building	$40450000	$20500000	$60950000
3. Machines and Equipment	$10880000	$80500000	$91380000
4. Transport and furniture's tolls	$380000	$7000000	$7380000
5. Expenses before processing	$11230000	$7000000	$18230000
Total costs	$68580000	$115000000	$183580000
The finance			
1. Internal finance	$57280000	$35000000	$92280000
2. External finance	$11300000	$80000000	$91300000
Total finance	$68580000	$115000000	$183580000

	1997 (A)	1998 (P)	Total
The rate of internal finance =	83.52%	30.43%	50.27%
The rate of external finance =	16.48%	69.57%	49.73%

It was realised from the previous table that the company achieved a financing balance between internal and external finance. This will give the company the ability to pay the interest on its loans.

The Conclusion of the Report

The results of the company this year indicate that:

1. All the company's measures indicate that the company has succeeded in achieving its goals and objectives.
2. There has been improvements from year to year in increasing the company's sales, throughput, profit, and customer satisfaction through on time delivery, suitable prices and high quality of the products. It can be said that those improvements are attributable to implementing the JIT and TQM philosophies.
3. The Board of Directors of the company needs to give more push to all activities to maintain the continuous improvement concept, to be more competitive in the flexible packaging industry which have been developed in the last ten years in Egypt.
4. The company needs to bolster or support the production capacity to develop sales. This is in addition to the processing of complete units before starting production in the new factory at Sixth October City. The date for starting the production in the new factory is January 2000, to avoid the risk of inability to satisfy customers' demands.

5.7.4 Benchmarking Process

AMPCO is becoming increasingly aware of the value of information for competitive advantage. With that awareness comes a desire to measure its performance against performance of other world class companies in the field of the flexible packaging. This often takes the form of benchmarking, where performance is measured against the 'best in class' in flexible packaging. The benchmarking process gives a framework for determining the baseline performance of AMPCO's activities, provides information on performance levels of other flexible packaging companies in the benchmarking database, including 'best practice' companies, and indicates where the greatest benefits can be achieved in taking AMPCO from its current position to superior performance. Benchmarking in AMPCO has been defined as the practice of being humble enough to admit that someone else has a better way to get work done and clever enough to learn how to surpass them, and to be a good competitor to them in the new world market of being world class. Benchmarking in AMPCO provides the external focus that helps the company to identify improvement opportunities. The accounting department in AMPCO is responsible for the benchmarking process. Benchmarking came into use at AMCPO in 1997, as the pressures of world-wide competition increased. The company started to benchmark factors; sales prices of products, delivery time, quality and ROI, with the same factors in Vaassen Flexible Packaging Company in Netherlands. People in AMPCO, the President of the Board of Directors, production manager, financial manager and management accountants, mentioned that the company has used the benchmarking process to generate improvements in manufacturing and non-manufacturing operations, accelerate cost reduction for company's products and create customer service improvements. The President of the Board of Directors mentioned that benchmarking at AMPCO has become an integral part of its WCM strategy. The financial manager and his management accountants team defined benchmarking 'as a performance measurement tool used in conjunction with improvement initiatives to measure comparative operating performance and identify best practices'.

According to the financial manager, AMPCO pursues best practices for three reasons. First, it allows the company to set goals for its own continuous improvement efforts. AMPCO can set a good plan for WCM operations, when it understands how the

world's best achievers operate. Second, it allows the company to be good competitor in the new world market. Benchmarking allows the company to know where it stands in relation to its competitors, provides evidence of problems in activities, and demonstrates best levels of performance and solutions for each activity. By identifying the key success factors of AMPCO's business and then benchmarking them against the best in the world, this drives the focus toward leveraging the best practices to eliminate waste, reduce lead time and improve quality. Third, it is the least expensive way to perform research and development. AMPCO can develop additional innovations by using the best practices as a springboard to further refinement and improvement. The financial manager also mentioned that the best practices and benchmarking, as adapted to the specific circumstances of AMPCO, are targeted, proven solutions to the company's most pressing problems. This depends on the data which can be collected from the best practices. Conducting comparisons, benchmarking, in AMPCO is an important tool used by MAIS in searching for the company's improvement opportunities and to assist the company to leap ahead of their competitors. AMPCO benchmarking information assists by helping users, usually the Board of the Directors, to search for comparative performance data and the best practices that lead to superior performance. The information which is gathered by MAIS team, forms the basis for identifying gaps and seeking improvements to close these gaps. According to the financial manager, so far there is no formal form for the benchmarking report, and also there is no special time for the provision of benchmarking information. He indicated that there is no single 'best practice' because best is not best for everyone. AMPCO is different from other flexible packaging companies in some way; different missions, cultures, environments, and technologies. 'Best practices' for AMPCO means those practices that have been shown to produce superior results, and judged as exemplary, or successfully demonstrated. The following are some of the flexible packaging companies, which have been considered as the best practices in AMPCO benchmarking database process:

1. Constantia Veprackungen (Austria)
2. Amcor Flexible Packaging (Belgium)
3. Danapak Flexible and Danisco Flexible Raackmann (Denmark)
4. Walki Pak and Whihuri Wipak (Finland)

5. Danisco Flexible France and Pechiney Flexible Packaging Europe (France)

6. Ebert Folien, Hueck Folien, Kobusch Folien, and VAW Europack (Germany)

7. Burgopack (Italy)

8. Vaassen Flexible Packaging (Netherlands)

9. Amcor Packaging Espana (Spain)

10. Bonar Teich Flexibles, Rexam Medical Packaging and Sidlaw Flexible Packaging (UK)

5.7.5 The Benefits and Problems of the Change in PMS

The concept of continuous improvement inside AMPCO is playing an important role for the implementing of JIT and TQM techniques. The basic idea, which the company follows, is that nothing is ever perfect and no matter how much improvement has been made by the company, there is still chance for more. Throughout the implementation of JIT and TQM techniques, needs and priorities of the Board of Directors from the information have changed, but the new PMS was able to accommodate these changes. This is because the change in PMS is organised around flexibility. This is what happened when the accounting department started to provide benchmarking information in 1997 for competitive advantage (see point 5.7.4). One of the most important benefits of the change in PMS is related to the process of change itself. The process of change started first with education and learning. The accounting team spent more than one year in education and learning about WCM, JIT and TQM philosophies and their impact on accounting work. This established the basis to facilitate the change in business PMS and functional PMS, such as manufacturing PMS, purchasing PMS, and sales PMS. Another benefit of the change in PMS is related to the new monthly performance report. The new monthly performance report is supporting the Board of Directors in their monthly meeting with the financial and non-financial information needed. This report is giving the complete picture of the company's performance. It is also giving information about the rate of achievement and improvement, and the way to improve the company's performance in the future (see point 5.7.3.4). The change in PMS led to more power for the accounting department as the provider of information for decision-making activities. Before the

change, the accounting department was neglected as a provider of information for decision-making.

One of the biggest problems in the change of PMS is that only few management accountants have the skills for dealing with non-financial information. This is a very dangerous situation especially when the company starts to change its functional PMS, if those accountants decide to leave the company for any reason. In this regard, the financial manager mentioned that the accounting department has a plan to organise an internal training programme for other accountants in dealing with non-financial information. Another problem of the change is related to non-financial information. The accounting department is getting the non-financial information from other functional departments, such as manufacturing, purchasing, and sales. In this regard, there is possibility of lack of co-operation from the other departments, which could lead to a weakness in the information that will be provided by accounting department.

One of the most useful aspects of traditional performance reports is that the same reports were be used by everybody in the company, thus enabling a consistency of reporting that simplifies comparison. The traditional performance reports gave consistency of reporting, but the information being reported was misleading and irrelevant with the change inside the company. This standardisation of reports is not the case with the change in PMS. This means that management accountants need to spend more time and efforts to prepare different reports for different teams. This problem may appear clear in the future when the accounting department will start to change the functional PMSs.

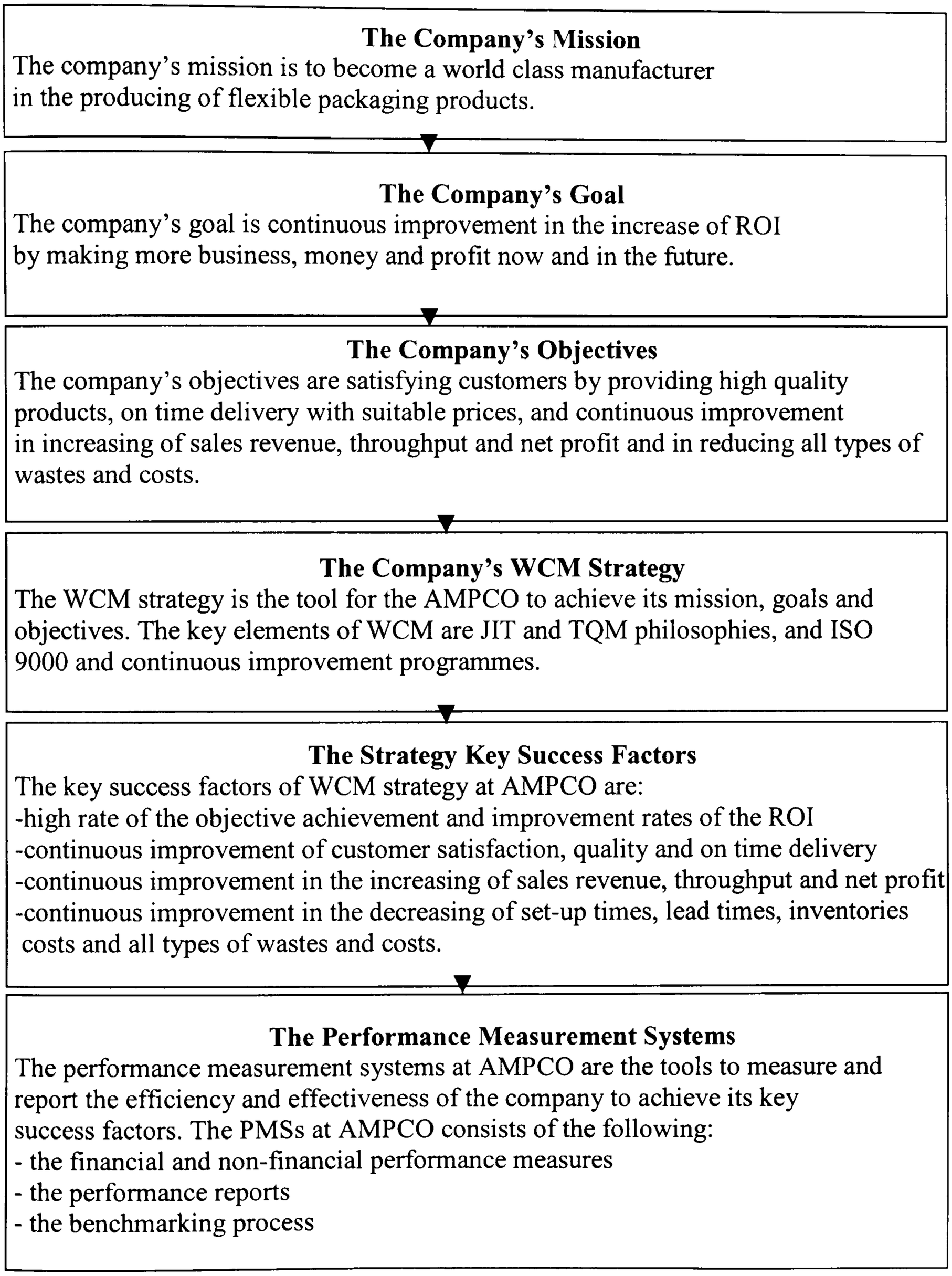
In general, according to the financial manager of AMPCO, the company's accounting changes have resulted in the elimination of direct labour reporting and direct labour classification, a production credit for quality first, fewer accounting transactions, a simplified PMSs, and an environment and attitude predisposed to the management of change and continuous process improvement.

5.8 Summary

According to AMPCO's people, increasing world-wide competitiveness in the flexible packaging manufacturing requires a world class manufacturing response and strategy. Becoming world class in the flexible packaging manufacturing is a long term process that requires continuous improvement and innovation to better the current level of achievement. This includes a commitment to continuous improvement in manufacturing and non-manufacturing processes, and a clear definition of the company's goals and objectives, satisfying customer requirements, developing better ways to do the job right the first time, simplifying work processes, and educating and training for new challenges. To achieve this, AMPCO has begun to manage itself differently, emphasising cross-functional teams and introducing new management philosophies, such as JIT and TQM. AMPCO was feeling the effects of the market globalization, which is driven by free trade and increasing industrialisation. The ISO 9000 series of quality management and quality assurance standards provides international consistency by allowing AMPCO, affected by globalisation, to implement standards that will detect and prevent non-conformance during production. The challenge for MAIS and management accountants at AMPCO was to put into place new performance measurement systems that will contribute to the success of the company in the ever changing business environment. With the new environment of WCM and implementation of JIT and TQM philosophies at AMPCO, the MAIS put in place new performance measures and reports to support the continuous improvement philosophy. The new PMS has a strong focus on financial and non-financial information that directly measures customer satisfaction and responsiveness to internal and external customers' requirements. The new performance measures were structured in the context of AMPCO's overall goals, specific objectives, WCM strategy and key success factors, to encourage and enable the managers and their teams to control and improve the company's activities. They were intended to be responsive to the needs of all management levels of the AMPCO, including top management, middle management who are responsible for the company's processes, and first line team who are responsible for specific operations, to encourage team empowerment. The following figure summarises the AMPCO case and at the same time highlights the relationships

between the company's mission, goal, objectives, strategy, key success factors and the PMSs:

Figure 5.8.1 The model of the AMPCO's case study



Chapter Six

South Egypt Drug Industries Co. (SEDICO) Case Study

6.1 Introduction

South Egypt Drug Industries Company (SEDICO) is a manufacturer of pharmaceutical preparations and has been established in Egypt since 1989. SEDICO is a research-based company whose people are committed to fighting disease by bringing innovative medicines and services to patients throughout Egypt, Arab and African countries and the health care providers who serve them. SEDICO is one of the market leaders in Egypt in the manufacture of pharmaceutical products. The company employs approximately 1000 people. The company has been carrying out a manufacturing improvement programme over the past few years.

Initial contact with SEDICO was made in July 1997. This company was identified through suggestions by the Faculty of Commerce and Business Administration, some of staff members at Helwan University (Egypt), and by the pharmaceutical information committee of the Egyptian Ministry of Health. During the initial visit and discussion with the Chairman of the company, the aims and objectives of the case study were outlined. After obtaining permission for the study, extended structured interviews were conducted with the Chairman and vice-president of the company, production manager and financial manager. The purpose of the structured interviews was to take the pulse of the company (see appendix 2). This was the first phase of on-site company visits.

During the second phase of on-site visits, unstructured interviews (see Appendix 2) were held. The interview questions were open-ended to encourage dialogue with interviewees for more detailed information and understanding of interrelationships between WCM strategy, JIT and TQM philosophies, and the PMSs changes. This field study of SEDICO started in June 1998 and lasted three months. The interview schedule helped to focus the investigation and ensured a consistent enquiry procedure was followed. During 24 visits, two days a week, to the company over a period of three months, extended interviews were conducted with the company employees from the chairman of the company to shop floor employees. Twenty five people were

interviewed in the company, for example the Chairman of the company and his vice-president, production manager, sales and marketing manager, financial manager, quality assurance manager, management accountants, production and shift supervisors, and various personnel in the production area during plant tours, amounting to approximately 75 hours of interviewing. In addition to the interviews, tours of the factory, offices, warehouses and stores were conducted. Some documentation was provided by the company. The information gathered from SEDICO was written up as a case study, which started with the company's background.

6.2 Company's Background

SEDICO is an Egyptian pharmaceutical company, established on the 16th October 1989, according to law No. 43 of 1974 concerning Arab & Foreign Investments, amended by law No. 132 of 1977 & 230 of 1989. It started its production at January 1990. SEDICO has approximately 1000 full-time employees in a continuous three-shift operation, headquartered in Egypt, at Six October City, Cairo. SEDICO produces more than 100 branded and generic products, which cover almost all of the pharmacological drug groups and all of the conventional pharmaceutical dosage forms. The soft gelatine capsule at SEDICO is a unique model. With the annual sales volume of 1998 exceeding $125 million, the company's customer base is 70% make-to-market and 30% make-to-order. According to the pharmaceutical information committee of the Egyptian Ministry of Health, SEDICO is the civilised face of Egypt in the pharmaceutical industry. SEDICO is noted for its sterile areas which are insulated with laminar air flow to obtain filtered air up to 97%-99.97% particulate free. The critical processes are carried out in a class 100 area with the aid of Hepa filtered air system. The water purification system in SEDICO was designed to supply the dispensing zones with demineralised, distilled and sterile water. SEDICO applies Good Manufacturing Practice (G.M.P.) regulations throughout the operational or line departments, beginning with evaluation of raw materials, calibration of equipment and control, holding and distribution of finished products. Because up to date production technology and GMP are the cornerstones in the SEDICO establishment, SEDICO is one of the most sophisticated and advanced pharmaceutical plants in Egypt and in the Middle East.

The U-shaped design of SEDICO production lines minimises mix-up/contamination by providing a single direction of materials flow. Each pharmaceutical process is sufficiently separated to minimise mix-up and/or cross contamination. The plant is surrounded by a green area as a protection from the surrounding environment. Training courses at SEDICO are of the highest possible level in the pharmaceutical industry. SEDICO produces new dosage forms that have never been produced in Egypt before, like the spansule capsules (long-acting). SEDICO produces non-traditional dosage forms such as soft gelatine capsules. Its priorities are:

- To make new products to replace imported ones;
- To cover the market need for products not completely covered by local production;
- To implement new technology and research;
- Mutual co-operation between the Egyptian experts, and researchers at SEDICO and those of the foreign international pharmaceutical companies according to licence agreements.

SEDICO has its own computer systems of the latest generation, used in various activities: production, storage and administration, accounting and co-ordination between different activities. SEDICO has entered into licence agreements with a group of international pharmaceutical companies to produce their specialities to replace imported products, to cover increasing demand and to acquire technology and know-how.

SEDICO's expansion project include:

* Project of producing Diagnostic Products.

  Production started.

* Project of producing raw materials of antibiotics.

  Scientific and economic studies are finished.

* Project of producing pharmaceutical raw materials.

  Scientific and economic studies are finished.

SEDICO distinguishes itself by direct selling (Spot Delivery). Its vans cover all Egypt. Moreover, SEDICO's products are available at all pharmacies all over the country.

6.2.1 Products

The following are the SEDICO products, which have been classified by drug group.

DRUG PRODUCTS	DRUG GROUP
ANTIBIOTICS	• Biomox Capsules • Biomox Dry Syrup • Erythromycin Sachets • Flucamox Capsules • Oflocin Tablets • Tobracin Vials
ANTIDYSENTERICS & ENTEROSTATICS	• Furamebe Tablets • Furamebe Forte Tablets • Sedomid Capsules
ANTI-FUNGAL	• Flucoral Capsules
ANTIHISTAMINIC	• Astemizole Tablets
ANTI-INFLAMMATORY PREPARATIONS	• Feldoral Capsules • Feldoral Suppositories • Rheumarene Gel-Tablets
ANTI-VIRAL	• Cycloviral Eye Ointment • Cycloviral Tablets
CARDIACS / VASCULARETICS	• Anaplate 75 Tablets • Diosed Tablets • Vascular Tablets
CENTRAL STIMULANT	• Cinacetam Capsules
HEPATOBILINOGENICS	• Hepaton Tablets • Silymarin Sachets
LAXATIVE	• Sedalac Syrup
GASTROINTESTINAL ULCER HEALING DRUGS	• Famotak Tablets • Omepak Capsules • Ranitak Tablets
PULMONICS	• Acetylcistein Sachets • Aironyl Tablets • Aironyl Syrup • Solvex Capsules • Solvex Syrup
VITAMINS / MINERALS / GERIATRIC PREPARATIONS	• Calcium Sachets • Royal Vit G Capsules • Vitamin C Sachets
MISCELLANEOUS	• Dentinox Teething Gel • Hi-Sept Solution • Metronal Tablets • Omega-3 Plus Capsules • Prostatin- 1 Suppositories • Tricof Vaginal Ovules • Uroxate Sachets

The products under licence

Organon Products
- Andriol capsules
- Antibiophilus capsules
- Cotazym forte tablets
- Dexatopic cream
- Gynohilus vaginal inserts
- Humegon injection
- Ovestin cream
- Ovestin cream
- Ovestin suppositories
- Ovestin tablets
- Visceralgine ampoules
- Visceralgine suppositories
- Visceralgine syrup
- Visceralgine tablets

Cyanamid-Lederle Products
- Cinopal tablets
- Gevral protein sachets
- Minocin tablets
- Pipril 2g vials

Bio-Strath Products
- Bio-strath elixir
- Bio-strath tablets

Chauvin Products
- Cebemyxin eye drops
- Cebemyxin eye ointment

Debat Products
- Nibiol tablets
- Tadenan capsules

Doms Laboratories Product
- Escino gel

F. Trenka Product
- Eucarbon tablets

Zeneca Products
- Nolvadex tablets
- Nolvadex D tablets
- Zestril tablets

6.2.2 Mission, Strategic Objectives and Key Success Factors

6.2.2.1 Mission Statement

Each department within the company has its mission statement. The mission statement for SEDICO as a whole is "to be a leader of the pharmaceutical products in the Egyptian and Middle East markets, with products that provide expanded solutions to customer needs and health and that enhance the desire to do business with reliance. This is addition to facilitating continuous improvement and increased customer satisfaction."

According to the Chairman of the company, to ensure that the overall mission and strategic thrust of the company is understood by every department, the chairman and vice-president of the company, along with all department managers, meet twice a year to share their strategic plan and talk specifically about the company's mission. They describe the actual performance of the company and each department for the last six months, discuss goals, and describe the results of the company plan. The chairman of the company also mentioned that on 30 June 1998, they discussed, in addition to the above factors, the development of a quality culture, world class manufacturing concepts, product and package designs issues and customer technical support. The chairman of the company believes that the mission statement is the foundation upon which all actions pertaining to the business are built.

6.2.2.2 Strategic Objectives

The South Egypt Drug Industries Company has embarked upon a new strategy to grow the business via sales and productivity improvement. The strategic objectives include the following:

1. Continuing to develop world class manufacturing capabilities within the company and each process.
2. Instituting employment programmes which foster professional growth and develop working relationships with academic institutions for research and development.
3. Providing employee incentives which allow all employees to share in the profitability of the company.

In addition to the previous strategic objectives, SEDICO has also instituted a growth strategy which consists of the following objectives:

1. Increasing sales, reducing total costs and achievement of long-term profitability.
2. Promoting international sales in existing business; increasing promotion and advertising activities.
3. Maintaining technological leadership by increased investment in research and new product development.
4. Promoting continual professional growth of all employees; continuing to invest in the education and training of employees.

According to the vice-president of the company, a key to SEDICO's growth objectives is the achievement of total quality management in all of its operations and in the elimination of all kinds of waste.

6.2.2.3 Key Success Factors

The key success factors at SEDICO are defined by the business issues that have been addressed for the period from 1995 to 2005 for competitive advantage and which have been tied to the company's strategy to achieve the previous objectives. According to production and financial managers, those factors are quality, delivery, time, cost, and customer satisfaction.

6.2.3 Research and Development at SEDICO

SEDICO is research-based pharmaceutical company where new highly innovative pharmaceuticals, together with disease prevention and management capabilities and information technologies, are forming creative and effective new health care solutions for patients.

The convergence of pharmaceutical science and information technology is providing unprecedented opportunities to understand better and address people's health care needs and to affect positively the prevention and management of diseases. By improving communication among patients, health care providers, pharmacists and those who pay for care in Egypt, all those involved in the delivery of health care in Egypt, SEDICO is improving the quality of health care and helping lower the costs. According to the R&D manager, SEDICO has proven internal capabilities in many areas of pharmaceutical discovery research, including medicinal chemistry, computational chemistry, biochemistry, and molecular biology.

Drug development involves a great amount of risk. The R&D manager at SEDICO said that "it is important to note that, historically in the pharmaceutical industry, only 12 percent of compounds that make it to the research phase just prior to clinical trials are ever marketed. Bringing a product to patients, from preclinical evaluation to market launch, traditionally has taken 15 years. SEDICO has implemented plans to cut that time nearly in half, aiming for seven years from pre-clinical to the formal product launch to patients."

Pharmaceutical product development at SEDICO begins with discovery research, which is responsible for identifying new chemical entities that may be useful for treating a disease or disorder. In selecting compounds to study, researchers consider whether a new compound satisfies unmet medical needs or how a compound

might compare with pharmaceutical products already available. Once a compound is approved for further development, a comprehensive plan is prepared that will guide the compound through the development process to product launch. Compounds identified as candidates for further development undergo extensive testing to ensure they can be safety administered in humans. Appropriate regulatory submissions also be made to gain approval to administer the first human dose. Quality checks are built into the development process to evaluate the implications for administering the compound to humans.

According to the Chairman of the company, SEDICO is committed to continuous research and development to discover new solutions to today's foremost medical challenges. This includes finding new uses for existing drugs, and investigating entirely new areas of pharmaceutical science. The production manager said that "owing to the steady, unceasing development of SEDICO, the company has been able to add to the market several new products covering a wide variety of therapeutic groups. Those products were carefully selected to meet the local and export market needs."

According to the Chairman of the company, investment in R&D is essential, to be a world class manufacturer in the pharmaceutical industry.

6.3 World Class Manufacturing Strategy at SEDICO

The Chairman of the company mentioned that SEDICO has a new mission of continuing to be the pre-eminent supplier of the pharmaceutical products in the Egyptian, Arabian, and African markets. He also indicated that recent changes in those markets have caused the company to re-assess its current strategy. Each market segment requires different types of marketing and pricing structures, and the expectations of the customers are different in each segment. Accordingly, the company decided to implement the WCM strategy to satisfying the customers' needs and expectations in each market segment. The basic business concepts of continuous improvement, quality, and customer satisfaction were the key areas for the company's WCM strategy.

SEDICO's sharp customer focus allows it to answer and anticipate customer needs. According to the sales and marketing people inside SEDICO, the company works to "stay close to its customers" and to understand the requirements of their varied businesses. The chairman of the company mentioned that by cultivating strong relationships with health care professionals, SEDICO seeks to become a true partner in providing products for constantly changing health care challenges.

The manufacture of pharmaceutical products in SEDICO is critical to the company's mission of providing customers world-wide with pharmaceutical-based health care solutions. SEDICO products are manufactured with the highest standards of quality. The company's manufacturing operations cover the entire manufacturing process, from chemical processing of active drug substances to the final packaging of vials or bottles. In order to meet the company's objective of producing products of the highest quality while at the same time minimising impact on the environment, the operations utilise state-of-the-art processing and automation technology. Critical technologies utilised in finishing operations include high speed liquid filling, freeze drying, aseptic processing, dry powder processing, tablet compression, capsule filling, and high speed labelling and packaging. SEDICO products are manufactured with consistent excellence in accordance with company standards and in compliance with local and international registration requirements and good laboratory practices, good clinical practices, and good manufacturing practices requirements.

The Chairman of the company mentioned that major changes in the world of pharmaceutical manufacturing have taken place. The most important changes are the increase in competition in the local and international pharmaceutical markets as the result of the GATT or WTO agreement, the introduction of advanced technology for the production and packaging of pharmaceutical products and the implementation by the majority of competitors of new management philosophies such as TQM and JIT. It has been mentioned at SEDICO that world-wide competition is a fact of pharmaceutical manufacturing life, and it will get stronger in the future. On the other hand, everyone has access to the advanced technology provided, and technology can always be purchased. The Chairman of the company indicated that the way for SEDICO to succeed in the manufacturing of pharmaceutical products is to follow the WCM strategy by implementing JIT and TQM philosophies that can bring about delivery on time to the customers and superior quality products at the lowest possible cost. The change of world-wide competition as the result of WTO agreement forced SEDICO to change to be ready for the year 2005, when the agreement will be fully implemented in Egypt. There are some factors which drive the change inside SEDICO.

6.3.1 The Drivers of Change at SEDICO

The drivers of change for renewal were manufacturing excellence, responsive product development, and marketing innovation. The three elements of manufacturing excellence were employee involvement through training and education, statistical process control (SPC) which emphasise the human element of the process by implementing TQM philosophy, and by implementing JIT inventory. Responsive product development and marketing innovation were the result of an all-pervasive close to the customer approach as the result of increasing the rate of make-to-order. The process of change was led by a focus on the long-term directional thrust for a complete organisational transformation. The emphasis was on day-to-day actions and problems. The main elements were a basic training program, team-building process, joint problem-solving, and improved communications. Key aspects of the change process were: it involved everyone in the company; implementation of TQM and JIT philosophies; a voluntary basis for training in the beginning of the change, and leadership change. The process of the change to the WCM strategy are related to the stages of awareness, which the company has been built. There were three stages of

awareness during the change. The first stage consisted of presentations by well-recognised speakers in their areas of specialisation. The second stage looked at specific awareness topics through the review of the experiences of other local and international companies. The third stage focused on the improved communication of business processes. The emphasis was on renewal in action to improve performance. The benefits of these stages provide a basis for facing the difficulties in start-up of the change, the ability to meet customers' needs, and the demands of cross-functional management.

WCM strategy at SEDICO aims to achieve world class performance. According to the people inside SEDICO, world class performance can be attained when WCM philosophies and the continuous improvement concept extend into all departments and activities within the company. SEDICO, under its WCM strategy, has a plan to extend TQM and JIT philosophies and the continuous improvement concept to manufacturing and non-manufacturing activities. WCM strategy for SEDICO, means greater profits through increased sales revenue, lower operating costs, reduced waste through identifying and eliminating activities that do not add value, and increased responsiveness to customers' changing requirements.

According to the people at SEDICO, the adoption of WCM philosophies is becoming a competitive requirement for the company. This is due to strategic changes, which are taking place in the market. The customer is demanding new things of the company and SEDICO is facing competition on a global scale. SEDICO is finding that its customers are increasingly demanding higher quality in pharmaceutical preparations and requiring quick, accurate and consistent delivery performance. According to the SEDICO's management, this can be achieved by implementing TQM and JIT philosophies

6.4 Total Quality Management Philosophy at SEDICO

Quality at SEDICO used to be just an element of the production process. According to this philosophy, the production department used to be the department which was responsible for quality. Today, the majority of SEDICO's people are familiar with the expression, 'quality is everyone's business'. The Chairman of the company indicated that no department can be excluded, even those that think they do not affect quality. The quality manager and his department at SEDICO are not directly responsible for quality; it is a collective responsibility. The quality manager and his department are responsible for monitoring the effectiveness of the quality system and indicating to the management where and when weaknesses and deficiencies are detected. They do not have executive powers but report directly to executive management on the achievement of their quality policy. Therefore, quality at SEDICO is everyone's responsibility, from the Chairman of the company to the receptionist. According to the quality department team, for example, the plant quality assurance function conducts tests on all incoming ingredients, assists manufacturing operators in monitoring process quality, and conducts all analytical tests on pharmaceutical finished products. The plant quality assurance team consists of 9 quality assurance technicians, 3 quality assurance supervisors, and a quality assurance manager. It provides SEDICO with quality information which goes beyond that collected by the operators on the production floor. A key role of the quality assurance technicians is to provide operators with immediate feedback on the quality results of each production run. The technicians also assist the production team in monitoring process quality on each manufacturing operation. Because SEDICO is implementing a TQM philosophy, every person in the manufacturing team is becoming an 'evaluator', as opposed to inspector, of the product while it is being produced.

According to the quality department manager, quality cannot be imposed by one party or another, it is totally dependent upon good relationships between the company, suppliers and both internal and external customers. He also mentioned that SEDICO has a good communication, understanding, agreement and co-operation with suppliers and customers to provide high quality pharmaceutical preparations. The pharmaceutical preparations of the SEDICO are seen as an extension of the company and the way in which the company deals with customers and potential customers is seen as reflecting upon the quality of the final preparations.

The quality manager said that "quality at SEDICO is simply good management aimed at customer satisfaction and management in a planned, logical, economical and demonstrably effective way. It requires that the company recognise weaknesses and failures and do something positive to eliminate them. The pursuit of quality at SEDICO is a journey of improvement that requires the commitment to undertake it and sustained effort and patience to reap the benefits."

TQM philosophy at SEDICO is defined as a comprehensive approach, covering all aspects of the company and doing it right, first time every time is the main objective of this philosophy. One of the fundamental elements of this philosophy at SEDICO is Statistical Process Control (SPC). The production manager mentioned that inspecting products for defects after manufacture is wasteful and unreliable. SEDICO now is building quality into production, so waste is avoided and pharmaceutical products become inherently more reliable. SEDICO has started to use SPC for identifying causes of quality problems very early on the production process. The concept of SPC at SEDICO is that processes are continuously monitored, as opposed to the traditional after-the-fact inspection of completed pharmaceutical preparations. According to the quality assurance manager, the related activity associated with SPC at SEDICO is the quick capture of the results of the manufacturing process. While SPC does not focus on inspection of finished pharmaceutical preparations, there is a focus on monitoring intermediate steps in the process to determine problems as quickly and early in the process as possible.

SEDICO has introduced the principles of TQM in its operations to improve the quality of its products. There are four principles which have been introduced by SEDICO under the TQM philosophy. First, all the functions and activities inside the company, including production, sales and marketing, purchasing, accounting and information systems, apply quality control to improve their output. Second, each part of the company plans to focus on meeting customer requirements and expectations the first time and every time. Third, each part of the company is striving to improve continuously. Fourth, all the employees of the company have been involved and empowered to achieve the aims of the company. According to the quality department manager, there are several elements of SEDICO's TQM philosophy. These include

quality at source, built-in-quality, quality control training for all of the employees of the company, statistical process control and continuous improvement.

TQM in SEDICO aims to improve performance at every level and function in the company, involving everyone in the company, managers and workers, in a totally integrated effort. The ultimate goal of TQM in SEDICO is customer satisfaction. Now, all employees of SEDICO have been trained in quality improvement techniques, and are expected to apply these techniques of continuous improvement in whatever area they work. The purpose of this effort to train employees was to improve quality and productivity and to reduce costs by eliminating non-value added activities. The vice-president of SEDICO said that " With TQM the emphasis in the company has been on establishing a partnership with customers and suppliers, developing and producing quality products, involving all employees, eliminating non-value adding activities, measuring performance objectively whilst manufacturing to high safety standards and on a wider basis, playing a full part in the health community".

The new quality policy of the SEDICO under its TQM philosophy is to build in quality rather than inspecting out poor quality, and to emphasise continuous, never-ending quality improvement. SEDICO distinguishes between quality improvement and quality control. Quality improvement seeks to enhance actively the quality of the company's products, often through process improvement, whereas quality control seeks to detect any changes in the process, without regard for whether the change is good or bad. SEDICO is applying Good Manufacturing Practice (GMP) regulations to support the new quality policy.

6.4.1 G.M.P Applied in SEDICO

According to the quality manager, G.M.P is "Good Manufacturing Practice" applied very commonly in USA, Europe and Japan. G.M.P. regulations mean an international set of regulations implemented to assure quality, effectiveness and safety of pharmaceutical products. So it is a matter of building in quality rather than testing the quality. SEDICO follows the latest W.H.O. regulation for G.M.P.

6.4.1.1 Philosophy, Concept and Rationale

The Chairman of the company mentioned that drug products are invariably potent and could cause serious injury or death if either product or administration is defective. He also indicated that another circumstance of great significance is the fact that the consumer is usually not in a position to judge the quality of a drug product, not even its identity. The purchaser of an antihistamine tablet, for example, is not in a position to determine whether the tablets are in fact antihistamine tablets or whether they contain the ingredients in the amounts required. He also highlighted that the situation is magnified when one considers such extremely potent drugs as cardiac drugs or hormones, especially those that are administered by injection or by intravascular infusion. In effect, the consuming public-society, being unable to recognise defective drug products, must rely implicitly on the men and women involved in the drug manufacturing, distribution, dispensing and administration of drug products for protection from defective drug products. According to the quality manager, total dependence on final quality control testing is not the solution, since quality control testing has the following defects:

a- Presumptive Testing

The tests are performed on components which are presumed to be there. For example, one tests for acetylsalicylic acid in aspirin tablets because one presumes that it is present in the tablet. These tests will not detect an accidental impurity which may have been introduced as the result of a mix-up, cross contamination or an improperly labelled component.

b- Destructive Testing

The drug product must be destroyed in the process of performing the test. For example, in determining the amount of acetylsalicylic acid present in a tablet of aspirin, a number of tablets are crushed. This method obviously prevents the determination of the amount of aspirin present in each of the tablets in any batch. Moreover, the tested samples are not going to be sold and the product which is going to be sold is not tested. Thus, SEDICO believe in the slogan "we test what we don't sell and we sell what we don't test". Also, such estimation on samples is subject to two types of risk factors:

i- The alpha (α) risk factor

This factor states that, even when everything is done right, there exists a probability that good lots are going to be rejected based on the data obtained from the samples. This is the manufacturer's risk.

ii- The beta (β) risk factor

It states that, there exists a finite probability that bad lots, defective lots, will be accepted based on data obtained from samples. This is the consumer's risk. SEDICO believes that in the manufacture of any object, including that of a drug product, there are four basic elements of quality that are identified as impacting on the specifications of the product. These are People, Material, Method and Machinery. SEDICO also believes that the people involved are the strongest quality element in the manufacture of the drug product.

6.4.1.2 Evolution of the Good Manufacturing Practice (GMP) Regulations

These regulations appeared after some major tragic events, which started with the "Elixir of Death" episode in 1938 in which more than 100 children died after ingesting an ethylene glycol-based sulphanilamide elixir, and were revised in 1963 after the Thalidomide Babies tragedy, when a tranquilliser for pregnant women led to babies being born without arms and/or legs. The 1978 revision was carried out after five high level officers of a Large Volume Parenteral manufacturing firm had been criminally prosecuted following reports of death due to septicaemia arising from the use of infusion solutions manufactured by the firm.

In summary, it can be stated that:

- The quality of a product has as degree of possession of those characteristics designed and manufactured into it which contribute to the performance of its intended function when the product is used as directed.
- The quality of medicinal and related products is the sum of all factors which contribute directly or indirectly to the safety, effectiveness and acceptability of the product.
- Quality must be built into the product during research, development and production. It cannot be achieved merely by checking, examination and/or testing.

Achievement of this goal requires a comprehensive system so designed, documented and implemented and so furnished with personnel, facilities and equipment as to provide assurance that the products will consistently be of superior quality.

6.4.1.3 Good Manufacturing Practice Regulations

The basic requirements of Good Manufacturing Practice, which SEDICO has implemented, are that: a- All manufacturing processes are clearly defined and proven to be capable of achieving the desired ends.

b- All necessary facilities are provided including:

i- Appropriately trained personnel.

ii- Adequate premises and space.

iv- Correct materials, containers and labels.

vi- Suitable storage and transport.

c- All procedures are written in instructional form, in clear and unambiguous language and are specifically applicable to the facilities provided.

d. All personnel are trained to carry out the procedures correctly.

e- All records are made during manufacture and packaging, which procedures were taken and that the quality and quality produced were those expected.

f- All records of manufacture, packaging and distribution, which enable the complete history of a batch to be traced, are maintained in a legible and accessible form.

g- A system is available to recall from sale of supply any batch of product that become necessary.

h- All local regulatory requirements are maintained.

If we apply these GMP regulations to what is taking place at SEDICO, the following can be stated:

A- Organisation and Personnel

The company follows the typical manufacturing organisation of staff and operational or line departments, both in the direct activities such as production and sales, and in the indirect activities, the technical services such as quality assurance and engineering. The training courses at SEDICO are at the highest possible level in the pharmaceutical industry.

B- Building and Facilities

The design of the SEDICO manufacturing facilities is the latest in the pharmaceutical industry. The U-Shape design is adopted which minimises mix up/contamination by providing a single direction of materials flow. The plant is surrounded by grass and foliage as protection from the neighbouring environment. Access to the building is totally controlled. There is enough space for each pharmaceutical process to be carried out apart, to minimise mix up and/or cross contamination. Lighting,

ventilation, air filtration, air heating and cooling, plumbing, sewage and refuse, washing and toilet facilities, sanitation and maintenance are according to the GMP requirements.

C- Equipment

The equipment at SEDICO, its design, size, location and construction are according to the GMP regulations. The cleaning and maintenance procedures, and calibration are in accordance with the regulations.

D- Control of Components, Drug Product Containers, Closures, and In-process Materials

The raw materials and packaging materials are received, inspected and approved following definite documented procedures. Sampling and re-testing are done on a scheduled basis.

E- Production and Process Controls

In production, the documentation is well developed. The Master Production Record (MPR), the Batch Production Record (BPR) and the standard operating procedure are designed and well followed to control all the production process.

F- Packaging and Labelling

These are carried out according to the requirements of the GMP regulations with respect to the material, printing and expire dating.

G- Holding and Distribution

SEDICO has a very impressive warehousing system in which all the rules are applied with both physical and documented separation of the different areas for the raw materials, packaging materials and finished products. There are specific areas for materials requiring special storage conditions. The dispensing centre is also well designed.

H- Returned and Salvaged Products

There is a specific way at SEDICO to handle returned and salvaged products. This way is abstracted mainly from the international regulations governing these matters.

I- Laboratory Control

SEDICO is well equipped with a laboratory which contains all the latest versions of instrumentation capable of carrying out all the analytical procedures to monitor the produced pharmaceutical during all the processes and steps of testing, microbiological controls, stability testing, preformulation studies and development work. There is also an animal house for carrying out biological tests, toxicity, safety and pyrogen testing.

J- Air Quality

SEDICO has a well designed system for air conditioning not only for heating, cooling and humidity control but also for filtration of air up to 97% particulate free air in non-parenteral areas and up to 99.97% particulate free and laminar flow in the controlled environment. The critical processes are carried out in a class 100 area with the aid of a HEPA filtered air system.

K- Water Quality

The water for non-parenteral use is demineralised water, passed on a 0.2 μ filter and UV lamps, circulating all the time to prevent dead points and decrease microbial investigation. The water used for sterile products is sterile distilled water circulating all the time and preserved at 80° to prevent microbial growth.

L- Steam

The company has two types of steam: industrial steam for heating purposes, which cannot come in contact with the products, and clean steam which is generated from sterile water, only this steam is allowed to come in contact with the product.

M- Compressed Air

The compressed air at SEDICO is free from moisture, oil and foreign particles. This makes it suitable for the pharmaceutical industry.

N- Sterilisation

The preparation of sterile products is carried out mostly under aseptic conditions. Sometimes final sterilisation is carried out. There are two sterile areas at SEDICO, one for powder filling and the second for liquid preparations. Both are physically separated and so is the air handling system. Each area is supplied with its own equipment for all necessary operations, e.g., autoclaves, hot air oven, etc. The equipment as well as the area itself is validated, monitoring of sterility is maintained utilising various methods of microbiological testing.

O- Records and Reports

All records and reports which help in the process of manufacture and control of pharmaceuticals are maintained in the company to help in monitoring and tracing whatever arises in the course of the use of the product.

From the previous discussion it can be concluded that that the pharmaceutical industry is well regulated by the GMP regulations and SEDICO complies with them

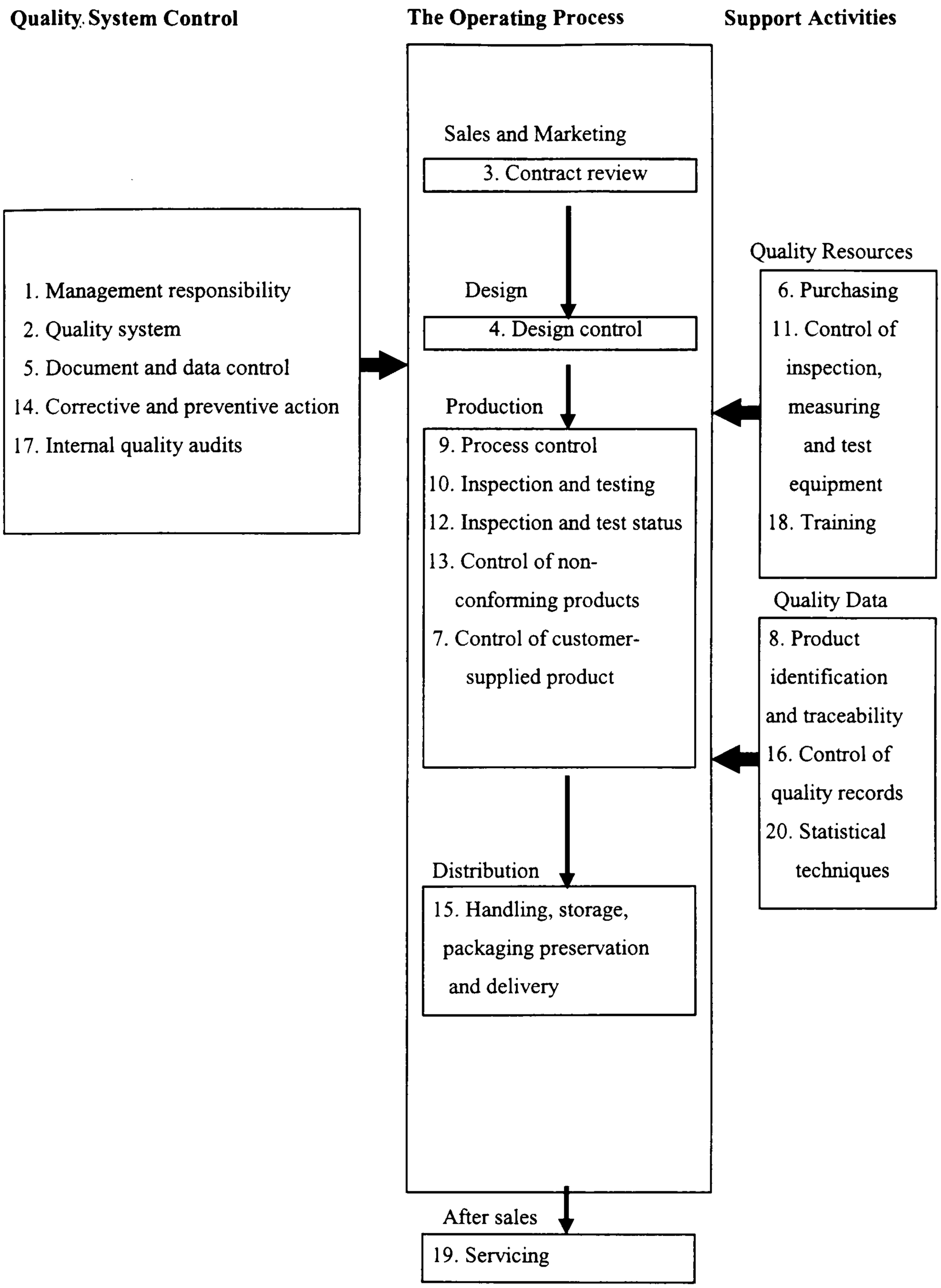
all as a way to maintain quality. In addition to the GMP regulations, which SEDICO follows, the company has also obtained ISO 9001 certification.

6.4.2 ISO 9001 at SEDICO

According to SEDICO's quality manager, doing it right first time, every time, all the time, is the first step in the TQM philosophy journey. The company started the journey of TQM philosophy in October 1995. On the same day, it was also announced that the company was going all-out for ISO 9001. The production manager mentioned that obtaining ISO 9001 certification is a global trend in the pharmaceuticals business, and it has become a marketing requirement in doing business with the local and world markets. The company had the assistance of outside consultants, who were primarily responsible for training on new approaches, had an established reputation in the quality field and advocated a state-of-the-art TQM programme with a proven track record. According to the production manager, the company worked diligently to establish quality standards, conduct quality training, develop corrective action procedures, secure employee and management involvement, and follow the consultant's proven quality improvement process. According to the company chairman, the system of TQM and highest quality assurance in design, R&D, production, installation and services enabled SEDICO to obtain the international certificate of ISO 9001. The company obtained the ISO 9001 certificate in 1997.

SEDICO, like many international companies, has arranged the requirements of ISO 9001 into three groups, which are shown in Figure 6.4.2. The first group is in the middle block of the figure. This group consists of nine requirements related to some of the activities of the operating process of the company, including some sales and marketing activities, design, production, distribution and after sales services. The second group, in the right hand block of the figure, consists of six requirements related to the some of the support activities that are carried out to enable the operating process to function effectively. Support activities include quality resources and quality records. The third group is in the left hand block of the figure. This group consists of five requirements related to the activities of the quality control system. These activities include management responsibility, quality system, document and data control, corrective and preventive action and internal quality audits activities. For each of the foregoing twenty activities, one or more of the standard's requirements are relevant.

Figure 6.4.2 The Implementation of the ISO 9001 at SEDICO



According to the people in the quality department, SEDICO's TQM philosophy aims to focus the company on both internal and external customer needs. It seeks to introduce quality practices into every area of the company, from R & D to manufacturing, sales and marketing, accounting and other departments. According to the Chairman of the company, as the result of TQM implementation, every manager, 60% of the manufacturing workforce and 40% of other workers have received training in team leadership, quality tools and team building. The company has a plan to reach 100% of the workforce in each department with training in these factors. He also mentioned that SEDICO has tried to develop a no blame culture, and to encourage employees, in order to develop empowerment throughout the company.

6.4.3 The Benefits and Problems of TQM Implementation

The implementation of TQM at SEDICO brings benefits from ensuring that the company focus on customers, manage processes and continuously improve all operations not just manufacturing operations. The benefits, which SEDICO gains from the implementing of TQM philosophy, are related to the new critical success factors, which the company has addressed and defined during the change for competitive advantage. These factors are:

Quality: Continuous improvement in reducing defects and variability in everything the company does, thereby increasing customer satisfaction.

Productivity: Concentrating first on doing the right thing and second, on doing that thing right, thereby ensuring the company does not waste precious human and financial resources.

Participation: Encouraging everyone to be open to the influence of others and allowing everyone to make a difference, thereby using everyone's intelligence and unique talents to the benefit of the company and its customers.

Flexibility: Operating in a manner which will allow us to respond effectively to changes in markets and other environments, thereby leading rather than following the competitors.

The ability of SEDICO to quantify the benefits of better quality of its pharmaceutical products, as the result of TQM implementation, shows that by far the largest benefits comes from the potential increase in sales volume and make-to-order rate, shown in the SEDICO's annual performance report of the year of 1997 (see table 6.7.1.2.2.6.1). Not only does this mean that the implementation of TQM philosophy at SEDICO to improve quality of products and services can be highly profitable, but also that there has been a fundamental change in the way that SEDICO approaches quality improvement and measures its performance. The approach to quality improvement at SEDICO starts with defining customers' needs and expectations, both short term and long term, and then identifies the changes, which need to be made to satisfy customers' requirements. The impact of TQM philosophy on SEDICO's performance measurement systems will be presented later in this chapter.

The main problem of TQM implementation was related to documents. There are no internal TQM documents at the company. The only data available about TQM is the information compiled for the executive training presentations. The quality dimension is communicated all-pervasively through the company with the exceedingly strong corporate culture and the commitment to continuous process improvement for increased customer satisfaction.

One of the most important partners of TQM philosophy at SEDICO, in its continuous improvement journey, is JIT philosophy.

6.5 Just In Time Philosophy at SEDICO

In 1996 SEDICO started a manufacturing improvement programme for its pharmaceutical products. Pharmaceutical products are segregated and the production area is arranged into work cells. Material is pulled through the production process using the kanban method. This improvement programme is JIT philosophy.

JIT at SEDICO is defined as an overall philosophy. The Chairman of the company defined JIT as 'a business philosophy of continuous improvement and the elimination of waste'. According to the people inside the production department, one of the cornerstones of this philosophy at SEDICO is the continuing elimination of waste. Waste at SEDICO is defined as anything that does not add value to the company's pharmaceutical preparations. Inventory at SEDICO is viewed as waste and every attempt is made to drive it to its lowest possible level. According to the production manager, the emphasis of the JIT philosophy at SEDICO focuses upon continuous improvement towards lower production costs, a higher rate of productivity, better quality and reliability of products, and achievement of promised delivery times for customer orders, by the elimination of all kinds of waste, and also development of close relationships with suppliers and customers. The Chairman of the company indicated that management attitudes changed from a style of direct command to participate management after TQM and JIT implementation. At the present time, the management is fully committed to supporting team working, which they believe is an essential factor to improve quality. An important part in JIT philosophy, which has been started to be implemented by SEDICO, is JIT purchasing.

6.5.1 JIT Purchasing or Supplier Relationships

SEDICO is collaborating with its suppliers in the effort to improve quality. SEDICO recognises that quality product problems often result from the delivery of raw and packaging materials that do not meet process specifications. SEDICO started in January 1997 to change its relationship with suppliers by implementing a JIT purchasing programme. Purchasing at SEDICO is regarded as one of the most important key elements to the success of the JIT philosophy. JIT purchasing at SEDICO is a programme of continuous long-term improvement. According to the people inside the purchasing department, this programme encourages SEDICO and its suppliers to work together to reduce lead times, lot sizes, and inventory levels. JIT

purchasing at SEDICO was the aspect of JIT to be implemented. According to the people in the production department, the main objectives of partial implementation of JIT philosophy at SEDICO were elimination of inventories, having pharmaceutical preparations produced at the right time and in the right quantities to guarantee delivery requirements, and to establish long term relationships and contracts with suppliers, so the latter would have the security of knowing that the relationship will continue as long as the supplier remains competitive. The production manager mentioned that to achieve these goals required a reversing of the traditional relationships with suppliers, which involved multiple sources and competitive bargaining. According to the purchasing manager, these relationships were often based on short term agreements, adversarial negotiation approaches, lack of co-operation, ineffective communication, and sometimes poor raw and packaging materials. He also mentioned that with JIT purchasing, the supplier has an extremely critical role to play with good delivery times and quality of raw and packaging materials. It was pointed out at SEDICO that the supplier is the critical element in successful JIT implementation and the improvement of quality. The new policy of the company is, whenever possible, to use a single supplier for specific raw and packaging materials. For example, for 75% of its packaging material, the company depends on AMPCO, which delivers daily directly to workstations. It was believed that the risk of having a single supplier for particular raw or packaging materials, is outweighed by the benefits of being able to develop a close relationship based on mutual trust, to improve quality and on time delivery of such materials. The company used to have over 20 suppliers for raw materials and 7 suppliers for packaging materials. This was reduced to 6 and 3 after JIT implementation. In order to do this, the company stopped dealing with those suppliers who could not accept and deliver raw and packaging materials in accordance with the company's new JIT requirements. New relationships with suppliers are based on long term agreements and mutual trust. The company holds regular meetings with its suppliers to communicate the company's expectations and needs. The company explains its manufacturing philosophies and the technologies that generate them; however, the main objective is to further promote and develop partnerships between the company and its suppliers. At present the company has very close relationships with major suppliers. At the same time, the company believes that there is still much more to be done in this area.

The following describes the process of change of how the company set up JIT purchasing for its packaging materials. The company needed to reassess the level of warehousing required to hold packaging materials for manufacturing and marketing its pharmaceutical products. Since packaging materials are, by their nature, bulky, the warehouse would have to be significantly increased with a corresponding increase in inventory carrying costs. The alternative was to implement JIT philosophy to minimise the need for storing packaging materials. The company decided to implement a JIT purchasing system. The company communicated the need to the Arab Medical Packaging company (AMPCO), which supplied most of SEDICO's manufacturing packaging materials. A good starting point for improving SEDICO 's relationship with AMPCO was openness. SEDICO has started in 1997 to build an open-door policy with AMPCO. A team comprised of SEDICO and AMPCO, staff was set up to design how the system would work. The new system, was built between SEDICO and AMPCO, used Kanban cards to allow AMPCO to ship the manufacturing packaging materials to SEDICO point of use, direct to the cells, daily. There was a free exchange of technical information, clear communication of needs, expectations, and performance, and a sharing of financial data about the products being supplied.

According to the people in the purchasing department, the benefits of this new system led to minimise the need to store manufacturing packaging materials, and correspondingly controlled the level of damage to this packaging inventory. They also mentioned that inventory carrying costs and indirect administration costs were reduced. This new system, which started in January 1998 as the result of JIT implementation, tied AMPCO into a closer relationship with SEDICO, whereby AMPCO was able to plan its own production level to correspond with SEDICO's production schedule. This change of open communication has provided a basis upon which trust has been built between the two companies. One of the most important benefits of this change is that, as this relationship progress, further co-operation has developed. For example, AMPCO's financial manager was playing the role of the adviser for the changing of SEDICO's performance measurement systems (see point 6.7). In return, AMPCO receives large orders, longer-term contract, and fair prices.

The major difference between JIT and the traditional purchasing systems at SEDICO is that the JIT philosophy required establishment of stable relations based on developing long term relationships and contracts with suppliers. Also, the company

was encouraged to reduce the number of its suppliers and develop close relationships with as small a number of suppliers as possible. SEDICO used to follow a material requirement planning system before the implementing of JIT purchasing system.

6.5.2 Material Requirement Planning (MRPI) and Kanban at SEDICO

SEDICO started at January 1990 with MRPI. This is used for master scheduling and management of the supplier/stock interface. MRPI is a push system of raw and packaging materials ordering and control. The push system at SEDICO is simply a schedule based system in which a multiperiod schedule of future demands for the company's products is prepared. The computer breaks down the schedule for manufacturing and develops the production schedule for each cell based upon the master schedule. According to the head of the material department, the MRPI programmes never yielded as much benefit as the company originally expected but they provided a sound basis for the next quantum change in manufacturing. MRPI mainly focuses on transactions between inventories and to some extent it limits ultimate inventory reductions and does not result in the lead time compression which has become an important factor inside SEDICO.

The company turned to JIT philosophy in early 1997 in order to eliminate waste, and reduce set-up, lead times and inventories level to improve customer satisfaction. The issue of material to the shop floor was the most critical element making up lead time. It was decided to mount a trial Kanban exercise to see if this element could be reduced. Because rigid materials management discipline is absolutely essential inside SEDICO, MRPI was still used to ensure stability in the supply/demand process and for forecasting. The company is trying to develop a unified system using both MRPI and JIT. SEDICO is using a single-card Kanban system. The single-card Kanban system at SEDICO is a combination of a push-and-pull materials ordering system. The manufacturing aspect in a single-card Kanban system is a push system because pharmaceutical raw materials are produced according to the daily production schedule rather than for immediate needs. Coupled with this push system for manufacturing is a pull system for deliveries. Raw materials in each cell are delivered using withdrawal Kanbans only as they are needed by the downstream processes. One of the most important issues at SEDICO, related to the MRPI and Kanban systems, is manufacturing cells.

6.5.3 Manufacturing cells at SEDICO

The facility at SEDICO was divided into manufacturing cells with each cell producing one or several products within a particular product line. Twelve work cells exist and an additional four are being organised. All of the materials, equipment, labour, and support required to manufacture product were contained within each product-focused cell. Machines in the cells are linked together. Completed pharmaceutical preparations are automatically moved to the next machine to reduce material handling. The company uses a U-shaped layout in the cells, which brings all the resources required to make the family of products into very close proximity. Operators in each cell are multi-skilled so that they can operate a variety of equipment within the cells.

SEDICO was under substantial pressure from its close customers to increase quality and lower prices. In this matter, the main concern in the company was the product defect rates for each manufacturing cell. Defect rates problems were ongoing and widespread in the company, with no end in sight. Increases in the product defect rate were increasing product cost, lowering productivity and threatening future contracts with customers. According to the production manager, when defect rates reached an unacceptably high level in a particular manufacturing cell, the company would respond with an engineering and management taskforce to investigate the problem and take immediate action to reduce the rejection rates to an acceptable level. This practice represented a traditional 'fire-fighting' response that demonstrated short-term thinking to systemic quality problems. Now SEDICO is looking for a more enlightened method of quality improvement by the implementing of TQM philosophy. According to the quality manager, this new philosophy enables the company to reach defect-free production in the manufacturing cells. The production manager mentioned that defect-free production has been viewed as the long range objective for each cell, and that specific goals such as to reduce defectives by 30% or more are viewed as milestones on a never-ending quest for zero-variability, defect-free production. Attainment of these short-term goals is not viewed as the end of quality improvement. He also indicated that each set of goals, once attained, serves as the starting point for a further cycle of improvement.

SEDICO now has a multi-functional and flexible workforce for doing jobs in different cells, and operatives in each cell can do all the different activities required such as running machines, controlling, testing and packing the pharmaceutical products. One of the most important goals of manufacturing cells at SEDICO. under JIT philosophy, is satisfying customers' needs.

6.5.4 Customer satisfaction

The sales and marketing manager mentioned that, today, the competitiveness of the pharmaceuticals products is becoming very aggressive. He also mentioned that a pharmaceutical product's competitiveness depends on two key elements: its price and its quality. A few years ago, the emphasis was on price. Quality was thought to be a secondary priority. Today, things have been changed, and the existence of pharmaceutical products has satisfied the basic needs of customers who, in turn, have become more demanding and more interested in quality. According to the people inside SEDICO, the company's policy for dealing with customers is to be able to react to customer requirements and be responsible for customer satisfaction. SEDICO started in the beginning of 1998 to use the customer satisfaction index, which is a quarterly measure based on customer survey responses carried out by sales and marketing staff. SEDICO has a plan to submit once in each three months a list of customers to be surveyed. Sales and marketing staff who are responsible for carrying out this job mail surveys to the customers and ask them to rank the performance of the company from 1 to 5, 1 = unsatisfactory, 5 = excellent, on performance measures such as product quality, prices, on-time delivery, services, etc. At the end of survey, customers are invited to give their suggestions and recommendations about the company's performance. The value of this survey is summed to determine the customer satisfaction index for the company's management to support their effort in the continuous improvement programme. The result is reported quarterly to the SEDICO's management in their quarterly meeting.

6.5.5 The Benefits and Problems of the Change to TQM and JIT Philosophies

According to the managers inside SEDICO and the Chairman of the company, in particular customer satisfaction is a powerful factor in SEDICO's survival and growth in local and international markets. The Chairman of the company mentioned that, in these days of higher competition SEDICO is focusing in realising greater customer satisfaction through TQM and JIT philosophies to attain greater benefits. He also indicated that after two years of moving toward TQM and JIT implementation the company had achieved some benefits from the change such as reduction of lead times by 20%, and of inventory levels by 25%, and increased sales revenue by 22% (see table 6.7.1.2.2.6.3). There were also increases in the inventory turnover ratios and net profit from period to period (see tables 6.7.1.2.2.6.3 and 6.7.1.2.2.6.1). The biggest benefit achieved was perhaps motivating of the Board of Directors to do better, the willingness to fight and the urge to protect the company's business and strengthen all activities, not just manufacturing. The experience of SEDICO with TQM and JIT implementation has led to the desire for continuous improvement and to the development of a no-blame culture. In highlighting the benefits of the change, the financial manager said that: "In terms of the linkage between TQM and JIT implementation and the company's performance, there was definitely a cause and effect relationship between TQM and JIT practices and the company's performance as measured by productivity, customer satisfaction and profitability."

As the result of the change, SEDICO was going to integrate the concepts of TQM and JIT into its daily operations. On this point, SEDICO's management mentioned that the results of the TQM and JIT implementation should be measured in order to ensure that the company is obtaining the expected benefits. They also mentioned that the evaluation of the outcome of implementation can begin by simply making a list of the expected benefits. This should be a realistic set of objectives that is reflective of the expectations of both the functional area personnel and management. According to SEDICO's management, it is also important to decide how the benefits will be measured. For the numbers to be useful and credible, the method of measurement must be chosen carefully. On this matter, the Chairman of the company indicated that an ongoing challenge for the accounting information department is to establish a good performance measurement system to support the company's journey to continuous improvement of activities and processes.

The problems which arose during the implementation of TQM and JIT were a consequence, at least in part, of the changing Egyptian government policy as the result of the pressure of the WTO agreement. Prior to the agreement in May 1995, the efforts of SEDICO and other Egyptian pharmaceutical companies were supported by government policy in two respects. First, an import policy for pharmaceutical products involved restrictions which encouraged local alternatives. Because the export policy of the Egyptian government in the 1980s used to restrict imports in order to support pharmaceutical companies, companies in the pharmaceutical sector were not competitive internationally. The Egyptian government promoted exports through a variety of subsidies (tariff rebates, tax exemptions, preferential export credits and export credit insurance). These provided the foundation, by the beginning of 1990s, for a systematic promotion of pharmaceutical exports.

Secondly, government institutions actively supported the search for local alternative supplies. Later, by signing up to the WTO agreement, the Egyptian government changed policy believing that increased integration into the world economy would create new opportunities to access new sources of finance, new technologies and new markets, and to accelerate its economic growth. At the same time, the Egyptian government decided, in the context of its participation in regional trade agreements, to sacrifice a large degree of policy autonomy in return for access to markets and the perceived benefits from integration. Certainly, the more generalised protection, which provided a backdrop for targeted policies in Egypt was no longer possible and many of the export promotion policies no longer appeared permissible.

In addition to the two approaches to subsidies mentioned above the Egyptian government, which had a minority share in the company, used to provide two additional kinds of support. Firstly, export subsidisation to cover the difference between the local and export prices. Secondly, financial rewards to encourage the company in its export policy. As a consequence the company used to utilise part of the rewards as financial incentives to the shop floor employees. When the WTO agreement was signed in 1995, the government was forced to withdraw these kinds of assistance. At the same time, the company's export earnings were reduced as a result of the government policy. Because the company found itself under pressure to cancel the financial bonuses which it used to give to its shop floor employees, these changes

in the Egyptian government policy had a knock-on effect on the behaviour of SEDICO's employees. In fact, the employees were led to believe their wages and financial rewards would increase as a compensation for internal changes. So they were de-motivated when the opposite happened and they lost a substantial proportion of their financial rewards. This had a negative effect when other approaches (TQM and JIT techniques) aimed at continuously improving the performance were introduced. The Board of Directors explained to their employees that this was a temporary situation because they planned to tackle the problem, for example, by running a cost reduction programme (Kaizen) to improve its financial situation.

The company used senior management as internal consultants to help overcome labour problems. In this regard, senior management had an extensive knowledge of the company, whereas had external consultant been employed they would have had limited understanding. They were able to appreciate the concerns of the shop floor operators and to convince them that the cancelled financial bonuses of exports were a temporary problem. If they had been unable to deliver this may have been a dangerous strategy. Trust would have been rapidly dissipated.

Senior management, starting in August 1998, concentrated on using the concept of *fitness to cost* under Kaizen technique to solve the problem of cancellation of the financial bonuses accruing from export sales. Fitness to cost focused on ensuring the exported pharmaceutical products that were produced to international quality standards and customers' specifications but also that these were produced economically. Fitness to cost meant high quality at a low cost. In order to reduce costs, any sources of waste had to be eliminated.

Senior management instituted programmes to improve delivery time (JIT), moving towards world quality standards (TQM) and cutting manufacturing cost (Kaizen). A reduction of 30% in total manufacturing cost was achieved. The factory had for several years been continually examining and improving its performance, concentrating in late 1998 on reducing costs and improving its ability to produce small lots economically. For example, cleaning out the glass transfer tubes between batches had been reduced from 60 to 30 minutes in early 1999, when a new steam cleaning process was introduced. Changing over a packaging line to a new container

shape or size used to take two skilled operators about two hours. In early 1999, however, the changeover time had been reduced to about 1.5 hours on average (and, in some cases, to less than one hour), and could be carried out by one skilled operator.

According to the financial manager, over the next few years, as part of an ongoing policy of identifying opportunities for improvement without investing a large sum of capital, SEDICO could anticipate further savings by implementing a Kaizen programme for systematically reducing waste all over the company. This approach relies strongly on the educational foundations that have been laid. It also encourages employees and management to recognise that substantial gains are likely to result from a series of small improvements over time, each of which provide a platform for more improvement, rather than one or two immediate big hits. As the number of improvements made increase, SEDICO's people learn to look for prospective sources of waste reduction as a matter of course.

It was obvious that such changes only thrive under a top management regime that had a genuine concern for the long-term health of the company. TQM and JIT are heavily embedded in the concept of continuous improvement. This is a never ending process.

Critique of the Relationship with AMPCO

The strategic decision to build a strong customer/supplier relationship with AMPCO implies risks. First, the capability risk concerning technical development and co-operation with AMPCO. AMPCO must maintain its position on low production costs and high quality. This means that AMPCO will have to invest in faster and better printing facilities in the near future. The capability risks of AMPCO and SEDICO are fairly equal. Equal risks increase the importance of a successful relationship for both companies.

Second, the change risk which concerns procurement. The close co-ordination of quality control, ordering quantities and timing might lead SEDICO in the direction of AMPCO. SEDICO will have to adapt its quality organisation and warehousing policy to the SEDICO/AMPCO system of ordering. Then SEDICO can only change to another supplier which can deliver the packaging in the same way as AMPCO or in the event of major re-investment by SEDICO. The costs of switching might be higher than before. This risk seems less equally divided. SEDICO can switch suppliers at limited cost. However, the risks for AMPCO are limited as well for they have few competitors who can supply flexible packages in the specific quantities that SEDICO requires.

Third, the openness risk concerns the protection of information. As both companies are open to each other, they provide each other with information they do not want to be generally known. They may both wish to keep all this information confidential. This is no problem as long as the relationship is good because the both companies will guard the relationship. But should the relationship turn sour and perhaps be terminated, SEDICO may have to protect its information in another way. From the above it can be concluded that SEDICO will have to make sure that AMPCO stays competitive in all aspects of the customer/supplier relationship.

6.6 Accounting Information Systems at SEDICO

The accounting function at SEDICO until 1994 focused on financial reporting. Operating and cost control tools were derived from the financial accounting system. Recently, the irrelevance of the accounting information for the activities and processes of the company was recognised with the change in the manufacturing environment under the TQM and JIT philosophies, which aim at continuous improvement of activities and processes.

Continuous improvement of the activities was extended to the accounting information department with its new emphasis on satisfying the requirements of every process inside the company at the beginning of 1998. This entailed an entirely different basis of reporting and report generation for the accounting information at SEDICO.

Computers at SEDICO have been an essential part of accounting information processing since 1995. A data processor in SEDICO's accounting information systems processes transactions and produces accounting reports. Prior to computers, data processing at SEDICO was performed manually. According to the financial manager at SEDICO, computer-based data processing has altered the speed and complexity of transaction processing.

SEDICO has two major accounting systems, financial and cost systems. The financial accounting system is concerned with the measurement of income for two specific periods, quarterly and yearly. This is done by preparation of income statements. It is also concerned with the reporting of financial status at the end of each period, by preparing the balance sheet. Financial accountants mentioned that the data of the financial accounting system provides a record of all monetary transactions in the company. A record is made of each transaction, describing what happened, when it happened, who was involved, and how much money was represented. Financial accountants also mentioned that financial accounting data can be analysed in various ways to meet management's information needs. According to the people inside the accounting department, financial accounting data, nevertheless, has limited usefulness for management decision making.

On the other hand, the cost accounting system at SEDICO is concerned with determining relevant costs and performing other analysis useful for management decision-making. The production manager mentioned that the accounting information provided by the cost accounting system in the past did not support proactive decision-making and the continuous improvement objectives of the business. For example, the manufacturing area at SEDICO utilised a traditional cost accounting system, which was focused on direct material, direct labour and manufacturing overhead variances. All overheads were allocated based on direct labour, despite accounting for only 8% to 10% of the total manufacturing cost. Monthly manufacturing performance reports were generated and distributed to all manufacturing cells, highlighting performance in the areas of labour, material and overhead variance tracking.

Now, according to the head of the cost accounting department, the department is focusing its efforts on tracking those activities which drive the business. The financial manager indicated that as the result of TQM and JIT implementation, the accounting department started in the beginning of 1998 to re-design the cost accounting systems to support the continuous improvement objectives of the company. One of the most important impacts of TQM and JIT implementation at SEDICO on the cost accounting system is the "cost improvement programme". The goal of the cost improvement programme is to develop methods that reduce the cost of SEDICO's pharmaceutical products without reducing value to the customer. The programme focuses primarily on raw and packaging materials costs, since these comprise over 65% of the total product cost. Labour costs represent approximately 10% of the total cost. According to the cost accountants, a greater emphasis will also be placed on overhead savings. However, improvement in the costs of raw and packaging materials are an important element of the cost improvement programme. The most significant saving in such costs comes from the competitive purchasing programme, which involves participation of the supplier in identifying cost savings opportunities. In this respect, the purchasing department plays an active role in the cost improvement programme.

To ensure that the cost improvement programme reflects true cost reductions, the accounting department has instituted a number of programme requirements. For example, cost improvements are not counted until the planned cost has been reached.

Reductions prior to achieving the planned cost are considered as cost avoidance, not cost savings. The cost associated with implementing a cost improvement programme is deducted from its savings.

Thus, new measures have been adopted in the cost accounting system to monitor business efficiency and effectiveness. These has also been a shift in its emphasis from external to internal reporting. The cost accounting system is now focused on providing information to the teams in the different management levels, that is timely, allows for proactive initiatives, and is relevant to problem solving. The financial manager mentioned that the cost and management accountants are now using their skills to help drive the continuous improvement efforts within the company, and to become more useful to management on a daily basis. One of the most important components of cost accounting at SEDICO is the performance measurement system.

6.7 Performance Measurement System at SEDICO

The Chairman of the company mentioned that performance measurement systems are powerful tools for charting organisational progress toward the future. He also mentioned that the achievement of the company's goals and objectives under the TQM and JIT implementation are driving forces for establishing a good PMS. Prior to the TQM and JIT implementation, a traditional PMS which depended on financial measures was used to measure and report the performance of the activities and the company as whole.

The results of interviews with the people inside the accounting information department indicated that SEDICO, before TQM and JIT implementation, used some financial measures and variance reports based on the cost accounting system to measure and report the performance of the company. These measures and variance reports were:

1. Labour cost variances
    a. variance in rate of wages
    b. variance in working hours
2. Raw material cost variances
    a. variance in raw material quantity
    b. variance in raw material price
3. Large variety of overhead variances

It seems that the biggest problem with the traditional PMS in SEDICO was in the underlying assumptions. When cost was measured so closely and so individually, SEDICO was making the implicit assumption that the company was competing on low cost. This was usually not true. Another problem with the traditional PMS in SEDICO was that the traditional cost accounting system was built on the assumption that direct labour was the major source of value added, but this is no longer true. Maybe the most important problem with the traditional PMS in SEDICO was that it was almost entirely based on cost, and little attention was given to the objectives of WCM philosophies, which the company has started to implement, other than cost.

The production manager and his team indicated that the traditional performance measurement system which was available before the JIT and TQM implementation did not provide all the information that was needed to monitor the company's

progress towards achieving its business objectives. They also said that this PMS hindered them in they efforts to improve performance to world-class standards.

Because SEDICO aimed to pursue the objectives of TQM and JIT philosophies other than low cost, it started to develop a PMS that would assess its progress in achieving the company's goals and objectives. The management accountants mentioned that the new performance measurement system focuses on daily, weekly, monthly, quarterly and yearly trends of performance, and will help the company in achieving world-class capabilities in all areas. According to the financial manager, the primary purpose of the new performance measurement system is to measure objectively how the company is accomplishing its mission, goals and objectives under a JIT and TQM environment. According to the people inside the accounting department, the new performance measurement systems can be classified into two categories. First, departmental area PMSs such as manufacturing, purchasing, and sale and marketing performance measurement systems. Those systems will be used to communicate departmental performance in its key success factors to other departments, to support the departments in achieving their goals and objectives and in their continuous improvement programmes. Second, the total business PMS. This system will focuses on key performance criteria, measures and reports used to control SEDICO's progress toward world class performance and to support its continuous improvement programmes.

In the beginning of 1998, the accounting department at SEDICO started to re-design its performance measurement systems. According to the people inside the accounting department, this re-design was about changing the way that performance measurement is done. The financial manager mentioned that the re-design was concerned with three issues. First and foremost, was the way of developing the PMSs. Second, was the creation of a new design for the PMSs. Third, was the implementation of the new systems in the company. SEDICO started first with its manufacturing performance measurement system. The financial manager views the manufacturing function as the 'customer' of all other supporting departments, including accounting. He stated that the 'product' of the supporting departments is customer service and the primary customer being served is the manufacturing area. He argued that by maintaining a customer/supplier relationship internally, as well as externally, each department will better understand its role and will develop stronger

relationships with others. This is why the accounting department started first to re-design and develop the manufacturing PMS. At the time of the interviews inside the company, the accounting department had finished only the re-design of the manufacturing PMS.

6.7.1 Manufacturing Performance Measurement System

According to the people in the production department, manufacturing performance reviews used to be held monthly and annually. If manufacturing performance failed to meet the objectives, causes were analysed and actions determined. Over longer timeframes, actions were expanded to include more individuals. But now, as the result of TQM and JIT implementation, manufacturing performance reviews are held daily, weekly, monthly, quarterly, and annually to improve the manufacturing performance continually. They also indicated that manufacturing performance measurement information plays an important role in the manufacturing performance reviews.

6.7.1.1 The Process of Change in Manufacturing PMS

In December 1996, the Board of Directors of the company approved the proposed manufacturing mission, objectives, and long-term manufacturing strategy to achieve the mission and objectives and the key success factors of that strategy. The production manager stated that the manufacturing strategy entails an investment of $25 million over the next five years to enhance the ability to increase capacity, flexibility to adjust to changes in the marketplace and further improve quality while reducing costs.

There was no role for the accounting department in supporting that change during the period 1997 until February 1998, except the providing of cost information which helped the company to know profitable products by comparing the sales price and the product cost. The cost information at that time was not helping any decision, even pricing decisions, because the product price decision was driven by the market and negotiation, not by cost.

In 1997, SEDICO started to build new relationships with its suppliers. For example, there was a regular meeting between SEDICO and AMPCO teams to improve the relationship between the two companies. The improvement teams consisted of the production, financial, purchasing, and marketing managers in both companies. The role of teams was establishing a long-term, satisfactory, and fair relationship for the two companies depending on the basis of JIT philosophy. One of

the most important benefits of this relationship to SEDICO was to take advantage of AMPCO's experience in the changing of its PMSs. SEDICO's team listened to AMPCO's financial manager through the different meetings about the experience of his accounting team with the change of business PMS, and his company's view about the important of changing manufacturing and non-manufacturing processes including PMSs to improve and support the performance of the company.

In January 1998, SEDICO's financial, production, purchasing, and sales managers agreed to highlight the importance of changing the company's PMSs, starting with manufacturing PMS, to the Board of Directors. In February 1998, the financial manager got the acceptance and guarantee of co-operation from the Board of Directors to change the manufacturing PMS. In March 1998, the accounting department started the process of change of the manufacturing PMS. The process of change links manufacturing mission, objectives, strategy, key success factors and performance measurement system.

According to the production manager, the key use of manufacturing PMS information by the production department is to assist in guiding the manufacturing team in the direction of continuous improvement. He also mentioned that the planned performance of the production department is the attainment of world class capabilities, which is driven by the department's mission statement and its objectives. According to the financial manager, by June 1998 a formal system for manufacturing performance measurement had been developed and documented. He also mentioned that the aim of re-designing the manufacturing PMS at SEDICO was to concentrate on those measures and reports which have the greatest impact on customer satisfaction and overall performance. The driver behind the re-design of the manufacturing PMS is a fundamental understanding of manufacturing activities and processes to support the aim of continuous improvement. The process of change of the manufacturing PMS was based on the analysis of manufacturing work. This raised three questions to the accounting team. First, what are the performance measurement information needs for the manufacturing activities and processes? Second, how is the existing performance measurement system supporting those needs? Third, what must be changed in the current manufacturing PMS to satisfy those needs? The analysis of

manufacturing work and the answers to previous questions led to certain relationships for the developing of manufacturing PMS.

SEDICO's model for the change of its manufacturing PMS shows the relationships between the new manufacturing PMS and manufacturing key success factors, strategy, objectives and mission. Figure 6.7.1.1 shows these relationships.

Figure 6.7.1.1 SEDICO's Model for Developing Manufacturing PMS

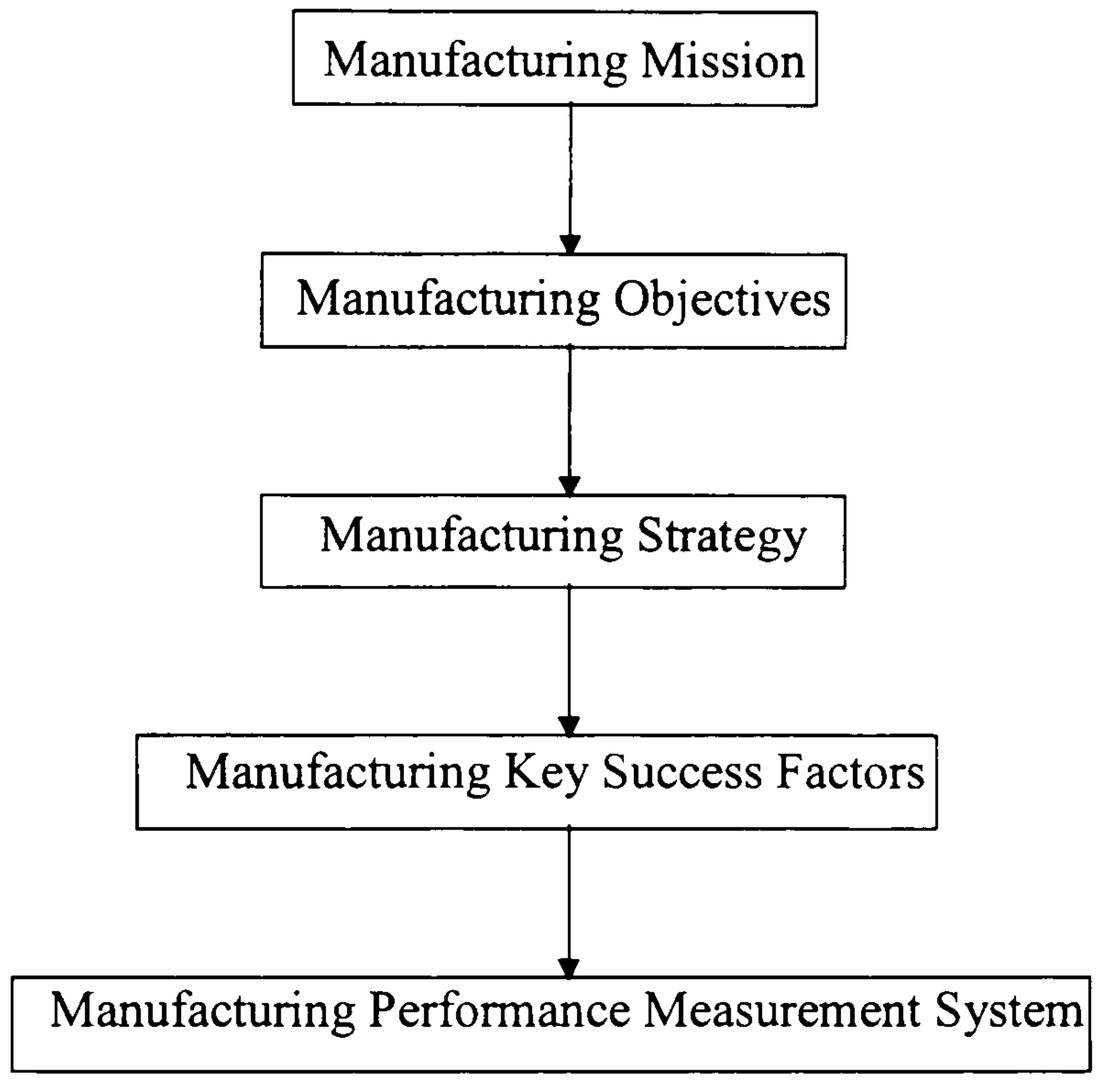


Figure 6.7.1.1 indicates that the manufacturing team has its own mission that reflects its particular objectives and strategy and its unique key success factors. Of course, it is important that the manufacturing mission also supports the company mission and is aligned with those of other related teams such as sales and marketing and purchasing. SEDICO's model for developing the manufacturing PMS shows that SEDICO's manufacturing mission is tied to the manufacturing objectives, manufacturing objectives are tied to the manufacturing strategy, the manufacturing strategy is tied to the key success factors, and the key success factors are tied to the new manufacturing PMS. The following are the contents of this model:

6.7.1.1.1 The Manufacturing Mission

The production manager indicated that the production department has a new manufacturing mission dating from 1997. This new manufacturing mission is to "generate competitive edge for SEDICO through the world class manufacture and producing of high-quality pharmaceutical products which satisfy customers' needs and exceed their expectations". He also mentioned that the mission is translated into strategic objectives, and a strategic plan is developed to achieve those objectives. This plan aims to maximise understanding of customers' businesses and requirements, to invest in manufacturing technology that reflects the future needs of customers, to fully implement TQM and JIT techniques, and to reduce the time needed to respond to the pharmaceutical markets' needs.

6.7.1.1.2 The Manufacturing Objectives

There are three main objectives for the manufacturing department at SEDICO, namely, to incorporating elements of TQM and JIT philosophies into the manufacturing of current pharmaceutical products; to achieve superior pharmaceutical product quality and to maximise assets effectiveness.

1. Incorporate elements of the TQM and JIT philosophies into the manufacturing of pharmaceutical products.This objective means continuing to incorporate the elements of flow manufacturing, quality at the source, doing it right first time every time, employee involvement, on time delivery, and improvement to the manufacturing processes. This is in addition to reducing overall manufacturing costs via cost improvement activities to enhance current product profitability and market share.
2. Superior pharmaceutical products quality. This objective means continuing to produce the highest quality pharmaceutical product on the market. According to the production manager, the key elements to achieving this objective are:

A. Remove as much variation from the process as possible to ensure product consistency.

B. Use certified suppliers to ensure that the highest quality raw materials are used in the product.

C. Train employees on the importance of quality and in the techniques of TQM and JIT philosophies.

3. Maximise asset effectiveness

This objective means utilising all resources to their maximum effectiveness, which means assets must be managed to allow the manufacturing operation to support the capacity demands of the market.

The production manager believes that the strategic objectives of quality, delivery and cost are essential to the survival of the business. He also thinks that product innovation, lead time which includes product and package design and development, and product and process flexibility are strategic objectives on which the company can compete.

6.7.1.1.3 The Manufacturing Strategy

SEDICO's manufacturing goals, prior to introduction of TQM and JIT philosophies, were cost reduction and improved labour utilisation, and very little attention was paid to how the manufacturing activities, which produce the company's pharmaceutical products, fit with the company's strategy. As the result of change in SEDICO's environment and the new aim to become a world class manufacturer, the manufacturing department is aiming to achieve highly efficient activities and quick production of high quality pharmaceutical products. SEDICO's management realised that some changes in manufacturing strategy were needed to do achieve this. Now, the manufacturing strategy has become an integral part of the company's strategy. The new company's strategy is responsive to the customers' requirements, as the result of the increase in the make-to-order rate. SEDICO's manufacturing strategy is concerned with setting the manufacturing policies and plans for the best use of the company's resources to achieve manufacturing objectives, meet customers' needs and support the company's strategy at whole. To support the best use of the company's resources, the manufacturing department highlighted the use of a new set of concepts and techniques, namely, TQM, JIT and continuous improvement. Some performance criteria have been identified inside the manufacturing department as factors for measuring the success of the manufacturing strategy. These performance factors are product quality and cost, delivery speed, flexibility and introduction of new pharmaceuticals to satisfy customers' needs and expectations. Those factors are considered as the most important key success factors of SEDICO's manufacturing strategy.

6.7.1.1.4 The Manufacturing Key Success Factors

SEDICO has identified five factors to measure the success of its manufacturing strategy. Those factors are called the key success factors of the manufacturing strategy to achieve the manufacturing goals and objectives. Those key success factors are:

1. Producing high quality pharmaceutical products.
2. Achieving 100% on-time delivery.
3. Flexibility in the products and processes.
4. Reducing manufacturing cost.
5. Product development or innovation.

According to the production and accounting managers, manufacturing performance is measured based upon its manufacturing objectives and its key success factors.

6.7.1.2 The New Manufacturing PMS

According to the manufacturing team and management accountants in the manufacturing area, manufacturing performance measurement information is collected and monitored daily. The information is reported at daily, weekly, monthly, quarterly and yearly intervals. The new manufacturing PMS has shown, through its new performance measures and reports, that manufacturing key performance measures are informally controlled daily, through daily morning discussion meeting with first line manufacturing teamwork, and formally assessed weekly, through weekly manufacturing performance reports in weekly manufacturing management staff performance meeting. Also, manufacturing performance is displayed monthly in the SEDICO's managers' meeting, to discuss the company performance. The manufacturing PMS at SEDICO consists of manufacturing performance measures and reports.

6.7.1.2.1 The manufacturing performance measures

The change of performance measures aims at ease of understanding, data availability, a focus on teamwork rather than individual performance, financial and non-financial information. The team involved in re-designing manufacturing PMS translated the manufacturing key success factors into manufacturing performance measures. They used two common rates with every performance measure to highlight and support the improvement idea of the company. The two common rates of performance measures are the achievement rate and the improvement rate. They are calculated as follows:

$$The\ Achievement\ Rate = \frac{The\ Actual\ Performance}{The\ Planned\ Performance} \times 100$$

$$The\ \mathrm{Im}provement\ Rate = \frac{(The\ Current\ Actual\ Performance - The\ \mathrm{Pr}evious\ Actual\ Performance)}{The\ \mathrm{Pr}evious\ Actual\ Performance} \times 100$$

It seems that those two common rates are used at SEDICO as the result of the AMPCO's financial manager advising, and have been accepted by manufacturing team. The following are some of the new manufacturing performance measures at SEDICO as the result of the changing of the manufacturing PMS:

6.7.1.2.1.1 Quality measures

According to the management accountants in the manufacturing area, the primary use of quality performance measures is to assist production teamwork in determining the root causes of quality problems so that corrective actions can be taken which would eliminate their future occurrence. From the beginning of 1998 a monthly quality workshop has been conducted by the quality department for the manufacturing team, whereby representatives from each manufacturing cell review the quality performance information, and a brief written explanation of the current status of key quality issues is also provided. The objective of the workshop is to collectively develop a plan on how to solve key quality problems, with an emphasis on finding the root cause prior to taking corrective actions. Quality department people provide information and analysis to the manufacturing team in the form of charts and graphs. The following are some of the manufacturing performance measures related to quality.

1. First-pass Ratio

This ratio represents the percentage of raw materials that meets the pharmaceutical products specifications the first time through the manufacturing process.

2. Defects Rate

This rate represents the percentage of defecting pharmaceutical products produced to total number of actually produced. The opposite percentage is the percentage of good products to total number actually produced. This information is provided for every product of SEDICO's manufacturing cells, to support the continuous improvement idea of the company to reach high quality products with free defects.

6.7.1.2.1.2 Delivery measures

SEDICO is aiming to achieve 100% on-time delivery of its pharmaceutical products to customers. Likewise, the company is looking to be supplied 100% on-time. The company has succeeded in reaching this rate with the suppliers of all its packaging and local raw materials, but the problem is with the international suppliers who provide 80% of the raw materials used by SEDICO. There are two measures used in this matter: delivery and supply rates.

1. Delivery rate

This rate represents the percentage of actual despatches of customer orders to scheduled deliveries of the order.

2. Supply rate

This rate represents the percentage of delivery dates entered on purchase orders to actual deliveries of incoming raw and packaging materials, with analysis of prices and quantities.

6.7.1.2.1.3 Flexibility measures

Flexibility is becoming very vital at SEDICO as the result of a changing and increasingly competitive environment. The SEDICO manufacturing operation focuses on providing flexibility in satisfying pharmaceutical products mix requirements demanded by the marketplace and customers, and equipment flexibility for producing new pharmaceutical preparations. One of the most important flexibility measures is manufacturing cell up-time. In this measure, total manufacturing cell time is divided into four major categories: actual run time, changeover time, scheduled downtime and unscheduled downtime. Unscheduled downtime is also divided into two categories, process-related and maintenance-related downtime. Both downtime and changeover information are collected daily and formally reported weekly. The information is used to assess utilisation effectiveness. Another measure is order fill rate. This measure provides the percentage of customers' orders filled in a given month as the result of inflexibility in performance. The aim of the company is to reach zero fill rate. The information on the fill rate is reported formally in the monthly manufacturing performance report. One of the most important flexibility measures at SEDICO is lead time. Lead time is measuring and comparing over periods of time according to the pharmaceutical product mix and according to improvements making.

6.7.1.2.1.4 Cost measures

There are two measures for the three elements of the manufacturing costs, raw and packaging materials, labour and overhead, the achievement rate and improvement rate. For example, the raw materials cost (RMC) measures are calculated as follows:

$$The\ achievement\ of\ raw\ material\ \text{cost}\ objective = \frac{The\ actual\ RMC\ of\ the\ product}{The\ planned\ RMC\ of\ the\ product} \times 100$$

$$The\ improvement\ rate\ of\ raw\ material\ \text{cost} = \frac{The\ current\ actual\ RMC - The\ previous\ actual\ RMC}{The\ previous\ actual\ RMC} \times$$

100

The above measures are used to monitor those variances associated with manufacturing costs of finished pharmaceutical products, and continuously reduce manufacturing costs. The information on those measures is formally reported in the monthly performance report. In addition to the two previous measures at the level of every categories of manufacturing costs, there is a measure called total manufacturing cost improvement measure. This measure determines the manufacturing cost improvement achieved quarterly under the cost improvement programme.

6.7.1.2.1.5 Innovation measures

SEDICO, like any pharmaceutical company in Egypt, is facing an increasingly intense competitive environment as the result of the GATT agreement. The company is continually improving its current pharmaceutical products and processes, and introducing new pharmaceutical preparations to its product range. Innovation is encouraged from first line teams and not just from management. This is because the first line team is closest to the activities and processes within the company. SEDICO uses two innovation measures: first, the percentage of sales of new products, which equals sales from new products/ total sales X 100. There are two rates which are also used with the previous measure, the achievement rate and the improvement rate of sales from new products. Second, the response time of new product development, which equals time taken from the research and development phase to the despatch phase, compared to planned time.

6.7.1.2.2 The manufacturing performance reports

Before the TQM and JIT implementation at SEDICO, performance measures were displayed in the form of tables only, but since implementation of those philosophies, visual displays of the performance measures in the reports are provided in the form of tables, graphs and charts. The new manufacturing performance reports include financial and non-financial information, and the actual and planned performance. According to the financial manager, to ensure the understanding of the new performance reports, the accounting department has conducted training sessions with the manufacturing team on how to read the new manufacturing performance reports. He also mentioned that this training will also be carried out in the future for all departments of the company. In the re-design of the manufacturing performance reports, attention was directed toward the basic purpose, description, and frequency of the reporting system to support the new strategy of the company of being a WCM. The following are some of the new manufacturing performance reports, a few of which existed before the development of the manufacturing PMS.

6.7.1.2.2.1 Daily performance information report

The prior day's performance information is reported in a 7. 00 am meeting held daily at the cell areas. The meeting is composed of all manufacturing cells' staff members. In the meeting, the performance information from the previous day is analysed, and action steps are developed relative to the results and manufacturing plan. This report focuses on performance factors of cost, quality, delivery and flexibility. The information in this report helps to focus attention on those raw and packaging materials and finished products which have a degree of failure or improvement, so that the appropriate actions can be taken to solve the problem or to continuously improve.

6.7.1.2.2.2 Weekly work order recap reports

These reports describe work order compilations by each cell in the manufacturing department. The information in those performance reports includes actual and planned performance of quality, delivery and cost of each work order in each manufacturing cell. Those reports provide feedback on work order performance to manufacturing management teams.

6.7.1.2.2.3 Monthly performance reports

Those reports highlight the manufacturing performance of each cell in the areas of quality, dependability, flexibility, cost, delivery and safety. The manufacturing safety information is collected weekly for each manufacturing cell and is reported monthly. Those reports are distributed to each cell team and the director of manufacturing.

6.7.1.2.2.4 Quarterly performance summary report

The key manufacturing performance results in the areas of quality, dependability, flexibility, cost, delivery and safety are summarised in graphs, tables and charts. This summary which is posted in the manufacturing area, provides feedback on manufacturing performance to each team in the manufacturing cells.

6.7.1.2.2.5 Customer's order performance report

As the result of the implementation of JIT and TQM in the manufacturing area at SEDICO, manufacturing performance related to customers' orders is measured from raw and packaging materials to the shipment of the customer order. According to the people in SEDICO, while the rate of make-to-order was 30% in 1998, the company plans to increase the rate of make-to-order to reach more than 50% by 2005. This plan includes ways to build a good relationship with the customers in the local and international markets, and to satisfy customers' needs and expectations. Measuring customer satisfaction is becoming a major focus within SEDICO. SEDICO defines customer satisfaction as "a measure of the company's success at meeting a customer's order in full and on time". Consequently, the accounting department has designed a new performance report called the 'customer's order performance report' for each finished order, at any time. The financial manager mentioned that measuring customer satisfaction is a key focus of the customer's order report. The company started to use this report for finished orders in August 1998. This report includes information about

planned and actual performance of quality, delivery, cost, and profit measures of the finished order, as well as information about the rates of achievement and improvement for every performance measure, for regular customers of the company.

It seems generally that manufacturing performance measures are displayed through the production area in the form of tables, charts and graphs. The new use of the information in these reports is to control manufacturing performance and to unveil new opportunities for the improvement of the performance. The close relationships between the organisational levels inside the manufacturing team have created a good atmosphere and a unified system of performance. The manufacturing performance measurement system plays an important role in linkages between organisational levels inside the manufacturing department. This is done in the quarterly meetings held with all manufacturing teams by the production manager. The production manager has the opportunity to discuss the performance issues covered in the manufacturing performance reports directly with all employees in the manufacturing team and to receive immediate feedback on the current performance results. The manufacturing performance reports which are presented in the meetings provide a direct communication link on performance issues between the highest and lowest levels of the manufacturing department.

According to the people inside the accounting department, SEDICO intended to start re-designing its business performance measurement system in October 1998. According to the financial manager, the business PMS would focus on financial and non-financial information. He also mentioned that the objective of the new business PMS was to provide the information needed to enhance total business performance. The annual performance report is one of the most important sources of information in a business PMS. The following is the annual performance report of SEDICO at 31.12.1997 which will exist in the future but with some changes, according to the people inside accounting department:

6.7.1.2.2.6 The annual performance report of the company's activities during the year of 1997

Introduction

This is the company's activities performance report during its seventh year of production which ended at 31.12.97. This report covers the period from January to December 1997. Certain conditions prevailed during the year of 1997. Those conditions were:

1. The increasing competition in the Egyptian pharmaceuticals market, which led to the use of new methods for commercial and advertising, in addition to the emergence of new companies, which started production during 1997.
2. The entry of international foreign companies into the arena of competition in the pharmaceutical market, as the result of the GATT agreement.

Despite those conditions existing, the company has achieved the following:

1. The company produced 67 medicine preparations during the year for the market including 9 new preparations. It also produced 14 constitutional preparations for tenders and 8 veterinary preparations including two new preparations.
2. The company achieved actual sales equal to $92,849,000 and planned sales equal to $83,979,000. The increase over plan was 10.6%. The increase compared with 1996 was $20,646,000, or 21.9%.
3. The company achieved net profit during the period equal to $21,899,000, compared with planned net profit of $15,962,000 an increase of 37.2%. The increase over the year of 1996 was $8,088,000 and the increase rate was 58.6%. The rate of net profit to sales equal to 23.59% for the year of 97, and 17.4% for 96.
4. The company achieved $12,856,000 sales for governmental tenders, the planned tenders were $1,470,000 and the increase rate was 775% over the planned, and 42% over the actual sales of 1996.

The following are the performance of the company's activities during the year of 1997 compared with the planned and the actual performance of the year 1996.

Table 6.7.1.2.2.6.1 The Company's Activities During the Period From 1.1.1997 to 31.12.1997

Items	1997 Actual	1997 Planned	1996 Actual
Production value	$114,717,000	$96,281,000	$91,560,000
Sales revenue	$92,849,000	$83,979,000	$79,268,000
Export amount	$10,685,000	$10,493,000	$7,320,000
Cost of inventory	$12,704,000	$10,898,000	$8,334,000
Total costs of the period	$70,950,000	$68,017,000	$65,457,000
Number of units produced	28,928,000 packages	20,582,000 packages	18,721,000 packages
Number of sales units	26,656,000 packages	21,088,000 packages	17,121,000 packages
Number of stock units	4,460,000 packages	4,343,000 packages	2,178,000 packages
Number of produced kinds	105 kinds	121 kinds	100 kinds
Number of contracts with international companies	11 contracts	9 contracts	5 contracts
Number of kinds produced by industrial contracts	36 kinds	29 kinds	20 kinds
Number of new products	9 products	9 products	5 products
Capital	$350,000,000	$350,000,000	$350,000,000
Loans	_____	_____	_____
Net profit of the period	$21,899,000	$15,962,000	$13,811,000

First: Production

The total number of pharmaceutical products was 105 preparations, including 14 constitutional preparations for governmental tenders and 8 veterinary preparations which were produced and sold during this period.

The amount of the actual production was $114,717,000, the planned production equalled $96,281,000 and the actual production of 1996 was $94,071,000, which means that the increase rates were 19.1% from the planned and 21.9% from the previous year. The amount of the production under licence was $39,509,000, an increase of actual over planned by 34.4% and by 33.8% over 1996.

The cost of production sold

The cost of production sold was $55,383,000, or 59.6% of actual sales revenue and the planned cost was $52,089,000, or 62.02% of planned sales. The cost of production sold for the 1996 was equal to $50,302,000, a rate of 63.5% of 1996 sales revenue. The following are the elements of the cost of production sold:

Table 6.7.1.2.2.6.2 Elements of the Cost of Production Sold

Items	Actual 1997		Planned 1997		Actual 1996	
	Amount	Rate%	Amount	Rate%	Amount	Rate%
L. cost	**$3,491,000**	**6.3%**	**$4,219,000**	**8.1%**	**$3,421,000**	**6.8%**
M. cost	**$47,561,000**	**85.9%**	**$41,654,000**	**80%**	**$42,656,000**	**84.8%**
Other costs	**$4,331,000**	**7.8%**	**$6,216,000**	**11.9%**	**$4,225,000**	**8.4%**
Total costs	**$55,383,000**	**100%**	**$52,089,000**	**100%**	**$50.302.000**	**100%**

Second: Sales Revenue

The actual amount of sales revenue during the year was $92,849,000. At the same time the planned sales equalled $83,979,000 and the actual sales for 1996 equalled $79,268,000. This means that the increase rates are 10.6% and 15.2%.

Third: Inventory Turnover Ratio

Inventory turnover ratio is considered as one of the most important financial performance measures in SEDICO. The ratio is calculated as:

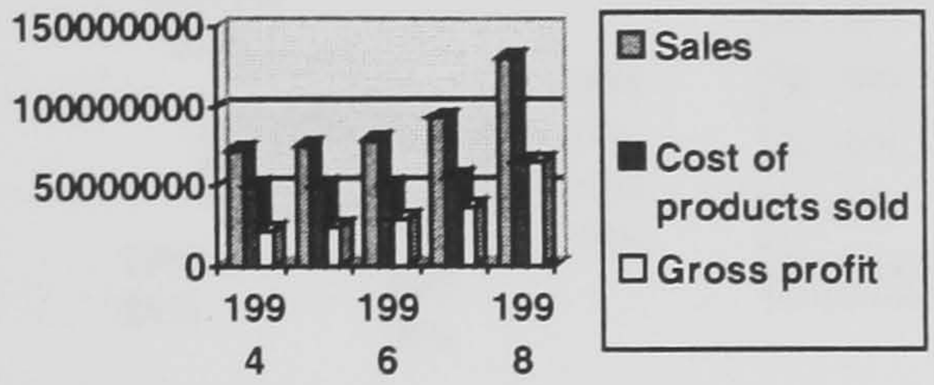
Inventory turnover (per time period) = Cost of products sold / average inventory

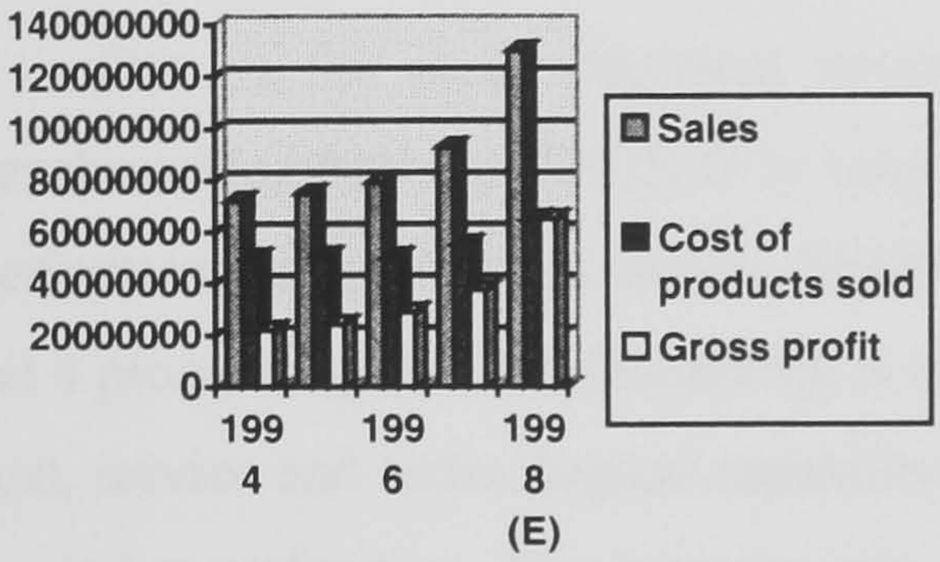
The time period is determined by the time period during which cost of products sold is calculated, typically a fiscal year in SEDICO. The average inventory is determined by the average of the inventories at the beginning of the income statement's time period and the end of that time period. The resulting inventory turnover ratio indicates how quickly inventory is sold. A rising inventory turnover ratio is considered as an indicator of better performance in SEDICO. The following table shows the inventory turnover ratios for SEDICO for the last four years and for the next year.

Table 6.7.1.2.2.6.3 Actual and Planned Inventory Turnover Ratios

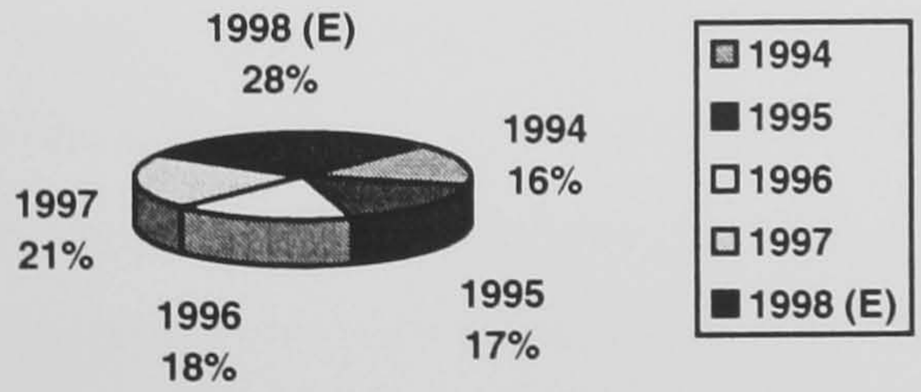
Item	1994	1995	1996	1997	1998 (E)
Sales	$ 72,000,000	$ 75,000,000	$ 79,268,000	$ 92,849,000	$ 130,000,000
Cost of products sold	$ 50,000,000	$50,750,000	$ 50,302,000	$ 55,382,000	$ 65,000,000
Gross profit	$ 22,000,000	$ 24,250,000	$ 28,966,000	$ 37,467,000	$ 65,000,000
Inventory	$ 14,400,000	$ 13,500,000	$ 12,800,000	$ 11,200,000	$ 11,000,000
Inventory turnover (actual)	$ 50000000/ $ 15000000 = 3.33	$ 50750000/ $ 13950000 = 3.64	$ 50302000/ $ 13150000 = 3.83	$ 55382000/ $ 12000000 = 4.62	$ 65000000/ $ 12000000 =5.42
Average inventory (planned)	$ 15,000,000	$ 14,000,000	$ 13,000,000	$ 12,000,000	$ 11,000,000
Inventory turnover (planned)	2.50	3.00	3.25	4.00	5.42

Sales, Cost of Production Sold and Gross Profit Relationships

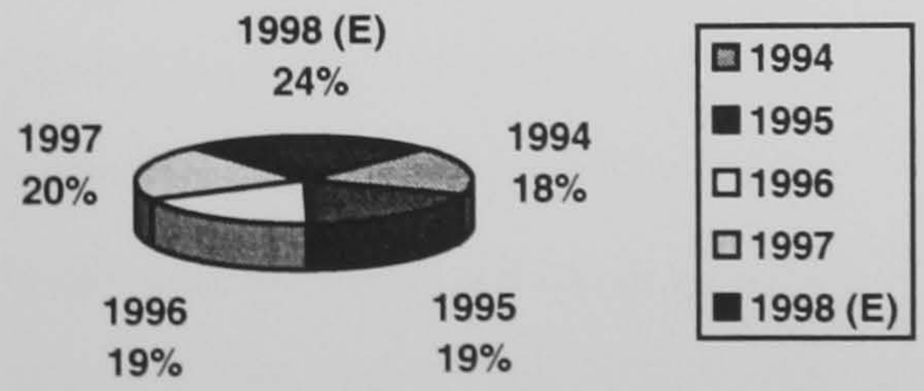




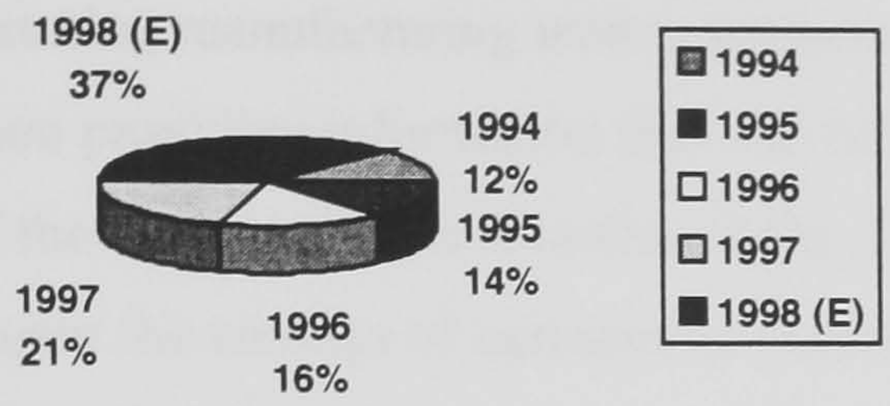
The Improvement of Sales Revenue



The Icreasing Rate of Production cost



The Improvement of Gross Profit



One of the most important issues related to the PMSs at SEDICO is the benchmarking process. SEDICO is considering benchmarking as part of its business performance measurement system. SEDICO has a benchmarking policy, although not yet a procedure, since benchmarking is largely against results, not processes. Quality, cost, service and technological capability are compared against competitors and best-in-market performers. This happens only for Egyptian pharmaceutical market, and has not been done yet for other markets. It was mentioned that Glaxo-Wellcome company, Egyptian branch, is considered as the best-in-market. According to the financial manager, benchmark information is used to set priorities for improvement.

6.7.1.3 The Benefits and Problems of the Change in Manufacturing PMS

Traditional manufacturing PMS in SEDICO was based very much upon the concept of monitoring manufacturing team's performance, so that they can be assessed, rather than upon providing information that will help the team to improve their performance. One of the most important benefits of the change in manufacturing PMS is that it is based upon the concept of continuous improvement in the measures and reports. One of the benefits of the change also is that the new performance measures are more focused on non-financial measures. The financial measures remain important for SEDICO external reporting, and there is still a need to have cost and financial information integrated and consistent. But the day-to-day control and improve of manufacturing operations are handled better with non-financial measures (see point 6.7.1.2.1).

In June 1998, the accounting department started to establish an accounting office in the shop floor, the role of this office is to provide direct information to the manufacturing team in the shop floor. Two accountants are responsible for displaying the results of the performance measures continuously every day on boards, charts and graphs located adjacent to the manufacturing cells. This direct reporting methods can be useful motivators because the shop floor people are able to monitor and improve their own performance on a continuous basis and the results are displayed clearly for all to see. The accounting department started in July 1998 to provide daily performance report to manufacturing cell teams. This daily performance report is given clear and concise pictures of the day-to-day operations, provide a common understanding among the operators, supervisors, and managers of manufacturing cell's strengths and weaknesses, and focus attention on key issues of the manufacturing strategy such as cost, quality, delivery, and flexibility (see point 6.7.1.2.2.1).

One of the benefits of the change in manufacturing PMS is that the accounting department has also started to provide a new performance report, which is called "customer's order performance report". The aim of this report is to provide information about the success or failure of the company in achieving the requirements of make-to-order customers. This to support the efforts of the company in increasing of the rate of the make-to-order customers (see point 6.7.1.2.2.5).

One of the problems of the change in manufacturing PMS is related to the using of ratios. SEDICO's accounting department is using the same ratios as AMPCO, which are the rate of achievement and the rate of improvement for every key success factors. Those ratios may be are useful to AMPCO because they are used with the business PMS, which is directed to the people who can understand the meaning of the ratios. In SEDICO's case, the ratios may not have any tangible meaning to the operators. In order to understand the importance of the ratio and to analyse changes in the ratio over time, the user is required to have a full grasp of the way the ratio has been constructed and weighted and to know precisely what the accountants had in mind when the measure was devised. Now, simpler performance measures are required within the manufacturing team inside SEDICO because more responsibility is being given to the shop floor operators and to people who do not have enough training and educational background to grasp the subtle and complex issues involved. In this regard, the financial manager mentioned that the accounting department has conducted training sessions with the manufacturing team on how to read the new manufacturing performance reports.

One of the problems of the change in manufacturing PMS is related to the determination of the cost of quality. There is no separate formal cost of quality for the four subsets of quality costs: internal failure costs, external failure costs, appraisal costs, and prevention costs. The accounting department deliberately does not tally detailed cost quality data because manufacturing management thought wrongly this would shift attention from quality to cost reduction. This is considered as wrong because SEDICO has already implemented the cost improvement programme. The aim of this programme is to develop methods that reduce cost on current products without affecting the quality.

Another problem is related to direct labour. Approximately 30 months after the implementation of TQM and JIT philosophies, the cost accountants were still valuing inventory, calculating product cost, and evaluating performance using direct labour as the basis for planning, budgeting, and control of operations. Direct labour was the only allocation base for the application of overhead to inventory. Although it was not apparent to the cost accountants until 1998, this was no longer practical.

6.8 Summary

According to the Chairman of SEDICO, sharing of information about company's performance, plans, strategies, and goals for teams is very important to employee involvement. He said that "without the information of strategies, plans, goals and performance of the company, it is difficult for teams to understand how the company is doing, to make good suggestions about how products can be improved and how work processes can be done more effectively, and to make a good contribution to its success." Recently, PMSs at SEDICO have been considered as the most important tools for sharing the performance information of the company and to measure the success of the company in achieving the company's goals and objectives. One of the most important goals and objectives at SEDICO is customer satisfaction. Customer satisfaction is a powerful approach to SEDICO to survive and grow in local and international markets. As the result of higher competition in the pharmaceutical markets through the GATT agreement, SEDICO is turning to realise greater customer satisfaction through the implementation of TQM and JIT philosophies to attain greater benefits. To support and improve its current market share, SEDICO has focused on improving customer satisfaction via quality and delivery improvements while simultaneously reducing product cost.

SEDICO has introduced some of the tools of TQM and JIT philosophies in its operations to improve the quality of its products. TQM philosophy in SEDICO aims to improve performance at every level and function in the company, involving everyone in the company, managers and workers, in a totally integrated effort. The ultimate goal of TQM and JIT philosophies in SEDICO is customer satisfaction. Now, all employees of SEDICO have been trained in quality improvement techniques, and are expected to apply these techniques of continuous improvement in whatever area they work. The purpose of this effort of training employees was to improve quality, productivity and reduce costs by eliminating non-value added activities.

SEDICO has moved from a company which focused on PMSs in terms of output, to one which requires quality with regard to all processes and performance. WCM philosophies, TQM and JIT, at SEDICO have not as yet changed all PMSs, but a long time frame could provide for such changes to be implemented. The changing

work environment at SEDICO has played an important role in the changing of its PMSs. SEDICO's PMSs are becoming an integral facet of its implementation of the TQM and JIT philosophies, as they provide performance information for the managers and their teams and an impetus for sustained improvement in pharmaceutical products and processes.

Chapter Seven

Data Analysis of the Two Case Studies and Discussion of the Research Questions

7.1 Introduction

In Chapter Five, the researcher discussed the data collected from AMPCO, as the first case study. In Chapter Six, the researcher discussed the data collected from SEDICO, as the second case study. In this chapter, a cross data analysis will be presented depending on the points which have been highlighted in the previous two chapters. Those points are world class manufacturing strategy, just in time and total quality management philosophies, management accounting information systems, and new performance measurement systems. In addition to those points, the research findings on both case studies, the building of a model for developing PMSs in JIT and TQM environment, and discussions of the research questions will also be presented.

7.2 World Class Manufacturing Strategy

Although there are some variations between AMPCO and SEDICO companies, both companies were faced with the same basic problems before implementing a WCM strategy, such as product quality, price, delivery, inventory, and customer requirements problems. The two companies are working now to be world class manufacturers, because they are facing new systems such as ISO and GATT. Those systems have created a global pharmaceutical market, which creates a competitive challenge for most Egyptian pharmaceutical companies. "Today's global economy provides tremendous competitive challenges for most business" (Kaye and Dyason, 1999). The WCM strategy in both companies is considered as the perfect way to achieve their mission, goals and objectives. Parker and Irving (1996) mentioned that:

> World class manufacturing melds together a number of techniques. These include total quality management, just-in-time manufacturing, employee involvement, continuous improvement, business process re-engineering, international benchmarking, and flexible working.

The most important key factors of WCM strategy in AMPCO and SEDICO are JIT and TQM philosophies, ISO 9000 and continuous improvement programmes. Those philosophies and programmes under WCM strategy are considered as new

management methods for changing the worklife inside AMPCO and SEDICO to achieve superior performance. Storey and Harrison (1999) indicated that:

> WCM is but one (albeit one of the more all embracing and powerful) manifestations of various recent attempts to (re)-represent and reshape the realities of current worklife. For example, it contains a narrative which re-draws the nature of inter-factory and international competition. It presents a rationale which suggests that employees in today's 'new' environment need to work more flexibly; they need to take personal responsibility for the attainment of quality; they must seek ways to ensure continuous improvement; work as team members; they must be self-disciplined enough to report for work on time (possibly without the discipline of a clocking-in mechanism); and to work diligently throughout the day.

Now, after adopting a WCM strategy, it is becoming possible for those companies to analyse the problems that they are faced with and solve them. One of the key features of AMPCO's and SEDICO's WCM strategy over the last five years has been the conscious effort to align all of their staff and initiatives towards continuous improvement of customer goals, high quality, on time delivery and competitive prices. This allowed both companies to set down a common language, which made a great difference and enabled every team to work together towards those common goals. In addition to that, WCM strategy in both companies helped in deciding which markets to enter, which customers to serve, which products to offer and how to provide value to the company and customers. One of the most important keys under WCM strategy to provide value to customers inside both companies is continuous improvement in activities and process. According to Douglas, Kirk, Brennan and Ingram (1999), "A key principle of 'Best Value' is continuous improvement." The data collected through interviews and direct observations show that AMPCO and SEDICO have found ways of doing things better than they have ever done them before through implementing WCM philosophies. Oakland (1999) indicated that "change must create something which did not exist before, namely a 'learning organisation' capable of adapting to a changing competitive environment." Those WCM philosophies in both companies are JIT and TQM. The new way of doing things inside the both of the two companies is based on continuous improvement with the objective of meeting and, over time, exceeding the needs and expectations of customers. In manufacturing, a great deal of literature has been written on JIT and TQM philosophies, and the achievements of a number of Japanese companies undoubtedly confirm the value of those philosophies (Simpson, Kondouli and Wai, 1999). The data collected from AMPCO and SEDICO

also shows that recently the people inside both companies are confronted daily with tasks of improving quality of products, process and activities, improving delivery performance, eliminating all kinds of waste and reducing costs to satisfy customers and remain competitive in today's changing environment. The management inside both companies believed that JIT and TQM techniques together, as WCM strategies, have been proposed as ways of achieving the desired change. However, in AMPCO the process of change began with the adoption of JIT followed by a TQM programme. In SEDICO the process of change began with the adoption of TQM followed by a JIT programme. Sriparavastu and Gupta (1997) in their research of "an empirical study of just-in-time and total quality management principles implementation in manufacturing firms in the USA", concluded that a joint implementation of JIT and TQM resulted in significantly higher performance levels than the results of implementing either one.

7.3 JIT philosophy

AMPCO started to implement JIT philosophy in 1995, and SEDICO started in 1997. The emphasis of JIT philosophy in AMPCO is on continuous improvement towards lower production costs, better quality, achievement of promised delivery times of finished products, minimum dependence on inventory and close relationship with customer, suppliers and employees. But the emphasis of the JIT philosophy at SEDICO is upon continuous improvement towards lower production costs, a higher rate of productivity, better quality and reliability of products, and achievement of promised delivery times, by the elimination of all kinds of waste, and also development of close relationships with suppliers and customers. It seems that both companies have the same aims in implementing the JIT philosophy.

JIT philosophy was introduced at AMPCO and SEDICO with the assumption that the most important improvement that the companies can make from the implementation of this philosophy is inventory reduction for raw materials and finished products. The reasoning that was given is that because direct labour is no longer a major cost element in those companies, attention has been directed to inventory, which is seen as one of the most important cost factors in both companies. Inventory reduction is considered as one of the most important tasks in both

companies because carrying inventory for those companies is assumed to be undesirable, and anything which reduces it must be favourable. Although the need to reduce inventory was given at AMPCO and SEDICO as the first reason for concentrating on JIT implementation, the changes which have been required to produce those companies' products just in time not only reduce inventory, but also improve quality and delivery performance, resulting in increased sales. In this respect, both companies have also developed good and close long-term relationships with suppliers. The emphasis was on a dynamic market response, quality, on time delivery and cost. There has been a great reduction in the number of suppliers in both companies as the result of the implementation of a JIT purchasing programme.

The other JIT element which existed in both companies is manufacturing cells. The plant layouts of AMPCO and SEDICO were designed around manufacturing cells to reduce lead time, scrap and rework, floor space requirements, and defects and improve the products' quality and productivity. The layout of the plants in both companies also allows for greater flexibility to engineer change orders and quick responsiveness to changing customer requirements. A JIT improvement programme which exists at AMPCO but not yet at SEDICO is setup time reduction. The efforts to reduce setup time at AMPCO are through machine downtime analysis, the elimination of scrap, rework, and operator frustration, and the reduction of lot sizes. SEDICO has a plan to implement the setup time reduction programme under the JIT philosophy.

The JIT philosophy at AMPCO and SEDICO serves as one of the drivers of continuous improvement in activities and processes, which requires the involvement of all teams of the company. Teamwork has been established in AMPCO under the JIT philosophy and become a part of the company's method of working. Teamwork has also been established in SEDICO but under the TQM philosophy and become a part of the company's method of working.

The key success factors of JIT philosophy in both companies are improving product and service quality, reducing inventory, reducing total costs, improving delivery performance, and matching customers' needs and expectations.

7.4 TQM Philosophy

According to Djerdjour and Patel (2000), "TQM is a management philosophy, which seeks continuous improvement in the quality of all processes, people, products and services of an organisation." The main reason for TQM implementation in AMPCO and SEDICO was continuously to improve the quality of all the company's activities, processes and products. Burrill and Ledolter (1999) mentioned that:

> Quality improvement brings many benefits: quality improvement cuts costs; the resulting lower costs allow lower prices; lower prices increase market share, which results in benefits of scale and further cost reduction. Moreover, quality improvements in the design of products increase the demand.

SEDICO started to implement TQM philosophy in 1994, and AMPCO started in 1998. Changing the culture at SEDICO was the key element in the quality improvement journey. It has required the introduction and acceptance of individual, team and company change. Culture change at SEDICO was relevant not only to quality improvement, although the increased emphasis on customers' needs and expectation within TQM makes some form of culture change important in the company. "Culture is a primary determinant of change and improvement. Possession of positive cultural characteristics provides the organisation with necessary ingredients to improve" (Ahmed, Loh and Zairi, 1999).

SEDICO is using SPC under TQM philosophy to determine whether acceptable quality levels are being met or whether production should be stopped in order to make remedial action. The emphasis of SEDICO when using SPC is on defect prevention rather than trying to inspect the quality into the product. There was no use of SPC at AMPCO until August 1998, which was the end of the data collection period in this company. In both companies, there is no separate formal quality cost reporting for the four kinds of quality costs, internal failure costs, external failure costs, appraisal costs and prevention costs. Neither company is interested to collect detailed data on the cost of quality, because they think this would shift the attention of production teams from building in quality to cost reduction. It seems this is not true, because cost reduction programmes exist in both companies, and they need detailed data to eliminate all kinds of waste. At the same time, the most important point in the cost reduction programmes in both companies is to make sure that there is no negative effect on

quality by reducing the cost. One of the most important programmes related to TQM strategy inside both companies is ISO 9000 implementation. Withers, Ebrahimpour and Hikmet (1997) in their survey results revealed that TQM and JIT firms have a better understanding of the importance of top management commitment, quality training, and communication to ISO 9000 implementation.

AMPCO and SEDICO are seeking certification of ISO 9000. SEDICO has already got ISO 9000 certification, but AMPCO had not done so, as of August 1998. The common reasons for ISO 9000 implementation in both companies were customer pressure, to gain marketing advantages, and because they considered it as a part of TQM strategy. Taylor (1995) reports on the findings of a survey of nearly 700 organisations across a broad range of industries, of which approximately 17% had obtained registration to ISO 9000. He found that the four main reasons for seeking certification were customer pressure, improved efficiency and productivity, higher grade product and image/marketing advantages. Only 7% saw ISO 9000 as part of an overall TQM strategy.

The phrase 'continuous improvement' has become increasingly popular in recent years, and is connected with many organisational developments including the adoption of JIT and TQM philosophies (Caffyn, 1999). The three common principles of focus in the continuous improvement journey of the two companies, under JIT and TQM philosophies, are customer satisfaction, understanding of activities and processes, and commitment of all teams to quality and elimination of non-value-add activities. According to Oakland (1999), "there are three basic principles of continuous improvement:

- focusing on the customer
- understanding the process, and
- commitment from the employees."

In this respect, every activity and process in both companies is subject to continuous improvements, and all teams co-operate to achieve better satisfaction of customers. Both companies also believed that teams are the source of ideas and innovation and their expertise, experience and contributions have to be used in order to get more improvement ideas implemented. There is now, in both companies, greater emphasis

on teamwork related issues, development and empowerment. AMPCO and SEDICO are striving to create an environment where teams at all levels can become empowered to make decisions, create positive change and improve their performance. Finally, as the result of JIT and TQM implementation and in order to remain competitive, AMPCO and SEDICO are keeping trying to improve all aspects of their activities and processes, whether it is manufacturing, marketing, purchasing, accounting, etc.

7.5 Management Accounting Information Systems

The accounting information department in AMPCO is different from that of SEDICO in its contents. The accounting information department at AMPCO consists of two systems, financial accounting and management accounting information systems. The cost accounting and performance measurement systems are considered as parts of AMPCO's management accounting information systems. At SEDICO there are two systems in the accounting department, financial accounting and cost accounting systems, and performance measurement information is provided by cost accounting. But there is a plan at SEDICO to divide the accounting department into three systems: financial accounting, cost accounting and performance measurement systems. This will be the case after the re-design of the all of the company's PMSs. Despite the difference in the contents of the accounting departments, there are ongoing efforts at AMPCO and SEDICO to improve the quality of the accounting information and reporting. The management of both companies believed that the success of the company comes when every function in the company, including accounting, focuses on the same goal of meeting the internal and external customers' needs and exceptions. According to Kaplan and Cooper (1992) and Blanchard (1995), the adoption of a modern operation improvement programme such as JIT and TQM philosophies calls for the provision of a wider range of information to a wider group of decision makers than is generally found in the more traditional operation programme. Performance measurement is one of the most important accounting implications which has been affected by the implementing of JIT and TQM philosophies inside AMPCO and SEDICO.

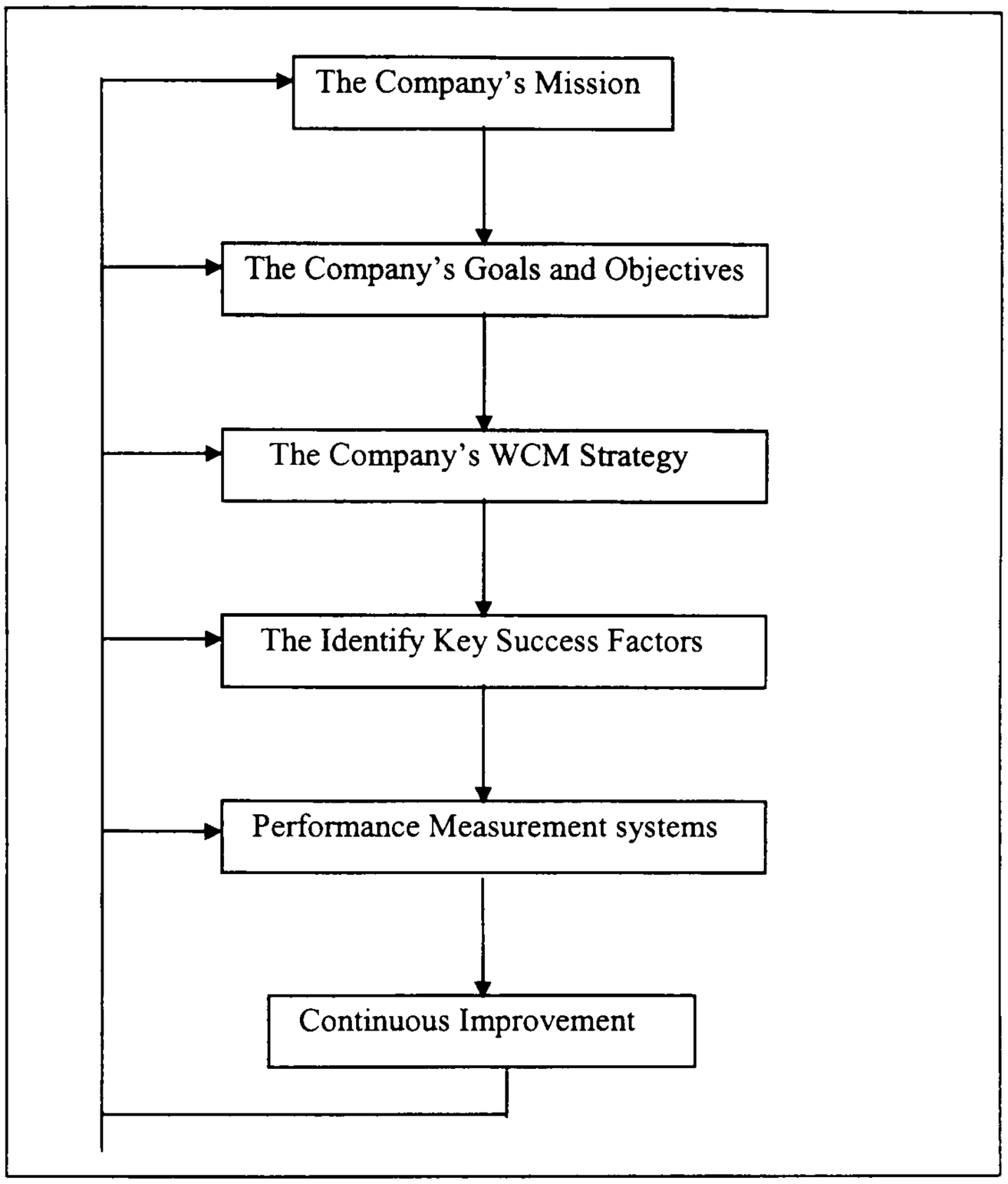
7.6 Performance Measurement Systems

The managers and their teams in the two case studies appear to understand the importance of improvement in the JIT and TQM objectives such as customer satisfaction, integration with customers, on time delivery, lead and setup times reduction, cost reduction, and quality of processes and activities. It appears from the data collected in AMPCO and SEDICO that there were gaps between the message and the reality of traditional PMSs in those companies. Traditional performance measures and reports in both companies did not focus on value-added activities (for example direct labour reporting is a non-value added activity) or on continuous improvement of the company's objectives under JIT and TQM philosophies. So it was the mission of the management accountants in both companies to satisfy the needs of their internal customers with the development of new performance measures and reports. In this respect, AMPCO is in the process of changing its PMSs, and SEDICO is in the process of re-designing its PMSs, starting with the manufacturing PMS. There is a common model for both companies for the developing of PMSs in a JIT and TQM environment

7.6.1 The Model of The Two Case Studies for Developing PMSs

The analysis of the data collection, through unstructured interview and documents, in both case studies, highlighted the importance of tying the performance measures and reports in the new PMSs to the key success factors, tying key success factors to the company's strategy, which is WCM strategy in both case studies, tying WCM strategy to the company's goals and objectives, and tying this to the company's vision and mission. Figure 7.6.1 shows the relationships between the new PMSs and the previous factors as a model for the two case studies. These relationships exist for the company as whole and for every specific activity, such as manufacturing, sales and marketing, and purchasing activities. The first factor in the model is a company's mission.

Figure 7.6.1 A Model for Developing PMSs in a JIT and TQM Environment in Both Case Studies



7.6.1.1 The company's mission

The first point in the model for developing PMSs is to determine carefully the company's mission. AMPCO and SEDICO have different performance missions. AMPCO's mission is to become a world class manufacturer in producing flexible packaging products for the Egypt, Middle East, Arabian, and African markets. This is can be done by providing better flexible packaging products, of high-quality, according to customers' requirements, in the right quantity, in the right place, in the right time, and at competitive prices. On the other hand, SEDICO's mission is to be a leading pharmaceutical producer in the Egyptian and Middle eastern markets, providing products that provide expanded solutions to customer needs and health and that enhance the desire to do business with reliance. This is in addition to facilitating continuous improvement and increasing customer satisfaction by identifying, communicating, and promoting the use of quality principles and technologies.

7.6.1.2 The company's goals and objectives

The second point in the model for developing PMSs is to translate the company's mission into some goals and objectives which can enable the company to achieve its mission. The two companies have different goals and objectives. AMPCO's goal is continuous improvement in the rate of return on investment (ROI). This can be done by making more sales now and in the future, making more money now and in the future, and making more profit now and in the future. In addition to that, AMPCO has some strategic goals. Those strategic goals are:

1. Providing the highest quality levels of the flexible packaging products.
2. Doing more business now and in the future.
3. Making more money now and in the future.
4. Making more profit now and in the future

AMPCO also has some objectives in the way to achieve its goal. Those objectives are:

a. Continuing to develop world class manufacturing capabilities at the company facility.

b. Continuing to develop the company's capabilities for faster and more accurate customer responses in all of its markets.

c. Continuing to satisfy customers by providing high quality products, on time delivery, with competitive prices.

d. Continuing to improve sales revenue.

e. Continuing to improve contribution margin (throughput).

f. Continuing to improve the reduction of total costs.

g. Continuing to improve the reduction of inventories costs.

h. Continuing to improve the reduction of setup and lead times.

i. Continuing to improve the elimination of all types of manufacturing and non-manufacturing wastes.

In contrast, SEDICO does not have any goal, but it has some strategic objectives. Those strategic objectives are:

1. Continuing to develop world class manufacturing capabilities within the company and each process.

2. Instituting employment programmes which foster professional growth and develop working relationships with academic institutions for research and development.

3. Providing employee incentives which allow all employees to share in the profitability of the company.

4. Increasing sales, reducing total costs and achieving long-term profitability.

5. Promoting international sales in existing business, increase promotion and advertising activities.

6. Maintaining technological leadership by increased investment in research and new product development.

7. Promoting continual professional growth of all employees, continue to invest in the education and training of employees

7.6.1.3 The Company's Strategy

The third point in the model for developing PMSs is to determine a suitable strategy which will enable the company to achieve its goal and objectives. The existence of properly formulated and explicit strategies, for the company at whole and for every activity of it, was regarded as essential to ensure the development and success of the business inside both companies. The company's strategy in each case is concerned with competitive positioning with respect to the factors of efficiency, effectiveness, quality, delivery, cost, flexibility, time, and innovation. The common strategy inside the two companies is WCM strategy, with JIT and TQM philosophies as the most important key elements for its success.

7.6.1.4 The Key Success Factors

The fourth point in the model for developing PMSs is to establish the key success factors of the company's strategy. The key success factors are the performance areas of such importance that outright success in those areas can bring the entire company up, and that outright failure in those areas can bring the whole company down. Every company has its own unique profile of key success factors, but here is a short list of factors that both companies have in common:

1. Quality
2. Delivery
3. Cost
4. Time
5. Customer Satisfaction

In terms of the linkage between JIT, TQM and performance, there is definitely a cause and effect relationship between JIT and TQM practices and the companies' performance as measured by their key success factors. The key success factors in both companies will be the ability to deal effectively with the increase in the rate of change in the detailed and dynamic complexity of their operations and environment.

7.6.1.5 The new performance measurement systems

The fifth point in the model for developing PMSs is to link the company's key success factors and its new PMSs. The new PMSs in AMPCO and SEDICO includes new performance measures and reports and the introduction of a benchmarking process. Selto, Renner and Youn (1995) in their study of "Assessing the Organisational Fit of A Just-in-Time Manufacturing System" found that performance measures were developed to measure the firm's JIT/TQC key success factors of cost reduction, quality, delivery and speed. The direction of the new PMSs in both companies is toward relevant and timely information for problem solving and for controlling and supporting the improvement of the company's key success factors through a comprehensive framework of integrated complementary performance measures and reports. The new PMSs in both companies currently focus on providing the area managers and their teams with daily and weekly financial and non-financial performance information. The challenge for the future, in both companies, for the MAISs or AIS in general and PMSs in particular, is to provide the first line teams with relevant-time information for decision making for the successful operation of

each cell in concert with the operation as a whole. Banker, Potter and Schroeder (1993) in their study of "Reporting Manufacturing Performance Measures to Workers: An Empirical Study" investigate the TQM/JIT practice of providing lower level workers with the performance information. The results of their study showed that the companies who are involved in the modern operation programme provide performance information to lower level workers and that the information has a positive impact on job satisfaction and in supporting the continuous improvement idea.

7.6.1.6 Continuous Improvement

Continuous improvement philosophy in both companies is established by involving all teams in improvement efforts through frequent communication by upper management of continuous improvement goals and the encouragement of active involvement of all employees in each team in the achievement of these goals. It is widely believed that success at continuous improvement depends upon co-operation from all employees inside each team (Bowles and Hammond 1991, Wruck and Jensen 1994). On this point, employee empowerment is becoming a popular term inside both companies since implementing JIT and TQM philosophies. It denotes an employee relations approach that involves encouraging all employees inside each team to participate actively in the continuous improvement effort. According to Boer and Gieskes (1999), it is widely believed that continuous improvement will lead to performance improvement. AMPCO and SEDICO have a plan continuously to improve their mission, goals and objectives, strategies, identify key success factors, and PMSs in order to improve and support their performance and to be the best in the business. Boer, Berger, Chapman and Gertsen (1999) mentioned that continuous improvement is "the planned, organised and systematic process of ongoing, incremental and company-wide change of existing practices aimed at improving company performance."

7.7 The Research Findings in the Two Case Studies

1. Both AMPCO and SEDICO have a clear mission statement. The key purpose of a mission statement inside each of the two companies is to enable top management to communicate its vision of the company's future to the whole workforce. The two companies also were making the message of the mission statement simple and concise, so that all can understand and relate to it, whatever their job.

2. The boards of directors of the two companies have put in the mission statement for every department, sufficient details on the level of improvements they are seeking. Every manager and his team in every department inside both companies have 'team commitment tasks' and the manager is required to report progress to his colleagues during the monthly meetings.

3. AMPCO and SEDICO have clear goals, objectives, strategy, key success factors and mechanisms to measure the performance of the company. Those factors are prerequisite at AMPCO to start the successful benchmarking process.

4. The key elements of WCM strategy at both companies, to satisfy customers, are JIT and TQM philosophies, ISO 9001 and continuous improvement programmes.

5. AMPCO started to implement JIT philosophy in June 1996, and is in the process of implementing TQM philosophy. AMPCO had also implemented all the requirements of the ISO 9001 Quality Programme by 1998. SEDICO started to implement JIT philosophy in 1996 and TQM philosophy in 1995 and it had the ISO 9001 certificate from 1997.

6. JIT and TQM philosophies in both companies stress that the different teams must constantly look for ways to reduce and eliminate wasteful activities, to increase flexibility and improve quality to satisfy customers.

7. As the result of JIT implementation at AMPCO, the operators in the manufacturing area have the power to stop production if any problem occurs; so they can signal to supervision and maintenance when they first notice a problem affecting quality or productivity, which means that the corrective action can be taken before it becomes serious.

8. The different teams at SEDICO, especially the manufacturing team, have striven and still strive to reduce all types of waste.

9. As the result of the implementing JIT philosophy, both companies regularly monitor quality, lead times, delivery performance, and setup times. The two

companies always ask their key suppliers for certificate deliveries of 'zero defect deliveries'. The two companies have also introduced cell manufacturing.

10. Quality at AMPCO is considered as one of the most important cornerstones of improvement under the JIT philosophy. The challenge of producing high quality flexible packaging products at AMPCO at the lowest possible cost, in the shortest possible time, with consistent on-time delivery, led the company to adopt the teamwork concept, with training and active involvement of every single person in the team. The company has a training programme linked to the strategy review, to ensure that the workforce as a whole will have the necessary skills to achieve the company's goals and objectives.

11. The people in AMPCO consider that ISO 9001 programme and TQM philosophy are the most important improvement projects currently in progress, not just to improve product quality, but also to improve the quality of every activity in the company. It is realised, however, that not everyone, throughout the company, understands the TQM philosophy and accepts personal responsibility for the quality of his or her work. According to the president of the board of directors and quality manager, problems come when they try to turn the theory of TQM into practice. These problems arise, they believed, because it is difficult to convince people to give up long-accustomed ways of working and to adopt TQM techniques just on the basis of what many will see as management's new ideology. The quality manager said that, "it is not easy for the people in the company to understand how applying the TQM concept of 'getting it right first time, every time' will have such a direct effect on their personal job security." For this reason, the company turned to Centerior experts for help in this matter.

12. AMPCO and SEDICO have continuous improvement programmes for all of the companies' activities and review their future strategy annually when preparing budgets for the next financial year. Both companies have improved their performance and continue to do so, in the ways which their customers think are important, and which will influence their purchasing decisions. Both companies are using new performance measurement systems to measure and control the efficiency and effectiveness of performance and to support company efforts in the continuous improvement process.

13. The traditional PMSs at AMPCO and SEDICO did not provide an adequate vision of the potential for improvement and the information obtained usually arrived too late

to take corrective actions. The traditional PMSs, namely financial, at AMPCO and SEDICO also were not appropriate for continuous improvement, because they were not effective in identifying causes of productivity and quality losses. The traditional PMSs relied heavily on financial information to measure and control the activities of the company. Such information was largely irrelevant to the new environment of being a world class manufacturer.

14. The new PMSs at AMPCO and SEDICO are means of gathering financial and non-financial data to support the process of making decisions and taking action throughout the company. These new PMSs are crucial to ensure the successful implementation and execution of JIT and TQM philosophies, and continuous improvement programmes.

15. AMPCO's traditional market research helped to establish how the overall market for its products was likely to change, but it was not so good at establishing what are the key factors that cause a potential customer to buy from a competitor rather than from AMPCO. So the company decided in June 1997 to use competitive benchmarking. The company expected that the factors that potential customers might take into account when assessing competing products are price, delivery, quality of production, ease of use, reliability and availability of customer services. The people at AMPCO mentioned that any improvements they can make in these areas will have a high probability of increasing customer satisfaction and hence of earning a quick reward through increased sales. The board of directors of the company hold monthly meetings to review progress. The objectives are to decide what actions need to be taken in order to protect the company's future, enable it to develop as a world-class manufacturer, and make sure that all its efforts are continually directed at improving performance in the ways which its potential customers think important.

In addition to the previous findings, there are some common findings related to the continuous improvement concept. Continuous improvement is a new concept which has been introduced in both companies as the result of JIT and TQM implementation. Continuous improvement within a JIT and TQM environment has been hailed as one of the cornerstones of Japanese manufacturing success (Imai, 1996). The following are the common findings related to the continuous improvement concept inside AMPCO and SEDICO:

1. According to Oakland (1999), "continuous improvement is probably the most powerful concept to guide management.....There are three basic principles of continuous improvement:

- focusing on the customer,
- understanding the process, and
- commitment from the employees."

The concepts of continuous improvement and customer satisfaction were the two common key factors for the development of the business in both case studies. The development of the business inside both companies is a result of their focus on the commitment of each team to the continuous improvement of activities and processes, development of the highest quality products, and the improvement of the companies' relationships with employees, suppliers and customers.

2. "Enterprises have to change and develop their performance in order to survive" (Taskinen and Smeds, 1999). Both companies have changed their manufacturing management practices. The direction of change was toward the full integration of product design/research and development and manufacturing process, quality, delivery, cost and performance. To do so, both companies have integrated JIT and TQM techniques to continuously improve their operations to achieve the required improvements.

3. One of the most important aspects of the change in both companies was the implementation of the continuous improvement idea in the above factor of full integration. Continuous improvement was seen in both companies as best gained by channelling the skills of employees and teams and giving them the tools and encouragement needed to improve their performance. The main contributions and success stories inside those companies were a function of employee and team involvement. Oakland (1999) indicated that:

> The only efficient way to tackle process improvement or complex problems is through teamwork, which allows individuals and organisations to grow. Of course, employees will not engage in continual improvement without commitment from the top, a 'climate' for improvement and an effective mechanism for capturing individual contributions. Teamwork must be driven by a strategy, have a structure, and be implemented thoughtfully and effectively.

4. According to Jarrar and Aspinwall (1999), "continuous change comes from continuous learning, and both aspects rely on fully committed and educated people." Both companies have placed a priority on education of employees and teams, and continuous improvement of activities and processes for the achievement of their long-term strategic objectives. Kerrin (1999) mentioned that continuous improvement needs to be strongly linked to business strategic objectives as a directed top down process, as well as encouraging bottom up participation of employees by good planning of education and training.

5. According to Zink (1998) "people empowerement offers numerous possibilities for involving employees on all levels, a process which is absolutely necessary for the continuous improvement of all processes within business excellence." Employee empowerment is becoming a popular term inside both companies. The basic elements of employee empowerment in both companies are training, teamwork and decentralised decision making. According to Wruck and Jensen (1994), training in scientific problem solving, teamwork skills, and decentralised decision making are very important factors for continuous improvement. "The most intriguing suggestion about how to improve performance was that organisations change their organisation and management systems to be more participative by involving employees in problem solving, decision making, and the financial success of the business" (Lawler lll et al., 1995).

6. Both companies are currently still in the review phase of all their manufacturing and non-manufacturing operations through ongoing continuous process and activity improvement in the areas of quality, cost reduction, delivery, flexibility, throughput, profit and innovation to gain competitive advantages to satisfy customers. According to Jarrar and Aspinwall (1999), "the major source of competitive advantage will come from more outward orientation towards customers, and competition will focus on superior customer value delivery. The customer who should enjoy all the attention is the end user."

7. The continuous improvement idea in both companies was extended to the accounting information systems in general and performance measurement systems in particular, with their new emphasis on satisfying the requirements of manufacturing and non-manufacturing teams, which will ultimately satisfy the customers' expectations and requirements. Lawler lll et al. (1995) mentioned that:

> Basic to employee involvement in companies is the sharing of information about business performance, plans, and goals. Without that information, it is difficult for individuals to understand how the business is doing and to make meaningful contributions to its success.

Both companies, in developing performance measurement systems, linked the company's or activity's mission to goals and objectives. These were linked to WCM strategy, that was linked to key success factors, and the key success factors to performance measurement systems. AMPCO and SEDICO have a plan to continuously improve the foregoing factors and the relationships between them. Oakland (1999) indicated that:

> Performance-based measurement of all processes and people development activities is necessary to determine progress so that the vision, goals, mission, and critical success factors may be examined and reconstituted if necessary to meet new requirements for the organisation and its customers, internal and external.

7.8 Discussion of the Research Questions

The major means of continuous improvement in AMPCO and SEDICO has been the use of improvement programmes, such as JIT, TQM and benchmarking. According to Parker and Harrison (1995), performance measurement systems including benchmarking are being undertaken as part of more widespread process improvement programmes such as JIT and TQM philosophies. They indicated that:

> Performance measurement is a crucial part of improvement programmes in many organisations.....Performance measurement is an essential part of continuous improvement. There are many pitfalls to its successful design and implementation, but the key to success is to ensure that measures reflect customer requirements, give visibility to the progress being made and have the full participation of process owners. Like any system, performance measurement should also be the subject of continuous assessment and review.

PMSs including benchmarking in a JIT and TQM environment of in both of companies are tools which can help the companies to measure where they are with continuous improvement and how they progress over time. Performance reports, the results of PMSs, will provide useful input to planning further development of continuous improvement. These tools will support the continuous improvement idea of JIT and TQM environment, but will not in themselves lead to continuous

improvement. "The tool is only that-a tool; using it will not in itself lead to continuous improvement" (Caffyn, 1999).

The purpose of this research study was to investigate the basic research question: How can performance measurement systems best be used to support the continuous improvement ideas of JIT and TQM philosophies? This was accomplished by addressing three more specific research questions as follows:

Question 1. What has changed in the performance measurement systems with the adoption of JIT and TQM philosophies?

The 'what' question required the identification of change in the performance measurement systems in the areas of performance measures, performance reports and benchmarking. Waggoner, Neely, and Kennerley (1999) mentioned that a performance measurement system is of no use if it is not able to adjust itself to changes in its manufacturing environment. The data collected, through interviews and documents, from AMPCO and SEDICO show that both companies have changed their performance measures and reports and introduced benchmarking as a result of changing their manufacturing environments to JIT and TQM philosophies.

As part of the change of manufacturing environment inside both companies, there has been a move away from traditional performance measures which emphasised cost, productivity and profit, towards a focus on customer satisfaction. These directed the companies' teams towards improving product quality, on time delivery, and competitive prices. This customer awareness encouraged the MAISs teams inside both companies to build a balanced set of financial and non-financial measures to support the continuous improvement idea of the new environment. "The development of an effective, efficient and balanced set of financial and non-financial performance measures for a business enterprise is one of the principal challenges confronting organisations today" (Waggoner, Neely, and Kennerley, 1999). As the result of implementing JIT and TQM philosophies, both companies are changing their performance measures from financial to financial and non-financial factors. AMPCO started by changing its traditional business performance measures to reach an effective and efficient set of financial and non-financial factors (see Chapter 5). At the same time, AMPCO has a plan to change its activities performance measures. On the other hand, SEDICO started with re-design of its traditional manufacturing performance measures, and at the same time it has a plan to continuously re-design

the other activities and business performance measures (see Chapter 6). Although both companies are different in their process of changing performance measures, they have a common interest in satisfying the requirements and expectations of internal and external customers in the developing of their financial and non-financial measures. Kaplan and Norton (1996) mentioned that the developing of a "balanced set" of measures, making better use of existing measures, and generally improving performance measurement systems can lead to enhanced business performance.

Performance reports play an important role as a chain of communication for feedback inside both companies. The information of performance reports inside AMPCO and SEDICO is directed to help the managers and their teams to accomplish their tasks, namely, planning, controlling and measuring performance. AMPCO and SEDICO used to provide the information of performance reports in table form, but now they provide it in tables, graphs and chart as the result of JIT and TQM implementation. Many issues related to performance reports have been changed inside both companies as the result of changes in their manufacturing environment (see Chapters 5 and 6). The challenge now for PMSs in both companies is to provide performance reports on a shift and daily basis to the team of each manufacturing cell. Banker et al. (1993), said that:

> Many firms have adopted just-in-time production, total quality management, and teamwork practices for their manufacturing operations. These new manufacturing practices rely on increased worker involvement in the control of all phases of manufacturing....Reporting manufacturing performance information provides line personnel with the feedback that is necessary for learning and directs their efforts to productivity and quality improvements. Demand for shop floor performance reporting systems is therefore likely to be greater where these new manufacturing practices are employed.

Benchmarking is used in both companies as a tool for performance measurement systems. This tool is used to compare the performance of the company against the best of practice to improve performance. Oakland (1999) mentioned that "the word 'benchmark' is a reference or measurement standard used for comparison, and benchmarking is the continuous process of identifying, understanding and adapting best practice and processes that will lead to superior performance." According to Parker and Harrison (1995), "all change programmes require an element of external comparison and benchmarking is being used to meet this need." The main purpose of

benchmarking inside AMPCO and SEDICO is to support the continuous improvement idea of JIT and TQM programmes. Liebfried and McNair (1994) mentioned that "benchmarking is an external focus on internal activities, functions or operations in order to achieve continuous improvement." The Society of Management Accountants of Canada (1994) defined benchmarking as "a systematic and continuous measurement process; a process of continuously comparing and measuring an organisation's business processing against business leaders anywhere in the world to gain information which will help the organisation take action to improve its performance." Parker and Harrison (1995) also indicated that benchmarking can be a powerful tool into performance measurement systems for those companies looking for continuous improvement and can give greater force to many change programmes such as JIT and TQM philosophies.

Question 2. Why have the performance measurement systems changed with the adoption of JIT and TQM philosophies?

The 'why' question looks at the reason for the process of change in performance measurement systems within the studied companies as the result of the implementation of JIT and TQM philosophies. Suitable PMSs are important to ensure the successful implementation and execution of JIT and TQM strategies, since they provide the link between strategies and action (Sinclair and Zairi, 1995). According to Schalkwyk (1998), Upton (1998), and Durden et al. (1999), manufacturing companies that have implemented JIT and TQM strategies have found that their traditional PMSs do not provide this link.

The data collected from AMPCO and SEDICO indicated that the main reason for changing their PMSs is that the traditional performance measurement systems, which they used to implement, were not suitable for implementing JIT and TQM philosophies. Those traditional PMSs inside both companies were almost entirely based on financial information and little attention was given to non-financial information. For example, some of the traditional performance measures, which were used by both companies, are raw material price, machine efficiencies, direct labour costs, and ratios of direct to indirect labour. Those traditional performance measures are incompatible with performance improvement measures such as high quality, on time delivery, flexibility, throughput times and inventory reduction, which are by nature non-financial measures. According to Oakland (1999), traditional PMSs

provide little motivation to support attempts to improve performance and, in some cases, actually inhibit the continuous improvement idea of JIT and TQM philosophies. He also said that "traditional performance measures based on cost accounting information provide little to support organisational excellence, because they do not map process performance and improvement seen by the customer." According to Kueng (2000), dramatic changes in the business environment such as the implementation of JIT and TQM philosophies have affected performance measurement systems to support the idea of continuous improvement.

Question 3. How have the performance measurement systems changed with the adoption of JIT and TQM philosophies?

The 'how' question identifies and reviews the factors perceived as responsible for originating the performance measurement systems changes. The analysis of the data collected, through unstructured interview and documents, in the two case studies, highlighted the importance of tying the performance measures and reports in the new PMSs to the key success factors, tying key success factors to the company's strategy, which is WCM strategy in the both cases, tying WCM strategy to the company's goals and objectives, and tying this to the company's vision and mission. Figure 7.6.1 shows the relationships between the new PMSs and the previous factors as a model for the two case studies. These relationships exist for the company as whole and for every specific activity such as manufacturing, sales and marketing, and purchasing activities. The idea of continuous improvement in these relationships focuses on continuously improving the mission, goals and objectives, strategy, key success factors and even PMSs. According to Caffyn (1999) and Oakland (1999), the Deming Cycle of continuous improvement: plan, do, check, act- clearly requires performance measurement systems to drive it, and yet it is a useful design aid for the PMSs itself:

Plan: Establish performance mission, goals and objectives, strategy, and key success factors.

Do: Measure actual performance in its key success factors.

Check: Compare actual performance with the planned.

Act: Take the necessary actions to close the gaps and make the necessary improvement in mission, goals and objectives, strategy, and key success factors or even in PMSs itself.

Bond (1999) mentioned that "in a perfect world a performance measurement system would:

- provide an early warning detection system indicating what has happened;
- diagnose reasons for the current situation (often requiring explosion of aggregate PMS into greater detail);
- indicate what remedial action should be undertaken."

The relationships between the previous factors (plan-do-check-act) and PMSs play an important role in supporting the continuous improvement idea in a JIT and TQM environment. These relationships allow the companies to see beyond the present and create improvements for the future. According to Ahmed, Loh and Zairi (1999), "Continuous improvement is probably best described as a pervasive attitude that allows business to see beyond the present and create the future." It is clear that JIT and TQM implementation leads to changes in mission, goals and objectives, strategy, key success factors, and the existence of a continuous improvement philosophy, and these automatically lead to change in performance measurement systems. Figure 7.6.1 illustrates the relationships between those factors, and at the same time presents an answer to the main and third research questions. This figure shows the mechanisms which companies can use to develop their performance measurement systems in a JIT and TQM environment.

Chapter Eight

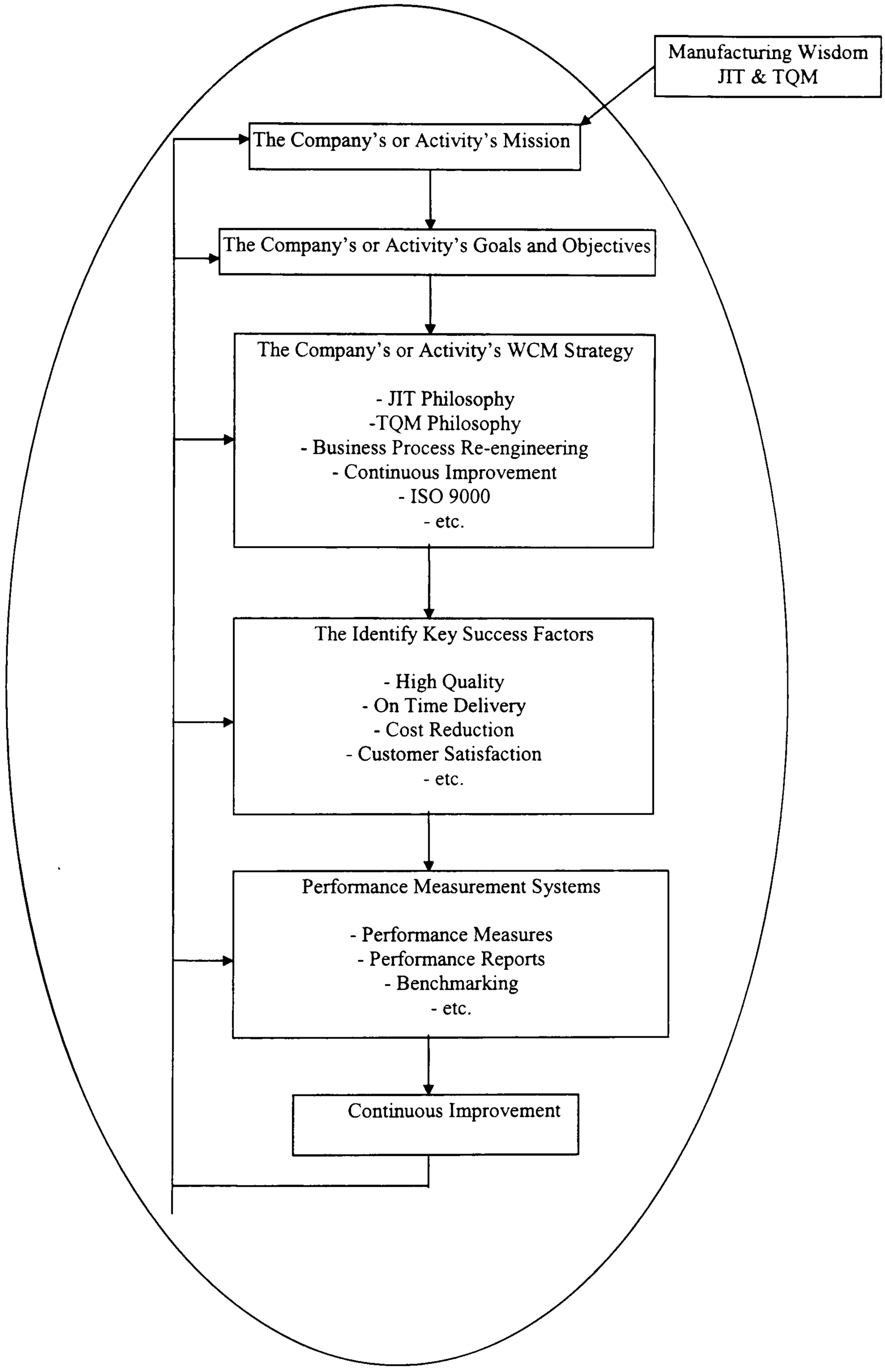
Conclusions, Recommendations and Suggestions for Further Research

8.1 Introduction

The development of the concept of performance measurement is the direct result of several dramatic changes in the way today's business environment is structured and how companies employ WCM philosophies or techniques to compete for marketplace advantages. These changes have impacted on the way companies are organised and in skills required to manage, motivate, and empower the workforce. Other changes, especially in the Egyptian environment, have come from the effect of international agreements, such as GATT and WTO agreements, and organisational pressures, such as the ISO 9000 programme. Over the past few decades, the business literature as well as the popular press have been filled with books and articles describing the dramatic changes occurring in the organisational environment, such as the implementation of WCM philosophies, the globalisation of the marketplace, business process re-engineering techniques, and the explosion in information and communication technologies. At the same time, the accounting literature describe the impact of an organisational environment on changes in management accounting information systems.

This thesis presents a theoretical and empirical study to determine 'what', 'why', and 'how' performance measurement systems are changing, as a challenge for management accounting information systems, with the adoption of JIT and TQM philosophies. Discussions of those questions were presented in Chapter 7. In order to investigate how can PMSs best be used to support the continuous improvement philosophy of JIT and TQM, a model for developing PMSs in a JIT and TQM environment was constructed (Figure 8.1). Detailed discussion of the relationships between the model's factors was presented in Chapter 7.

Figure 8.1 The Model for Developing PMSs



The model, as it stands, is exploratory in nature. It proposes a body of ideas that form a new theory formulated for developing PMSs in a JIT and TQM environment. The model could be applicable to manufacturing companies, which have started to implement or plan to implement JIT and TQM philosophies, since it provides a framework for the development and use of PMSs, rather than prescriptive lists of measures and reports that should be used. According to Norreklit (2000), models are needed which deepen our understanding of how PMSs are created, and to this end MAISs research has to make its contribution.

This study has used a qualitative method of research. The research findings and the model for developing PMSs in a JIT and TQM environment have been obtained from a review of literature and data collected from two case studies. The point here is can we learn and benefit from the data collected and empirically analysed from just two case studies, and what are the influences of the findings of this small sample? The small sample has two advantages in the process of impacts or influences. One advantage relates to influencing the companies (AMPCO and SEDICO) who are the researcher's research subjects, and the second advantage relates to influencing companies (other Egyptian pharmaceutical companies and perhaps other manufacturing companies) who are the wider audience for the research findings. Bloor (1997) has pointed out that:

> In respect of practitioners who are research subjects, qualitative researchers can call upon their pre-existing research relationships with their research subjects as a resource for ensuring an attentive and even sympathetic response to their research findings....In respect of other practitioners, who are not research subjects, the qualitative researcher has the advantage that the research methods allow rich descriptions of everyday practice which enable practitioner audiences imaginatively to juxtapose their own everyday practices with the research description. There is, therefore, an opportunity for practitioners to make evaluative judgements about their own practices and experiment with the adoption of new approaches described in the research findings.

According to Johnson (1992), it is possible to learn from just one case company and to research and build a model for developing PMSs in such environments.

This thesis has been divided into eight chapters. In this chapter, the conclusions derived from the research, recommendations and suggestions for further research will be presented.

8.2 Conclusions

Egyptian pharmaceutical companies are faced with challenges initiated by pressure from the external environment, for example, higher and more sophisticated demands from customers and pressure from the GATT agreement. There is also a kind of internal pressure, that could be either a reactive response to the external pressure or a proactive effort, for example, to find and develop a WCM strategy, formed by the search for new markets or new pharmaceutical products. In order to survive in this new situation and in today's highly competitive environment to obtain competitive advantage and to retain customers in the long run, Egyptian pharmaceutical companies must anticipate customer needs, modify their products and respond more quickly with better products than competitors. To achieve those results required by world class competitiveness, some Egyptian pharmaceutical companies have adopted the JIT and TQM philosophies. In many ways, JIT and TQM are two sides of the same coin and one without the other is not possible (Sriparavastu and Gupta, 1997). JIT and TQM are still quite new for the majority of the Egyptian manufacturing companies, and pharmaceutical manufacturers are still acquiring experience of how best to design and implement those philosophies.

Recently AMPCO and SEDICO started to implement JIT and TQM philosophies. The implementation of JIT and TQM philosophies in those companies concentrates on producing high quality products and elimination of waste and non-value added activities through the continuous improvement of the activities and processes, and through collective and continuous involvement of all employees. The continuous improvement idea in those companies has been tied to the continuous assessment of customer needs and expectations and flow of ideas on how to make improvements, reduce variation and generate excellent customer satisfaction. There are three basic principles of continuous improvement inside those companies, focusing on customer satisfaction, understanding the activities and processes, and the commitment of all the managers and their teams to quality and the elimination of waste and non-value added activities.

8.2.1 Concluding Remarks: AMPCO

AMPCO is one of the most important flexible packaging companies in Egypt. Initial contact with AMPCO was made during a visit in July 1997. This company was identified from suggestions by the Faculty of Commerce and Business Administration staff members at Helwan University (Egypt). and by the Pharmaceutical Information Committee of the Egyptian Ministry of Health. During the initial visit the aims and objectives of the case study were outlined to the President of the Board of the Directors. After obtaining permission for the study, extended structured interviews were conducted with the President of the Board of Directors and his Vice-President, and production, quality, and financial managers (see Appendix 1). The purpose of the structured interview was to take the pulse of the company. This was the first phase of on-site company visits. The second phase involved on-site visits with unstructured interviews (see Appendix 2). The design of the interview questions was open-ended to encourage dialogue with interviewees for more detailed information and understanding of interrelationship between WCM philosophies, JIT and TQM philosophies, and the PMSs changes. These field interviews at AMPCO started in June 1998 and continued for three months. The interview schedule helped to focus the investigation and ensured a consistent inquiry procedure was followed. During 24 visits, two days a week, to the company over a period of three months, extended interviews were conducted with the company employees from the president of the board of directors of the company to shopfloor employees. Thirty people were interviewed in the company, for example, the president of the board of directors and his vice-president, production manager, sales and marketing manager, financial manager, quality control manager, the chiefs of cost and management accountants, financial, cost and management accountants, production and shift supervisors, and various personnel in the production area during plant tours, amounting to approximately 90 hours of interviewing. In addition to the interviews, tours of the factory, offices, and stores were conducted. Some of the company documentation was provided by the company. The information gathered from the AMPCO was written up as the first case study (see Chapter 5). The following are some of the findings of the company:

1. As the result of market globalisation which is driven by free trade and increasing industrialisation, AMPCO began in 1996 to manage itself differently, emphasising cross-functional teams and introducing new management philosophies, JIT and TQM

philosophies. AMPCO was also prompted by globalisation and its customers to implement the ISO 9001 series of quality management and assurance standards.

2. It was found that the AMPCO's management believed that increasing world-wide competitiveness in flexible packaging manufacturing necessitated a world class manufacturing response and strategy inside the company. They also believe that becoming world class in flexible packaging manufacturing is a long term process that requires continuous improvement and innovation to better the current level of achievement inside the company. This included a commitment to continuous improvement in manufacturing and non-manufacturing processes. It also included clearly defined company goals and objectives, satisfying customer requirements, developing better ways to do the job right the first time, simplifying work processes, and educating and training for new challenges.

3. The challenge for MAISs and management accountants at AMPCO was to put into place a new PMS that would contribute the success of the company in the ever changing business environment. The new PMS has a strong focus on financial and non-financial information that directly measures customer satisfaction and responsiveness to internal and external customers' requirements. MAISs were challenged by putting in place a new performance measures and reports.

4. The new performance measures were structured in the context of the AMPCO's overall goals, specific objectives, WCM strategy and its key success factors, to encourage and enable the managers and their workforce to control and improve the company's activities.

5. The new performance reports were also intended to be responsive to the needs of all department levels of the AMPCO, including top management who are responsible for the company's strategic plans, middle managers who are responsible for the company's processes, and the first line teams who are responsible for specific operations, to encourage teamwork empowerment.

6. AMPCO was becoming increasingly aware of the value of information for competitive advantage. With that awareness came a desire to measure its performance against performance of other world class companies in the field of the flexible packaging. This often takes the form of benchmarking, where performance is measured against 'best in class' in flexible packaging. The benchmarking process gives a framework for determining the baseline performance of AMPCO's activities, provides information on performance levels of other flexible packaging companies in

the benchmarking database, including 'best practices' companies, and indicates where the grates benefits can be achieved in taking AMPCO from its current position to superior performance. Benchmarking in AMPCO is considered as a performance measurement tool used by MAISs in searching for the company's improvement opportunities and to assist the company to leap ahead of their competitors.

8.2.2 Concluding Remarks: SEDICO

SEDICO is a research based company whose people are committed to fighting disease by bringing innovative medicines and services to patients throughout Egypt, Arab and African countries and the health care providers who serve them. SEDICO is one of the market leaders in Egypt in the manufacture of pharmaceutical products. The company has been carrying out a manufacturing improvement program over the past a few years. The researcher followed the same procedures as for AMPCO to collect data and information about SEDICO. The information gathered from the SEDICO was written up as a second case study (see Chapter 6). The following are some of the findings inside the company:

1. SEDICO's people believed that sharing information about the company's performance, plans, strategies, and goals for teams is some thing very important to employee involvement. Recently, PMSs at SEDICO have been considered as the most important tools for sharing the performance information of the company and to measure the success of the company in achieving of the company's goals and objectives.
2. One of the most important goals and objectives at SEDICO is customer satisfaction. Customer satisfaction is considered as a powerful approach to SEDICO to survive and grow in local and international markets. As the result of stronger competition in the pharmaceutical markets, through GATT agreement, SEDICO is turning to realise greater customer satisfaction through the implementation of TQM and JIT philosophies to attain greater benefits. SEDICO has focused on improving customer satisfaction via quality and delivery improvements while simultaneously reducing product cost to support and improve the market share of current products.
3. SEDICO has introduced some of the principles of TQM and JIT philosophies in its operations to improve the quality of its products, such as doing it right first time every time and focus on internal and external customer satisfaction (see Chapter 6). TQM and JIT philosophies in SEDICO aims to improve performance at every level

and function in the company, involving everyone in the company, managers and workers, in a totally integrated effort. The ultimate goal of TQM and JIT in SEDICO is customer satisfaction. Now, all employees of the SEDICO have been trained in quality improvement techniques, and are expected to apply these techniques of continuous improvement in whatever area they work. The purpose of this effort to train employees was to improve quality, productivity and reduce costs by eliminating non-value added activities.

4. SEDICO has moved from PMSs experienced in terms of output, to one which requires quality with regard to all processes and performance. The change in the work environment at SEDICO has played an important role in the changing of its PMSs. SEDICO's PMSs are becoming an integral facet of its implementation of the WCM philosophies, as they provide performance information for the managers and their teams and an impetus for sustained pharmaceutical products and process improvements. WCM philosophies, TQM and JIT philosophies, at SEDICO have not as yet changed all PMSs, but a long time frame could provide for such changes to be implemented. By the end of the interview period inside the company, SEDICO had re-designed only its manufacturing performance measurement system.

8.2.3 Common Concluding Remarks

Supplier relationship

The AMPCO/SEDICO relationship involved short-term incidental orders being replaced by a long-term, structural agreement. The agreement was not restricted to quantity, price, quality, and due date, but was broadened to include all aspects of customer service: frequency of delivery, order processing, quality information, traceability, product design, etc. The AMPCO/SEDICO relationship may lead to a higher performance of the supply chain in terms of efficiency measures such as quality and flexibility: the development of this relationship requires additional investments. This association was structural adaptation to each other, which led also to a certain dependence, which might make it necessary to secure one's interests and that could lead to even more involvement and dependence. The development of AMPCO/SEDICO relationship was not easily reversible and to avoid the risk of dependence may be difficult. SEDICO had to guarantee that AMPCO remains competitive. At the same time, AMPCO had to avoid becoming too specific, too directed towards one chain or even towards SEDICO only.

Therefore, to develop a good customer/supplier relationship has to be a strategic decision. Decision making with respect to establishing a good customer/supplier relationship cannot only be based on the analysis of potential benefits on the one hand and investments and costs on the other hand. Dependence and risk play an important role. These two elements are much more difficult to analyse and evaluate than costs and benefits. An important condition for establishing a beneficial customer/supplier relationship is to involve the top management of both partners and to include the elements of dependence and risk in the decision-making process.

Operators

Doubtless, problems and failures inside AMPCO and SEDICO both witnessed resistance to change especially at operator level. Operators, who neither own nor control the company which employs them, are likely to be concerned primarily with securing or improving their wages and conditions of employment. Therefore, they *may* be responsive to initiatives linked to job security and even to the extent of intensifying their work. It is essential that the rationale behind the change is explained in detail. This interdependence means that there is considerable scope for

gaining the co-operation of operators and employees at all levels to implement quality or any change initiatives.

Based on the experience of AMPCO and SEDICO, the essential lessons are:

1. There is a need to determine who is actually accountable for the implementation and success of a change programme. Should it be viewed as the responsibility of the board of directors, quality or operations manager, consultants, or some one else? Top leadership is the key to any TQM and JIT programmes and the essential ingredient behind success or failure. Senior management commitment is critical and should be based a top-down strategy within a company.

Perhaps it is more realistic to acknowledge that while senior management's commitment is very desirable, as it happened in SEDICO case, it does not always occur as with AMPCO. Certainly, without commitment from senior management, the organisational culture change may take much longer, and improvement may be much harder to bring about. It is difficult to believe that every single company that now has a quality philosophy firmly in place started out by having the 'luxury' of senior management commitment. More than likely, some companies succeeded despite a lack of true commitment from senior management, by finding ways to overcome the problem. These may include a team of people who set out to bring about improvements within their own work area, or the hiring of a consultant adept at finding effective ways to circumvent management barriers as happened in the AMPCO case, when the company was dependent on the Centerior consultant to resolve the problem of SOC implementation under TQM philosophy.

2. The company should sell the advantages and benefits of JIT and TQM programmes. It is not good idea to force any programme on employees. Leadership must make the programme attractive and necessary to employees. The employees have to accept it and be willing to follow wholeheartedly otherwise the programme will fail as happened when AMPCO introduced the SOC programme for first time. In this regard, it was believed at AMPCO that, if SOC programme was implemented properly, it would necessarily be effective and would, therefore, provide the company with a competitive advantage over those companies that did not follow such a path. It urged staff within AMPCO to embrace the SOC programme. This only happened successfully after employing Centerior consultants to help in TQM implementation.

3. The results of both case studies indicated that performance problems could be attributed to external, uncontrollable forces, in these cases the change of Egyptian policy as the result of GATT pressure which was negatively associated with the uptake of TQM activities. Regulations, attitudes, policies and practices which may be an impediment to TQM efforts should be identified and dealt with at the outset. The introduction of *Good Manufacturing Practice* contribute significantly to overcoming obstacles to improving quality and introducing kaizen programmes to reduce cost.
4. The company should use the power of communication. Newsletters and reports are a good way to disseminate information to the whole company to keep employees informed and to get them involved in the company's change. This kind of power was under-utilised in both case studies, especially at the operators level, which led to the problems indicated.

Although many findings are specific to the two case studies, a number of implications for increasing the efficiency and effectiveness of PMSs can be derived. For example, the key finding of this research was the development of a model for developing PMSs, in a JIT and TQM environment, that should be adopted by manufacturing companies that have introduced, or a plans to introduce, JIT and TQM philosophies. This research focused on designing a model for developing PMSs that support a company's continuous activity and process improvement for a JIT and TQM environment. Thinking about PMSs to support activity and process improvement forced the researcher to consider a model for developing PMS for every activity, such as manufacturing, marketing, and purchasing, and for the company as whole. The model for developing a PMSs, as shown in Figure 8.1, considered first, the mission of the activity or company; second, the activity's or company's goals and objectives to reach this mission; third, the strategy to achieve those goals and objectives; fourth, the key success factors of this strategy; and fifth, the PMS which measures and reports the achievement and improvement of the key success factors. The following are some of the common observations derived from the research:
1. The concepts of continuous improvement and customer satisfaction were the two common key factors for the development of the business in both of the case studies. The development of the business inside the two companies is a result of their focus on the commitment of each workforce to the continuous improvement of activities

and processes, development of the highest quality products, and the improvement of the companies' relationships with employees, suppliers and customers. According to Oakland (1999), "continuous improvement is probably the most powerful concept to guide management....There are three basic principles of continuous improvement:

- ♣ Focusing on the customer,
- ♣ understanding the process, and
- ♣ commitment from the employees."

2. Both companies have changed their manufacturing management practices. The direction of change was toward the full integration of product design/research and development and manufacturing process, quality, delivery, cost and performance. To do so, both companies have integrated JIT and TQM techniques to improve their operations continuously, to achieve the required improvements. According to Taskinen and Smeds (1999), "enterprises have to change and develop their performance in order to survive."

3. One of the most important aspects of the change in the two companies was the implementation of the continuous improvement idea in the above factor of full integration. Continuous improvement was seen as best gained inside both companies by challenging the skills of employees and teams and giving them the tools and encouragement needed to improve their performance. The main contributions and success stories inside those companies were a function of employee and team involvement. Oakland (1999) indicated that:

> The only efficient way to tackle process improvement or complex problems is through teamwork, which allows individuals and organisations to grow. Of course, employees will not engage in continual improvement without commitment from the top, a 'climate' for improvement and an effective mechanism for capturing individual contributions. Teamwork must be driven by a strategy, have a structure, and be implemented thoughtfully and effectively.

4. Both companies have placed priority on employees and teams education, and continuous activities and processes improvement for the achievement of their long-term strategic objectives. According to Jarrer and Aspinwall (1999), "continuous change comes from continuous learning, and both aspects rely on fully committed and educated people." Kerrin (1999) mentioned that continuous improvement needs to be strongly linked to business strategic objectives as a directed top down process,

as well as encouraging bottom up participation of employees by good planning of education and training.

5. The two companies are currently still in the early stages of all their manufacturing and non-manufacturing operations through ongoing continuous process and activity improvement in the areas of quality, cost reduction, delivery, flexibility, throughput, profit and innovation to gain competitive advantages to satisfy customers. According to Jarrar and Aspinwall (1999), "the major source of competitive advantage will come from more outward orientation towards customers, and competition will focus on superior customer value delivery. The customer who should enjoy all the attention is the end user."

6. The continuous improvement idea in both companies was extended to the accounting information systems in general and performance measurement systems in particular, with a new emphasis on satisfying the requirements of manufacturing and non-manufacturing teams, which will ultimately satisfy the customers' expectations and requirements. Lawler lll et al. (1995) mentioned that "basic to employee involvement in companies is the sharing of information about business performance, plans, and goals. Without that information, it is difficult for individuals to understand how the business is doing and to make meaningful contributions to its success." Both companies, in developing performance measurement systems, linked the company's or activity's mission to goals and objectives, these were linked to WCM strategy, that to key success factors, and the key success factors to performance measurement systems. AMPCO and SEDICO have a plan continuously to improve the foregoing factors and the relationships between them. According to Oakland (1999), "performance-based measurement of all processes and people development activities is necessary to determine progress so that the vision, goals, mission, and critical success factors may be examined and reconstituted if necessary to meet new requirements for the organisation and its customers, internal and external."

7. As the result of JIT and TQM implementation at AMPCO and SEDICO, major changes have taken place in the way company performance is measured. Measuring performance is vital to the success of those companies. They have started to measure their activities and processes, to guide their efforts towards the achievement of the companies' mission and objectives. Those companies started to measure their performance in factors that are key to success, and in factors that are important for success, such as customer satisfaction, high quality of product and service, on time

delivery, and cost reduction, and which support the implementing of JIT and TQM philosophies. However, with the change in those Egyptian companies' environment, the role of traditional PMSs, which focus on providing financial measures and reports, is becoming more and more redundant. While the traditional PMSs will be around, their value in the new environment is increasingly limited. The major shift now, for those Egyptian companies, is that nearly every manager and his team in each company have contact with internal or external customers. The managers and their teams are responsible for their activities and are in a position to make decisions on a daily basis, so they are expected to meet their department goals and objectives that are in line with the company's mission, goals and objectives, and key success factors. So those managers and their teams needed new PMSs to support their effort to achieve their departmental goals and objectives on the one hand and the company's goals and objectives on the other. As the result of JIT and TQM implementation, AMPCO and SEDICO have moved from PMSs based on financial information towards new PMSs based on financial and non-financial information.

8. The new PMSs at AMPCO and SEDICO reflect the key success factors of the different departments and levels inside those companies, to satisfy their customers. Satisfying the customer in both companies refers to the key dimensions of quality, price, delivery and services desired by the marketplace. Continuously searching for ways to satisfy the customer forms a common performance measurement that unites all the activities of the company and directs them toward a common objective. Figure 8.1 shows the common model for developing PMSs in a JIT and TQM environment which can be used by the company as whole and by any activity inside it.

9. Utilising the concepts behind JIT and TQM philosophies, both of the companies are attempting to rebuild themselves from the inside in an effort to close the gap between themselves and emerging pharmaceutical industry leaders. In this regard, the benchmarking process as a tool for performance measurement system is playing an important role. In addition to that, the companies are using benchmarking information to generate new performance objectives and to direct improvement efforts. AMPCO is using local and international benchmarking of performance measures, but SEDICO has just started to use local benchmarking, and plans to use international benchmarking of performance measures and processes if possible in the future, because it knows that much is to be learnt from it.

10. It was observed that the new PMSs inside the two companies are maintained functionally within each department in addition to the organisational or business PMS. The performance measurement information exchanges between functions and across organisational levels inside both companies are accomplished through periodic performance reports in the inter-functional meetings. One of the most important inter-functional meetings which provides PMSs linkages in both companies is the monthly management review meeting. This meeting is used to develop action plans for departments and overall business improvement based upon the performance measurement information. A key mechanism for accomplishing PMSs linkages between departments and across organisational levels inside the two companies can be found in the model for developing PMSs. The model allows departments and the company as whole to establish continuous improvement plans based upon the philosophies of JIT and TQM, that are consistent with and support the company's WCM strategy. This model helps to integrate functional efforts by the establishment of inter-departmental improvement plans, leading to shared key success factors and performance measures and reports.

Accordingly, the new PMSs will provide suitable information to those who are planning, controlling for and implementing improvement in a JIT and TQM environment, then they can learn, and can confirm whether their improvement efforts have caused improvement or not. In a JIT and TQM environment, PMSs are not just used for control but also to aid the systemic planning and improvement of performance (Kald and Nilsson, 2000). It appears clear that a good PMS will support or enable continuous process and activity improvement and show improvement, but will not directly cause improvement (Caffyn, 1999; Kerrin, 1999; Kuegn, 2000; Oakland, 1999). Dixon et al. (1990) note five characteristics of a good PMS. They mentioned that a successful and good PMS should:

1. Be mutually supportive and consistent with the business's operating goals, objectives, critical success factors, and programs;
2. Convey information through as few and as simple a set of measures as possible;
3. Reveal how effectively customers' needs and expectations are satisfied. Focus on measures that customers can see;
4. Provide a set of measurements for each organisational component that allows all members of the organisation to understand how their decisions and activities affect the entire business;
5. Support organisational learning and continuous improvement.

The developed PMSs (see Figure 8.1), in a JIT and TQM environment, are tools that will enable company's management to take decisions and actions aimed at improving the current level of the performance. Management decisions and actions cause changes in the company's performance which may then lead to performance improvement or not. It is clear that management decisions and actions may be taken without the information of the PMS, but management would take better decisions and actions with the information of the PMS than without. In this case the PMS will enable but not cause performance improvement. Recently, developing PMSs that support continuous activity and process improvement and learning are considered as the aims of many Egyptian manufacturing companies. In the following point, the researcher will provide some suggestions for Egyptian pharmaceutical companies to support their effort in continuous improvement of activities and processes.

The changes which happened in the Egyptian case studies companies has come as a result of the pressure of the GATT or WTO agreement with Egypt in 1995. The main aims of the changes in these case studies companies are to improve their performance and competitiveness by the end of the grace period which will finish in 2005. These changes accrued inside the companies led to implement JIT and TQM philosophies as a manufacturing wisdom. This manufacturing wisdom had taken from the experiences of the successful international companies in Egypt, such as Toyota and Glaxo-Wellcome. Moreover, the availability of manufacturing experts in Egypt helped the case studies companies to implement these philosophies.

The question raising up here is why the implementation of JIT and TQM in case studies companies was not accompanied by adoption of Western MAIS and PMS. In fact, there were many reasons to justify that. First, the accountants who work in these case studies companies were graduated from the Egyptian universities. These universities teach only the traditional accounting systems during the under-graduate level. Therefore, the accountants in these companies have no idea about the western MAIS and PMS. Second, Egyptian accounting experts in these areas were not available. In addition the Western accounting systems, which applied in the international companies worked in Egypt were not available for the Egyptian companies to study and benefit from them. Third, within the MAIS there were some

techniques which were not suitable to be applied in the case studies companies. For example, the activity based costing (ABC) technique needs a lot of effort, time, and highly-cost to be implemented. At the same time, it was not beneficial to these companies. That was because the overhead cost in these case studies represent a small portion of total cost (see tables 5.7.3.5.3 and 6.7.1.2.2.6.2). In addition the price of products in these companies is driven by market not by cost.

The Western cost of quality (COQ) approach was not applied in both companies because of the misunderstanding of their managers that COQ information might attract the attention from improving quality to reducing the cost of quality. The only Western MAIS technique applied in the case studies companies is throughput accounting (TA). This technique was applied because the raw material cost represent a high portion of the total cost and the companies considered it as the only cost which should be deducted from sales revenue (see tables 5.7.3.6.3 and 6.7.1.2.2.6.2). At the same time, the accounting departments in case studies companies have decided to implement simpler costing model to meet their user needs by applying TA.

On the other hand, the Western PMS was not applied because the case studies companies used their own PMS. They preferred their own PMS which helped them to link between the process of changes in the businesses and the process of changes in PMS through the key success factors. According to the opinion of the AMPCO financial manager, this sort of link was not included in some of Western PMS such as balanced scorecard and EFQM. As the result of the customer/supplier relationship between SEDICO and AMPCO, SEDICO has benefited from the experience of AMPCO in implementing its own manufacturing PMS (see section 6.7.1.1 the process of change in SEDICO's manufacturing PMS).

The IMF and the World Bank have been recognised as lenders of the last resort. The conditionalities employed in their policy-based lending were, in principle, invoked only in the cases of those countries which have faced the unfortunate situation of balance of payments crisis and/or resource crunch, and which approached these bodies for support. The effects of the conditionalities, both the favourable ones and the adverse ones, were to be experienced by the countries who borrowed from these institutions. In practice, however, almost all the developing countries have come under the surveillance of these twin institutions. The

surveillance of the IMF and the World Bank was asymmetrical as between the developing and the developed countries. As against this, the jurisdiction of GATT or WTO seems to be wide enough to cover the policy systems of both the developed and developing countries. The different agreements under WTO have made inroads into the domestic policy system in a much more comprehensive manner than what has been possible under the IMF and the World Bank framework. The WTO prescribes that the public distribution system in a developing country should confine only to the urban and the rural poor. It also mandates as to what should be the policy towards the foreign direct investments, banks, and insurance companies. It has the outreach to the subsidy and expenditure policies of even the local governments in a country.

Egypt as a developing country has faced to a large extent some political-social-cultural resistances in applying the GATT agreement. Politically, the opposition parties rejected some parts of the agreement. That was because of their negative effects on social and cultural life of the society. Socially, the agreement resulted in sending many of employees out of their jobs. In Egypt, the public companies employed around one million persons. Most of those had lost their jobs as a result of privatisation, which led to an increase in the rate of unemployment and social instability in the society. Culturally, the Egyptian people have got their own traditions which they adopt for thousands of years. Therefore, they could resist any new thing not in line with these inherited traditions. According to the GATT agreement, the Egyptian market should be kept open for any international products. But, some of these products might not be accepted culturally in Egypt. For example, some of satellite media were not accepted by most of the Egyptian people. As the consequences of these kinds of political-social-cultural resistances, the expected results, such as accesses new sources of finance, new technologies and new markets, and accelerates the Egyptian economic growth, have not been achieved.

The experience of the Egyptian case studies companies which affected by the GATT agreement was to a large extent not differ from the experience of other developing societies companies (see Lumpur, 1996; Panchamukhi, 1996; Hoekman and Kostecki, 1998). The companies in these developing societies have also faced some political-social-cultural resistances. But, the differences were in their way to implement WCM techniques and MAIS to face the challenges of the GATT agreement. In Saudi Arabia, for example, Western international companies were

invited to invest in the country (Al-Mulhem, 1997). They were given all facilities to enable them to establish good manufacturing systems in the country. These companies have got the right to bring in their own advanced manufacturing technology and the related MAIS as well as their own staff. The Saudi experience, particularly pharmaceutical industry, has achieved good results by implementing the Western WCM and MAIS. Even though this experience has succeeded, it has not resulted in perfect solutions to help the Saudi society to face the challenges of the GATT agreement. That was because it created a social problem. This problem was that many of the graduated students didn't find jobs in these companies which almost depend on their own staff. This led to increase the rate of unemployment in Saudi society. From the cultural point of view, some of the products of these pharmaceutical Western companies were not accepted in the Saudi society. For example, Viagra and other sexual products were highly profit products according to MAIS reports but were met with a considerable cultural resistance. These types of products were against the Islamic teaching which deep rooted in the Saudi culture.

The other Gulf states have almost faced the same experience of Saudi Arabia. That was because Saudi Arabia and the other Gulf states have inherited the same political-social cultural resistances.

However, the resistance in developing countries for some parts of GATT agreement is not something governments can change at will, but is a highly complex structure combining an array of legal, market and financial relations, formal and informal rules, shared values and traditional modes of behaviour, all of which are rooted in countries' political, social, and cultural institutions (Wood and Mayer, 1998; Wangwe, 1998). Moreover, these institutions comprise individuals and groups whose capabilities and knowledge are integral to the success of the institution to which they belong. Recognising this should lead policy-makers in developing countries to expect the pace of institutional change to show considerable variation.

8.3 Recommendations

1. The management in the Egyptian pharmaceutical companies should heighten their awareness of global competition and market developments to all managers and their teams. They also must become comfortable in doing business in new markets, frequently working in other languages and business cultures.

2. Egyptian pharmaceutical companies in today's changing environment should concentrate on the following key business factors: satisfying the customer and continuous development of pharmaceutical products and services marked by superior design, high quality, low cost, on time delivery, and demanded by today's marketplace. In this regard, the continuing changes driven by the global marketplace should be followed by a WCM response, strategy and a dramatic change in the traditional operational of manufacturing and non-manufacturing activities.

3. Egyptian pharmaceutical companies should focus on a commitment to continuous improvement in manufacturing and non-manufacturing activities and processes, clear definition of the company's goals and objectives, satisfying customers' requirements, and developing better ways to do the job right the first time every time, by TQM implementation, eliminating all kinds of wastes and simplifying work processes, by JIT implementation, and educating and training all teams for new challenges.

4. Education must be given first, for the transition from one practice to another to be smooth. This is because training and education programmes are key elements in implementing any change, whether JIT and TQM or any other technique. Therefore, one of the most important recommendations to those companies that want to implement JIT and TQM philosophies is that planning for training and education must be considered before starting JIT and TQM implementation. The objective of training and education programmes in a JIT and TQM environment should be to ensure depth of understanding of those philosophies and their objectives.

5. Employees and teams must be empowered to make decisions to serve the customer and their contributions must be recognised, rewarded and encouraged, to gain the successful implementation of JIT and TQM philosophies.

6. Egyptian pharmaceutical companies should be shifted their focus further from cost control to aspects such as quality, customer satisfaction, flexibility, cost reduction, waste elimination, and advanced technology. Quality should be considered as the most important competitive edge for the Egyptian pharmaceutical companies,

followed by process and product innovation, delivery and lead time, process and product flexibility, and cost, so those companies need to measure all the above performance factors. It is also a good idea for those companies to implement and exploit new manufacturing technologies which promise to become more popular in the future, such as computer integrated manufacturing (CIM), computer-aided design (CAD), and computer-aided manufacturing (CAM).

7. Egyptian pharmaceutical companies should re-design their traditional financial, costing, and management accounting systems in order to generate information relevant for PMSs and at the same time to support their aims of continuous improvement of processes and activities.

8. Continuous improvement should be also focused on companies' mission, goals and objectives, strategy, identified key success factors and PMSs. In this regard, the model developed in Chapter Seven provides a framework whereby WCM companies can develop an integrated approach to PMSs, based on the continuous improvement philosophy of a JIT and TQM environment. In the developed model, PMSs should be linked to identified key success factors, key success factors should be linked to WCM strategy, WCM strategy should be linked to goals and objectives, goals and objectives should be linked to companies' mission.

9. Managers and their teams in all of a company's departments should be involved in the development of performance measures and reports for the activities or processes that they operate, to gain an effective and efficient PMSs.

10. Key success factors, performance measures and reports established on the current strategy must be dynamic and change with the internal and external environmental conditions of the business.

8.4 Suggestions for Further Research

1. Further research needs to be carried out to suggest essential cultural factors required for successful JIT and TQM environments in Egyptian manufacturing companies in general and Egyptian pharmaceutical companies in particular. A fundamental basis of a JIT and TQM environment is a culture of continuous improvement, because the aim is to improve continuously. "Culture" is a very strong intervening factor in the implementation of JIT and TQM philosophies, so that it deserves more explicit attention in future research.

2. Further research should to be carried out to develop WCM strategy in Egyptian pharmaceutical companies because the subject of WCM strategy has received little or no attention in Egyptian pharmaceutical companies until 1995. Significant research needs to be undertaken on the integration of WCM strategy with, for example, the company's marketing, manufacturing, purchasing and financial strategies.

3. There is a need for further research in the areas of performance measurement systems. The relationship between JIT and TQM philosophies and PMSs is unlikely to be one-way. The implementation of JIT and TQM philosophies has been shown to affect the use of PMSs. In other way, PMSs, as well as possibly supporting the implementation of JIT and TQM philosophies, will also influence the development of JIT and TQM philosophies. Therefore, there is a need to study changes in PMSs and JIT and TQM over time, in order to better understanding of the relationship between them. The analysis of the case studies suggests the need for further research into the use of performance measurement systems as follows:

A. Future research in the Egyptian pharmaceutical companies is needed in the area of PMSs. The theory and model for developing PMSs presented in this study must be tested by further research. As the number of WCM companies with new PMSs might be increased in the future, comparative studies between these companies and other companies can be made to determine if significant differences exist.

B. As the population of world class manufacturers begins to grow in Egypt, researchers can develop studies using larger samples to further knowledge in the area of PMSs development and linkages.

C. Careful future research is needed to determine what specific measures and reports are required for the identified key success factors based on the company's strategy and other features. In this regard, future research is also needed to determine whether

the model for developing PMSs developed in this study contain all of the features options, or whether additional ones are needed.

D. A very important area of research is to study by a survey the use of PMSs over time, in order to discover what are the primary reasons behind any change in the use of performance measures and reports in the manufacturing companies.

E. Study is needed of the changing role of the management accountants within the manufacturing companies and the use of information technology to facilitate information analysis in the PMSs.

F. Careful research attention must be paid to the role and behavioural impacts of the information of PMSs in solving-problem and decision-making within the manufacturing companies.

G. Careful research is needed to explore how the manufacturing companies are linking their PMSs to the performance requirements of their customers to achieve advantages in the marketplace. In this regard, because the majority of manufacturing companies are attempting to integrate their customers' requirements into their internal systems more effectively, customer needs and requirements and PMSs linkages have become increasingly important.

H. Future research is required to understand better the relationship between the performance measures used in the WCM companies. On this point, is there a 'best set' of performance measures for a particular strategy such as WCM strategy?

I. In addition to the study of the PMSs in manufacturing companies, future research is recommended to examine all the above research areas in service and non-profit companies.

APPENDICES

APPENDIX 1

QUESTIONS OF THE STRUCTURED INTERVIEW

Introduction

Dear Sir

I am conducting research, under the supervision of Dr Chris Bond at the Department of Accounting and Finance of the University of Hull (UK). The title of my thesis is "A Theoretical and Empirical study of Performance Measurement : A Challenge for Management Accounting Information Systems".

At this stage I am concerned with 'taking the pulse' of some Egyptian manufacturing companies. You may rest assured that responses to all questions will be kept strictly confidential which I hope you will contribute to the objective by completion of the questions. After collecting and analysing the data from your company, I will send you, for your information, a summary report about my investigation into your company. The check-lists which follow are subdivided into sections corresponding to the subjects covered in separate sections of my thesis.

I would like to thank you in advance for your time and effort spent in completing this questions with me through our structured interview. Your co-operation will help us deepen our knowledge into the complicated nature of performance measurement work.

General Questions

1. Company name_____
2. Primary product(s) _____
3. Total number of employees _____
4. Annual sales turnover_____

CHECK-LIST: WORLD CLASS MANUFACTURING STRATEGY

'Taking the pulse' doesn't just mean looking at your factory. i.e. the supply side. You also need to look at the demand side, assessing how your customers react to both you and your competitors. The objective is to ensure that whenever you are planning any improvement activities, the emphasis is always on improving your competitive strength, so that your efforts will be rewarded by customers being willing to give you more business.

Q1. Have you already implemented any Just-in-time (JIT) technique?

€Yes €No

If yes, when (month/year) did you start the JIT implementation?
If no, do you have a plan to implement JIT philosophy?

Q2. Have you implemented any Quality Management Programme?

€Yes €No

Q3. Have you implemented Total Quality Management (TQM) technique?

€Yes €No

If yes, when (month/year) did you start the TQM implementation?
If no, do you have a plan to implement TQM philosophy?

Q4. Have you used Business Processes Re-engineering (BPR) technique?

€Yes €No

If yes, when (month/year) did you start the BPR implementation?
If no, do you have a plan to implement BPR philosophy?

Q5. Has the Board of Directors approved a corporate strategy document?

€Yes €No

Q6. Has there been a formal review of strategy, involving the top management team in the last 1-2 years?

€Yes €No

Q7. Do you have a 'mission statement', clarifying management's vision?

€Yes €No

Q8. Does your company have a statement of quantified aims and objectives for the next few years (comparison of these with present performance will enable specific improvement objectives to identified and quantified)?

€Yes €No

Q9. Does your company periodically undertake market research, specifically aimed at establishing what potential customers think of your products and services compared with those of your competitors?

€Yes €No

Q10. Does your company use competitive benchmarking?

€Yes €No

Q11. Does your company use benchmarking as part of strategy formulation?

€Yes €No

Q12. Does your company periodically review the current life-cycle position of your main products?

€Yes €No

Q13. Does your company have any improvement projects currently in progress aimed specifically at achieving a major step change improvement in performance(such as new products or processes)?

€Yes €No

Q14. Developing new products is time-consuming and costly, there is a limit to how much can be done in any one year.
Do you make decisions on what needs to be done now and what can be left until later on the basis of what is essential to enable you to achieve your strategic objectives and protect the company's future?

€Yes €No

Or

Q15. is your decision based simply on how much you think your current resources can cope with?

€Yes €No

Q16. Do you have regular strategy update meetings to review whether changing circumstances mean that the strategy may need to be revised?

€Yes €No

CHECK-LIST: JUST-IN-TIME PHILOSOPHY

The aim of JIT philosophy is to provide a fast, reliable and flexible response to customer's requirements , eliminate waste of resources, with minimum dependence on inventory. In assessing Egyptian manufacturing companies under this heading, key issues are lead time, delivery performance, teamwork, non-added value work, setup time, and stock levels. The emphasis of JIT philosophy focuses upon continuous improvement towards lower production costs, a higher rate of productivity, better quality and reliability of products, achievement of promised delivery times of finished goods, and close relationships with customers, suppliers and workforce. From time to time step change improvements involving investment are needed to make major improvements.

Q1. Do your operators have the power to stop production if a problem occurs?

€Yes €No

Q2. Do you have a 'traffic light' system in your manufacturing area, so that operators can signal to Supervision and Maintenance when they first notice a problem affecting quality or productivity, so that corrective action can be taken before it becomes serious?

€Yes €No

Q3. Do your people, generally, think that 'waste' means process scrap, or do they understand the wider concept and continually strive to reduce all types of waste?

€Yes €No

Q4. Do you regularly monitor lead times?

€Yes €No

If so, have there been a significant improvement over the last year?

€Yes €No

Q5. Do you regularly monitor delivery performance?

€Yes €No

If so, have there been a significant improvement over the last year?

€Yes €No

Q6. Do you regularly monitor set-up times?

€Yes €No

If so, have there been a significant improvement over the last year?

€Yes €No

Q7. Do you receive 'certificated deliveries' from your key suppliers (i.e. 'zero defect deliveries)?

€Yes €No

Q8. Do you regularly monitor batch sizes ordered from outside suppliers?

€Yes €No

Q9. Have you introduced cell manufacturing?

€Yes €No

Q10. Do you use Kanbans to control the flow of materials within a production cell?

€Yes €No

Q11. Do you use simulation techniques before introducing major changes in process equipment or layout to anticipate and avoid potentially serious problems that might otherwise have been overlooked?

€Yes €No

Q12 Are there any improvement programme to:

(a) Reduce inventory product levels ( )
(b) Reduce raw material and work in process inventories ( )
(c) Reduce set-up times and lot sizes ( )
(d) Reduce manufacturing lead times ( )
(e) Reduce scrap and rework ( )

(f) Eliminate production inefficiencies such as machine capacity imbalances( )
(g) Facilitate material transfer ( )
(h) Improve plant efficiency ( )
(i) Improve product design ( )
(j) Improve competitiveness ( )
(k) Increase worker flexibility ( )
(l) Increase workforce innovation ( )

CHECK-LIST: TOTAL QUALITY MANAGEMENT

The TQM philosophy is based on defect prevention rather than the traditional defect detection followed by correction. TQM is a total philosophy whose objective is to meet or exceed the needs of internal and external customers by creating an organisational culture in which every one at every stage of creating the product and every level of management is committed to quality and clearly understands its strategic importance. Achieving world class standards, therefore, means developing a 'quality creation' culture, in which every member of the workforce takes personal responsibility for the quality of his or her own work, and where it's accepted by all that the goal of 'right first time, every time' applies to every employee and to every aspect of the company's operations, not just to the manufacturing process.

Quality should be widely recognised as being everyone's responsibility, and not just that of the inspectors and the Quality Control Department. This requires teamwork, customers and suppliers involvement and continuous improvement (Kaizen).

Q1. Do you regularly monitor product quality?

€Yes €No

If so, have there been a significant improvements over the last six months?

€Yes €No

Q2. Do you have 'production delay' reporting procedure in which operators can draw attention to quality or productivity problems which cause delays to planned work?

€Yes €No

Q2. Have you implemented any Quality Management Programme?

€Yes €No

Q3. Do you have any improvement projects currently in progress to improve product quality?

€Yes €No

Q4. Does everyone, throughout the company, understand the Total Quality Management philosophy and accept personal responsibility for the quality of his or her work? €Yes €No

Or

Q5. Are your company in an era where people rely on others to inspect what they have done? €Yes €No

Or

Q6. Are your company part-way there with a framework of formal quality assurance systems and procedures in place, independently assessed by a recognised certification authority (e.g. ISO 9000)?

€Yes €No

Q7. Have your people formally analysed who their major customers and suppliers are, and agreed standards for all their inputs and outputs?

€Yes €No

Q8. Have you completed a 'quality qualitative analysis' within the last 12 months? If so, have you used this as a basis for deciding where action is most needed to focus on 'getting it right first time, every time'?

€Yes €No

Q9. Do your people think that quality assurance is responsibility of quality control department only?

€Yes €No

Q10. Do you use market research techniques such as 'competitive benchmarking' to find out what your customers really think about the quality of your products and the service you provide?

€Yes €No

Q11. Do you use Statistical Process Control(SPC) charts as a means of anticipating processes going out of control before this happens and in time for corrective action to be taken?

€Yes €No

CHECK-LIST: TOTAL EMPLOYEE INVOLVEMENT

The best opportunity for achieving a major breakthrough in company's performance will come not so much from investing in new equipment or computers, nor from improving incentive payment schemes, but from making better use than ever before of the skills and experience of whole workforce (teamwork).

Q1. Do you use teams for:

(i) assembly ( )

(ii) fabrication ( )

Q2. Do you empower teams to take responsibility for making decisions and implementation?

€Yes €No

Q3. Has the company in general a climate of willingness to participate?

Yes No

Q4. Are your improvement projects structured for teams, with a facilitator to co-ordinate their work in place of the traditional project manager?

Yes No

Q5. Do you review progress on world-class improvement activities regularly and routinely at company and departmental management meetings, quantifying what has actually been achieved and comparing this with targets set?

Yes No

Q6. Do your managers have 'personal commitment tasks' and, if so, are they all required to report progress regularly in front of their colleagues?

Yes No

Q7. Have you prepared a 'people plan' that details the proposed development of your human resources, placing greater emphasis than in the past on training?

Yes No

Q8. Are these perceived training needs formally linked to the strategy review, to ensure that the workforce as a whole will have the necessary skills to achieve the company's corporate objectives?

Yes No

Q9. Have you restructured the way in which your management is organized, to reflect the 'empowering people' concept and to place greater emphasis on team leaders instead of the traditional multi-level management structure?

Yes No

Q10. Have you ensured that your whole workforce understands the world-class concepts, in particular the need for both step change and continuous improvement, through a company-wide briefing programme?

Yes No

CHECK-LIST: MANAGING THE CHANGE

Some specific aspects of managing a programme of change aimed at achieving world class performance are summarised in the check-list below.

Q1. Do you have a successful record of introducing change in recent years, encompassing any of the world-class philosophies, for example elements of just-in-time or total quality management?

Yes No

If so, are you still experiencing resistance to change?

Q2. If you have launched a project aimed at achieving a step change improvement in productivity, did you at the same time launch a project aimed at increasing sales sufficiently to at least absorb the resources freed, in order to counter the assumption that 'improving efficiency means that some people will lose their jobs'?

Yes No

Q3. Have your efforts to involve the whole workforce in the 'continuous improvement' process been preceded by step change projects, to provide a high-profile demonstration of what can be achieved through effective teamwork?

Yes No

Q4. Are your continuous improvement efforts directed towards improving the quality of service provided at each customer/supplier link?

Yes No

Q5. Do you make sure that everyone is regularly informed about your world-class activities and the successes achieved?

Yes No

Q6. Do all members of the top management team keep reaffirming publicly their whole-hearted commitment to the company's world-class objectives?

Yes No

Q7. Do you particularly re-engineer your processes?

Yes No

Q8. Do you particularly re-design for a cell?

Yes No

CHECK-LIST: MANAGEMENT ACCOUNTING INFORMATION SYSTEMS

Management accounting and performance measurement systems should not be thought of in their own right as the means of achieving world class performance, but rather as an enabling tool. The whole point of reporting on company's performance should be to enable teams and management to see that progress is being made towards achieving the goals they have set, and to identify where improvements are feasible or necessary. This means that Egyptian manufacturing companies may be need to introduce new methods of performance measurement systems which satisfy these management requirements, and at the same time it need to review existing performance measures and reports to ensure that those are irrelevant as far as possible either modified or removed. The following check-list may be help.

Q1. Could you please specify the functions and responsibilities of the accounting department?

_____

_____

_____

Q2. What cost accounting method do you use?

a. Job order ( )

b. Process ( )

c. Standard cost ( )
d. Direct cost ( )
e. Product cost ( )
f. Budgeting ( )
g. Others (please specify)

Q3. Do you use activity-based costing (ABC) system?

Yes No

Q4. What kinds of financial measures do you use?

a. Return on Investment (ROI) ( )
b. Residual Income (RI) ( )
c. Contribution Margin (CM) ( )
d. Net Profit (NP) ( )
e. Sales Revenue (SR) ( )
f. Throughput (T) ( )
g. Raw Material Costs (RMC) ( )
h. Operation Costs (OC) ( )
i. Others (please specify)

Q5. Have you changed your financial measures recently?

Yes No

Q6. What kinds of performance reports do you use?

a. Variances analysis reports of:
1. Raw Material Costs
2. Operation Costs
3. Sales Revenue
4. Throughput
5. Contribution Margin
6. Net Profit
7. Return on Investment
8. Residual Income
9. Others (please specify)

Q7. Is there any change in performance reports?

Yes No

Q8. Do you use any non-financial measures?

Yes No

If yes, what kinds do you use?

Q9. Have you changed your non-financial measures recently?

Yes No

Q10. Are the non-financial measures when compared to the financial measures:

(a) Less important ( )
(b) Equally important ( )
(c) More important ( )

Q11. Do you routinely monitor and report lead times information?

Yes No

Q12. Do you routinely monitor and report delivery performance information?

Yes No

Q13. Do you routinely monitor and report set-up times information?

Yes No

Q14. Do you routinely monitor and report products quality information?

Yes No

Q15. Do you routinely monitor and report customer satisfaction information?

Yes No

Q16. Do you routinely monitor and report productivity information?

Yes No

Q17. Do you routinely monitor and report supplier information?

Yes No

Q18. Do you routinely monitor and report inventory product levels?

Yes No

Q19. Do you routinely monitor and report raw material and WIP inventories?

Yes No

Q20. Which Performance Measures have exhibited a steady improvement?

Q21. Do you use benchmarking technique in yours performance measurement systems?

The using of benchmarking technique involves the following:

- identifying a product or process within your company;
- specifying its key performance criteria, e.g. time, cost, quality;
- selecting 'partners' against which the performance of the product/process is to be measured. These could be other departments in your company, or other companies, whether similar to yours or not;
- collecting data on the key performance criteria from your company and your partner, and making comparisons;
- where there are performance gaps, analyzing their cause and assessing whether there are improvements which can be incorporated into your company's practices.

Q23. Do your performance measurement systems readily provide all the information you need to monitor the progress you are making towards achieving your business objectives?

Yes No

Q24. Do your current performance measurement systems help or hinder you in your efforts to improve performance and achieve world-class standards?

Help Yes No

Hinder Yes No

APPENDIX 2

QUESTIONS OF UNSTRUCTURED INTERVIEW

Introduction

Dear Sir

I am conducting research, under the supervision of Dr. Chris Bond at the School of Accounting, Business and Finance, University of Hull (UK). The title of my thesis is "A Theoretical and Empirical study of Performance Measurement : A Challenge for Management Accounting Information Systems".

At this stage I am concerned with collecting data and information from some Egyptian manufacturing companies to have in depth understanding of company's strategies and mission, goals and objectives, manufacturing systems, JIT and TQM techniques, management accounting information systems, performance measurement systems and company's performance. You may rest assured that responses to all questions will be kept strictly confidential which I hope you will contribute to the objective by completion of the questions. After collecting and analysing the data from your company, I will send you, for your information, a summary report about my investigation into your company. The parts which follow are subdivided into sections corresponding to the subjects covered in separate sections of my thesis.

I would like to thank you in advance for your time and effort spent in completing this questions with me through our unstructured interview. Your co-operation will help us deepen our knowledge into the complicated nature of management work.

Background Information

1. Company name_____
2. Primary product(s) _____
3. Total number of employees _____
4. Annual sales turnover_____

Part A: Strategies, Mission, Goals and Objectives Questions

1. Please describe the company strategies prior to the JIT and TQM implementation.

2. Please describe the company strategies after the implementation of JIT and TQM philosophies.

3. Please define the company mission.

4. Please define the strategic objectives of the company.

5. Please define the other goals and objectives of the company.

6. How are the mission, goals and objectives made known to the various teams in the company?

7. Describe the company's relationship with its customers.

8. Describe the company's relationship with its suppliers.

9. Describe the teams' relationship inside the company.

10. Describe the factors that are critical to the success of the company.

Part B: JIT and TQM Philosophies Questions

The aim of JIT philosophy is to provide a fast, reliable and flexible response to customer's requirements , eliminate waste of resources, with minimum dependence on inventory. In assessing Egyptian manufacturing companies under this heading, key issues are lead time, delivery performance, teamwork, non-added value work, setup time, and stock levels. The emphasis of JIT philosophy focuses upon continuous improvement towards lower production costs, a higher rate of productivity, better quality and reliability of products, achievement of promised delivery times of finished goods, and close relationships with customers, suppliers and workforce. From time to time step change improvements involving investment are needed to make major improvements.

The TQM philosophy is based on defect prevention rather than the traditional defect detection followed by correction. TQM is a total philosophy whose objective is to meet or exceed the needs of internal and external customers by creating an organisational culture in which everyone at every stage of creating the product and every level of management is committed to quality and clearly understands its strategic importance. Achieving world class standards, therefore, means developing a 'quality creation' culture, in which every member of the workforce takes personal responsibility for the quality of his or her own work, and where it's accepted by all that the goal of 'right first time, every time' applies to every employee and to every aspect of the company's operations, not just to the manufacturing process.

Quality should be widely recognised as being everyone's responsibility, and not just that of the inspectors and the Quality Control Department. This requires teamwork, customers and suppliers involvement and continuous improvement (Kaizen).

1. Please describe the manufacturing process prior to the JIT implementation.
2. Please describe the JIT manufacturing process.
3. Please explain the aims and objectives of your company from implementing the JIT manufacturing process.
4. Have you implemented the pull production system (kanban)?
    a. If yes,
        i. Please describe.
        ii. When did you implement the system?
        iii. How did you implement the system?
        iv. Why did you implement the system?
        v. Did this feature exist before the JIT implementation?
    b. If no, why have you not implemented the pull production system?

5. Are your employees cross-trained (multi-skilled)?
    a. If yes,
        i. Please describe.
        ii. When did you start cross training?
        iii. How did you cross train?
        iv. Why did you cross train?
        v. Did this feature exist before the JIT implementation?
    b. If no, why are your workers not cross-trained?

6. Have you implemented an employee training programme other than cross training (problem solving, team interaction)?
   a. If yes,
      i. Please describe.
      ii. When did you start the programme?
      iii. How did you start the programme?
      iv. Why did you start the programme?
      v. Did this feature exist before the JIT implementation?
   b. If no, why have you not implemented a training programme?

7. Have you organised cells or moved machines to 'points of use'?
   a. If yes,
      i. Please describe.
      ii. When did you reorganise the plant?
      iii. How did you reorganise the plant?
      iv. Why did you reorganise the plant?
      v. Did the current plant layout exist before the JIT implementation?
   b. If no, why have you not organised cells or moved machines?

8. Have you implemented a lot size reduction programme?
   a. If yes,
      i. Please describe.
      ii. When did you implement the programme?
      iii. How did you implement the programme?
      iv. Why did you implement the programme?
      v. Did this feature exist before the JIT implementation?
   b. If no, why have you not implemented lot size reduction?

9. Have you implemented a setup time reduction programme?
   a. If yes,
      i. Please describe.
      ii. When did you start reducing setup times?
      iii. How did you reduce setup times?
      iv. Why did you reduce setup times?
      v. Did this feature exist before the JIT implementation?
   b. If no, why have you not implemented a setup time reduction programme?

10. Have you implemented a lead time reduction programme?
   a. If yes,
      i. Please describe.
      ii. When did you start reducing lead times?
      iii. How did you reduce setup times?
      iv. Why did you reduce setup times?
      v. Did this feature exist before the JIT implementation?
   b. If no, why have you not implemented a lead time reduction programme?

11. Have you implemented an inventory reduction programme?
   a. If yes,
      i. Please describe for raw materials, work in process and finished products

inventories?
ii. When did you start reducing inventories level?
iii. How did you reduce inventories level?
iv. Why did you reduce inventories level?
v. Did this feature exist before the JIT implementation?

b. If no, why have you not implemented an inventory level reduction programme?

12. Have you implemented JIT purchasing or supplier involvement?
a. If yes,
i. Please describe.
ii. When did you implement this feature?
iii. How did you implement this feature?
iv. Why did you implement this feature?
v. Did this feature exist before the JIT implementation?
b. If no, why have you not implement JIT purchasing or supplier involvement?

13. Please explain the aims and objectives of your company from implementing of JIT purchasing or supplier involvement..

14. Have you implemented any small group improvement activities or quality circles as part of a JIT programme?
a. If yes,
i. Please describe.
ii. When did you implement the programme?
iii. How did you implement the programme?
iv. Why did you implement the programme?
v. Did any activities exist before the JIT implementation?
b. If no, why have you not implemented small group improvement activities?

15. What is the role of the quality assurance department in your company?

16. How does the company define quality?

17. Have you implemented Total Quality Management (TQM) philosophy?
a. If yes,
i. Please describe.
ii. When did you implement TQM philosophy?
iii. How did you implement TQM philosophy?
iv. Why did you implement TQM philosophy?
v. Did this philosophy exist before the JIT implementation?
b. If no, why have you not implemented TQM philosophy?

18. Please explain the aims and objectives of your company from implementing of TQM philosophy.

19. Describe how is quality measured?

20. Describe how is quality communicated?

21. What quality gurus are the company familiar with?

22. What is the cost of quality in your company?

23. What are the cost of quality categories do you track?

24. Have you implemented statistical process control technique?
    a. If yes,
        i. Please describe.
        ii. When did you implement statistical process control?
        iii. How did you implement statistical process control?
        iv. Why did you implement statistical process control?
        v. Did this feature exist before the TQM implementation?
    b. If no, why have you not implemented statistical process control?

25. Have you implemented ISO 9000 programme?
    a. If yes,
        I. Please describe.
        ii. When did you implement ISO 9000 programme?
        iii. How did you implement ISO 9000 programme?
        iv. Why did you implement ISO 9000 programme?
        v. Did this programme exist before JIT and TQM implementation?
    b. If no, why have you not implemented ISO 9000 programme?

Part C: Management Accounting Information systems (MAISs) and Performance Measurement Systems (PMSs) Questions

Management accounting and performance measurement systems should not be thought of in their own right as the means of achieving world class performance, but rather as an enabling tool. The whole point of reporting on manufacturing performance should be to enable teamwork and management to see that progress is being made towards achieving the goals they have set, and to identify where improvements are feasible or necessary. This means that Egyptian manufacturing companies may be need to introduce new methods of performance measurement systems which satisfy these management requirements, and at the same time it need to review existing performance measures to ensure that those are irrelevant as far as possible either modified or removed.

1. What is the structure of the accounting department in the company?

2. Please identify the major changes in the accounting department over the past ten years.

3. Please describe the management accounting information systems (MAISs) and their role in your company.

4. What is the level of integration between financial accounting information and management accounting information systems in your company?

5. Please describe the cost accounting information system (CAIS) and its role in your company.

6. What is your cost accounting model?

7. Describe the overall cost structure.

8. Describe your allocation methods.

9. How does total product cost relate to pricing?

10. How do you use cost of quality data?

11. Why is cost of quality information necessary?

12. How is the cost of quality information used for the benefit of the company?

13. Please describe the PMSs used to measure manufacturing and non-manufacturing performance in your company.

14. Have the PMSs changed as a result of the JIT and TQM implementation?
    a. If yes,
        i. What key success factors or criteria were used prior to the implementation?
        ii. Why was the system changed or developed?
        iii. How was the system changed or developed?
        iv. When was the system changed or developed?
    b. If no, why was the system not changed or developed?

15. Please define the performance key success factors or criteria used in JIT and TQM environment.
    a. When were the key success factors selected?
    b. How were the key success factors selected?
    c. Why were the key success factors selected?

16. Are other key success factors or criteria being considered?
    a. If yes,
        i. What other key success factors are being considered?
        ii. Why are they being considered?
        iii. How are they being considered?
    b. If no, why are other key success factors not being considered?

17. Please define the performance measures used in JIT and TQM environment.
    a. When were the performance measures selected?
    b. How were the performance measures selected?

c. Why were the performance measures selected?

18. Are there any other performance measures being considered?
    a. If yes,
        i. What other performance measures being considered?
        ii. Why are they being considered?
        iii. How are they being considered?
    b. If no, why are other performance measures not being considered?

19. Please describe the performance standards, or satisfactory levels of performance, that have been set for all of the key success factors.
    a. What are the standards?
    b. How are the standards set?
    c. Are standards revised? If so, how are they revised?

20. How are the key success factors measured?
    a. What data are collected?
    b. How are the data collected?
    c. Who collects the data?
    d. How often are the data collected?

21. Please describe the performance reporting system and its uses.
    a. What data are reported?
    b. How are the data reported?
    c. How often are the data reported?
    d. Who prepared the reports?
    e. Who receives the reports?
    f. How are the reports used?
    g. How are differences between actual and satisfactory performance handled?

22. Did you use a benchmarking system?
    If yes,
    a. Please define and explain this system.
    b. What are the performance key success factors and measures being considered?
    c. Why are they being considered?
    d. How are they being considered?
    If no, why are this system not being considered?

23. Please describe any implementation problems associated with the JIT and TQM performance measurement systems.

24. Please describe any operation problems associated with the JIT and TQM performance measurement systems.

25. What is the future direction of the PMSs in the company?

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