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OVERALL PERFORMANCE MEASUREMENT FOR LOGISTICS OPERATIONS

(PENGUKURAN PRESTASI MENYELURUH BAGI OPERASI LOGISTIK)

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We would like to take this opportunity to express our greatest gratitude to MOX, dearest family members, friends and fellow colleagues who have contributed directly or indirectly to this project. Thanks for all the support and encouragement.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATION

BOC	British Oxygen Company
BOS	Business Operating System
CAM-I	Computer Aided Manufacturing – International
CLM	Council of Logistics Management
CPM	Competitive Profile Matrix
CRM	Customer Relation Management
CSF	Critical Success Factors
CSP	Critical Success Process
DIFOT	Delivery In Full On Time
FEO	Far East Oxygen
ISP	Industrial and Special Products
JIT	Just in Time
KOF	Key Operational Factors
KPI	Key Performance Indicators
LOB	Line of Business
LOM	Logistics Operations Management
LPM	Logistics Performance Measurement
LSCM	Logistics and Supply Chain Management
LWCR	Lost Workday Case Rate
MOL	Malayan Oxygen Limited
MOX	Malaysian Oxygen Berhad
MWP	Malayan Welding Products Sdn Bhd
NIOI	Nissan Industrial Oxygen Incorporated
NOTIF	Not On Time In Full
NOTNIF	Not On Time Not In Full
OPCS	Operations Planning And Control System
OPM	Overall Performance Matrix
OTC	Order to Cash
OTNIF	On Time Not In Full

PGS	Process Gas Solutions
PI	Performance Indicators
PMQ	Performance Measurement Questionnaire
PMS	Performance Measurement System
POA	Performance of Activity
PSO	Product and Service Offer
PTO	Product to Order
ROCE	Return of Capital Employed
SCM	Supply Chain Management
SLA	Service Level Agreement
SWOT	Strength, Weakness, Opportunity, Threat
TAAR	Truck Avoidable Accident Rate

ABSTRACT

Logistics and Supply Chain Management (LSCM) has become common practice across all industries, however, the topic of Logistics Performance Measurement (LPM) does not receive adequate attention therein. Current logistics operations performance measurement systems in MOX (subject for the case study) are also inadequate because they rely heavily on the use of cost as a primary (if not sole) measure. More often than not, they are inconsistent with the strategic goals of the organizations, and do not consider the effects of uncertainty. In the transportation and distribution sector, as in many others, it is important to have a good performance in operations. A good performance measurement system is a necessity for a company to grow and sustain industry leadership. As an indispensable management tool, performance measurement provides the necessary assistance for performance improvement in pursuit of supply chain excellence. The main objective of this project is to study and understands the existing logistics operations performance measurement systems in MOX and identifies its drawbacks, and suggests improvements in line with the excellent practices. The scope of discussion is focusing on safety, productivity, costs and delivery reliability of the department. Interviews and discussions with management team have been conducted; strategies tools such as SWOT analysis, CPM analsyis and etc. have also been applied in executing this project. Upon completion, a set of Critical Success Factors (CSF) and Key Operational Factors (KOF) of the department will be identified and put together as an overall performance measurement matrixs for the department. As stated earlier, a good performance measurement systems supports sound management decisions. It is believed that the newly developed Overall Performance Measurement System is effective as it provides high quality, reliable, and timely information to influence management's decisions and employee's behavior.

ABSTRAK

Pengurusan Rantaian Bekalan dan Logistik telah menjadi amalan biasa dalam kebanyakan industri, walau bagaimanapun, topik Pengukuran Prestasi Logistik belum lagi menerima perhatian yang mencukupi. Sistem Pengurukuran Prestasi Operasi Logistik kini di MOX (subjek bagi kajian kes) juga tidak mencukupi kerana mereka lebih menitikberatkan kepada kos sebagai kayu ukur utama. Seringkali juga mereka tidak konsisten dengan matlamat strategik organisasinya., dan juga tidak mengambilkira kesan-kesan yang tidak pasti. Dalam sektor pengangkutan dan pengagihan, seperti yang lainnya juga, adalah perlu untuk mempunyai prestasi operasi yang baik. Sistem pengukuran prestasi yang baik adalah keperluan bagi sesebuah syarikat untuk membangun dan menjadi juara dalam industrinya. Sebagai alat pengurusan yang amat penting, pengukuran prestasi akan menyumbang kepada peningkatan prestasi dalam usaha menjayakan rantaian bekalan. Matlamat utama projek ini adalah untuk mengkaji dan memahami sistem pengukuran prestasi operasi lojistik semasa dalam MOX dan mengenalpasti masaalahnya, dan seterusnya mencadangkan peningkatan selaras dengan praktis yang cemerlang. Skop perbincangan menumpukan kepada keselamatan, produktiviti, kos dan keanjalan penghantaran bagi jabatan tersebut. Soal jawab dan perbincangan dengan pasukan pengurusan telah dijalankan; alat-alat strategi seperti analisis SWOT, analisis CPM dan sebagainya telah digunakan dalam perlaksanaan kajian ini. Di peringkat akhirnya, Faktor Kejayaan Kritikal dan Faktor Kunci Operasi jabatan telah dikenalpasti dan akan dihimpunkan sebagai matrik pengukuran prestasi menyeluruh bagi jabatan tersebut. Seperti dinyatakan terlebih dahulu, sokongan terhadap sistem pengukuran prestasi yang baik melambangkan keputusan pengurusan. Diyakini bahawa Sistem Pengukuran Prestasi Menyeluruh yang baru ini adalah berkesan dan berupaya memberikan kualiti yang tinggi, boleh harap, dan maklumat terkini bagi mempengaruhi keputusan pengurusan dan sikap pekerja.

CHAPTER 1

INTRODUCTION

1.1 History of Malaysian Oxygen Berhad

Malaysian Oxygen Berhad (MOX) is the leader and largest industrial gases company in Malaysia with:

- more than 65% market share
- Employs over 600 people
- Total sales turnover in year 2000 in excess of RM 400 million

Listed since 1981 on the KLSE main board, Malaysian Oxygen Berhad (MOX) is the leading manufacturer and supplier of industrial, medical and specialty gases, welding electrodes and equipment in Malaysia. It has over 40 years of industrial gases manufacturing experience in Malaysia. In its original form as Malayan Oxygen Ltd (MOL), which was incorporated on September 1960, the company, on 1 October 1960, acquired the business and assets of Industrial Gases (Malaya) Ltd., which had been operating in Malaysia and Singapore since 1946. Subsequently, in September 1974, it acquired Malayan Welding Products Sdn Bhd (MWP). November 1978 saw the establishment of MOX as a result of the merger between MOL and Far East Oxygen (FEO). MOX took over the business and operations of FEO in February 1979 and MWP in March 1980, following which the companies were liquidated. The company further expanded and strengthened its organisation by acquiring one of its major competitors Nissan Industrial Oxygen Incorporated (NIOI) in July 2002. This history of MOX is presented in Figure 1.1.

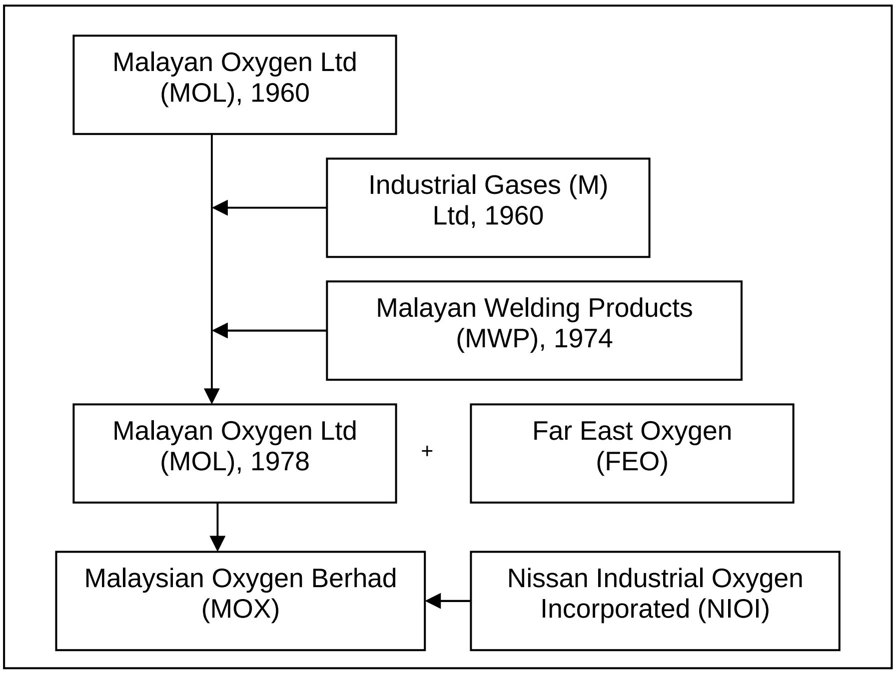

Figure 1.1: Formation of Malaysian Oxygen Berhad

MOX is currently part of the British Oxygen Company (BOC) and Air Liquide Groups where 45% of its share is held by ALBOC Holdings Ltd. a joint venture investment holding company between BOC Group Plc of United Kingdom and L'Air Liquide of France, the two leading industrial gas manufacturers in the world. Having over 200 years of experience, the world number 1 and number 2 industrial gas manufacturing companies leverage off their knowledge, resources, technology and support. These two international gas companies bring to MOX technological, research & development, gas application and operational support from their global base, as well as experienced expertise.

The major shareholders of MOX are:

- Alboc (Jersey) Ltd 45.0%
- Employees Provident Fund Board 10.45%
- Permodalan Nasional Bhd 8.3%

Picture on the left is the corporate logo for MOX. The base colour of the logo is in red, representing BOC Group, while the “roof” like logo below MOX wording is the logo of Air Liquide (AL).

1.1.1 MOX's Business

MOX gases and equipments are widely used by the petrochemical, oleo-chemical, electronic, steel, engineering and fabrication, shipyard, foundry, food and beverage industries, laboratories, hospitals and clinics, and research institutions and other manufacturing industries. The pie chart in Figure 1.2 displays the distribution of its sales income in various industries:

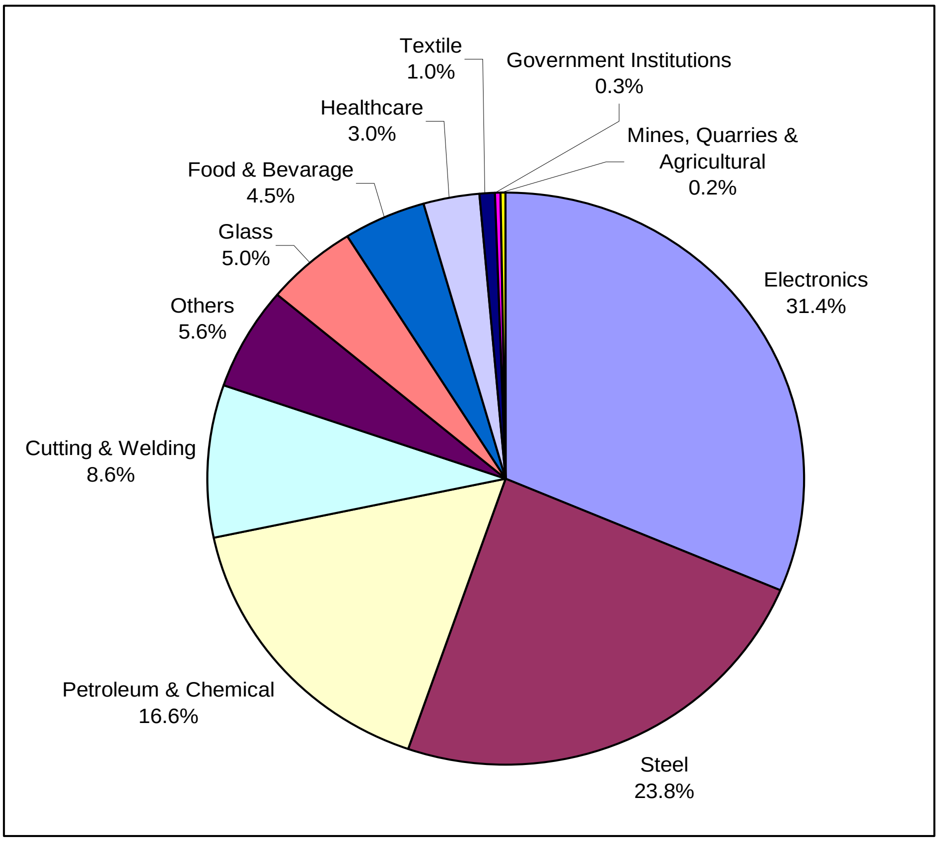

Figure 1.2: Distribution of MOX sales according to Market Sector.

MOX supplies its gases in various forms to customers - via pipeline from a MOX plant, in liquid form to storage tanks or in gaseous form in cylinders. Currently, MOX has production plants in 17 sites, and distributes its products to customers from these 17 locations, 18 sales centres and over 70 distributors throughout Malaysia (refer to Figure 1.3 and 1.4). The gases and electrode production plants are accredited to ISO 9002 and the special gases laboratory to SAMM accreditation.

Figure 1.3: Location of MOX Plants Nationwide

Figure 1.4: Location of MOX Sales Centres Nationwide

In addition to the standard supply of gases, refrigerants, welding electrodes and equipments, MOX also provide total gas solutions to its customers to improve cost, productivity and quality within their operating premises, the company is also in the business of installing gas piping systems to the industrial and medical industries. In addition, it has embarked on providing and installing ultra clean technology piping systems and equipment to the high end electronics industry. The principal activities of the Group companies are complementary. The Company currently holds 66% market share in Malaysia, as shown in Figure 1.5.

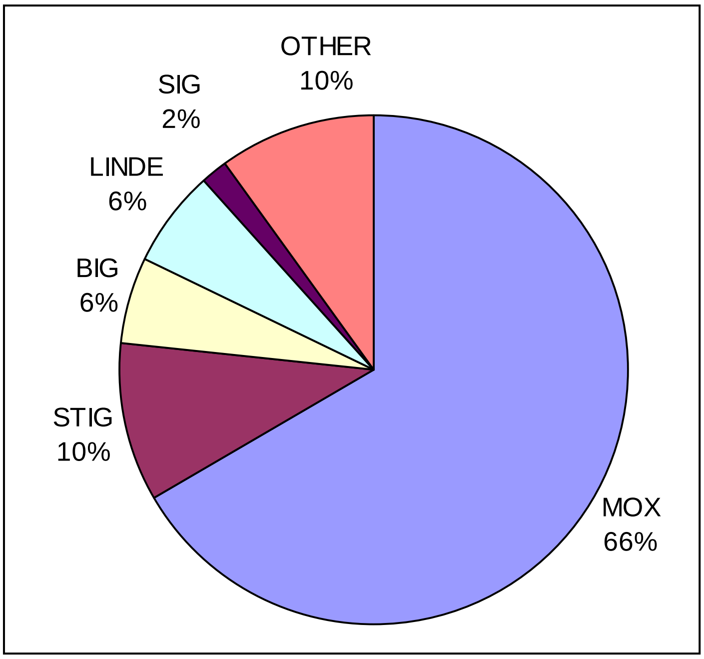

Figure 1.5: MOX's market share and its major competitors.

Tables 1.1 and 1.2 below summarise the range of product and services MOX provide, while Figure 1.6 presents the type of production by sales value.

Table 1.1: Type of products provided by MOX to its customers.

Products	
Industrial gases	nitrogen; oxygen; argon; hydrogen; carbon dioxide; refrigerant; and dissolved acetylene.
Speciality gases	helium; purified gases; gaseous chemicals; laser gases; envirosols; and electronic gases
Equipment and consumables	electrodes; wires; gas equipment and consumables; and special gases equipment

Table 1.2: Type of services provided by to its customers.

Services	
Pipeline installations	industrial; medical; and ultra clean technology (UCT)
On site management	maintenance of on site gas systems for customers

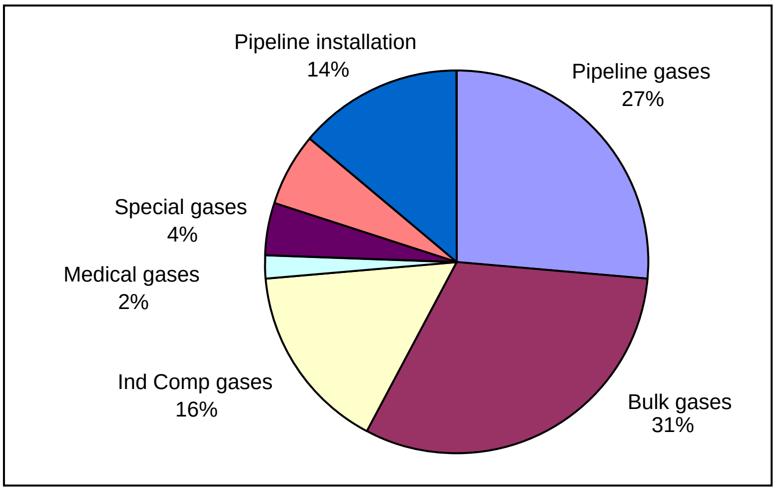

Figure 1.6: Contribution of MOX's sales value by product group.

1.1.2 Corporate Organisation

Adopting the practice of BOC Group, MOX has a corporate structure which is consisted of three Lines of Business (LOB). A LOB is a global organisation created around a set of customers and applications. The three lines of business are:

1. **Process Gas Solutions**: PGS provides global solutions in the tonnage and merchant markets for a range of process industries, notably petrochemicals, metals, food and glass.
2. **Industrial and Special Products**: ISP develops and delivers packaged solutions to markets as diverse as fabrication, medical, scientific and hospitality.
3. **BOC Edwards / Electronic**: BOCE is a market leader in development and delivery of gases, equipment and services to semiconductor, chip packaging and other markets.

The breakdown of the contribution of each LOBs to MOX's turnover are as below and as presented in Figure 1.7.

- Process Gas Solutions : 37% of MOX's total turnover
- Industrial and Special Products : 30% of MOX's total turnover
- Electronics : 33% of MOX's total turnover

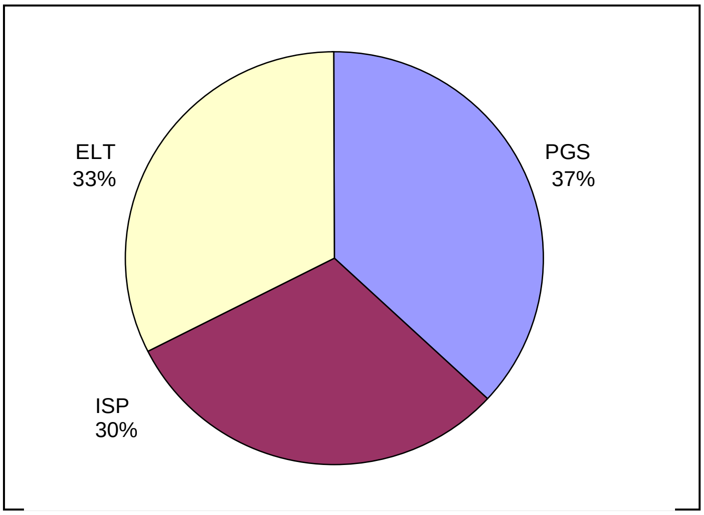

Figure1.7: Contribution of each LOB to MOX's turnover.

The basic principle of MOX organising its business into LOBs is that all customers, field sales team, marketing team and the operational activities are divided into PGS, ISP and BOCE. This segmentation is based on customer application. This is done so that the respective LOB can specialise in understanding and meeting the customers' needs both in terms of buying behaviour and process support. This structure is seen as the optimal way to:

- Best serve the company's customers/markets
- Provide value to the shareholders
- Keep all employees safe and healthy; and
- Protect the community and environment.

The Enabling Functions such as Human Resources Service, Financial Service and Information Management remain stand alone and provide service across all line of business. The role of the enabling functions is to align with Group and Line of Business strategies and provide high quality support in their area of speciality to the business units; and implement and contribute towards best practice. The structure of the organisation is presented in Figure 1.8.

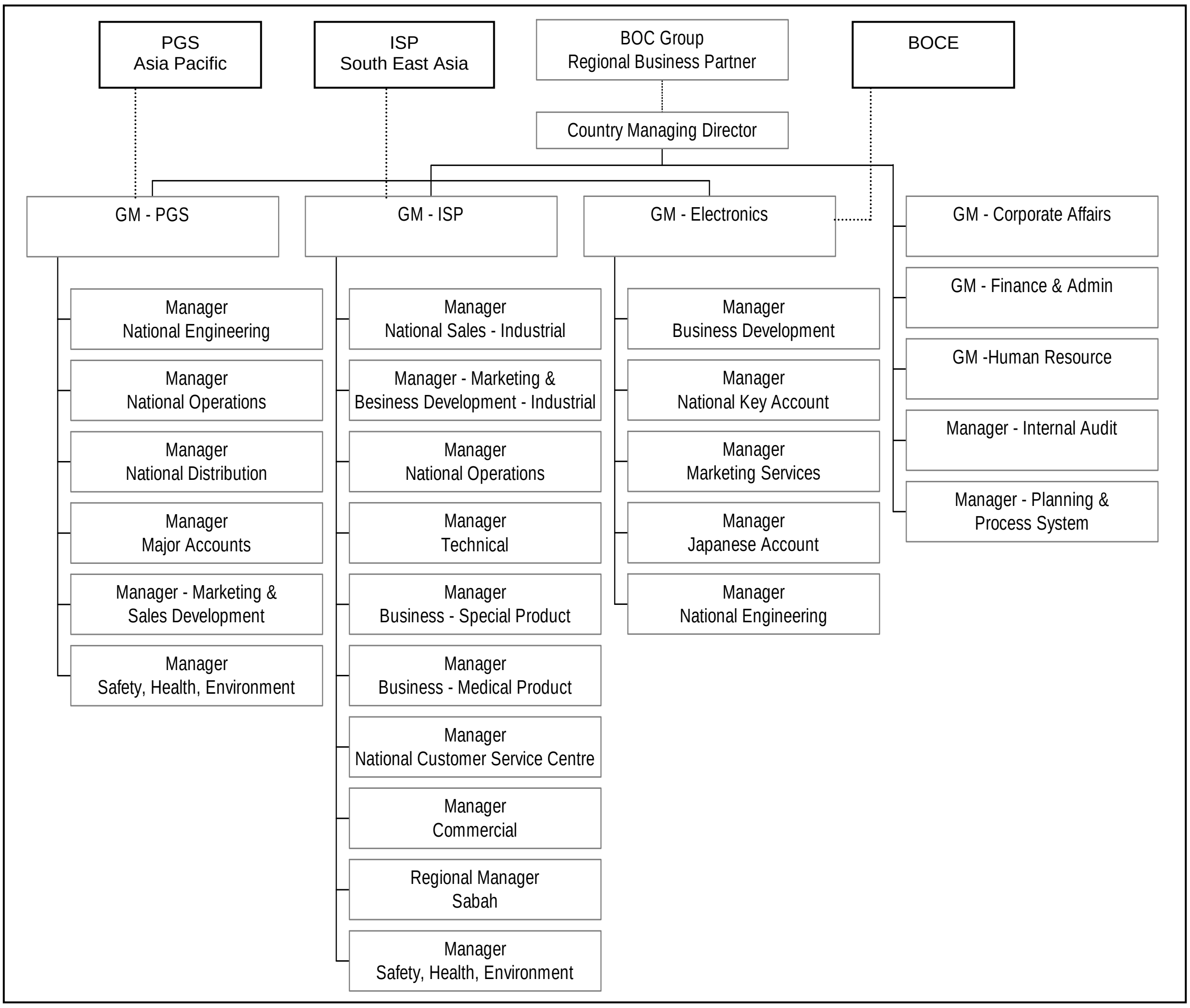

Figure 1.8: MOX's organisation structure

While there are differences in market practices from country to country, basic customer needs around the world are largely the same. The Line of Business structure enables BOC to offer consistent products and services to all the geographies where the organisation do business and provide the following business benefits:

- Customer focus: focusing on distinct groups of customers and applications provides the organisation with a competitive advantage.
- Growth & Efficiency: by setting and executing strategy in a common way globally, the organisation should be able to increase its rate of growth and efficiency.
- Operational excellence: by operating the same line of business globally, it can be more easily identify and share best practice around the world.

1.1.3 Corporate Vision and Mission

BOC Vision is to be recognised as the most customer-focused industrial gases company world wide. They claim that they will achieve this vision through innovation and service created by working together around the globe. With this, the management of MOX has adopted the following vision:

- To be acknowledged as the undisputed market leader and preferred supplier of gases, welding equipment and consumables related product and service for the industrial, healthcare, scientific and electronic markets in Malaysia.
- Recognised as Malaysia’s leading industrial quality service organisation.
- Achieve profitability to meet the aspirations of the shareholders, employees and customers.

In order to achieve the above mentioned visions, MOX has a mission:

> *“To be the undisputed market leader through excellence in customer service, quality, productivity, safety, environment, innovation and integrity, thereby accelerating Malaysia’s Vision 2020.”*

1.1.3.1 MOX Core Values

MOX has a slogan namely “Poised for Growth” showing that MOX is an organisation which urge for improvement. The six common values that drive the team to work towards the ultimate goal can be summarised as CACOWS:

- **C**ommitment and action leading to meeting customer needs and exceeding their expectations.
- **A**chievement of superior results.
- **C**reativity and innovations.
- **O**penness, trust and respect in dealing with people.
- **W**inning as a team.
- **S**afe working practices.

1.1.3.2 MOX Operations Principles

MOX also provides a set of principles outlining how MOX's employees should do their job. These are the principles that should underpin the employees' behaviour, competencies and day-to-day work practices. The principles of ACTS are:

- Believe in **accountability**, where each and everyone knows:
  - What they are responsible for; and
  - What they are empowered to deliver.
- Maximise achievements as a group through **collaboration**, not solely as individuals.
- Expect **transparency** in all dealings, because visible problems can be solved and informed people make better decisions.
- Never be satisfied with mediocrity, aim to **stretch** performance and to push continually the boundaries of what is possible.

1.1.4 Company's Business Performance

Malaysian Oxygen Berhad (MOX) is principally involved in the manufacture and distribution of industrial gases, special gases, medical gases, packaged chemicals, welding product and consumables as well as other related product and services. MOX also provides installation of gas equipment and pipeline system to the industrial, high tech and medical sectors.

MOX is a company with four subsidiaries namely MOX Gases Berhad, MOX Welding Products Sdn Bhd, MOX Shah Alam Industrial Gas Sdn Bhd and MOX Gebeng Industrial Gas Sdn Bhd (refer to Figure 1.9). The principal activities of its subsidiaries are the manufacturing of welding electrodes and industrial gases. The above four subsidiaries are all 100% owned by MOX. Another new subsidiaries which MOX has a 51% of direct holding equity, Duta Ikhtisas Sdn Bhd, is responsible of trading MOX medical products and construction.

Besides, MOX also has business relationship with its four associate companies, which are Eastern Oxygen Industries Sdn Bhd (direct equity holding 49%), Dayamox Sdn Bhd (direct equity holding 40%), Kulim Industrial Gas Sdn Bhd and Johor Industrial Gas Sdn Bhd.

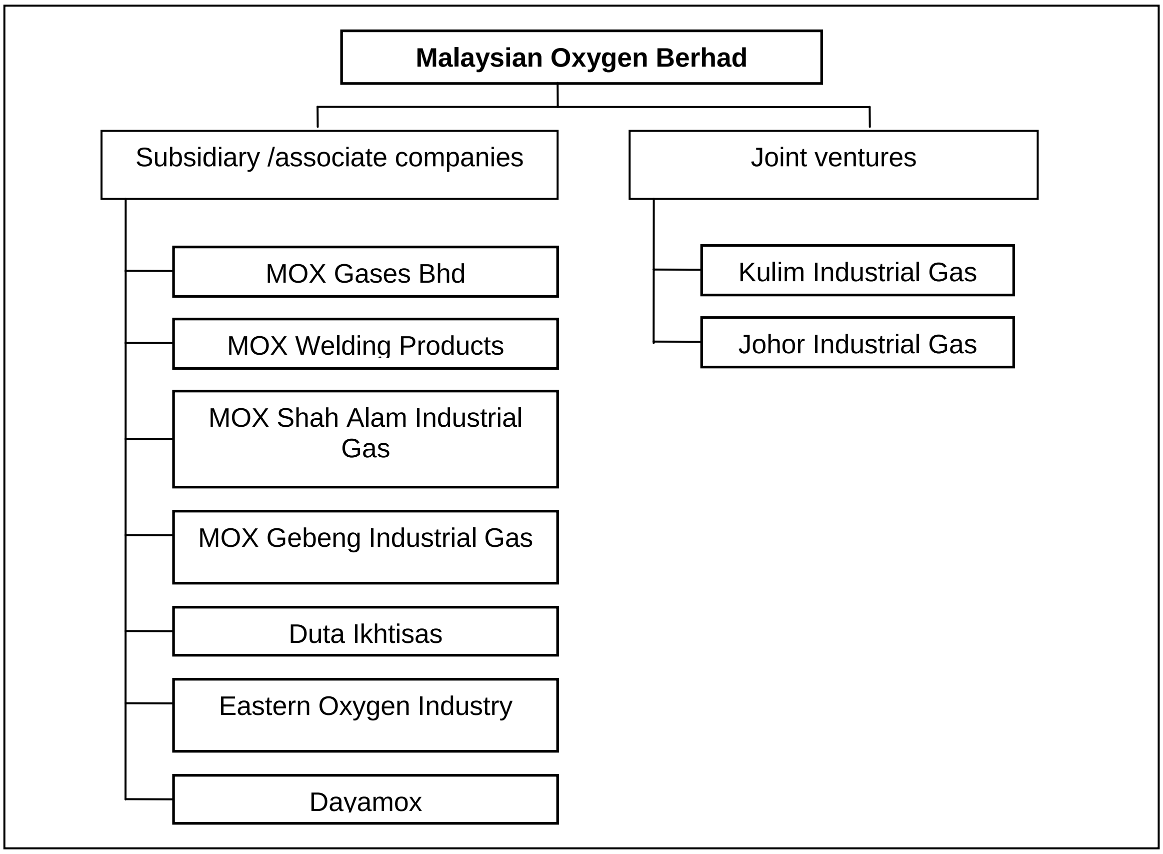

Figure 1.9: MOX and her subsidiaries and joint ventures.

The company has made a significant leap in the year 2002 by acquiring another big market player in the industrial gas industry, i.e. Nissan Industrial Oxygen Incorporated Berhad (NIOI). This represents a business strategy of MOX to strengthen and broaden its customer base through integration. The acquisition was completed 100% on the 17th September 2002 while NIOI was de-listed from KLSE main board and subsequently changed its name to MOX Gases Berhad and become one of the five MOX subsidiaries mentioned above. This total cash purchase consideration was RM217 million @ RM 5.16 per share. With this acquisition, MOX continues to lead in the industrial gas industry by owning 68% of the market share, representing an improvement of 13% from its original 55%.

1.1.5 Company Overall Performance Review

MOX manage to end the year (FY 2003) with revenue of RM 554.5 million, which was about 11% higher than last year. This is another record for MOX, mainly due to the consolidation of NIOI results in the previous year and overall increase in gases revenue.

Profit before tax for the year at RM 141.75 million was RM 12 million (9%) higher than last year (2002) and RM 8 million higher than the year before (2001). The low record of profit before tax for year 2002 was mainly due to the one-off expenses associated to the NIOI acquisition and integration. Profit after tax of RM 109.7 million was 22% higher than last year. Both the revenue growth and improvement in profit was largely attributed to both a successful integration of NIOI (now renamed to MOX Gases Berhad) and the company's ability to continue protect, sustain and grow its well balanced portfolio.

Among the revenue gained in year 2002, 85% were contribution from sales of gases while the remaining 15% were project revenue and sales of other product. From the five years financial statistics reported in MOX Financial Report (see Table 1.3), the Profit Retained in the fiscal year 2001 was among the highest in the company's history. This was a step taken by the management to be ready for the acquisition activity in year 2002.

Table 1.3: MOX 5 years Consolidated Financial Performance.

Five Year Consolidated Results:

	1999 RM'000	2000 RM'000	2001 RM'000	2002 RM'000	2003 RM'000
Sales	358,871	434,742	476,087	499,733	554,527
Profit from ordinary activities before taxation	96,061	110,992	133,937	129,984	141,753
Taxation	-10,033	-43,975	20,348	-40,291	-32,000
Net profit	86,028	67,017	154,285	89,693	109,753
Dividend	-21,537	-40,306	-47,724	-63,448	-66,714
Retained earnings	64,491	26,711	106,561	26,245	43,039

Despite all national as well as global issues, which made the global economics continue to be weak after the global economy down turn in year 1998, the company managed to have consistent growth in term of sales and net profit since year 1999. Total dividend issued also has increased triple since year 1999 to RM 66.7 million in fiscal year 2003. Other summaries extracted from the financial highlights are as below:

Table 1.4: MOX 2003 Financial Highlights

Financial Highlights	***RM ' 000***
Capital expenditure	17,769
Shareholder's funds (year-end)	652,825
Capital employed (year end)	915,161
Return on average capital employed (ROCE)	15.4%
Earnings per share	102.41
Dividend per share	51 sen

The trend of the Sales, Profit before tax and Dividend over the years is presented in Figure 1.10 below.

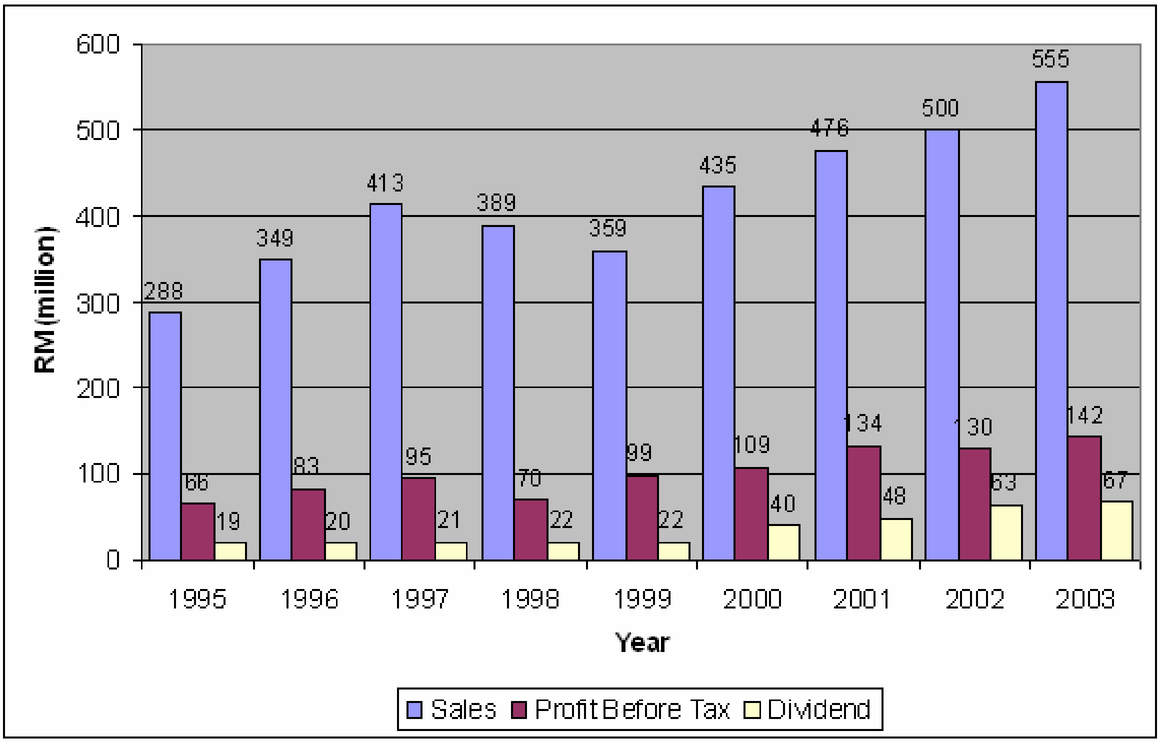

Figure 1.10: MOX's Sales, Profit before tax and Dividend over pass 9 years.

1.2 Project Background

The field of transportation and distribution which once described as the Rodney Dangerfield of the firm, that is, it "couldn't get no respect". The fundamental understanding is that it took engineering genius to produce the product, marketing skill to sell the product, but anyone could get it from point X to point Y. However, in the 1950s, those with foresight planted a seed that field of transportation and distribution was important. A third of a century ago, management guru Peter Drucker even called logistics the last great unexplored continent of business. Since that statement was made, logistics has become a recognised field in many academic institutions. However, since the field is new and just being developed recently, limited research has been done on it. In most of the firm, logistics was viewed as a fragmented and often uncoordinated set of activities spread throughout various organisational functions.

Physical distribution refers to that portion of a logistics system concerned with the outward movement of products from the seller to customer. The prime objective of physical distribution is to ensure that materials and products are available at the right place, at the right time, and in the right quantities to satisfy demand or customers and to give a competitive advantage to the company.

Although Logistics and Supply Chain Management (LSCM) has become common practice across all industries, the topic of Logistics Performance Measurement (LPM) does not receive adequate attention therein. While there are many ongoing research efforts on various aspects and areas of supply chain management as well as performance measurement and management respectively, so far little attention has been given to the performance evaluation, and hence to the measures and matrics of supply chains. In the transportation and distribution sector, as in many others, it is important to have a good performance in operations. As an indispensable management tool, performance measurement provides the necessary assistance for performance improvement in pursuit of supply chain excellence.

The prevailing business model of the new decades was very much based upon the search for greater levels of efficiency in the supply chain. Just-in-time (JIT) practices were widely adopted and organisations became increasingly dependent upon delivery function. The viability of a firm now depends largely on how well it is capable of responding to customer requirements while becoming lean. Hence, the challenge in today's MOX's distribution service is how best to combine 'lean' practices with an 'agile' delivery response. In order to achieve high performance levels, it is necessary to know which operation factors are critical for success and which are less important. Only then, can management focus on those factors that have an effect on performance.

1.2.1 Objective of the Project

As previously mentioned, a supply chain performance measurement system that consists of a single performance measure is generally inadequate since it is not inclusive. Current supply chain performance measurement systems are also inadequate because they rely heavily on the use of cost as a primary (if not sole) measure. More often than not, they are inconsistent with the strategic goals of the organisation, and do not consider the effects of uncertainty. A good performance measurement system is a necessity for a company to grow and sustain industry leadership.

The objective of this project is to understand and assess the measurement system used in today's logistics operations facilities, identify best practice and areas for improvement.

1.2.1.1 Main Objective

To study and understands the existing performance measurement system in MOX Logistics Operations Management (LOM) and identify its drawbacks and suggest improvements in line with the world class practices. A new concept of Performance of Activity (POA) will be adopted to identify and employ performance measures and matrics.

1.2.1.2 Measurable Objectives

1 To identify and define the elements of Critical Success Process (CSP) and determine the related Key Performance Indicators (KPIs).

2 To examine existing performance measurement system against current business requirement.

3 To establish improved performance control and measurement system.

1.2.2 Scope

The study will be focused on physical distribution activity of the company, i.e. 'cylinder distribution'. The four aspects of performance measurement to look into are:

i. Operation performance
ii. Cost performance
iii. Delivery Service performance
iv. Safety performance

The project scope overview is presented in Figure 1.11.

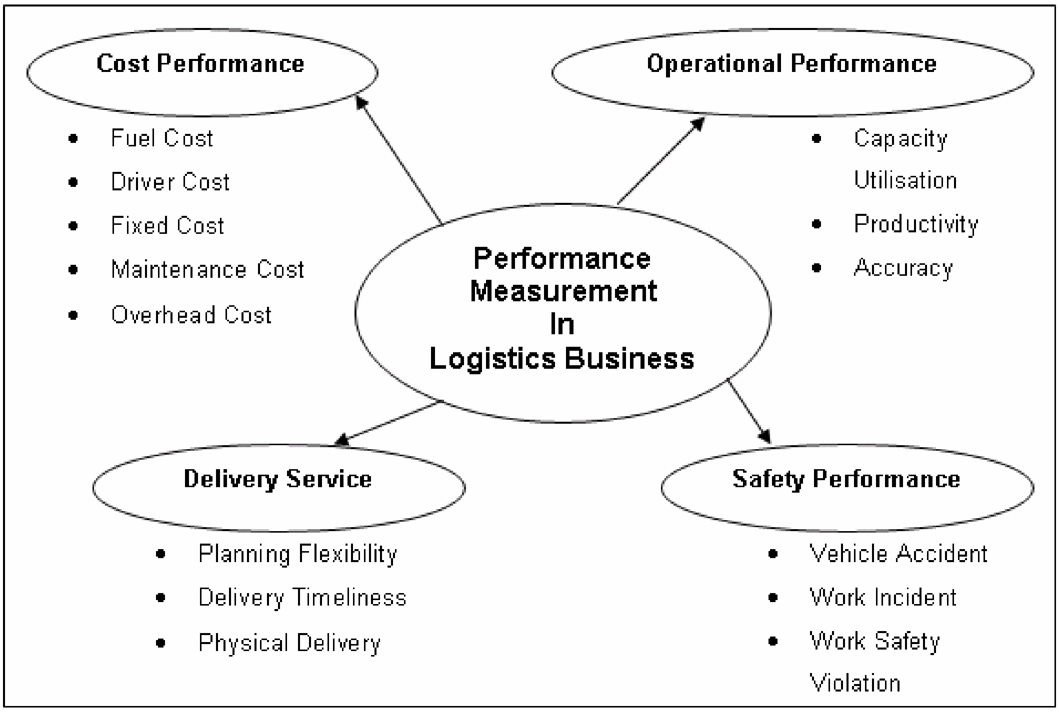

Figure 1.11: Project scope overview.

1.2.3 Benefit to Organisation

As stated earlier, a good performance measurement system supports sound management decisions. A performance measurement system is effective if it provides high quality, reliable, and timely information to influence management decisions and employee behaviour.

A good performance measurement system is a necessity for a company to grow and sustains industry leadership. It is clear that the research will benefit the department as well as company in both short term and long term considerations:

1.2.3.1 Short Term

There are two main short-term benefits to the company after the research has been completed:

1. A complete performance system to provide a better understanding of the department’s performance and helps to identify the strength and weaknesses.
2. Better operating performance and enhanced distribution service will help the company to continue to be the market leader of the industry.

1.2.3.2 Long Term

The working culture of continue improvement will be installed into the company which at the end will benefit the company in terms of revenue as well as other aspects.

1.3 Brief Introduction to the Project

The main purpose of this project is to discuss and review current performance measurement system in Logistics Operations Department in MOX. The author has revised the conventional performance measurement system and its areas of improvement via various means including interview with all levels of employees, discussion with senior management, as well as review previous documentations.

The author has identified that the current measurement of department's Key Performance Indicators in Logistics Operations Department is fragmented and incomplete. The department's performance is solely tied to company's financial performance, which the author feels that it is too broad and tends to get distorted. Identifying these shortfalls of current performance measurement system in MOX, the author has suggested an overall performance metrics to consolidate all the Key Performance Indicators to give a complete view of the department's performance. This metrics then be converted in to a Department Performance Healthcard in which the performance of each KPI will be captured and overall department performance comprises of all KPI will be reported.

The author has also arranged the report in a systematic way so that readers can follow through the report just as if they are undertaking the project. After the introduction to the company background and project background in Chapter 1, the literature review is presented in Chapter 2 while methodology of project in Chapter 3. In Chapter 4, MOX's Logistics Operations function is being reviewed followed by MOX's Performance Measurement system focusing on Logistics Operations activities in Chapter 5. The findings of the project are also mentioned in these two chapters while suggestions on areas of improvement are being discussed in Chapter 6. Chapter 7 will consider some important issues related to implementation. The report will then be wrapped up as a complete presentation in Chapter 8, the last chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Supply Chain and Logistics Operations Management

2.1.1 The Management of Supply Chain

Supply chain management is increasingly being recognised as the integration of key business process across the supply chain; hence a well-organised and well-managed supply chain is important. The Global Supply Chain Forum was defined Supply Chain Management (SCM) as the integration of key business process from end user through original suppliers that provides product, services, and information that add value for customers and other stakeholders.

The editor of a new publication defined SCM as "successful coordination and integration of all those activities associated with moving goods from the raw materials stage through to the end user, for sustainable competitive advantage. This includes activities like systems management, sourcing and procurement, production scheduling, order processing, inventory management, transportation, warehousing and customer service. Product development, operations management, manufacturing operations, and customer service management are also included in the implementation of SCM in leading edge companied, such as 3M, Hewlett-Packard and others. (Cooper et al, 1997)

Every business that manufactures or moves tangible products from place to place faces a similar set of demands from customer: to deliver products faster, reduce inventory, lower operating costs, and deal with increasingly complex orders while meeting wide-ranging customer expectations. However, managing the supply chain is a complicated task as product/service flows and related information, from point-of-origin to point-of consumption is very challenging. Location and network efficiency are always used as competitive weapon to drive down overall operating cost and create value in the supply chain. Houlihan, Jones and Riley stated that the objective of SCM is to "lower the total amount of resources required to provide the necessary level of customer service to a specific segment".

According to Cooper, Lambert and Pagh (1997) in their presentation entitled "Supply Chain Management, More Than a New Name for Logistics", the Supply Chain Management framework encompasses the combination of three closely inter-related elements: the structure of the supply chain, the supply chain business processes and the supply chain management components. It is believed that the combination of these three elements captures the essence of SCM. This is shown in Figure 2.1.

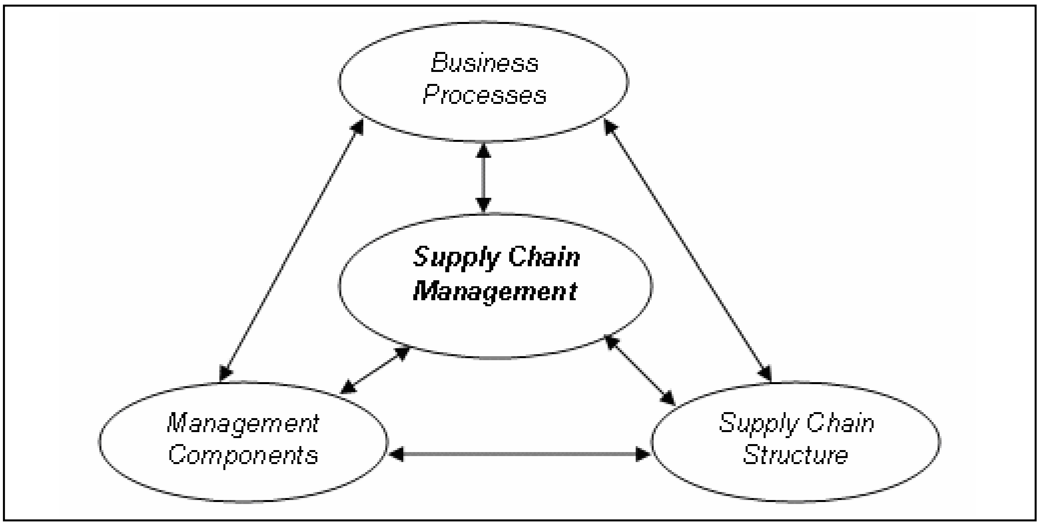

Figure 2.1: The three elements of supply chain management.
Source: Adapted from Cooper, Lambert and Pagh, "Supply Chain Management: More Than a New Name for Logistics," The International Journal of Logistics Management, Vol. 8, No. 1 (1997)

The supply chain structure is the network of members and the links between members of the supply chain. The management components are the managerial variables by which the business processes are integrated and managed across the supply chain while the business processes are the activities that produce a specific output of value to the customer.

a) **Supply Chain Structure:** One key element of managing the supply chain is to have an explicit knowledge and understanding of how the supply chain network structure is configured. (Lambert et al, 1998) The three primary structural aspects of a supply chain structure are: 1) the members of the supply chain, 2) the structural dimensions of the network, and 3) the different types of process links across the supply chain.

b) **Management Components:** An essential underlying premise of the SCM framework is that there are certain management components that are common across all business processes and members of the supply chain. These management components can be divided into two groups, which is the 1) physical and technical group, which includes the most visible, tangible, measurable and easy to change components. 2) Managerial and behavioural components which define the organisational behaviour. (Lambert et al, 1998)

c) **Business Processes:** The definition of process by Davenport is a "structured and measured set of activities designed to produce a specific output for a particular customer or market". A process can also be viewed as a structure of activities designed for action with a focus on end-customers and on the dynamic management of flows involving products, information, cash, knowledge and ideas. In the dynamic world of business, each company had different strategic objectives, hence having different business processes and number of business processes. (Lambert et al, 1998)

The implementation of SCM involves identifying the supply chain members, with whom it is critical to link, what processes need to be linked with each of these key members, and what type/level of integration applies to each processes link. The objective of SCM is to maximise competitiveness and profitability for the company as well as the whole supply chain network including the end customer. (Lambert et al, 1998)

2.1.2 Supply Chain Management Processes

The Global Supply Chain Forum identified eight key processes shown in Figure 2.2, that make up the core of supply chain management, i.e. Customer Relationship Management, Customer Service Management, Demand Management, Order Fulfillment, Manufacturing Flow Management, Procurement, Product Development and Commercialisation, Returns Management. (Cooper et al, 1997) This eight key business processes run the length of the supply chain and cut across firms and functional silos within each firm. Functional silos include Marketing, Research and Development, Finance, Production, Purchasing and Logistics. The typical set up is as the figure 2.2.

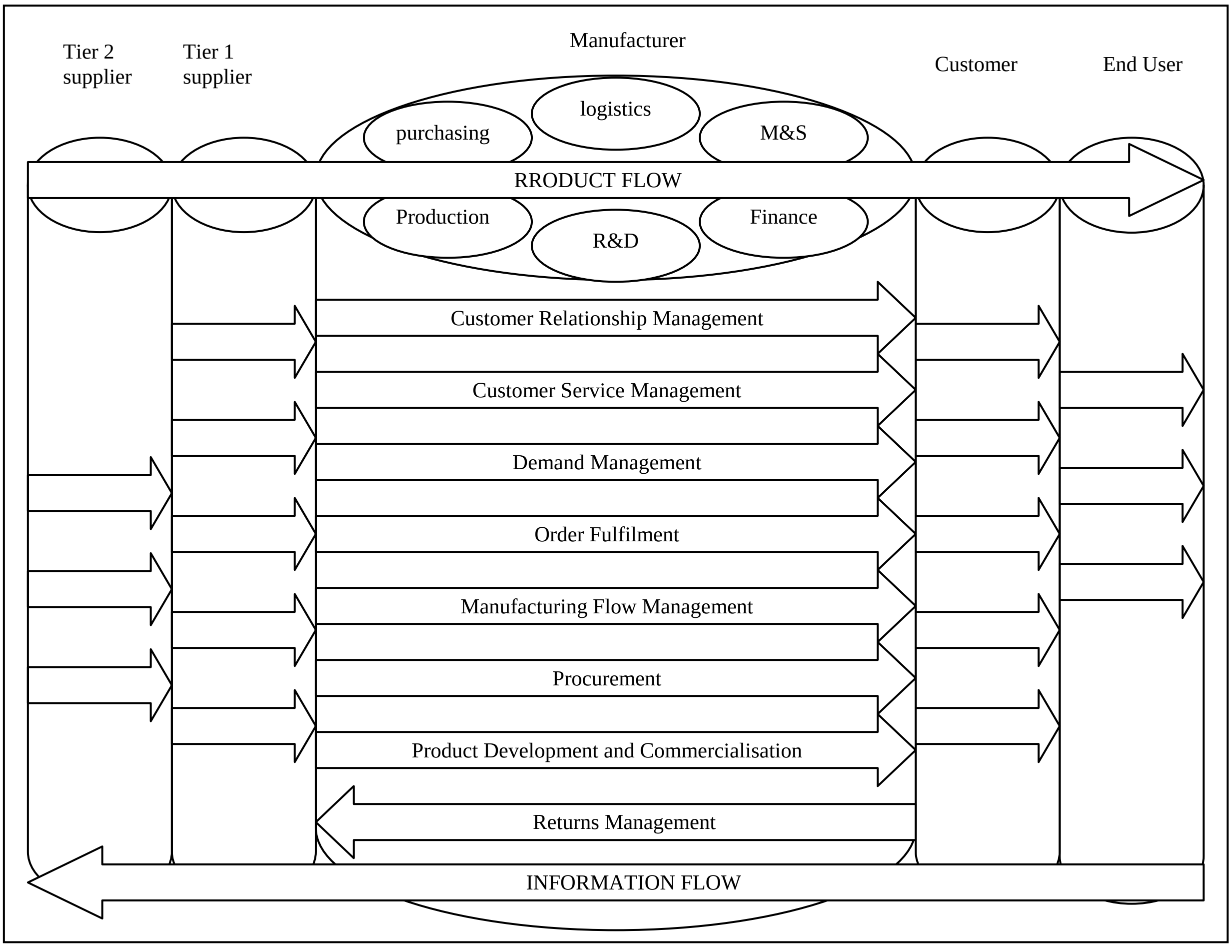

Figure 2.2: Integration of supply chain management processes and organisations functional silos.
Source: Adapted from Cooper, Lambert and Pagh, "Supply Chain Management: More Than a New Name for Logistics," The International Journal of Logistics Management, Vol. 8, No. 1 (1997)

Activities in these processes reside inside a functional silo, but an entire process will not be contained within one function. While management of all firms in each supply chain should consider these eight processes, the relative importance of each process and the specific activities may vary. Next, each of the process will be discussed.

a) **Customer Relationship Management:** The objective of customer relationship management at the strategic level is to identify customer segments, provide criteria for categorising customers, provide customer teams with guidelines for customising the product and service offer, develop a framework for matrics and provide guidelines for the sharing of process improvement benefits with the customers.

Meanwhile, at the operational level, CRM process deals with writing and implementing the Product and Service Offers(PSOs). The customer relationship management process provides the structure for how the relationship with the customer is developed and maintained. Customer teams tailor PSO to meet the needs of customer according to market segmentation. Teams work with key accounts to improve on current processes, smoothen demand variability and eliminate demand variability. (Croxton et al, 2001)

b) **Customer Service Management:** The customer service management process is the firm's face to the customer. It provides the single source of customer information, such as product availability, shipping dates and order status. The objective of customer service management at the strategic level is to develop the necessary infrastructure and coordination means for implementing the PSO and providing a key point of contact to the customer. At the operational level, the CSM process is responsible for responding to both internal and external events. (Croxton, et al, 2001)

c) **Demand Management:** The demand management process needs to balance the customers' requirements with the firms supply capabilities. This includes forecasting demand and synchronising it with production, procurement and distribution. The process is also concern with developing and executing contingency plans in the events that disrupt the balance of supply and demand. In order to find ways to increase flexibility and reduce variability, the process team works with the sales, marketing and manufacturing organisations, customers and suppliers. This process interfaces with customer relation management, customer service management, manufacturing flow and supplier relationship management. (Croxton et al, 2001)

d) **Order Fulfillment:** A key to effective supply chain management is to meet customer requirements in terms of order fulfilment. Effective order fulfilment requires integration of the firm's manufacturing, logistics and marketing plans. The process defines the specific steps regarding how customer orders are: generated, communicated, entered, processed, documented, picked, delivered and handled post delivery. (Croxton et al, 2001) According to Croxton and Keely, the design and operation of the network has a significant influence on the cost and performance of the system.

e) **Manufacturing Flow Management**: The manufacturing flow process deals with making the products and establishing the manufacturing flexibility needed to serve the target markets. The process includes all activities necessary for managing the product flow through the manufacturing facilities and for obtaining, implementing and managing flexibility. This could be categorised into Strategic Sub-Processes which are determine degree of manufacturing flexibility, determine push-pull boundaries, identify manufacturing constrains, determine, manufacturing capabilities and Operational Sub-Processes including developing a master production schedule and last but not least synchronised capacity and demand. (Croxton et al, 2001)

f) **Supplier Relationship Management**: Supplier relationship management is the process that determines how a company interacts with its suppliers. It is a mirror image of customer relationship management. Just as a company needs to develop relationships with its customers, it needs to foster relationships with its suppliers too. At the strategic level, the output of the process is an understanding of the levels of relationships the firm will maintain, and the process for segmenting the suppliers and working with them to develop appropriate PSOs. Once the process team determines the criteria for categorisation of suppliers and the levels of customisation, the operational supplier relationship management process develops and manages the PSOs.

g) **Product Development and Commercialisation:** Developing new products quickly and getting them to the marketplace in an efficient manner is a major component of corporate success. Time to market is a critical objective of this process. As product life cycles shorten, the right products must be developed and successfully launched in ever-shorter timeframes in order to remain competitive. This includes the sub-processes of establish new product project guidelines, develop product rollout issues and constraints, design and build prototypes, make/buy decision, determine product distribution channels and etc. (Croxton et al, 2001)

h) **Returns Management:** Effective returns management is a critical part of supply chain management. While many firms neglect the returns process because management does not believe it is important, this process can assist the firm in achieving a sustainable competitive advantage. Effective management of the returns process enables the firm to identify productivity improvement opportunities and breakthrough projects. (Croxton, et al, 2001) At the operational level, the returns management process is about managing the day-to-day returns activities, initiated by a customer. The subsequent sub-processes including analyses of the return and select appropriate dispositions and post-return credit management.

2.1.3 Logistics Operations Management

Logistics is big business. Its consumption of land, labour, capital and information – couple with its impact on the world's standard of living – is enormous. Curiously, it has only been within the past 35 years that the business community has taken a real interest in logistics. However, during that period, logistics has increased in importance from a function that was perceived as barely necessary to (1) an activity where significant cost saving could be generated; (2) an activity that has enormous potential to impact customer satisfaction and hence increase sales; and (3) a marketing weapon that could be effectively utilised to gain a sustainable competitive advantage. The importance if logistics is now being recognised all over the world. (Lambert et al, 1998)

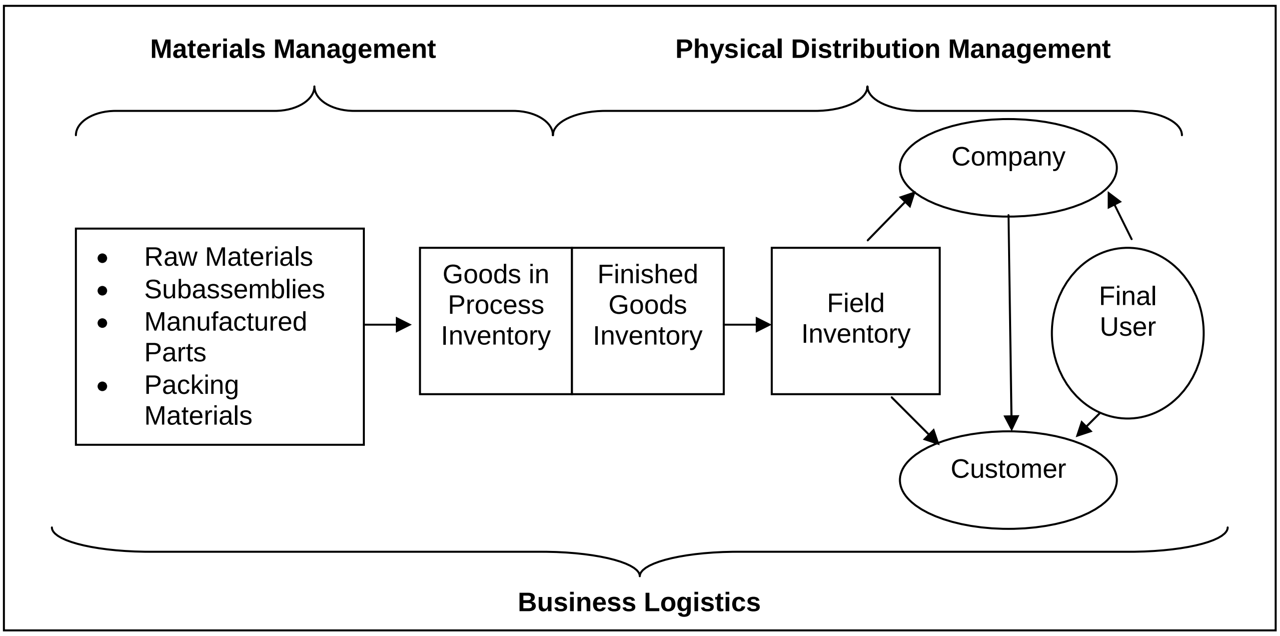

Figure 2.3: About business logistics.

Because logistics is the focus of this project, it is important to establish the meaning of the term. Logistics has been called by many names, including; Business Logistics (refer to Figure 2.3); Channel Management; Distribution; Industrial Logistics; Logistics Management; Material management; Physical Distribution; Quick-response systems; Supply chain management; and also known as Supply Management. What these terms have in common is that they deal with the management of flow of goods or materials from point of origin to point of consumption, and in some case even to the point of disposal.

The Council of Logistics Management (CLM), one of the leading professional organisations for logistics personnel, uses the term logistics management to describe as the process of planning, implementing and controlling the efficient, effective flow and storage of goods, service and related information from point of origin to point of consumption for the purpose of conforming to customer requirements. Logistics is about getting the right items needed for consumption or production to the right place at the right time and in the right condition at the right cost. These five rights of logistics credited to E. Grosvenor Plowman, are the essence of the two utilities provided by logistics: time and place utility. (Lambert et al, 1998) The component of logistics management is presented in Figure 2.4 below.

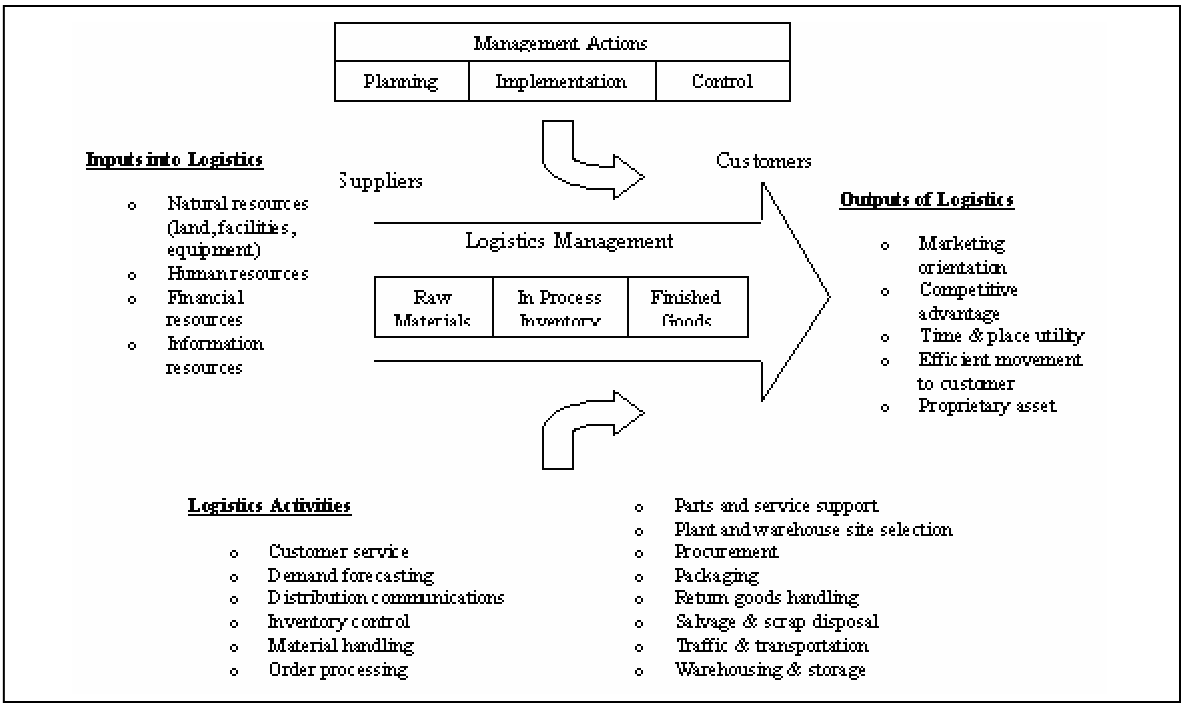

Figure 2.4: Components of Logistics Management

Source: Adapted from Lambert, Stock and Ellram,"Fundamentals of Logistics Management"Pg.5 (1998)

Time utility is the value added by having an item when it is needed. This is closely related to place utility, which means having the item or service available where it is needed. Without both time and place utility, which logistics directly supports, a customer could not be satisfied.

2.1.4 Logistics as a Subset of Supply Chain Management

How is Supply Chain Management different from this definition of Logistics Management? Many of those writing, talking, and offering seminars about SCM are using the words as synonym for logistics. The original use of the term SCM emphasised a reduction on inventory both within and across firms but that initial perspective has been broadening. The CLM definition makes it clear that logistics, properly implemented, was always intended to be from dirt-to-dirt. Other views of SCM include more functions than logistics being integrated across firm boundaries.

In 1998, the Council of Logistics Management modified its definition of logistics to indicate that logistics is a subset of supply chain management and that the two terms are not synonymous. (Cooper et al, 1998) The revised CLM definition is:

> *"Logistics is that part of the supply chain process that plans, implements and controlling the efficient, effective flow and storage of goods, service and related information from point of origin to point of consumption for the purpose of conforming to customer requirements."*

Logistics plays a key role in the economy in two significant ways. First, logistics is one of the major expenditures for businesses, thereby affecting and being affected by other economic activities. Thus, by improving the efficiency of logistics operations, logistics makes an important contribution to the economy as a whole. Second, logistics supports the movement and flow of many economics transactions, it is an important activity in facilitating the sale of virtually all goods and services. (Lambert et al, 1998)

2.1.5 The Outbound Logistics System – Physical Distribution

We will focus our attention upon what was defined as physical distribution or outbound logistics systems. Physical distribution management is an attempt to systematically manage a set of interrelated activities including transportation, distribution, warehousing, finished goods, inventory levels, packaging and materials handling, to ensure the efficiency of delivery of finished goods to customers. (Lancaster) The focus of physical distribution management was to manage finished goods distribution in a way that met customer expectations at the lowest possible cost. In addition to transportation, physical distribution management involves close liaison with production planning, purchasing, order processing, material control and warehousing. All these areas must be managed so that they interact with each other to provide the level of services that the customer demands and at a cost that the company can afford. (Lancaster)

The distribution process begins when a supplier receives an order from a customer. Lead time is the period of time that elapses between the placing of an order and receipt of the goods. This can vary according to the type of product and the type of market and industry being considered. Customer make production plans based on the lead time agreed when the order was placed. Hence, a late delivery is no longer acceptable in most purchasing situations.

There were three reasons why most of the logistics operations management focuses on the physical distribution. These reasons are still valid today for firms seeking to begin a logistics evolution. First, finished goods are the largest single segment of inventory to be managed. Second, because of its proximity, visibility, and frequent contact with customers, finished goods distribution most directly impact customer service expectations and performance. Third, management of finished goods allows intervention in an important process without venturing into production processes or other powerful cost centres of the firm. (Waller, 2002) That is, altering physical distribution management is a low-risk, high-gain endeavour relative to altering other functions.

Although today's logistics concepts and practices are advanced beyond those of the physical distribution stage, managers must remain cognisant of the fundamentals that brought about the stage: focus on high-impact finished goods distribution inventories and operations, as well as careful monitoring and control of the cost-service trade-off. The higher the level of service required by the customer, the higher the cost will be. It is never possible to provide maximum service at a minimum cost. (Lancaster) Having decided on the necessary level of service, a company must then consider ways of minimising costs, which should never be at the expense of, or result in, a reduction of the predetermined service level.

2.1.6 Transportation

Transportation physically moves product from where they are produced to where they are needed. This movement across space or distance adds value to products. This value is often referred to place utility. Transportation is also a factor in time utility, it determines how fast and how consistently a product moves from one point to another. (Lambert et al, 1998)

Transportation moves products to markets that are geographically separated and provides added value to customers when the products arrive on time, undamaged, and in the quantities required. In this way, transportation contributes to the level of customer service, which is one of the cornerstones of customer satisfaction: an important component of the marketing concept.

Transportation usually represents the greatest distribution cost. It is usually easy to calculate because it can be related to weight or numbers of units. Costs must be carefully controlled through the mode of transport selected amongst alternatives. And these must be constantly reviewed. The chosen transportation mode should adequately protect goods from damage in transit. Not only do damaged goods erode profits, but also frequent claims increase insurance premiums and customers' inconvenience, endangering future business.

2.1.7 Customer service

This section examines customer service within a logistics supply chain. While customer service has no single widely used definition, customer service is often viewed in three principal ways. We can think of them as three levels of customer service involvement or awareness. (Coyle et al, 1996)

- *Customer service as an activity.* This level treats customer service as a particular task that a firm must accomplish to satisfy the customer's need. Order processing, billing and invoicing, product returns, and claims handling are all typical examples of this level of customer service. Customer service department, which basically handle customer problems and complaints, also represent this level of customer satisfaction.

- *Customer service as performance measures.* This level emphasises customer service in terms of specific performance measures, such as the percentage of orders delivered on time and complete and the number of orders processed within acceptable time limits. Although this level enhances the first one, a firm must look beyond the performance measures themselves to ensure that its service efforts achieve actual customer satisfaction.

- *Customer service as a philosophy.* This level elevates customer service to a firm wide commitment to providing customer satisfaction through superior customer service. This view of customer service is entirely consistent with many firm's contemporary emphasis on quality and quality management.

The focus upon performance measures for customer service is very important because it provides a method of evaluating how well the logistics system is functioning. Over time, such measurement provides benchmarks to gauge improvement, which is especially important when a firm is trying to implement a total quality management program.

Customer service has multifunctional interest for a company, but from the point of view of the logistics function we can view customer service as having four traditional dimensions: time, dependability, communications, and convenience. (Coyle et al, 1996)

- *Time:* the time factor is usually order cycle time, particularly from the perspective of the seller looking at customer service.
- *Dependability:* to some customer, dependability can be more important than lead-time. That is, a customer needs to have 100 percent assurance of the order delivery time/date.

- *Communications:* the two logistics activities vital to order filling are the communication of customer order information to the order filling area and the actual process of picking out of inventory the items ordered.
- *Convenience:* convenience is another way of saying that the logistics service level must be flexible.

Customer service is a vital component of logistics management. While each activity of logistics management contributes to the level of service a company provides to its customers, the impact of transportation on customer service is one of the most significant. (Lambert et al, 1998) The most important transportation service characteristics affecting customer service levels are (i)dependability – consistency of service, (ii) time in transit, (iii) market coverage – the ability to provide door to door service, (iv) flexibility – handling a variety of products and meeting the special needs of shippers, (v) loss and damage performance and (vi) ability of the carrier to provide more than basic transportation service

2.2 Performance Measurement and Performance Management

The subject of performance measurement is encountering increasing interest in both the academic and managerial ambits. This, for the most part, is due to the broadening spectrum of performances required by the present-day competitive environment and the new production paradigm known as lean production or world class manufacturing. In addition, there is a need to support and verify the performance improvement programmes such as just-in-time, total quality management, concurrent engineering etc. (Toni & Tonchia, 2001)

Well defined performance measure help keep everyone on the same track. A well-defined system of performance measures also improves performance by providing a framework for making decisions. (Kaydos, 1991) When managers clearly understand what is best for the company, the thousands of decisions that must be made every day will be better decisions. Without the proper frame of reference, some of these decisions will be based on false assumptions and personal values.

Objective performance measures help keep everyone honest, even those who may not appreciate it. If increasing performance is seen as an exercise in identifying and solving problems, information must first be available to identify when problems are occurring. (Kaydos, 1991) It is usually easier to ignore problems than solve them but performance measures make it difficult to do that by making them visible.

Performance measures also keep problems in perspective. Consistent measures of performance help managers cut through the clutter and keep them focused on significant problems instead of emotional issues. (Kaydos, 1991) Performance measures can alert managers to opportunities as well as problems, but managers must ask questions and take action to convert opportunities to real benefits.

a) ***Diagnosing problems*:** The most important step in solving a problem is to identify the causes of the symptoms. Performance measures are the only way to get consistent objective information. (Kaydos, 1991)
b) ***Understanding the process*:** Performance measures enable managers to see relationships between variables, providing them with insight into how their production system works that cannot be obtained from any other sources. (Kaydos, 1991)
c) ***Allocating resources efficiently*:** Both subjective and quantitative information is required in making every day’s decision to allocate resources, performance measures can be use as useful estimates and will help put the options in perspective. (Kaydos, 1991)
d) ***Defining responsibility*:** Most job descriptions define responsibilities and tasks but don’t say what “good performance” means. Performance measures can make that very clear and also be constant reminder of what matters most. (Kaydos, 1991)
e) ***Identifying when and where action is needed*:** If managers are going to have good control, they must know when and where to take corrective action. To do this, they need to know (1) how the production system is currently performing and (2) what normal performance looks like. Without performance measurement, deciding what needs attention must be based on subjective judgment. Without timely performance measures too, problems must often reach catastrophic proportions before they can be seen. (Kaydos, 1991)

f) ***Guiding and changing behaviour*:** Performance measures accelerate individual and group development by providing constant feedback. Without good performance information, feedback will be infrequent and probably confusing. (Kaydos, 1991)

g) ***Making accomplishment visible*:** Many jobs simply don't provide the opportunity for people to see their individual achievements. Performance measures can overcome this problem by making visible what is otherwise invisible. (Kaydos, 1991)

h) ***Making delegation easy and effective*:** Without good feedback, on performance, effective delegation is nearly impossible. Performance measures let managers see what is happening while keeping their distance. (Kaydos, 1991)

i) ***Recognising and rewarding performance*:** Managers always talk about rewarding performance, but if you're not measuring performance, it is more likely that appearances will be rewarded instead of accomplishment. Having specific performance measures in place helps assure that the right kind of behaviour is recognised, and rewarded. (Kaydos, 1991)

Performance measurement is essential for achieving and maintaining high levels of productivity ad quality, for good management controlling and planning, and for developing and motivation organisation. But all things considered, the most valuable benefit of proper performance measures is a sound understanding of how the production system works and the forces that drive it. (Kaydos, 1991)

Managers without performance measures for their areas of responsibility are like travellers without a map, pilots flying blind, or doctors without a stethoscope. Managers who do not have adequate performance information for their areas of responsibility are working harder and accomplishing less they could. Hence, if you want to manage performance, you must measure performance.

2.2.1 Conventional Performance Measurement

The literature concerning the conventional performance measurement began in the late 1880s and went through the 1980s. In this phase the emphasis was on financial measures such as profit, return on investment and productivity. Of these performance measures productivity has been considered the primary indicator of performance. The above and other traditional performance measures have many limitations that can be classified into two categories: general limitations due to the overall characteristics and limitations specific to certain traditional performance measures such as productivity or cost. Both of these types of limitations make traditional performance measures less applicable in today's competitive market. (Ghalayini & Noble, 1996)

2.2.1.1 Limitations of Traditional Performance Measures

Traditionally, performance measures have been primarily based on management accounting systems. This resulted in most measures focusing on financial data. Of these performance measures productivity has been considered the primary indicator of performance. The traditional notion of productivity which has been a good indicator of the performance and progress of an organisation also has many limitations. However, the simple forms of productivity are misleading while the aggregate ones are complicated and neglected in practice. There are some extend of contradiction within these measures and performance, a handful of them are as below:

a) **Productivity:** Productivity is mostly concerned with direct labour which is longer a significant portion of cost. Thus, decreasing the cost of direct labour and/or increasing direct labour efficiency do not contribute to the overall performance of the company. (Ghalayini & Noble 1996)
b) **Cost:** Customer's demands have changed, low cost is only one and no longer the most important factor for competing in most markets. Other competitive advantages includes quality, reliable delivery, short lead time, customer service, rapid product introduction, flexible capacity and efficient capital deployment are equally important. (Ghalayini & Noble 1996)
c) **Profit:** it is important to realise that when a company is making a profit this does not necessarily imply that its operations, management and control systems are efficient. Therefore profit as a performance measure can only reveal that there is a problem, but provides little about the nature and the reasons for that problem. (Ghalayini & Noble 1996)

Besides the above argument, Gunasekaran, Patel and Tirtiroglu also stated two major shortfall in most of the performance measurement systems in the logistics companies:

a) Lack of a balance approach between financial performance measures and non-financial performance measures. While financial performance measurements are important for strategic decision and external reporting, day-to-day control of manufacturing and distribution operations is better handled with non-financial measures. (Gunasekaran et al, 2001)
b) Lack of a clear distinction between matrics at strategic, tactical and operational levels. Matrics that are used in performance measurement influence the decisions to be made at strategic, tactical and operational level, hence it is important to have such classification in the performance management system. (Gunasekaran et al, 2001)

Traditional performance measures also have many limitations that make them less applicable in today's competitive market. They are based on outdated traditional cost management systems, lagging matrics, not related to corporate strategy, inflexible, expensive and contradict continuous improvement. (Ghalayini & Noble 1996)

a) Lagging Matrics: Financial reports are usually closed monthly, as a result, the operations managers will always consider financial reports too old to be useful for operational performance assessment.
b) Corporate Strategy: Traditional performance measures have not incorporated strategy.
c) Relevance to Practice: Traditional performance measures are often ignored in practice at the factory shop floor level.
d) Inflexible: Traditional financial reports are inflexible in that they have a predetermined format which is used across all departments. However, even departments within the same company have their own characteristics and priorities.
e) Continuous Improvement: Setting standards for performance measures in general conflicts with continuous improvement, because standards had the effect of setting norms rather than motivating improvement.
f) Customer Requirements and Management Techniques: Traditional financial reports used by middle managers do not reflect a more autonomous management approach since more responsibility and authority is given to shopfloor operators in their work nowadays.

As a summary, traditional financial performance measures of local ratios of indirect to direct labour, absorption and volume variance – are harmful and should be eliminated, since they conflict with attempts to improve quality, reduce inventories and increase flexibility. As a result of the traditional performance measures many researchers have suggested that a new set of operational performance measures should be used. These measures should provide managers, supervisors and operators with on-time information that is necessary for daily decision making. These measures should be flexible, primarily non-financial and able to be changed as needed. Globerson from Neely et. al. (1995) has stated that a performance measurement system of an organisation should include: a set of well defined and measurable criteria; procedures to compare actual performance to standards; and procedures for dealing with discrepancies between actual and desired performance.

2.2.2 Defining the New Concept of Performance Measurement

Performance measurement is a topic, which are often to discuss but rarely defined. Literally, it is the process of quantifying action, where measurement is the process of quantification and action leads to performance, thus:

a) ***Performance measurement*** can be defined as the process of quantifying the efficiency and effectiveness of action.
b) ***A performance measure*** can be defined as a metric used to quantify the efficiency and/or effectiveness of an action.
c) ***A performance measurement system*** can be defined as the set of matrics used to quantify both the efficiency and effectiveness of actions. (Neely et al, 1995)

Even with these definitions, the topic of performance measurement remains a broad topic. Figure 2.5 below shows the framework which highlights the fact that performance measurement system can be examined at three different levels:

a) The individual performance measures;
b) The set of performance measures – the performance measurement system as an entity; and
c) The relationship between the performance measurement system and the environment within it operates. (Neely et al, 1995)

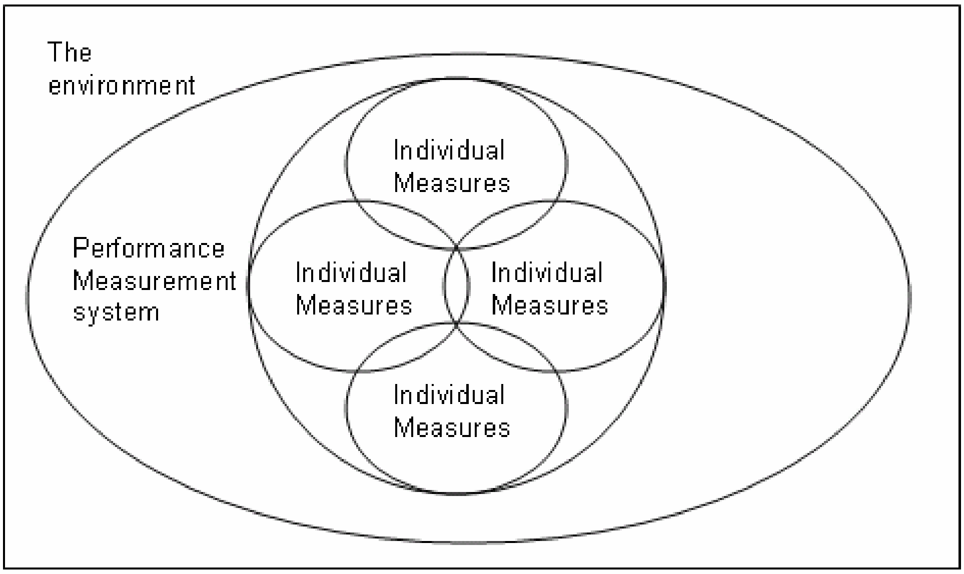

Figure 2.5: A framework for performance measurement system design.

Source: Adapted from: Neely, Gregory and Platts, "Performance Measurement System Design" International Journal of Operations and Production Management, Vol.15, No.4, Pg. 81, (1995)

2.2.2.1 Framework for Individual Performance Measure

The individual performance measures of the operations can be conceptually divided into two: (a) *Cost performance,* including the production costs and the productivity and (b) *Non-cost performance*, regarding the time, flexibility, safety and quality.

There is various ways in which these performance measures can be categorised. The rationale underlying is that performance measures need to be positioned in a strategic context, suits to the environment which it operates. For example, a set of proven relatively good performance measures for a service industry may not be suitable and practicable apply in a manufacturing environment and vice versa. Table 2.1 below has grouped various individual performance measurement aspects into four generic terms quality, time, cost and flexibility.

Table 2.1: The multiple dimensions of quality, time, cost and flexibility.

Quality	**Time**	**Flexibility**
Q1: Performance	T1: Manufacturing lead time	F1: Material quality
Q2: Features	T2: Rate of production introduction	F2: Output quality
Q3: Reliability	T3: Delivery lead time	F3: New product
Q4: Conformance	T4: Due-date performance	F4: Modify product
Q5: Technical durability	T5: Frequency of delivery	F5: Deliverability
Q6: Serviceability		F6: Volume
Q7: Aesthetics	**Cost**	F7: Mix
Q8: Perceived quality	C1: Manufacturing cost	F8: Resource mix
Q9: Humanity	C2: Value added	
Q10: Value	C3: Selling price	
	C4: Running cost	
	C5: Service cost	
	C6: Operating cost	

2.2.2.2 The Performance Measurement System as An Entity

The previous section focused on the individual measures which together constitute a performance measurement system. To examine the performance measurement system as a whole is nevertheless important. Perhaps the best known performance measurement framework is Kaplan and Norton's "Balanced Scorecard" which is based on the principle that a performance measurement system should provide managers with sufficient information to address the following questions as addressed in the Figure 2.6:

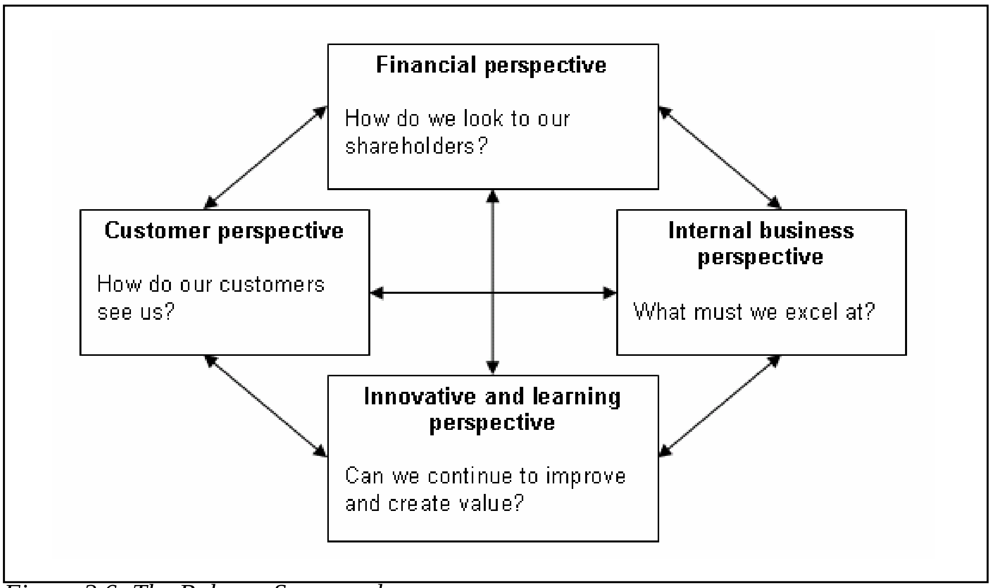

Figure 2.6: The Balance Scorecard

Source: Adapted from Neely, Gregory and Platts "Performance Measurement System Design – A Literature Review and Research Agenda" International Journal of Operations and Production Management, Vol.15, No.4, Pg. 81, (1995) However, other authors prefer to provide criteria for performance measurement system design. For example, Globerson from Neely et. al. (1995) suggests that the following guidelines can be used to select a preferred set of performance criteria: (Neely et al, 1995)

- Performance criteria must be chosen from the company's objectives.
- Performance criteria must make possible the comparison of organisations which are in the same business.
- The purpose of each performance criterion must be clear.
- Data collection and methods of calculating the performance criterion must be clearly defined.
- Ratio-based performance criteria are preferred to absolute number.
- Performance criteria should be selected through discussions with the people involved (customers, employees, managers).
- Objective performance criteria are preferable to subjective ones.

2.2.3 Comparison between traditional and non-traditional performance measures

The Table 2.2 below summarises the comparison between traditional and non-traditional performance measures as discussed in section 2.2.1 and 2.2.2 respectively.

Table 2.2: Comparison between Traditional and Non-traditional Performance Measures.

Traditional performance measures	Non-traditional performance measures
• Based on outdated traditional accounting system	• Based on company strategy
• Mainly financial measures	• Mainly non-financial measures
• Intended for middle and high managers	• Intended for all employees
• Lagging matrics (weekly or monthly)	• On-time matrics (hourly or daily)
• Difficult, confusing and misleading	• Simple, accurate and easy to use
• Lead to employee frustration	• Lead to employee satisfaction
• Neglected at the shopfloor	• Frequently used at the shopfloor
• Have a fixed format	• Have no fixed format (depends on needs)
• Do not vary between locations	• Vary between locations
• Do not change over time	• Change over time as the need change
• Intended mainly for monitoring performance	• Intended to improve performance
• Not applicable for JIT, TQM, CIM, FMS, RPR, OPT, etc.	• Applicable
• Hinders continuous improvement	• Help in achieving continuous improvement

2.2.4 Integrated Performance Measurement Systems

There are few integrated performance measurement systems in order to give an overall view of companies' performance and to guard against sub-optimisation. These integrated systems are appropriate for world-class manufacturing firm in many aspects. However they have some limitations. The following three such systems will be discussed separately. (Ghalayini & Noble, 1996)

a) ***The "SMART" System***

The strategic measurement analysis and reporting technique (SMART) system was developed by Wang Laboratories Inc. as a result of dissatisfaction with traditional performance measures such as utilisation, efficiency, productivity and other financial variances. The objective was to devise a management control system with performance indicators designed to define and sustain success.

The SMART system can be represented by a four-level pyramid of objectives and measures. At the top is the corporate vision or strategy. At this level management assigns a corporate portfolio role to each business unit and allocates resources to support them. At the second level, objectives for each business unit are defined in market and financial terms. At the third level more tangible operating objectives and priorities can be defined for each business operating system (BOS) in terms of customer satisfaction, flexibility and productivity. At the fourth level, the department level, customer satisfaction, flexibility and productivity are represented by specific operational criteria: quality, delivery, process time and cost. As the foundation of the performance pyramid, these operational measures are the keys to achieve higher level results and ensure successful implementation of the company strategy. The SMART performance pyramid is presented in Figure 2.7.

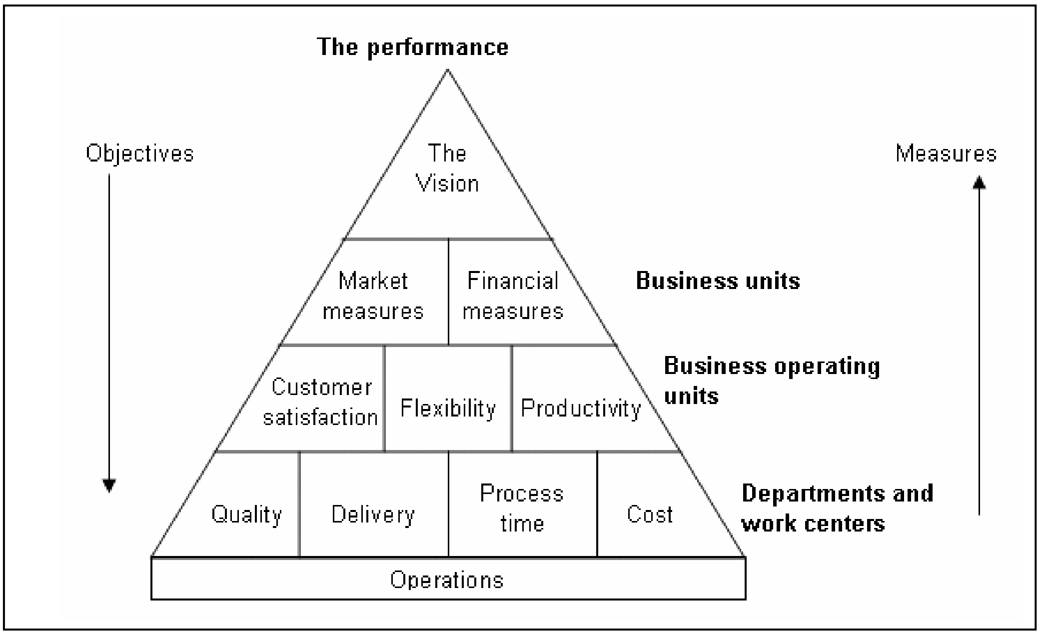

Figure 2.7: SMART Performance Pyramid

Source: Adapted from: Ghalayini & Noble,"The Changing Basis of Performance Measurement", International Journal of Operations and Production Management, Vol 16, No.8, Pg.74, (1996)

b) ***The Performance Measurement Questionnaire (PMQ)***

The performance measurement questionnaire was developed to help the managers identify the improvement needs of their organisation, to determine the extent to which the existing performance measures support improvements and to establish an agenda for performance measure improvements.

The PMQ consists of four parts. The first part provides general data to be used to classify the respondents. Part two of the PMQ assesses the companies' competitive priorities and performance measurement system. It consists of items labelled as "improvement areas". The third part of the PMQ is similar to part two except the focus is on performance factors. The final part of the questionnaire asks the respondents to provide performance measures that best evaluate their own performance and any other general comments.

The results of the PMQ are evaluated in four ways: alignment, congruence, consensus and confusion. Alignment analysis is conducted to investigate in general terms how well a company's actions and measures complement its strategy. Congruence analysis is conducted to provide a detailed understanding of how well the measurement system supports and organisation’s actions and strategy. Consensus analysis is carried out by grouping the data by management level or by functional group. This analysis shows the effect of communication. The goal of the confusion analysis is to determine the extent of consensus (standard deviation) regarding each improvement area and performance measurement.

c) ***The Balance Scorecard***

The Kaplan and Norton’s balance scorecard is a framework for an integrated performance measurement system for strategic, operational and financial measures. The balanced scorecard provides answers to four basic questions: How do our customers see us? (customer perspective); What must we excel at? (internal perspective); can we continue to improve and create value? (innovation and learning perspective); and How do we look to shareholders? (financial perspective).

For each of the above perspectives goals are set by the managers. Similarly, specific measures are specified in order to achieve each goal. The balanced scorecard has two main strengths. First, it summarises in one management report many of seemingly disparate elements of a company’s competitive agenda. Second, it prevents sub-optimisation by forcing senior management to consider all operational measures at the same time.

2.2.4.1 Analysis of the existing integrated performance measurement systems.

The three integrated performance measurement system discussed have some strengths and weaknesses relative to each other. (Ghalayini & Noble, 1996) These are presented in Table 2.3.

Table 2.3: Strengths and weaknesses of integrated performance measurement system.

	Strengths	Weaknesses
SMART System	• Integrate corporate objectives with operational performance indicators.	• Does not provide any mechanism to identify key performance indicators for quality, cycle time, cost and delivery. • Does not explicitly integrate the concept of continuous improvement
PMQ	• Provides a mechanism to identify the improvement areas of the company and their associated performance measures. • It determines the extent to which the existing measurement system support improvement areas.	• Cannot be considered comprehensive integrated measurement system. • More work is required to link these areas of improvement and performance measures to the factory shopfloor. • Does not explicitly integrate the concept of continuous improvement
Balanced Scorecard	• Integrate four important performance perspectives in one simple and easy-to-use management reports.	• It is primarily designed for senior managers to provide them with an overall view of performance, thus not intended for, nor applicable at, the factory level.

In summary, the existing integrated measurement systems have the following limitations: (Ghalayini & Noble, 1996)

- They are mainly constructed as monitoring and controlling tools rather than improvement tools.
- They do not provide any mechanism for specifying which objective should be met in a specific time horizon.
- They are not dynamic systems. They do not allow any systematic revision of critical areas, performance measures, historical data, decisions and outcomes.
- They do not look ahead to predicting, achieving and improving future performance. They are only concerned with present performance.
- They do not provide any mechanism to achieve global optimisation especially at the operational level.

- Most of these systems do not stress the importance of time as a strategic performance measure.
- They do not provide a specific tool that could be used to model, control, monitor and improve the activities at the shopfloor.

2.2.5 Measuring, Managing and Maximising Performance

Quality and productivity are examined in broad terms and are viewed as two different dimensions of what everyone calls performance. Therefore, the general problem is performance management and improvement. If you are going to manage performance, you must first define what it means. Then by measuring performance and the factors that affect it, a logical approach can be taken to improving it. (Kaydos, 1991)

2.2.5.1 Understanding Productivity

In spite of all the attention given to productivity, the true meaning of the word has been generally overlooked. Most people assume productivity means units per labour hour, and most people are wrong. Taking a narrow-minded viewpoint on productivity or quality ignores other issues which may be far more important. Factors such as short order lead times, on-time deliveries, being able to handle a complex product mix, and high quality can be much more important in the marketplace. Working on the wrong priorities will waste resources and miss opportunities. Any efforts to improve productivity must be directed at increasing the total performance of a business, not just the performance of a few of its parts. (Kaydos, 1991) That must start with the customer.

Productivity is defined as output divided by input. Simple enough, but the big question is: “what output do you want?” a better question is: “what outputs do your customers want?” after all, if you are efficiently making what the market doesn’t want, that can hardly be considered productive. If you want to improve productivity, the first thing to do is make sure you are going after the right outputs – what your customer wants.

2.2.5.2 Understanding Quality

Quality has several meanings depending on the customer's needs and wants. In the ideal situation, what is delivered conforms to the specification and exceeds the customer's expectations. These quality factors can be lumped into two broad categories – design quality and execution quality. Design quality reflects the functions, feature and aesthetics of a product. Increasing design quality generally raises product cost because better materials, more materials and more labour are required in the product. Execution or conformance quality reflects how well a product meets its specifications. In our discussion of measuring performance, quality of conformance is the only concern. (Kaydos, 1991) Understanding that quality means conforming to requirements and that the customer is the source of these requirements is the first step on the road to improving the performance of any business function.

2.2.5.3 The Relationship between Quality and Productivity

Quality and productivity are different dimension of a higher level measure that could be called "performance" or "effectiveness". These two factors are strongly related because they both come from the people and machines that make up a production system. As quality increases, productivity increases – not the other way round.

It is always dangerous to accommodate any quality issue, be it only a small problem. This is because after operating with quality problems for a period of time, the current performance level becomes acceptable unless someone decides better results are possible. It is patently wrong thinking that any problem is not worth the effort to solve it. That kind of thinking only leads to the development of thousands of little problems that slowly bleed a company to death.

All productivity problems are ultimately caused by poor quality. (Kaydos, 1991) Managers who want to improve productivity should not think only in terms of speeding up processes and making people work harder. Those are valid considerations, but managers will get better results if they start working on increasing the quality of raw materials, improving the reliability of equipment, improving the skills of people, and reducing the barriers to doing the job right the first time. When process quality increases, so does product quality and productivity.

2.2.6 Measuring the Performance

Identifying key performance factors is important, but that alone will not give managers the information they need to improve performance. Like everything that works well, an effective performance measurement system is the result of good initial design and then development through trial and error. Good performance measurement systems are developed, not designed. A good system is one which provides a manager with timely, reliable information which is relevant to the decisions he or she has to make. If an information system doesn't meet this test, it isn't worth much no matter how sophisticated it may be. The key to having a cost-effective performance measurement system is to measure everything that matters and not much else.

2.2.6.1 Operational Requirement for an Effective Performance Measurement System

The quality of any decision is limited by the information available when it is made. Managers at all levels need performance information to make good decision about when and where action is needed. Department managers and supervisors especially need timely performance information about their area of responsibility, since that is most often where something can be done to minimise problems and improve the production process.

Unfortunately, meaningful information at the actionable level is always often missing. As a result, management is often blissfully unaware of many problems and potential opportunities.

Accounting system alone cannot fill all of management's need for information, especially when it comes to improving quality and productivity. By themselves, accounting systems are not complete management information systems even though that misnomer will probably exist forever. It is more than a question of semantic: by no stretch of the imagination can current accounting systems provide managers with all the information they need to make timely and effective decisions. Accounting systems must be supplemented with systems that measure operational performance.

Measuring all the right variables in a production system is the first condition for an effective performance measurement system, but it is not enough. To be effective, it will also have to meet the following requirement: (Kaydos, 1991)

a) *Validity:* The performance measures must be valid. That is, they must measure what counts and be accepted and understood by the users.
b) *Completeness:* the productivity and quality measures must be designed to prevent people from doing the wrong things as much as it will guide them to do the right things. It must be "closed" in the sense that it considers all aspects of the balancing act that have to be performed.
c) *Sufficient detail:* it is no use to have something measured and recorded but the information is not detailed enough to make any conclusion/decision. The purpose of measuring performance is to take action of improvement, hence data recorded must be relevantly sufficient in assisting decision making process.
d) *Accounting for the performance gap:* the measurement system must account for at least 80 percent of the gap (or variation) between actual and desired or normal performance. If you can't explain the gap, you haven't identified all the significant causes of the variations in the output of the production systems.
e) *Sufficient measurement frequency:* if measurements are not taken often enough, a distorted picture results. Increasing the sampling frequency presents a truer picture. There is no disadvantage to measure more frequently than needed, it only increases costs.
f) *Timeliness:* having the right information is one thing, having it when you need it is quite another. Time lag is important because too much delay between a stimulus and the corresponding response makes learning difficult.
g) *Useful accuracy:* highly accurate Figures are generally not required for performance information to be useful. Being consistent and reasonably accurate is all that is needed to have useful performance information.
h) *Easily understood terms:* the measures used must be easily understood by the people using them. Translating quality or production problems into cost, lost wages or benefits can help people appreciate the cost of poor performance, but it is better to use familiar terms for day-to-day communications.
i) *Accountability:* while accountability is not a property of a performance measurement system, the system will not be of much value unless there is strict accountability for each and every measures. This means that one and only one person is assigned to responsibility for each measure.

j) *Trust and credibility:* the output of an information system can be no better then its input. If the people in an organisation do not trust each other, then the data reported and the information exchanged will be filtered or distorted.

2.2.6.2 Measuring Key Performance Factors

Achieving maximum performance or something close to it should be every company's objective, but the hard fact of life is that you can't have it all. No company has the resources to be all things to all people and some desirable objectives are inherently conflicting. Without a clear definition of company strategy and what performance means for each department to support that strategy, there is a real danger of sub-optimisation. This occurs when department objectives are not consistent with the needs of the total company and each other. Maximum performance of the whole does not result from trying to independently maximise the performance of each of the parts.

Achieving maximum performance is a balancing act, not a simple problem of optimising one variable. Management must determine the most important factors for the entire company and assign departmental objectives and performance measures which are consistent with them.

Like companies, departments should also have key performance factors. Poorly defined key performance factors result in goals that keep changing from week to week. Maximising the total productivity of a business is a delicate balancing act that must be accomplished by management. Maximum performance can only be achieved if a department has specific performance measures that reflect the company's key performance factors. (Kaydos, 1991)

2.3 Logistics Operations Performance Management

Organisational performance can be measured against many criteria. It is vital that management identify the measures of organisational effectiveness it wishes to utilise, and to single out them in order of priority. The selection of particular measures of logistics organisational effectiveness depends on a firm's characteristics and needs. Perhaps the most difficult process is developing the techniques or procedures needed to measure the criteria of effectiveness.

2.3.1 Measuring and Selling the Value of Logistics

In the logistics and transportation sector, as in many others, it is important to have a good performance level in operations. In order to achieve high performance levels, it is necessary to know which operational factors are critical for success and which are less important.

In order to receive adequate rewards for the firm's innovations and performance in logistics, managers also have to measure and sell the value that is being provided to customers. Financial measurements such as total cost analysis only capture part of the value created by logistics. One of the problems faced by logistics professionals over the years is that logistics has been viewed simply as a cost that needs to be reduced.

It cannot be taken for granted that customers will understand the value being provided and be willing to compensate the supplier for it. Customer must be shown on a regular basis the value that is being created by logistics, and so must top management within the organisation. It is easy for management within the firm to ignore logistics and to underestimate its importance when logistics is performing well. For this reason, logistics managers must measure and sell the value created by logistics internally as well as externally throughout the supply chain. (Lambert & Burduroglu 2000)

There are few aspects of logistics performance and will be discussed separately below:

2.3.1.1 Delivery Performance: Definition and Measurement

In any typical delivery distribution mode, the delivery channel, vehicle scheduling, and warehouse location play an important role in delivery performance. An increase in delivery performance is possible by selecting suitable channel, scheduling and location policies. The most important aspect of delivery performance is on-time delivery. This determines whether a perfect delivery has taken place or not, and it acts as a measure of customer service level. (Gunasekaran et al, 2001) The following five aspects are identified as the measures of delivery performance:

- Delivery-to-request date;
- Delivery-to-commit date;
- Order fill lead time;

- Goods in transit;
- Partial delivery; and
- Undelivered

Another aspect of delivery service, which is the flexibility of delivery systems to meet particular customer needs, reflect customer satisfaction, hence is wise to be taken into consideration while developing the measurement matrics. Nowadays, the delivery systems are becoming more flexible towards customer needs. By being flexible, a delivery system can positively influence the decision of customers to place orders, and hence, this can be regarded as a metric for winning and retaining customers.

Like other activities, delivery heavily relies on the quality of information exchanged. Thus, the quality and the way information is presented determine the delivery performance to a large extent, which, therefore, can be used to measure and improve performance.

2.3.1.2 Customer Satisfaction

As customer place demands on suppliers for more value-added service, it is becoming increasingly important to be able to measure the value of these services in terms that are meaningful to the customer. Failure to do so will result in erosion of profitability since it will cost to provide the services to customer, but the firm may not receive adequate compensation for these services. (Lambert & Burduroglu, 2000)

Customer satisfaction occurs when business successfully fulfill their obligations on all components of the marketing mix: product, price, promotion and place. The place component represents the manufactures expenditure for customer service, which can be thought of as the output of the logistics systems. (Lambert & Burduroglu, 2000) There are at least four reasons why companies should focus on customer service:

a) satisfied customers are typically loyal and make repeat purchases;
b) it can be up to five times as costly to attract a new customer as it is to keep an old one;
c) customer who decide to defect are very likely to share their dissatisfaction with others and

d) it is more profitable to sell more to existing customers than it is to find new customers for this same level of sales increase.

Customer satisfaction measures are the less quantitative in financial terms as compared to other performance measurement. However, it is a critical measurement because it allows management to align the company's service package with customer's needs. Higher levels of service can have direct impact on customer's financial performance through higher revenues as well as lower cost as a result of better service.

While there are a number of approaches to the measurement and management of customer satisfaction, it is generally considered best to measure the firm's performance relative to specific competitors and identify gaps that represent opportunities for differentiating the company. Usually, customer satisfaction measures are collected using surveys. Prior than that, customer service audit can be used by management to identify the elements of service that are important in customers' purchasing decision, and to evaluate the level of services being provided by each of the major suppliers in the market. (Lambert & Burduroglu, 2000)

2.3.1.3 Total Distribution Cost

Perhaps the most important research concerning logistics that is going on is in the area of designing efficient and cost – effective distribution systems. Therefore, a thorough understanding and a good performance evaluation of total distribution cost are essential. A profile consisting of various distribution cost elements should be developed so that appropriate trade-offs can be applied as a basis of planning and reassessment of distribution systems, and thus, the overall cost effectiveness can be achieved. The total distribution cost is presented in Figure 2.8.

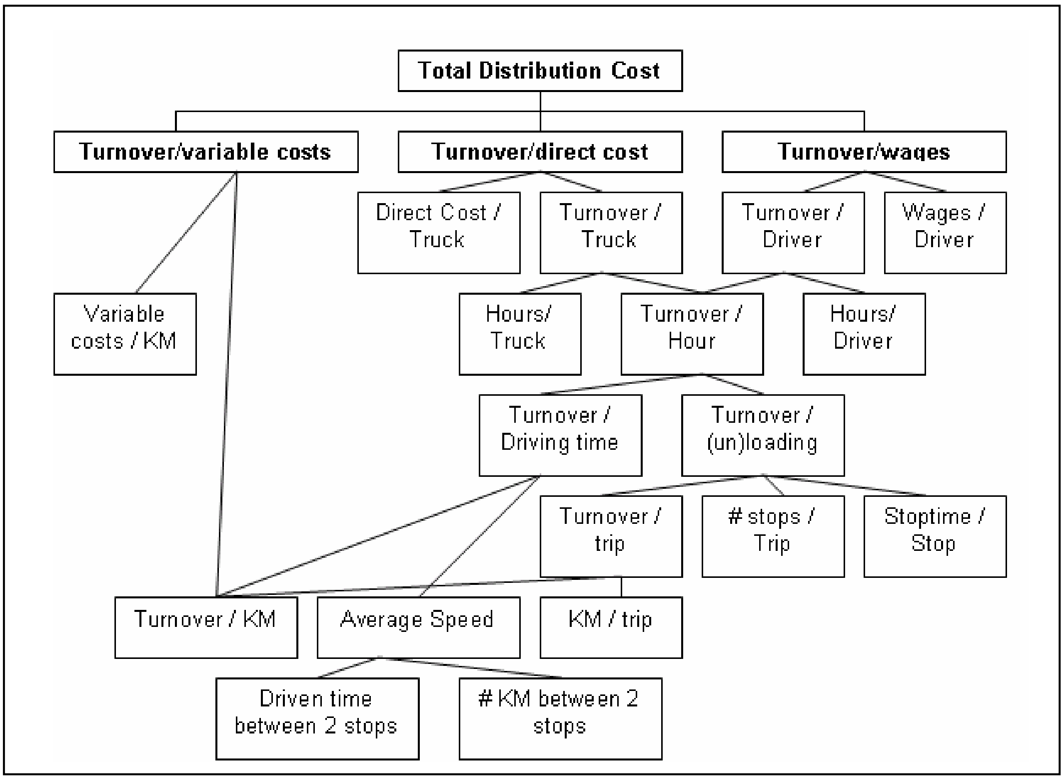

Figure 2.8:Total Distribution Cost Model

Source: Adapted from: Donsellar, Kokke & Allessie, "Performance Measurement in the Transportation and Distribution Sector" (1998)

According to Thomas and Griffin (1996), the single largest cost component of logistics is transportation cost, often comprising more than half of the total logistics cost. To reduce the delivery cost, this total should be treated as a metric id high priority. However, there is an argument that in distribution service, the operational accent lies on stopping and not on driving, which means a large part of the performance is determined by stopping operations such as the number of stops per trip and the stop-time per stop. (Donsellar et al, 1998) The total distribution cost model is shown in Figure above.

2.3.1.4 Productivity standard

Logistics cost can be controlled by the use of productivity ratios. These ratios take the form of:

$$\text{Productivity} = \frac{output}{input}$$

Productivity ratios for transportation might include:

$$\text{Productivity} = \frac{ton\ miles\ transported}{total\ actual\ transport\ \cos t}$$

$$\text{Productivity} = \frac{stops\ served}{total\ actual\ transportation\ \cos t}$$

$$\text{Productivity} = \frac{shipments\ transported\ to\ destination}{total\ actual\ transportation\ \cos t}$$

Productivity measures of this type have been developed for most logistics activities. In the absence of a standard costing system, they are particularly useful with budgetary practices, because they provide guidelines on operating efficiencies. Furthermore, such measures are easily understood by management and employees. However, productivity measures are not without their shortcomings:

1. Productivity measures are expressed in terms of physical units and actual dollar losses caused by inefficiencies, and predictions of future logistics cost cannot be made. This makes it difficult to cost justify any system changes that will result in improved productivity.
2. The actual productivity measure calculated is seldom compared to a productivity standard. Without work measurement or some form of cost estimation, it is impossible to know what the productivity standard should be in efficient operations.
3. Changes in output levels may in some cases distort measures of productivity. This distortion occurs because the fixed and variable elements are seldom delineated. Consequently, the productivity measure computes utilisation, not efficiency.

2.3.4 Logistics Performance Indicators

Certain performance indicators can serve practically as an impetus for continual improvement. Logistics analysis is therefore based in the main upon appropriate performance indicators. These values are meant to show the degree to which enterprise goals are fulfilled or not fulfilled. Logistics performance indicators analysed the effect of logistics an enterprise goals in the four targets of quality, cost, delivery and flexibility.

Whenever possible, a logistics performance indicator will give direct indication of fulfilment of one of the individual goals within a goal area. A performance indicator relates to a logistics object and thus becomes an attribute of that object – and sometimes becomes a logistics object in its own right.

In actual practice, the measuring of logistics performance indicators varies in difficulty and usually requires that certain aspects be counted. It is not always possible to assess these aspects without expending a lot of time and energy. In addition, integrating and compressing the performance indicators of single events into global performance indicators, covering several levels for example, can be very problematic.

The following sums up central problems in terms of the meaning and practical applicability of performance indicators in the form of practical methods. The problems are typical of any quality measurement system and, in part, costing systems as well.

- *General performance indicators:* Simple, measurable performance indicators are often so general and qualitative in meaning that no practical steps can be derived from them without making additional, non-quantitative, and implicit assumptions. An example of such a performance indicator is customer satisfaction.
- *Lack of comprehensive measurement methods:* Simple, applicable performance indicators often cannot be measured directly. They require various, sometimes complicated or inexact measurements that are then combined with non-measured, implicit methods to yield the desired performance indicator. A good example is flexibility potential.
- *Distortion of the process:* Each measurement affects the process being measured. The disturbance can be so great that the process would behave differently under non-measurement conditions.
- *Meaning of the performance indicators:* The absolute value of a performance indicator has little meaning as such. Only repeated comparison of measurement of the same performance indicator over time can make the performance indicator an instrument of a continuous improvement process.
- *Comparability of performance indicators:* Benchmarking, the measuring of a company's products, services, costs etc. against those of competitors, has meaning only

if the competitor has used the same bases of measurement. In practice, it is common to find different reference objects, the objects to which certain performance indicators refer. As example is service level.

- *Practical applicability in logistics networks:* All of the important performance indicators can be applied in the total logistics networks as well as in the individual company. Because the companies forming a logistics network follow the same principal goals, logistics performance indicators should be comparable in the main.

It makes sense to weigh the value of the potential application of the measurement against the expenditure in time and effort required by measurement. In the world of practice, a few, simply measured performance indicators have proven worthwhile. Employees then must apply the measurement using a multitude of means that cannot be directly derived from the measurement.

2.3.5 Methods to Control Logistics Performance

Logistics cost may exceed 25 percent of the cost of doing business at the manufacturing level. For this reason, better management of the logistics function offers the potential for large savings, which can contribute to improved corporate profitability.

In the past, various financial performance indicators were seen as relevant management information; today management needs additional performance indicators. Insufficient accounting information is a significant problem in most firms. Many of the problems encountered by manufacturers result from the use of a full costing philosophy that allocates all indirect cost to each product or customer group on some arbitrary basis. As a result, companies use management controls that focus on the wrong targets: direct manufacturing labour or sales volume.

Most managers do not know the true cost of their company's products or services, how to reduce expenses most effectively, or how to allocate resources to the most profitable business segments because of the following factors:

a) Accounting systems are designed to report the aggregate effects of a firm's operations to its stockholders, creditors, and governmental agencies.

b) Accounting costs are computed to provide a historical record of the company's operations. All of the firm's costs are allocated to the various business segments. Because cost common to multiply segments are allocated, the process is necessarily subjective and arbitrary.

c) Accounting systems typically record marketing and logistics cost in aggregates natural accounts, and seldom attempt to attach the cost to functional responsibilities and to individual products or customers.

d) Profitability reports do not show a segments contribution to profitability, but include fixed cost, joint product or service cost, and corporate overhead cos. Top management often encourages this approach because it fears that knowledge of variable cost will lead to unrealistically low price. In most cases, however, prices are set by the marketplace, not on the basis of cost.

e) In most standard cost systems, fixed cost are often treated the same as variable cost, which masks the true behaviour of the fixed costs.

The need for operational performance indicators and information about the connection between these indicators and the financial performance indicators is growing. One of these reasons in the emphasis of many firms on continuous improvement. To improve the economic performance one has to know which factors influence the performance.

Logistics performance measurement selection is a critical step in the design and evaluation of any system. It can be monitored by using standard cost, budgets, productivity standards, statistical process control, and activity-based management. Generally, the larger and more complex the system, the more challenging it becomes to measure effectively. The following categorisation of performance measures for logistics systems in general, i.e. from the aspect of three separate types of performance measures: resource measures, output measures and flexibility measures. (Beamon, 1999)

2.3.5.1 Resource Measures

Resources are generally measured in terms of the minimum requirements or a composite efficiency measure. One general goal of supply chain analysis is resource minimisation. The following is an example list of logistics resource performance measures: (Beamon, 1999)

a) *Total Cost:* Total cost of resources used.
b) *Distribution Cost:* Total cost of distribution, including transportation and handling cost.
c) *Manufacturing Cost:* Total cost of manufacturing, including labour, maintenance and re-work costs.
d) *Inventory:* Cost associated with held inventory.
e) *Return on Investment:* Measures the profitability of an organisation.

2.3.5.2 Output Measures

Output performance measures must not only correspond to the organisation's strategic goals, but must also correspond to the customer' goals and values, since strategic goals generally address meeting customer requirements. (Beamon, 1999)

a) *Sales:* Total revenue
b) *Profit:* Total revenue less expenses
c) *Fill rate:* Proportion of orders filled immediately
d) *On-time deliveries:* Measures item, order or product delivery performance
e) *Backorder/stockout:* Measure item, order or product availability performance
f) *Customer response time:* Amount of time between and order and its corresponding delivery
g) *Manufacturing lead time:* Total amount of time required to produce a particular item or batch
h) *Shipping errors:* Number of incorrect shipments made
i) *Customer complaints:* Number of customer complaints registered.

2.3.5.3 Flexibility Measure

Flexibility, which is seldom used in supply chain analysis, can measure a system's ability to accommodate volume and schedule fluctuations from suppliers, manufacturers and customers. Indeed, flexibility is vital to the success of the supply chain, since the supply chain exists in an uncertain environment nowadays. (Beamon, 1999) There are four types of flexibility:

a) *Volume Flexibility:* Measure the range of volume in which the organisation can run profitably.

b) *Delivery Flexibility:* Ability to move planned deliveries to accommodate rush orders and special orders.

c) *Mix Flexibility:* Measures the range of different product types that may be produced during a particular time period, or the response time between product mix changes.

d) *New Product Flexibility:* The ease with which new products are introduced to the system.

2.3.6 Logistics Operations Standards and Variance management

A standard is an accepted measure of comparison for quantitative or qualitative value. Standards set the realistic optimal performance level, but they are based on the level of activity in the transport operation.

One element of best practice in the management of costs in transport operations is where a system is in place which holds the relevant standards for each location. A report detailing the deviation to standard is then reported monthly to the local transport/distribution manager allowing management actions to be identified. For an activity-based task, a standard can be established based on the completion of a task in a given time frame. The standard time can be established by using a time study for completing the task. In other words, the task is completed and timed to determine how long it takes to complete the task. This procedure is repeated a number of times and the average time can be used as the standard for that task. This standard time can be converted to a cost per distance travelled by multiplying the time by a cost factor and dividing that number by the distance travelled.

Industry or historical based standards - in other areas that are not activity based such as the cost of parts, a standard can be established using an industry standard or a historical based cost. A fuel standard can be established by using a distance travelled per unit of measure based on a target or historical Figure. It is also necessary to have an agreed cost per unit of measure. The cost per unit divided by the distance travelled per unit would equal the standard cost per distance travelled.

A standard tells management the expected cost of performing selected activities and allows management to make comparisons that point out any operating inefficiencies.

Once standard has been set, the actual performance is compared to the standard to see if it is acceptable. If so, the system is under control and that is the end of the control process. Where performance differs from the standard, investigation may be warranted. It is most meaningful to judge variances in terms of their practical significance. How significant is the variance in its effects on bottom-line performance? If significant, the next question to ask is whether some action is required.

CHAPTER 3

METHODOLOGY

3.1 Developing Performance Measurement System

Generally, this project is focuses on analysing performance measurement systems that are already in use, categorising performance measures and then studying the measures within a category, and building a frameworks by which performance measurement system can be apply to Logistics Operations in MOX.

Besides analysing the measures based on their effectiveness, benchmarking is another important method that is used in evaluation stage. Benchmarking serves as a means of identifying improvement opportunities here. In order to study a large number of performance measures, it is always easier to categorise them. The categorisation of performance measures in this project follows categories suggested by Neely (1995) including: quality, productivity and cost.

One of the most difficult areas of performance measure selection is the development of performance measurement system. Important questions must be addressed here: What to measure? How to measure? How often to measure? How are multiple individual measures integrated into a measurement system?

Although all of the ideas important to examining measurement systems already in place apply, the problem is more difficult since the objective is to create the “best” possible measurement system for the MOX Logistics Operations of interest.

3.2 Phases in Performance Measurement System Implementation

It is proposed here that the development of performance measurement system can be divided into three main phases. These are (i) the design of the performance measurement, (ii) the implementation of the performance measures, and (iii) the use of the performance measures.

From the literature, the design phase can be subdivided again into identifying the key objectives to be measured and designing the measures themselves. There is now a strong consensus amongst authors that measures should derived from strategy and the literature is dominated by processes which answer the question “what should we measure?” The importance of designing measures in a way which encourages behaviour which will support the strategy is absent from all but two processes but the benefits of this approach are well documented. Therefore, the two requirements of the design phase are identifying the key objectives to be measured and designing the measures.

However, the **purpose of this project is not to develop a new performance measurement system for MOX, but to improve on it.** This chapter present a proposal of practical improvement of measurement system for MOX Logistics Operations performance. These measures, in combination of the conventional and the new performance measurement approach, is believe that can be used to monitor the progress of the business as well as detailed enough to track individual and department performance inline with the company’s strategic direction.

These performance measures are not new, in fact, very few performance measures used by world class manufacturers are entirely new. However, these performance measures are construct in a way that it suits MOX business and can reflect its logistics operations department’s performance as a whole. The performance measures selected will be able to track the department’s performance form various aspects, and this is constructed to a weight that reflects company’s strategic emphasis.

Before starting the discussion, it is important to note that it took a considerable length of time to progress from design, through implementation to the measures being used. From a study conducted by Bourne et. al. (2000), entitled Designing, Implementing and Updating Performance Measurement Systems, generally, the initial performance measurement system design could be completed over a period of three to four months. However, it took another 9 to 13 months before the performance measures reached the stage of being regularly measured, reviewed and displayed. Therefore the task of implementing and using the performance measurement matrics is far from complete at this point of time. Hence, due to the limitation of the project scope, the implementation of the performance system will only be briefly discussed in this study.

3.2.1 The Design of the Performance Measurement

The design of a performance measurement system is principally a cognitive exercise, translating views of customer and other stakeholder needs into business objectives and appropriate performance measures. There are three activities to be carried out during the system design phase, such as below:

1. Assemble and organise the raw case data. There are three ways to collect data from a system: ask, observe, and use system documentation.
2. Edit data, summarise the case information and eliminate redundant data.
3. Developing a comprehensive performance measurement system. A total performance measurement matrics will be developed.

The objective of this phase is achieved through few interviews (please refer Appendix I) with line management and senior management team to analyse the company's current business. Through the interviews, the organisation's business strategy, company's long term goals and objectives, as well as the department's short term goals and objectives will be discussed. The department's short term goals and objectives will be translated into department key operations and will be illustrated in more detail in Chapter 4 and Chapter 5.

A series of tools such as SWOT Analysis, Gap Analysis, Competitive Profile Matrics (CPM) Analysis, System Thinking and Pareto Analysis were used to facilitate the interview as well as to compile and summarise the results. These tools are important as it helps the author to reassess the company's strategy systematically and identifying both customer and stakeholders' needs before blending these to develop a new set of performance measurement system. These tools provide guided frame works for the author to arrange and organise pieces of raw information collected from interviews, readings as well as other means, into meaningful information.

3.2.1.1 Use of Business Analysis Tools

The SWOT Analysis (attached as Appendix IV) was employed to categorised management and employee's opinions on MOX's business environment and it helps to identify company's internal strength and weaknesses; CPM Analysis was used to identify how customer view MOX's performance against other competitors, and the result is presented in Chapter 6; Gap Analysis, as shown in Chapter 6, was employed to measure the improvement gap of the identified key performance indicators between current performance and desired target; System Thinking was practised while organising the results while Pareto Analysis was used to identify the most important factors to be taken care during the improvement process.

An employee opinion survey (please refer to Appendix III) was carried out to identify the Critical Success Factors (CSF's) for gas industry. A total of 25 sets questionnaires were distributed to employees from various departments. Employees were asked to choose 8 of the listed CSF's which they think is most important and applicable to MOX. Then, they were requested to rate the performance of MOX and other competitors for the selected CSF's. a summary will be presented to the management and they are required to assign a weightage to the short listed CSF's. Finally, the combination of weightage assigned and performance rating will be summarised and presented as CPM analysis.

The CSF's which is direct controllable by Logistics Operations Department will be selected and transformed into Key Performance Indicators (KPI's). Again, a weightage will be assigned to each KPI by the management according to the importance of the KPI. Next, the Gap Analysis will be carried out. A discussion will be conducted together with Logistics Operations Manager and Transportation Supervisor to analyse department's current situation and desired performance on these KPI's. Lastly, current score and desired score will be awarded to the KPI and the gap in between will then be identified.

3.2.2 The Implementation and The Use of Performance Measures

The implementation of the performance measures can be viewed as a process of data collection, collation, sorting and distribution. The purpose of qualitative inquiry during this phase is to produce findings through analysis, interpretation and presentation of findings. The challenge in data analysis is to "make sense of massive amounts of data, reduce volume of information, identify significant patterns, and construct framework for communicating the essence of what data reveal".

As suggested by Bourne (2000), the implementation is primarily a mechanistic exercise and should be susceptible to being managed by classic project management tools. This will be briefly discussed in Chapter 7.

3.3 Project Methodology

This project will be conducted in the following phases:

Phase 1: Assemble and organise the raw case data. There are three ways to collect data from a system: ask, observe, and use system documentation. In this research, all of these data collection methods were used.

Phase 2: Edit data, summarise the case information and eliminate redundant data. There are four relevant tests relevant in evaluating the quality of any research study: construct validity, internal validity, external validity, and reliability.

Phase 3: Developing a comprehensive performance measurement system. Most important phase among the five phases throughout research. A total performance measurement matrics will be developed.

Phase 4: Analysing result. The purpose of qualitative inquiry is to produce findings through analysis, interpretation and presentation of findings. It involve making sense of massive amounts of data, reduce volume of information, identify significant patterns, and construct framework for communicating the essence of what data reveal.

Phase 5: Documentation of the study findings. Final write up and presentation on findings.

3.4 Expected Results

From the completed project, a set of Critical Success Factors (CSF) and Key Operational Factors (KOF) of the department, which are important to the organisation's success in the competitive market, will be identified. Once these parts and parcel of the performance factors are identified, they will be benchmarked and put together to develop a complete performance measurement matrics for the department which incorporate all of the identified Critical Success Factors.

CHAPTER 4

MOX's CURRENT LOGISTICS OPERATIONS MODEL

4.1 Operations Management and the Supply Chain

Operations management is not an isolated function. It is an integral part of a complex supply chain, involving the deliveries of inputs from suppliers to the transformation area, movement of materials within the transformation zone and distribution of finished products to the client. In addition to material flow, there is an information supply chain with a reverse sense, communicating product needs, specification and timing. Operations and the supply chain have to consider as an integrated system, since merely producing a product or service has no meaning to the customer unless it is deliver in a timely manner.

The ultimate driving force behind the operations manager is the client. The customer is expecting to have a product delivered at the right time, right place, at an acceptable quality, at required quantity, at a reasonable price and courteously. In MOX, the front line body driving these expectations is the Logistics Operations unit.

Since logistics operations are the front line interface of the company with customer, managing its performance is crucial to make the operations is always up to standard and continuous improving to serve customer better. Before looking into the performance management of these logistics operations, it is good to understand how this Logistics Operations unit works and what it does in within the company.

4.2 MOX's Supply Chain Management

MOX is committed in manufacturing and selling high quality products around Malaysia, which meet the needs of their customers. A nationwide supply chain management strategy, which aims to improve quality, lower costs, increase productivity and strengthen customer service, has been implemented. This Supply Chain Management Strategy has the visions to make MOX to be recognised as world class by customers, suppliers and other organisations through:

- The implementation of best supply chain management practices throughout MOX and BOC Group.
- Focusing on the development of relationships with "best in class" suppliers, in order to leverage MOX's corporate purchasing volumes by presenting themselves and acting as a single enterprise.
- Working together in these new relationships to develop continuous cycle time reduction, quality, innovation and cost improvements.
- Jointly developing with MOX's strategic suppliers, the new services and products which will differentiate MOX in tomorrow's markets.

A simple model for any operation is a supply chain comprising three basic blocks, inputs, transformation and outputs, which when integrated provide the net work of product flow to clients. Then in the opposite sense, is an information flow network providing all the necessary details of the products demanded. In general:

- **Input** is where the raw materials are received by the operating firm. These may originate locally, nationally or internationally.
- **Transformation** is where the state of the received raw materials is modified according to desired requirements. The transformation may be in a multitude of steps and occur at different locations.
- **Output** is where the desired products is finished and distributed to customers. The customer may be local, national or international.

MOX operates in a typical total supply chain system shown in Figure 4.1 below:

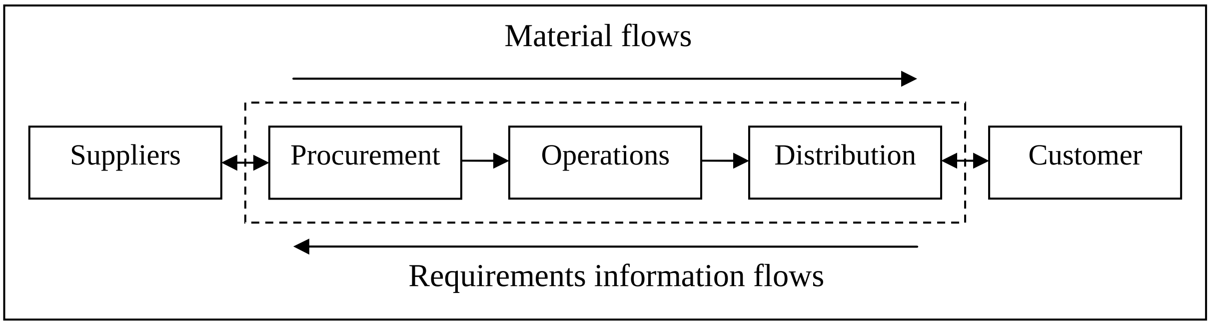

Figure 4.1: Material & Information flow of a typical supply chain.

Management of the supply chain involves rigorous attention to quality, cost and lead or delivery times. It implies teamwork, cooperation and effective coordination throughout the entire organisation. From MOX management point of view, the supply chain in MOX is considered as two distinct activities:

a) Material management is the upstream part of the chain. It covers purchasing of raw material, components and packaging, their storage and the production transformation phases, including internal transfer within the work center.

b) Physical distribution management or better known as logistics operations management, is the downstream portion of the chain and covers storage and inventory control of the finished products, order processing, distribution planning, order picking, transportation of the finished products to the distribution centers and then to customers.

As determined by the scope of the project, the discussion will only focus on the logistics operations management.

4.3 MOX Logistics Operations

MOX recognise excellence logistics management as one of its Core Competencies that distinguish her from other competitors in the market. It is also part of the company's corporate strategy. The prime objective of logistics management is to ensure that materials and products are available at the right place, at the right time, right manner and in the right quantities to satisfy demand or customers. Not forgetting also at the right cost, lower if possible, to give a competitive advantage to the company. It is closely related to the time and place utility.

4.3.1 Logistics Supports Marketing

By the late 1980s and early 1990s, customer service took center stage in many organisations. The trend toward strong customer continues today. As effective logistics management has been recognised as a key opportunity to improve both the profitability and competitive performance of firms, the integration of logistics support into marketing strategy will definitely provide a better and stronger "marketing concept". Figure 4.2 shows the integrated logistics function into a marketing mix.

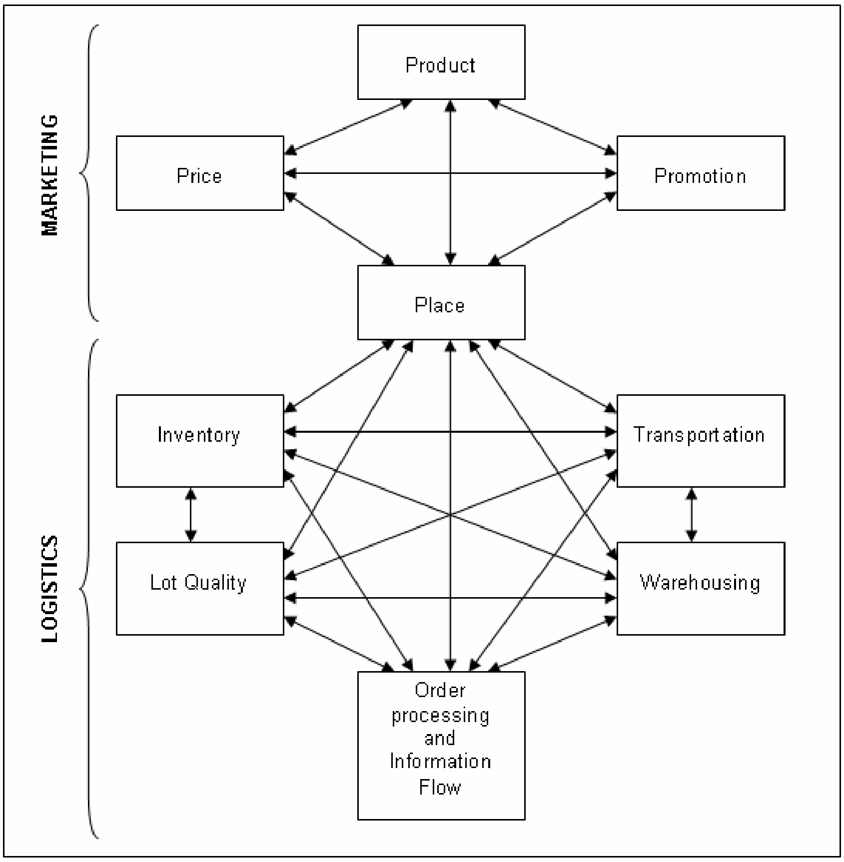

Figure 4.2: Integration of Marketing and Logistics.

Source: Adapted from Douglas M. Lambert, James R. Stock, Lisa M. Ellram (1998), "Fundamental of Logistics Management", IRWIN Mc Graw-Hill, United States of America.

The "marketing concept", as mentioned above, is a "marketing management philosophy which holds that achieving organisational goals depends on determining the needs and wants of target markets and delivering the desired satisfactions more effectively and efficiently than competitors". (Lambert, Stock & Ellram, 1998) Thus, the marketing concept is a "customer-driven" perspective which holds that a business exists to meet customer needs. The "four P's" (Product, Price, Promotion & Place) of the marketing mix are require that for a firm to be successful, any marketing effort must integrate the ideas of having the right product, at the right price, publicised with the proper promotion, and available in the right place. Logistics plays a critical role particularly in support of getting the product to the right place. As discussed in previous chapter in conjunction with utility, a product or service provides customer satisfaction only if it is available to the customer when and where it is needed.

The matrix in Figure 4.3 below shows a different level of distribution services provide to MOX customer base on what kind of service they need. These customised Product Service Offers (PSOs) are developed based on market research. Customers are categorised, or more often than not, customer themselves will opt to select level of service preferred or needed. With this, MOX will be more able to understand customer's desire and meet their requirement by not providing more or less at a cost which is value for service.

Preferred Physical Distribution	Preferred Sales Approach →		
↓	*Price Focus*	*Basic Service Offer*	*Expert Advice*
Self Collect	Discount Shoppers	Pick up Convenience	Local Service Shoppers
Base delivery offer	Price Traders	Hassle free Service	Knowledge Seekers
Superior Delivery		Rapid response	Total Solution Partners

Figure 4.3: Level of distribution services provided by MOX.

4.3.2 Logistics Operations Management

MOX practices world class manufacturing practices as suggested by Professor Richard Schonberger (1986) wherein he said that the term world class manufacturing "nicely captures the breadth and essence of the fundamental changes taking place in the industrial enterprises. The term world-class manufacturing is a very broad one but will generally include the following, such as, a new approach to product quality; just-in-time production techniques; change in the way the work force is managed; and a flexible approach to customer requirement.

A key to effective supply chain management is to meet customer requirements in terms of order fulfilment. Effective order fulfilment requires integration of the firm's manufacturing, logistics and marketing plans, to design the distribution network. The order fulfilment process defines the specific steps regarding how customer orders are: generated and communicated, entered, processed, documented, picked, delivered and handled post delivery. The key activity to effectively managing logistics process in MOX can be categorised into Order to Cash (OTC), Product to Order (PTO) and Delivery In Full On Time (DIFOT).

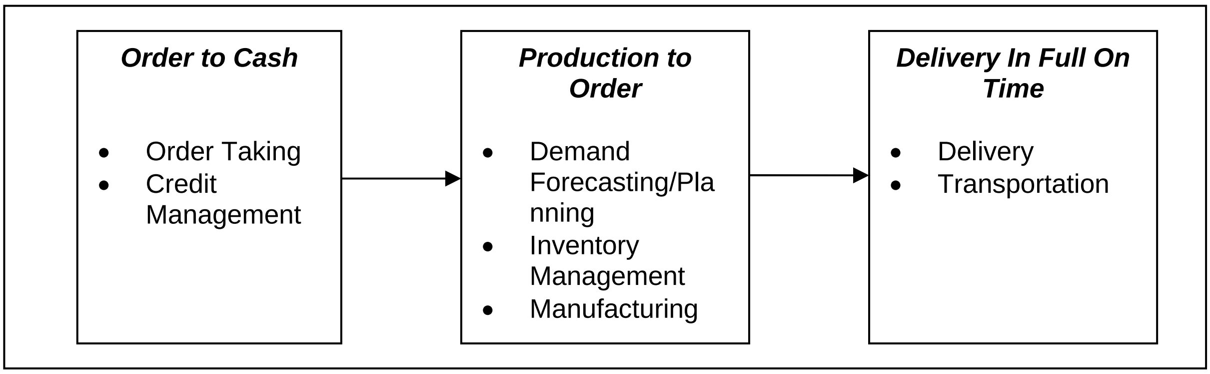

Figure 4.4: MOX's Logistics Operations Activities

4.3.2.1 Order to Cash (OTC)

- Customer service: the firm's face to the customer. It provides the single source of customer information, such as product availability, shipping details and order status. The team needs to have a thorough understanding of the firm's operation, and try to foresee the effects of a given event on the customer and on the internal operations of the firm. They are responsible for responding to both internal and external events.

4.3.2.2 Production to Order (PTO)

- Demand forecasting/planning: the demand management process needs to balance the customers' requirements with the firm's supply capabilities. This includes forecasting demand and synchronising it with production, procurement and distribution. Another important component of the demand management process is developing contingency plans in the event of either internal or external events that disrupt the balance of supply and demand.

- Inventory management: inventory management involves trading off the level of inventory held to achieve high customer service levels with the cost of holding inventory, including capital tied up in inventory, variable storage costs and obsolescence. It is held as protection from uncertainties, that is, to prevent a stock out in the case of variability in the replenishment cycle. Inventory team will also make it possible for the firm's plants to specialise in the products that it manufactures. The finish products will then be shipped to field warehouses where they are mixed to fill customer orders.

- Manufacturing Flow: the manufacturing flow process deals with making the products and establishing the manufacturing flexibility needed to serve the target markets. The team determines the manufacturing capabilities and translates them into deliverables to the customer, provide manufacturing capabilities and constrains, and define the make/buy strategy, leads to the determination of the push-pull boundaries. The team needs to identify the expertise and the changes in the manufacturing technology that are needed to operationalise manufacturing flow, as incompatibility between the manufacturing process and market characteristics may have unfavourable impact on business performance.

4.3.2.3 Delivery In Full On Time (DIFOT)

- Delivery/Transportation: Physical distribution refers to that portion of a logistics system concerned with the outward movement of products from the seller to customer. The prime objective of physical distribution is to ensure that right materials and products are available at the right place, at the right time, and in the right quantities to satisfy demand or customers and also at a right cost to give a competitive advantage to the company. It is closely related to the time and place utility. The basic distribution network can be shown as Figure 4.5 below:

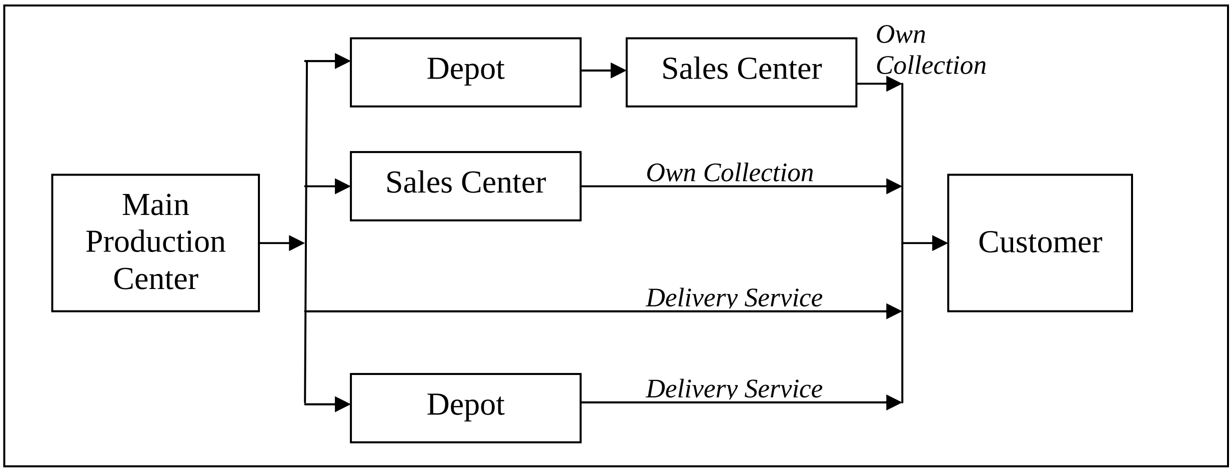

Figure 4.5: MOX's distribution network

The scope of the project will focus on the third stage of the logistics operations activities, i.e. delivery in full on time.

4.3.3 Daily Order Delivery Flow

The daily operations of the logistics operations department can be summarised as: transforming customer's order into successful deliveries. In a typical manufacturing organisation, nothing is more crucial than this as these are the last activities that bring revenues to the organisation. A product is basically worth nothing if it is not delivered to the customer at the final stage regardless of how many efforts has been put in the early stage. In general, MOX promised 1 day lead time in delivering standard order. The daily operations include: Order Processing, Scheduling, Dispatch, Delivery, Collection and Post delivery data entry. The successful deliveries here refer to both physical goods ordered as well as deliveries information. The Figure 4.6 illustrates the cycle of transforming customers order to deliveries.

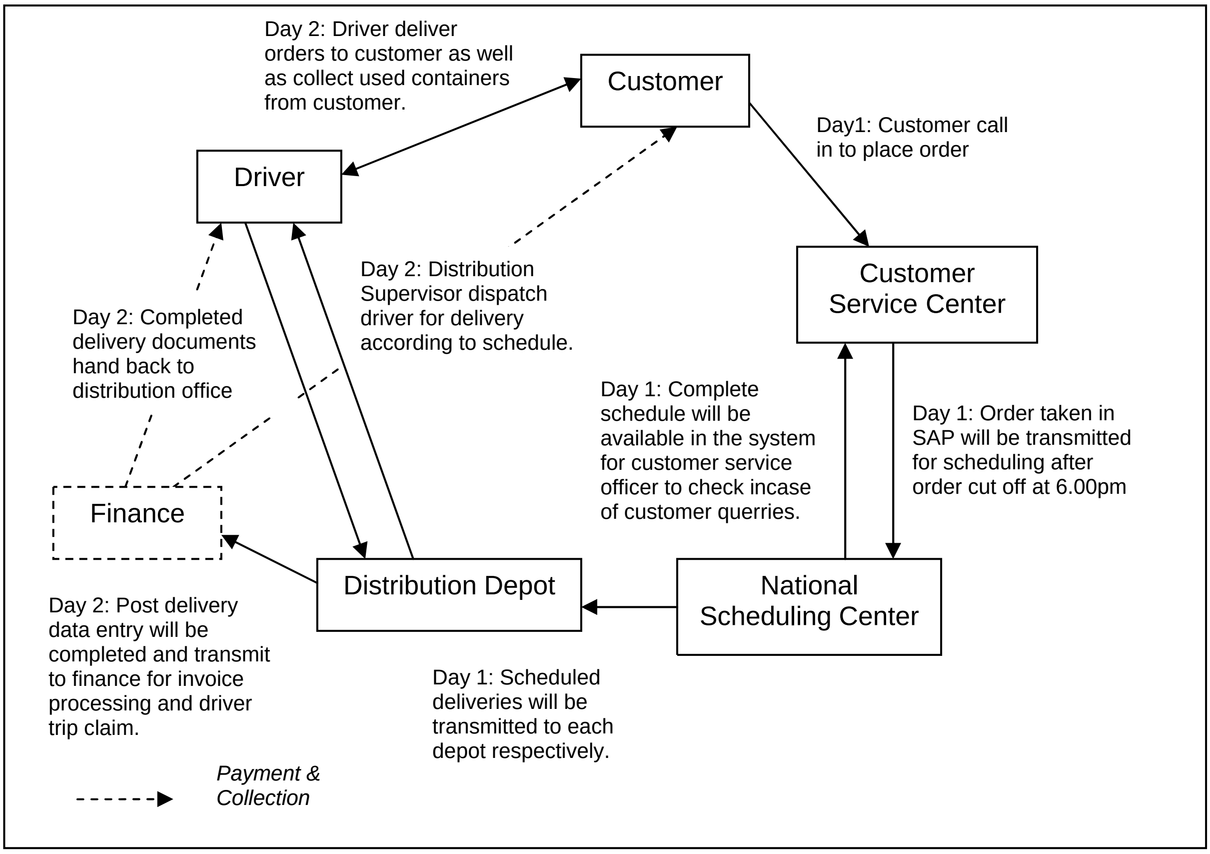

Figure 4.6: MOX Daily Order Realisation Process.

4.3.3.1 Order Taking

Order processing entails the systems that an organisation has for getting orders from customers, checking on the status of orders and communicating to customer about them, and actually filling the order and making it available to the customers. Part of the order processing includes checking inventory status, customer credit, invoicing and accounts receivable.

In MOX, daily order taking is done by the customer service officer in National Customer Service Center from 8.00am to 6.00pm Monday to Saturday. Customer shall call to a toll-free number 1 800 388 388 and place their order to the Customer Service Officer. Orders details are captured on line using SAP system. These details including customer account, name, address, location, order type and order quality are populated in the system, hence updating the order demand interface and scheduling interface.

4.3.3.2 Scheduling

Everyday, order taking cut off by 6:00 p.m, and from there, daily scheduling starts taking place. All the orders being captured earlier by Customer Service Officer will be downloaded according to required delivery date into the Scheduling interface and then import into an in-house scheduling software called VISIT Plus.

Scheduler will schedule all the orders using pre-defined strategies in VISIT Plus. Orders are clustered into "groups" and assigned to driver and vehicle accordingly. Factors determining the assignment of orders are: Customer location; Order quantity; Type of products ordered; Customer receiving time window; Accessibility of vehicles to customers site; and Availability of loading and unloading equipment at customers site.

Scheduled groups are then upload into SAP and all delivery documents are printed and assigned to drivers as "Trips". The scheduling are done centrally by the National Scheduling Center but the local Distribution Supervisor will extract the delivery documents from respective distribution depot and allocate to drivers according to the schedule.

4.3.3.3 Dispatch, Delivery and Collection

Every morning, drivers are dispatched for delivery according to the scheduled trips. As the driver delivers the cylinders to the customers as ordered, they will also collect the empty cylinders from customers. Problematic deliveries will be feed back to the supervisors. Besides physically delivering the cylinders to customers, drivers are also responsible in filling up delivery sheet and the necessary documents. These documents are used for proof of delivery (Delivery Note) and for trip payment/claims purpose. The drivers will go back to delivery depot after delivering and hand back all the documents to the distribution office. The Distribution Supervisor is responsible in managing these day-to-day operations. He will response to all the inquiry from customer which is forwarded by the customer service officer, answer drivers on their queries and help them to solve the problems, as well as liaise with other depot's personal on ad-hoc or special arrangement of deliveries and collections.

4.3.3.4 Post Delivery Data Entry

Post Delivery Data Entry is another important process in completing delivery cycle to ensure customer are billed correctly and system are updated accurately. Any discrepancy in billing and invoicing will cause customer to be dissatisfied and complaint to the company. The worse scenarios may be the customer will leave and look for another supplier. Hence, the data entry clerk will have to manage this data entry in a fast and accurate manner to ensure the systems are updated and completed deliveries are closed on time to reflect a correct stock level in the system. An accurate post delivery data entry will ensure that:

- Delivered products are captured and write off from stock level. This will allow Material Replenishment Planning (MRP) to generate the daily production demand to replenish the safety stocks.
- Collected empty containers are captured in the return management. As these high pressured containers are company's asset and has a good market value, a good return management is important to prevent loss containers.
- Delivered products and collected containers updated promptly will also allow customer to check and verify on site full stock and empty cylinders. This will help them in their purchase planning which eventually will ease MOX in reducing numbers of urgent requirement and last minutes order.
- Updated delivery will allow billing to be generated accurately.
- Post delivery data entry will also update deliveries by drivers which will allow drivers trip payment to be generated end of the month.

4.4 Logistics Operations Performance Measurement

The logistics and marketing literature rarely focuses on measuring logistics performance or supply chain performance for a number of reasons:

1. Measuring supply chain performance is difficult.
2. Some aspects of supply chain performance are hard to quality, making it difficult to establish a common performance standard.
3. Differences in supply chains make it difficult to establish standards for comparison.

In MOX, each area or level of the company is required to:

- Implement the actions required to achieve their business plan
- Monitor performance against their business plan
- Report performance against their business plan.

To ensure the true performance is accurately assessed, areas in which performance is to be measured should be clearly identified. The performance is to be measured in an objective, transparent and consistent manner. Monitoring of the performance should follow a pre-determined plan and it is the responsibility of managers at all levels to agree with their immediate superior on the scope of any required measurements, the frequency of monitoring and how/when they are to be reported.

Figure 4.7 gives a big picture of how MOX business strategies being transformed into business plans, executed in a business processes and being measured by business performance management. General Operating Strategy and Business Plan have been discussed in Chapter 1. The scope of this project will limits the discussion of Business Processes to be done on Operations only, specifically on Logistics Operations, which was also addressed. Hence, the Performance Measurement will also be focused on Logistics Operations, which involves managing; deliveries, safety, productivity and last but not least, cost.

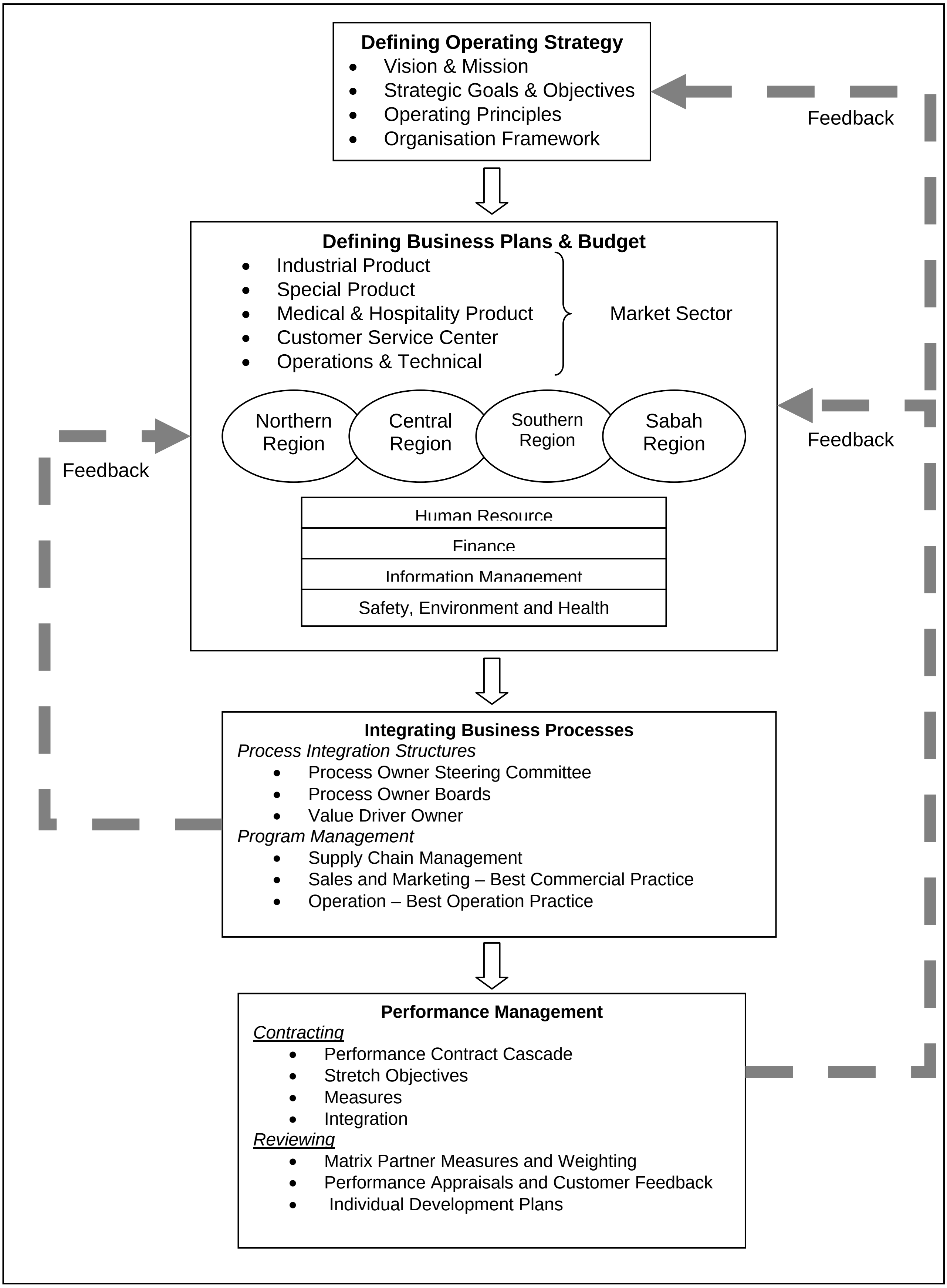

Figure 4.7: From Operating Strategy to Performance Management

4.4.1 Standards, KPI's and SLA's

A standard is an accepted measure of comparison for qualitative value. Standards set the realistic optimal performance level, but they are based on the level of activity in the transport operation. It is more useful to use standards than the budget for assessing a transport manager's performance as standards will be dependent on, for example, the actual distance travelled. The budget costs are based on an assumed level of demand which may vary from what actually occurs. The budget profitability targets are important in an overall business context and clearly still need to be met.

For an activity based task, a standard can be established based on the completion of a task in a given time frame. The standard time can be established by using a time study for completing the task. In other words, the task is completed and timed to determine how long it takes to complete the task. This procedure is repeated a number of times and the average time can be used as the standard for that task. In other areas that are not activity based such as the cost of parts, a standard can be established using an industry standard or a historical based cost.

In MOX, these standards are set at a benchmark against other sister company in the region, as well as against other company in the similar industry. These standards will then be set as Key Performance Indicators for department or individual. MOX relies on several key performance indicators (KPIs) for measuring the performance of its transport operation and it is these that should be reported to senior management. Hence, these are referred to as *Key* Performance Indicators. The KPIs can be categorised into the following four areas: Safety; Delivery Service; Cost; and Productivity.

In addition there are also KPIs for scheduling activity. Some of these are shared measures, for example, capacity utilisation and delivery service while others address the efficiency of scheduling only. These KPIs will then be compiled as Internal Service Level Agreement. The Internal SLAs are a contract between a relevant enabling function or operation unit and the Business Unit. The SLA outlines the services that will be provided to the business unit to enable it to meet its obligations and should align with the business unit's strategic and implementation plans. The services listed in the SLA will be provided with detailed KPIs and its standards. The method of measurement and reporting is to be agreed by the parties to the SLA. The details of each KPI will address in detail in the following chapter.

CHAPTER 5

REVIEWING MOX PERFORMANCE MEASUREMENT - TRANSPORTATION

5.1 MOX Performance Management

The purpose of having a performance management system is to transform strategic and business plans into individual performance contract and objectives. A performance contract should include four components, i.e. goals, measures development plans and performance ratings. In MOX, the performance management generally involves the following steps:

a. *Setting individual performance outputs.*

   Line/Unit manager will list the performance outputs that apply to current unit outputs and in conjunction with corporate vision and mission. The line manager will then discuss with their subordinates and together will sign off an agreed performance contract. The performance targets were set at committed desire target and stretch target.

b. *Providing performance resources.*

   Resources, in the most cost effective way, will be provided in order to reach each high priority performance output. These include training and whatever financial, physical, human, technical and information support.

c. *Monitoring individual performance.*

   This is to build strong collaborative relationships between manager and subordinates.

d. Coaching for performance.

In case performance was not up to expectations, the manager must begin coaching, aimed to help their subordinates back on track. The main reason of disappointing performance (inadequate focus, inadequate support, inadequate capacity and inadequate motivation) must be identified and apply with corrective action.

e. Planning effective performer development.

If an individual have proven their ability to consistently reach or exceed their performance output, it becomes important to provide additional challenges so that it benefits both the organisation.

f. Assessing individual performance.

This is the last part of managing individual performance. It is to formally evaluate the performance results that an individual has produced during the current assessment period. Typically, this will be the annual review of performance and will require input from both manager and employee, sitting together in a meeting.

5.2 Managing Delivery Service

Delivering goods on time is the essence of just in time manufacturing. In a company making anything other than a very simple product, the delivery of the finished product on time to the customer is the culmination of a long series of steps being done right. These stage include correct scheduling; ensuring high quality; on-time deliveries of raw materials and components, manufacturing at the right time in the right quantity; and shipping the finished product when it is needed. On time deliveries have always been important because early deliveries build inventory and late deliveries cause production disruption and wasteful expediting activities.

The key question that needs to be answered by any company seeking to serve its customers is: “Are we delivering the right products, the right quantities, and on the right date?” Very few companies can affirm that they always deliver the full quantity on time every time. In previous years, it has been strongly argued that most companies should not try to achieve this status because the level of inventory investment required to meet this objective would be prohibitively expensive. A world class manufacturer would view this issue differently, customers deserve a 100-percent level of service, and if they do not get it from one company – they will go to another.

5.2.1 Delivery Reliability

Delivery service is one of the key considerations a customer will make in deciding whether to buy and continue buying company's product. In the case of the gases and equipment industry, it can be major way in which a company can establish market share and differentiates itself from its competitors, thereby contributing to the overall financial success of the company. Due to the increasingly competitive nature of this industry, if MOX cannot deliver the product in time and in line with customer expectations, surely someone else can.

The service KPI is designed to call attention to the critical nature of the service aspect and to provide for continuous improvement. The measure compares the number of successful deliveries to the total number of deliveries attempted.

It is important to note that success must be defined in the context of the customer, that is, the customer must regard it as successful and not by some internal measure of success. For example, a situation where we arrived at the customer site only to find them to be closed could not be regarded as successful as we did not incorporate the customer opening and closing times into the trip schedule or trip execution. It is also worth nothing that if a single line item on the order is late, the entire order is considered late.

5.2.2 Measuring Delivery Service

There are a number of performance indicators in MOX which can be used to analysed performance and therefore help drive continuous improvement:

a) **On Time Orders:** This is a KPI for operations. It shows the percentage of orders delivered on time in line with customer expectations.

b) **On Time Cylinders:** This is also a KPI for operations. It shows the percentage of cylinders delivered on time in line with customer expectations.

c) **Product Shortages:** Typically a KPI for plant and/or ware house operations. This list would include all products which would normally be defined as "stock" items which were not available to be shipped at the time the trip was dispatched.

d) **Missed Deliveries or Brought-Backs:** Typically a KPI for distribution operations. This list would include all orders scheduled and dispatched on a trip, but not delivered as promised to the customer.

5.2.3 Delivered In Full On Time (DIFOT)

DIFOT is measured by comparing the promised delivery dates and quantities for the different line items in an order, with the actual delivery dates and quantities of the order. If there is any discrepancy, for example the product was delivered late, or the full quantity wasn't delivered, then the order is recorded as a failure. The order is considered failure for DIFOT if it was:

- **Delivered On Time Not In Full (OTNIF) –** Products delivered to customer are more/less than quantity ordered on a promised delivery date.
- **Delivered Not On Time In Full (NOTIF) –** Products delivered to customer are at correct amount but on date earlier/later than agreed delivery date.
- **Delivered Not On Time Not In Full (NOTNIF) –** Products delivered to customer are more/less than quantity ordered on a date earlier/later than agreed delivery date.

DIFOT failure here is measured from the point of view of a customer. An order is only consider successful as and when the customer consider it achieve promised service level. It has to be taken into consideration that delivery early than promised date is considered not on time and more than required quantity is also considered not in full, and both of these criteria are categorised as failure. And if there is an order with more than 1 line items, failing any single line item will cause the whole order to be categorised as unsuccessful order.

$$\boxed{DIFOT = 1 - \left(\frac{OTNIF + NOTIF + NOTNIF}{Total\ Number\ of\ Order} \right)}$$

For DIFOT to work, it relies on the order being taken accurately, as well as correct lead times being attached to all products. The success rate for all orders processed in a warehouse is then accumulated to determine the overall success rate for that warehouse.

This could then be accumulated up to company level. The intended service levels will be properly defined once the measure is fully operational.

A failure to meet customer's order in full and on time could be attributed to a number of reasons, including but not limited to the following:

a) Order Taking error - Order incorrectly taken at the Customer Service Centre
b) Inventory error - Stock not available at the supplying warehouse
c) Scheduling error - Delivery not scheduled to the customer
d) Order Picking error - Product not loaded onto the truck
e) Driver error - Delivery not made by the truck

At the moment, DIFOT measurement taken into consideration all orders taken in the system as a base of measurement and the delivery failure could be both MOX controllable and MOX non-controllable, and the 5 five main classification above in incomplete to reflect all situations faced during delivery attempt. For example, customer reject order upon delivery due to changes of their plan but did not inform MOX, this is a situation where MOX is out of control and according to current 5 classification of delivery failure, and there is no appropriate classification to park this failure. The most possible classification the author could think of is *Driver Error* or *Others*. To put the delivery failures as *Driver Error* is being unfair to driver but *Others* is not a better choice as it does not reflect the real situation. The author feels that an improvement could be made here to exclude the MOX non-controllable delivery failure in DIFOT measurement as it is unfair to tie the uncontrollable factor on a personal/department performance. The measurement could be continue as DIFOT is suppose to be used to assist in identifying problems in the supply chain and resolving them in order to provide superior customer service. A more detailed breakdown of DIFOT failure code will also be developed and will be discussed in chapter 6.

5.3 Managing Safety

In most country, companies are required by law to keep detailed information about safety problems within their plants. It is the same in Malaysia. MOX do have a safety procedure that exceeds the minimum requirements of the local law.

5.3.1 Truck Avoidable Accident Rate (TAAR)

The Truck Avoidable Accident Rate (TAAR) is determined by multiplying the number of avoidable accidents by one million and dividing that number by the total distance travelled.

$$Truck\ Avoidable\ Accident\ Rate = \frac{No.of\ avoidable\ truck\ accidents \times 1{,}000{,}000 km}{Total\ distance\ travelled}$$

Each year, a standard or target is established for the avoidable accident rate. Continuous improvement is achieved by setting a standard which is a reduction on the current actual avoidable accident rate.

However, a standard by itself cannot prevent accident; it is a goal to achieve through constant training and supervision. Once that standard is set, the employee must be trained to achieve the standard. The definition of an avoidable accident and the expected performance rate must be thoroughly explained to the employee and administered both strictly and fairly. Training in vehicle control, hazard recognition, and safe driving techniques must be adequate.

5.3.2 Lost Workday Case Rate (LWCR)

The lost workday case rate is determined by multiplying the number of lost workday cases by 200,000hrs and dividing this number by the total number of hours worked. In some operations, the lost workday case rate is referred to Lost Time Incident.

$$Lost\ Workday\ Case\ Rate = \frac{No.of\ Lost\ Workday\ Cases \times 200{,}000 hrs}{Total\ Hours\ Worked}$$

A lost workday case is defined as any personal injury which results in the employee not being able to report for a full work shift at their next regularly schedule work day or future work days, if he absence is a consequence of the injury. Within a transport operation, other work groups such as maintenance will also be covered by this measure.

5.3.3 Managing Safety Standards

The definition of an avoidable accident and personal injury accident and the expected performance rate must be thoroughly explained to the employee and administered both strictly and fairly.

All drivers should have performance checks through periodic observation rides. The results from observations, accident analysis or complaints against a driver help check training effectiveness and compliance to the standard. Usually only those drivers who are known to stretch the rules are checked extensively.

Follow up remedial and rehabilitation efforts should be extensive at the outset until there is evidence of satisfactory performance. Spot checks for all drivers are occasionally needed to disclose “soft spots” in their performance, and to help in training and retraining. Due to driver cannot be personally supervised every minute, they must be motivated to police their own driving. Driver must know what is correct performance in driving safely. Once they are trained in technique, drivers can then be motivated through pride of workmanship, skill, or other factors to do a superior job.

Any employee with a long accident free record may be lulled into a false sense of security and may develop careless safety habits. Help to overcome this problem through the use of incentive programs, periodic retraining and consistent demonstrations of the importance of safety.

Tracking the total case rate should allow further information on minor accidents to be gathered. Detection of any trends in minor accidents may help to prevent more serious accidents, by implementing corrective actions after completing root cause analysis.

5.4 Managing Productivity

The purpose of this sub-chapter is to provide the reader with an understanding of the costs associate to distribution and the means through which targets can be set to enhance transport operational performance.

5.4.1 Capacity Utilisation

By optimising capacity utilisation, local Transport/Distribution managers are able to improve the productivity of distribution operations. This can be achieved by optimising equipment capacity utilisation and increasing the amount of product delivered per distance travelled. The lower cost is based on the fact that increased capacity utilisation should result in lesser trips. This would result in the need for fewer vehicles and a reduction in fixed costs.

The maximisation of equipment capacity utilisation and increasing the amount of product delivered per distance travelled contributes to lowering the cost per unit of product delivered. Capacity utilisation measures the percentage of the units of product delivered compared to the available carrying space of the vehicle, which varies according to fleet size and total fleet in use. This figure is based on past historical trends.

$$Capacity\,Utilisation = \frac{Nominal\ Delivered}{Maximum\ Nominal\ Capacity} \times 100$$

This is done at the local site and is obtained by reviewing each trip and determining the capacity utilisation for that trip. The site daily average could then be determined by dividing the total amount of nominal delivered by the total nominal capacity of all the vehicles utilised to complete the deliveries. Capacity utilisation should also be tracked by individual vehicle. Changes in these numbers may indicate a maintenance problem that needs to be corrected. Source of data:

- ISP KPI System
- Daily Trip Reports
- VISIT Plus

5.4.2 Vehicle Utilisation

Vehicle utilisation measures the number of productive hours of vehicle use per week divided by the total hours per week and is expressed as a percentage. Productive hours of a vehicle equals time spent driving plus time vehicle is use to deliver to customers plus standard loading time plus any allowances for inspections and paperwork.

$$Vehicle\,Utilisation = \frac{Productive\,Hours\,of\,Vehicle\,Use\,per\,Week}{Total\,Hours\,per\,Week\,(168)}$$

The ability to effectively schedule deliveries and trips can greatly influence vehicle utilisation. The ability to ‘link’ trips or multi-tripping reduces the total vehicle requirement. Some other key elements to be aware of are as follows:

- *Driver Hours Legislation* needs to be managed so drivers are available to meet the needs of the scheduling function. Too many or too few drivers will lead to inefficiency and thus degrade vehicle utilisation.
- *Fleet Composition* affects capacity utilisation and subsequently vehicle utilisation. Trailers which are lighter and have a greater carrying capacity will result in fewer trips and vehicles required. Sites should identify their ‘normal’ or ‘optimum’ delivery pattern, customer type, access and so on and derive both the total fleet required and composition.
- *Use of Carriers* at peak periods whether these be weekly or seasonal can also reduce the demand on the MOX fleet. However, a trade-of needs to occur as to whether it is cheaper to continue utilising a company asst or placing it in reverse and using a carrier. In certain cases it will be appropriate to evaluate whether it is financially viable to purchase new equipment or utilise a carrier. This will depend upon the likely requirement for the asset and also the risks of not guaranteeing its availability.
- *Accurate Scheduling Tool* will benefit the scheduling process. The ability to effectively route and determine vehicle return times will enhance vehicle utilisation.
- *Communication of Available Fleet Resources* from sites to the scheduling centre will also enhance performance of the assets. It is essential that sites also have the manpower available for the utilisation of these assets before declaring them for scheduling purposes. In addition to this there should be a constant flow of information regarding fleet level fluctuations, for example, vehicle maintenance (preventive and non-preventive).

5.4.3 Factors Contributing and Contradicting to Productivity

Close analysis of vehicle utilisation will identify those operations where there are issues within vehicle maintenance, specific vehicle type and performance related activity. Improvements in vehicle utilisation leading to reducing the number of vehicles will reflect both on vehicle depreciation costs and running costs. Vehicle purchase costs and subsequent financing costs will reduce depreciation cost. Running cost will reduced in taxation, licensing, maintenance labour, tyres, parts and so on. However, by reducing the number of vehicles, the average distance travelled of the remaining vehicles will increase. This can result in an increase in maintenance cost depends upon vehicle maintenance servicing intervals.

An area that is hard to control and must be discussed with local sales management is customer demand changes. Generally, customer demand patterns fluctuate over time as customers are added and leave for other suppliers. In order to maximise capacity utilisation, the correct amounts must be carried on the vehicle and delivered each time a visit to customer is scheduled. If the amounts loaded and delivered consistently do not match a decision must be made to revise the amounts forecasted.

Demand smoothing is a process which optimises the relationship among delivery day frequency, location delivery boundaries, customer area demand and maximum vehicle load factors. The goal of demand smoothing is to improve productivity by reducing drive, non-value added time and increasing the number of units delivered on a trip. The local transport manager must work with the sales, marketing and logistics planning functions to effectively implement demand smoothing as required.

5.5 Managing Distribution Cost

The running of a business requires a level of expenditure. The value and type of expenditure will vary according to the business type and structure. Expenses which a business incurs are expresses as cost and have a number of individual components. In a competitive environment, cost control has become an integral part of the daily management routine. This has made cost management one of the key competencies in driving business improvement and profitability.

The supply chain costs are high. Figure 5.1 gives a generic breakdown of the supply chain cost, upstream activity accounts for about 29 percent, transformation 7 percent and down stream cost 64 percent. The biggest logistics cost is the transportation cost. This figure will speak for itself, that managing transportation cost is important.

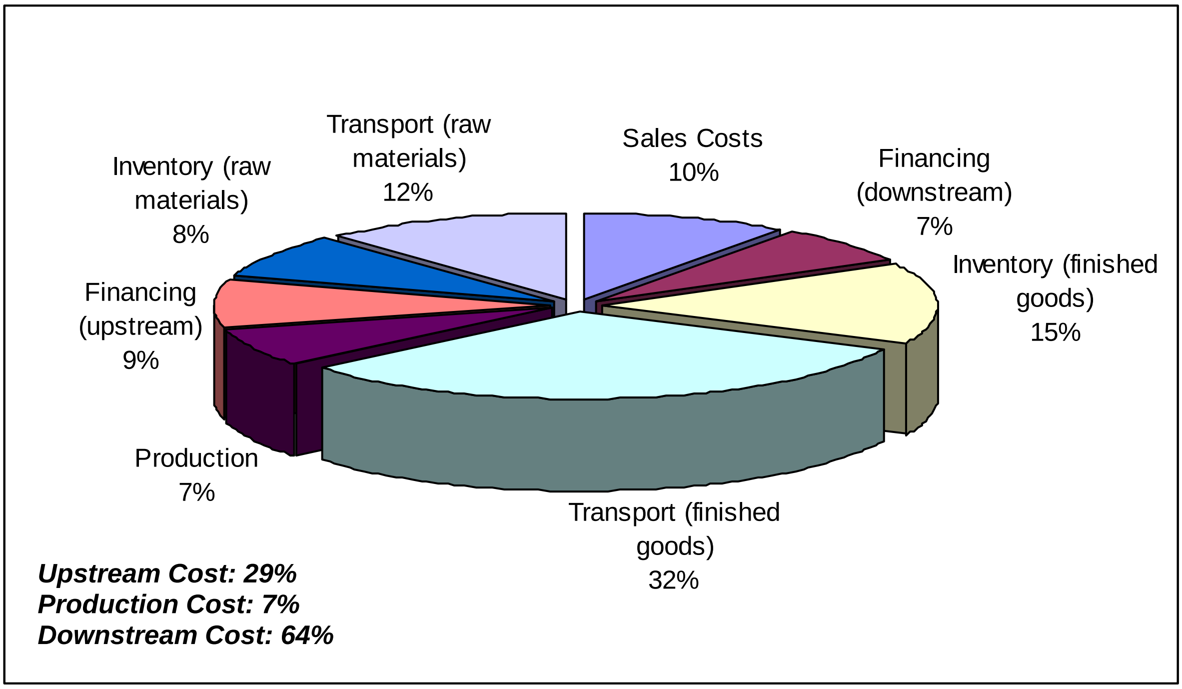

Figure 5.1: Percentage Breakdown of Supply Chain Cost

In a cost focused business (in this case, the logistics operations), Performance Indicators (PI's) are the fundamental link between the operation and the financial impacts of how it is being managed. PIs measure current performance and are a means through which operational targets and budgets are set, in order that financial improvement is achieved whilst maintaining a high level of customer service. Financial improvement may be reflected through greater revenue or a reduced cost base. Within each specific cost elements it is possible to generate a PI. The level of analysis and its reporting frequency will vary according to the type of cost, example, it would be beneficial to identify and manage the total cost per day, but measuring tyre expenditure on a daily basis would not add value as the information gathering would be a difficult task. The content and structure of financial reports also varies throughout the operation and in different geographies. The use of PI's within an organisation links individual cost elements into the overall financial reports of a business. It is essential that both the financial reports and their corresponding links to PI's are understood as they ultimately drive business profitability.

5.5.1 Total Distribution Cost Per Distance Travelled.

Logistics cost may exceed 25 percent of the cost of doing business at the manufacturing level. For this reason, better management of the logistics function offers the potential for large savings, which can contribute to improved corporate profitability. The key to managing the logistics function is Total Cost Analysis. That is, at a given level of customer service, management should minimised total logistics cost, rather than attempt to minimised the cost of individual activities. The major shortcoming of a non-integrative approach to logistics cost analysis is that attempts to reduce specific cost within the logistics function may be less than optimal for the system as a whole, leading to greater total cost.

Similar to the gas industry, the transport industry is extremely competitive. From the perspective of both customers and organisation, it is essential that transport operations are as efficient as possible. In order to operate at the lowest possible cost and to be equal to the best practices in the region that we operate in, MOX has adopted the Activity Based Costing concept to measure total logistics cost for the firm. In the total logistics cost concept, MOX do not respond to cost-cutting techniques individually geared to warehouse, transportation or inventory cost.

To effectively manage the cost of a business there has to be an understanding of the individual cost components, measures to drive improvement within each of those components and an understanding of where the specific costs are allocated within a business profit and loss account. Transport/distribution managers and other personnel who are in position to influence that operation must understand the cost incurred in running a transport operation and how to control these costs from the perspective of overall cost reduction.

The primary measure of transport efficiency in MOX is total distribution cost per unit distance travelled and is reported on a monthly basis due to the considerable data which is required to compile the calculation. Figure 5.2 is an example of a primary measure of transport efficiency.

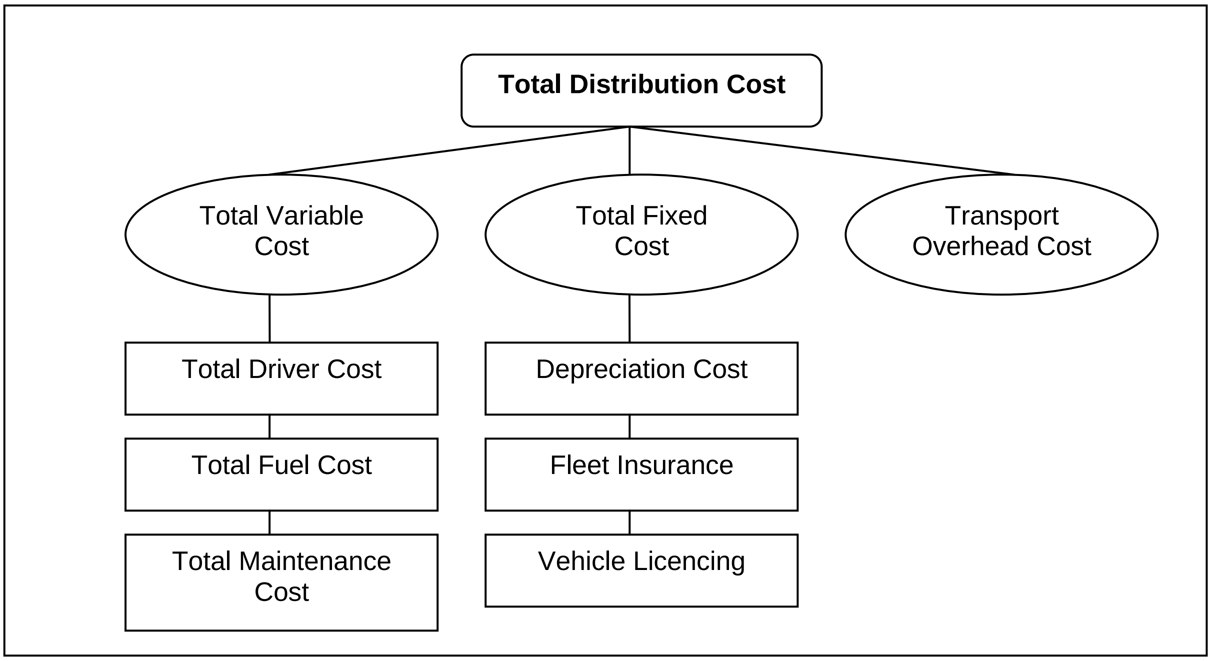

Figure 5.2: Total Distribution Cost structure.

As Total Distribution Cost per distance travelled will vary between sites due to geographic location, customer profile, customer location (stem distance travelled), etc, the purpose of this KPI is not to compare site by site, but to measure a site's performance month on month. It is important however, that the relationship between site performance indicators is understood so that it is possible to establish Best Operations Practice (BOP) in certain aspects of managing the operation where the difference in the geography is not the only reason for the performance.

$$Total\ Distribution\ Cost = \frac{Total\ Fixed\ Cost + Total\ Variable\ Cost + Total\ Overhead\ Cost}{Distance\ Travelled}$$

The breakdown of cost consumption in percentage of the three main cost component are as in Figure 5.3. Total Variable Cost takes up 78 percent of the Total Distribution cost, and Drivers Cost is the main contributor taking up 41 percent followed by Fuel Cost at 21 percent. These three main cost components will be discussed in further detail later.

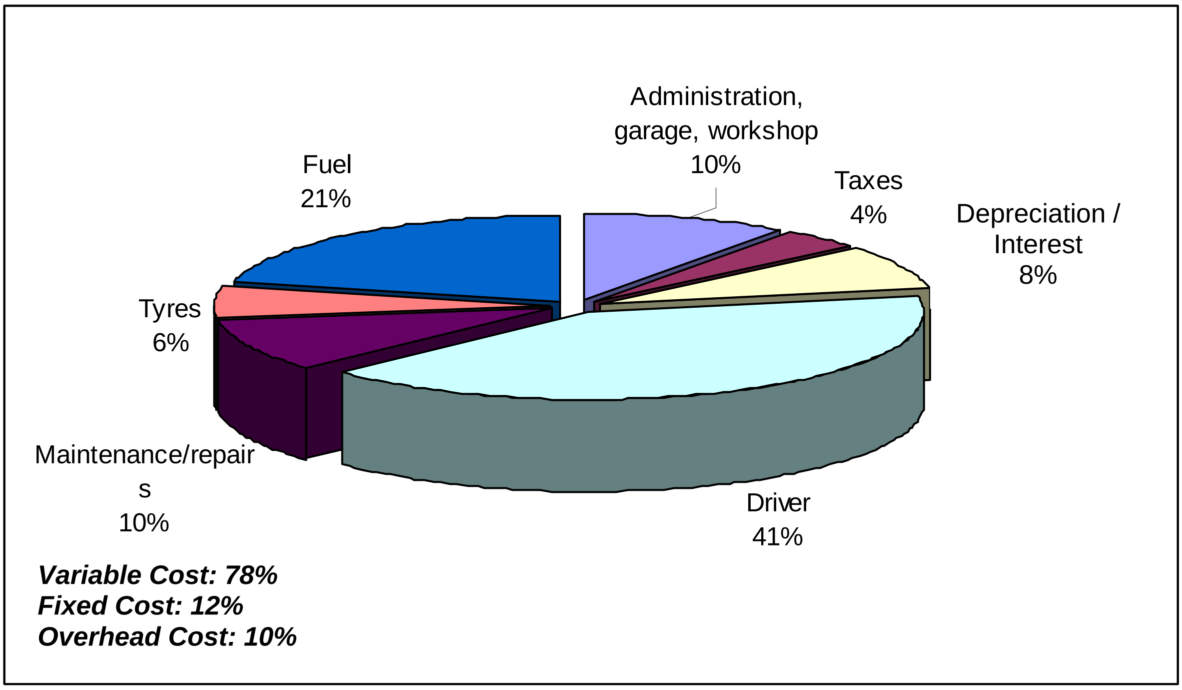

Figure 5.3: Percentage Breakdown of Total Distribution Cost

5.5.2 Total Variable Cost

The Total Variable Cost will vary with the level of output or activity. With variable cost components, expenditure varies but the unit cost remains the same. In MOX transport operations environment, variable costs are often referred to as running cost. Most of the time, Variable Cost will be measured in RM/Cyl. This unit cost depends on two elements, ie. transport efficiency and planning efficiency. The three main contributors to Total Variable Cost are as below:

- **Total Driver Cost:** Generally, driver costs are the largest cost element of variable costs and have the potential for financial savings based on increased management focus and awareness.
- **Total Fuel Cost:** The cost of fuel for distribution vehicles is a significant portion of total variable cost. Fuel cost is expressed as a cost per distance travelled. Fuel cost as a percentage of total cost varies globally mainly due to fuel price differences.
- **Total Maintenance Cost:** Maintenance costs are the costs associated with maintaining the vehicles and equipment in peak operating conditions. It is categorised as labour costs, parts costs, tyre costs, vendor maintenance costs, accident repair costs and warranties. It is calculated as a cost per distance travelled.

Maintenance costs will vary based on the type of equipment and the age of the equipment. Generally, the older the equipment the higher the maintenance costs.

5.5.3 Total Fixed Cost

As a component of total distribution costs, fixed costs are relatively easy to control but the most difficult to reduce. A large proportion of fixed cost is the cost of vehicles. Increasing vehicle utilisation by reducing the total number of vehicles required will reduce fixed costs. These costs are also expressed in per unit travelled.

$$\boxed{Total\ Fixed\ Cost\ Per\ Distance\ Travelled = \frac{Total\ Fixed\ Cost}{Total\ Distance\ Travelled}}$$

Improving fixed costs must be accomplished through improvements in Depreciation Costs, Vehicle Licensing and Vehicle Insurance, which depends heavily on Vehicle Utilisation.

- **Vehicle Depreciation Costs:** Vehicle depreciation is the value of a foxed asset over a period of time and usage. It is calculated to record the real expenses in a business financial account as well as to establish a life cycle, renewal policy and evaluate the required financial provisions for actual renewal. Depreciation is calculated by obtaining the initial purchase cost, the likely resale value and the life of the vehicle. There are two main methods for calculating depreciation: the straight line method and the reducing balance method. Within MOX, it is commonly to calculate vehicle depreciation using the straight line method.
- **Vehicle Licensing:** Vehicle licensing is a small proportion of total fixed costs. In Malaysia, it is a legal requirement to register vehicles to a transport authority. Vehicle registered at different plated weights will be issued with a licence specific to that vehicle and operating authority,
- **Vehicle Insurance:** Vehicle insurance is a legal requirement for vehicle operations. Insurance premiums are generally sourced centrally and the insurance certificate will cover vehicles throughout an operation. The premium is set yearly and refers to the number of vehicles in the fleet, the monthly charge is fixed. If the fleet is reduced, the benefit will not be evident until the premium is re-quoted the following year. However, minimise vehicle accidents and ensure that the operations

in 100% safety compliance will help to control extra loses in vehicle insurance due to third party claims.

5.5.4 Transport Overhead Cost

Transport overhead costs are the costs associated with office facilities, office equipment and staff salaries. These costs are relatively constant and not directly related to the amount of work performed. These indirect costs reflect those costs that support individual activities and are necessary for the operation of the business.

$$Transport\ Overhead\ Costs\ per\ Distance\ Travelled = \frac{Transport\ Overhead\ Cost}{Total\ Distance\ Travelled}$$

$$Transport\ Overhead\ Costs\ (\%) = \frac{Transport\ Overhead\ Cost}{Total\ Distribution\ Cost}$$

The control of Transport Overhead Cost is by measuring the percentage variance of actual cost vs. budgeted / historical cost. It can also be measured by percentage variance from standard percentage of total distribution cost, ie. one of the measures for transport overhead cost is as a percentage of total distribution cost. Once this standard percent is established by each local operation, the actual percentage would be compared to that to determine the variance.

5.6 Systems Approach to Operations

A manufacturing company is constantly confronted with the operations environment. Many firms try to manage these activities by optimising or minimising resource and output. However, the real operations management is about the effective planning, organising and control of all the resources and activities necessary to provide the market with tangible goods and services. In order to achieve the objective, all operations in the firm have to be managed as a whole integrated entity and overall performance is important to provide a big picture on how the firm is performing.

An organisation, be it manufacturing, services or non-profit, can be considered as a system, an approach developed by Jay Forrester. A system is a grouping, perhaps complex, of independent components, variables, activities or subsystems. The objective of the system design is that the final output, performance or appearance is optimised. A business firm is a system and marketing, operations and finance are the principle subsystems. High profits, large market share, low cost and high employee moral would be indicators of an optimum firm. The same analogy applies, the Logistics Operations Department is a system and safety, scheduling and dispatch as well as the transport operations are the subsystems. Fast and prompt delivery, accurate scheduling, high vehicle utilisation, good customer relationship, low cost and high delivery crew moral are the indicators of an optimum firm. It is important to always remember that if we manage the subsystem individually and independently, these optimised subsystems may not mean an optimised system.

- The objectives of work safety unit are to make sure all drivers are well trained, vehicles are installed with safety devices and works are ergonomically to be done.
- Scheduling and dispatch will have to make sure vehicles are fully utilised as well as the deliveries are planned as accurate as possible.
- The objectives of transport operations are making sure all fleet are always good in condition and presentable.

In the real world, optimum system performance may imply suboptimal performance of the subsystem, since it is not possible to satisfy all requirements of the sub-system. And also because of conflicting objectives of each of these subsystems, there is a potential for suboptimality to occur between the three functions:

- The safety unit will wants to retain the drivers for training but the scheduler will wants all of them to be available to perform deliveries at all times.
- The transport operations unit would like to maintain the vehicle at peak performance but these would drives the maintenance cost to ceiling.
- Scheduling and dispatch unit would like to maximise the utilisation of a vehicle by using it 24 hours a day at full capacity if possible, but this would also destroy the vehicle fast at the same time.

Thus, the safety, scheduling and dispatch as well as transport operations unit need to work as a team to ensure that products are delivered on time, conform to customer requirements and are at an acceptable price and the necessary investment is available for their development. The goals of each subsystem must be properly tuned so that the output of the system (whole department) attains the desired objectives.

5.7 Reconsider Measurement / Evaluation System

The last issue which the author wishes to address is to change the unit's performance measurement system. Most measurement systems were designed not for leaders but for accountants so that companies could report their financial results to shareholders and tax authorities. Same problem occurs in MOX where the performance is judge by the sales revenue.

These systems were then inappropriately pressed into service to support management decision making, where for the most part they are useless. When you see that costs are high, sales are low, and profit is falling, you know that action is necessary, but you do not know what kind. Business are so complex and change so rapidly that gut feel for what is important is extraordinarily difficult to develop and impossible to maintain. There are relentless pressures to improve performance and to do so immediately. An organisation's measurement system should be able to reveal the sources of performance inadequacies.

The purpose of measurement is not to know how a business is performing but to enable it to perform better. To this end, a contemporary measurement system must have two basic features. First, all data must include a rationale and a purpose; people must know why things are measured, and more important, what they are supposed to do with them. Second, all measurement must be based on a careful analysis of the business, one that links the objectives of the business to the things over which managers and front-line personnel have control.

It is hope that by adopting the new performance measurement system, more staff will feel comfortable and less will feel threatened.

CHAPTER 6

IMPROVEMENT

6.1 A System View of an Organisation's Performance

As defined in Chapter 5, a system is a set of individual components or subsystems, by some form of interaction to achieve some common purposes. A management system according to Turner et. al (1993) is a specific set of components or subsystems, each of which has some relationship to at least one other component or subsystem in the set, working together for the common goals of the organisation, while the management control system will be concerning on processes and procedures related to planning, measuring and controlling all activities within the organisation.

Simply having the common objectives or purposes is insufficient to keep the organisation running on track. Continuous monitoring of the actual performance of organisational unit must be deployed to ensure that objectives and performance goals are being met. It is instructive to visualise a management control system as a feedback control loop as shown in Figure 6.1.

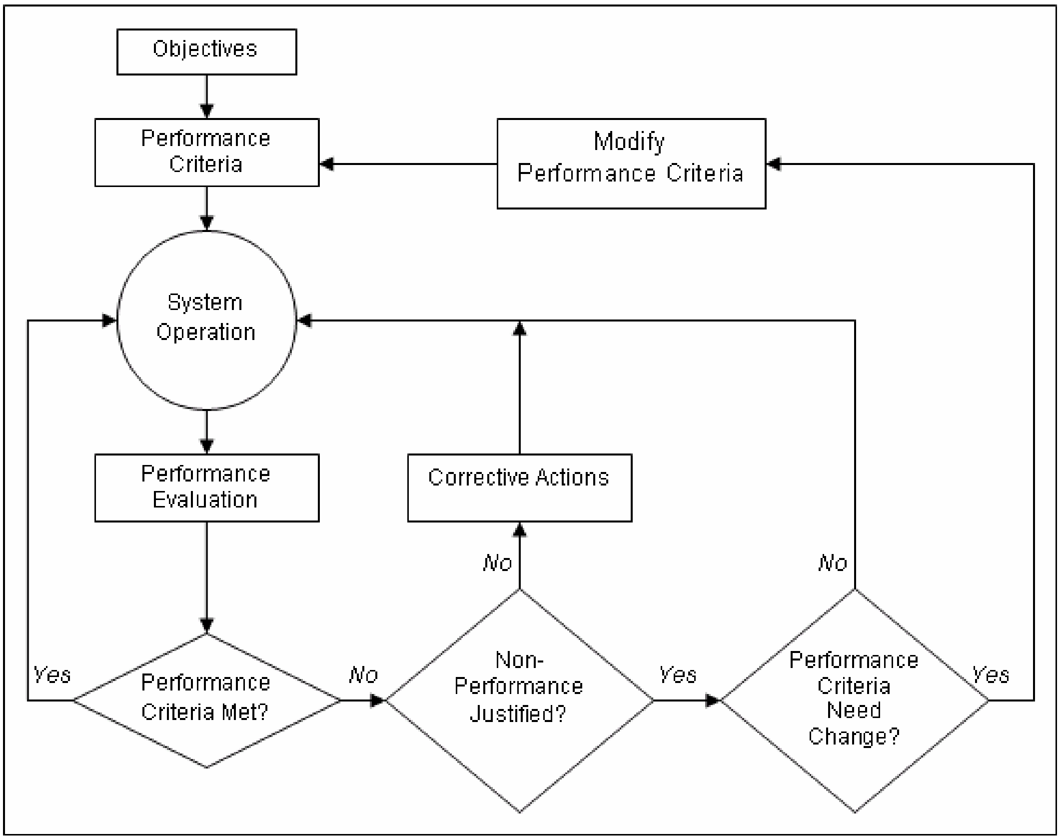

Figure 6.1: Close Loop Performance Management System.

Source: Adapted from Wayne C. Tunner et. al. (1993), Introduction to Industrial and Systems Engineering, Prentice Hall Inc, United States if America, Pg. 451.

6.1.1 Identifying Key Performance Indicators

Most of the literature on performance measurement has suggested that a performance measurement can be study from four distinct dimensions: Cost; Productivity; Flexibility; and Quality.

The first dimension is that of cost while the other three are non-cost in nature, even though influencing the economic-financial performance. These four distinct classes of performance coincide with the four basic components by means of which the manufacturing strategy of a firm is generally expressed, and these competencies determine the market competition focused on “price”, “product” and “place”.

From the interview and discussions, MOX management has agreed to adopt three out of four dimensions mentioned above, and replaced the dimension of “Flexibility” with “Safety”. As mentioned in Chapter 1, MOX’s core value is to have a safe working practice;

measuring safety performance is to make sure that the Performance Measurement System (PMS) is inline with the organisations global strategy of putting safety at the first of its priority on their business. Also, in the Competitive Profile Matrix (CPM) Analysis conducted to evaluate the position of MOX together with three other major competitors, which were said to be the top market player in the industry, has shown in Table 6.1 that MOX did better (by a small margin of 0.5 points) than its major competitor and Product and Operational Safety is one of the Critical Success Factor (CSF) which carries a high weight and contributing to the difference.

Table 6.1: CPM analysis for MOX and its competitors.

Critical Success Factor		**Weight**	**MOX**		**C1**		**C2**		**C3**	
			Rating	***Score***	**Rating**	***Score***	**Rating**	***Score***	**Rating**	***Score***
1	Advertising & Marketing	0.15	3	*0.45*	3	*0.45*	3	*0.45*	2	*0.3*
2	Product Quality	0.2	4	*0.8*	4	*0.8*	3	*0.6*	2	*0.4*
3	Price Competition	0.15	2	*0.3*	5	*0.75*	4	*0.6*	4	*0.6*
4	Product and Operational Safety	0.1	5	*0.5*	2	*0.2*	2	*0.2*	2	*0.2*
5	Financial Position	0.05	5	*0.25*	3	*0.15*	3	*0.15*	1	*0.05*
6	Customer Loyalty	0.1	3	*0.3*	4	*0.4*	3	*0.3*	3	*0.3*
7	Global Expansion	0.05	4	*0.2*	2	*0.1*	2	*0.1*	2	*0.1*
8	Market Share	0.05	4	*0.2*	2	*0.1*	1	*0.05*	1	*0.05*
9	Delivery	0.15	3	*0.45*	3	*0.45*	5	*0.75*	5	*0.75*
	TOTAL	**1**		***3.45***		***3.4***		***3.2***		***2.75***

In the CPM analysis, nine CSF's were identified through an employee opinion survey. These nine CSF's, were the top nine most favourable CSFs in the employee opinion survey. Total of 25 employees from various departments were invited to participate in the survey. Each of them was required to select eight CSF's which they think is important to MOX's business and to assign performance rating for relevant company for the selected CSFs, ranging from 5 to 1 for best to worst performance. Score for each CSF was acquired by multiplying average rating with the weightage assigned by management. The weightages assigned were based on judgement on the importance of the CSF as well as the emphasis that has to be laid on. Summation of all the scores will then represents the company's overall achievement.

From the CSF's identified in CPM analysis, Price Competition, Product and Operational Safety and Delivery was recognised as direct controllable (to a certain extend if not all) by Logistics Operations Department. At the mean time, high weightage carried by these CSF's shows that management had put the accent on these areas.

As a summary, MOX has adopted cost, productivity, safety and quality as the main dimension of focus in its performance measurement system. These four dimensions of performance measurement will be translated into a model with related Key Performance Indicators suitable to MOX.

a) Cost
   - Total Distribution Cost per Distance Travelled
   - Delivery Cost per Nominal
b) Productivity
   - Capacity Utilisation
   - Vehicle Utilisation
c) Safety
   - Truck Avoidable Accident Rate (TAAR)
   - Lost Workday Case Rate (LWCR)
d) Quality (Delivery reliability)
   - Delivery In Full On Time (DIFOT)

6.1.2 Gap Analysis

A gap analysis is being carried out to identify the gap between current performance and desire performance for the four main identified KPI's. The result is shown in Figure 6.2.

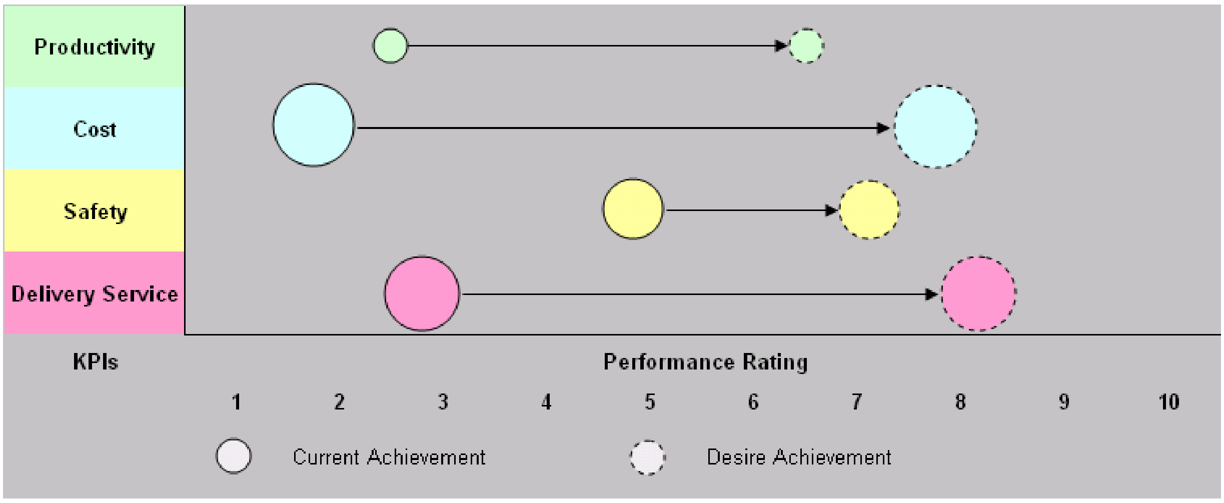

Figure 6.2: Gap Analysis

The size of the bubble represents the weight that the KPI carries, i.e. the bigger the bubble, the management has indicated that it is a relatively important KPI. This is translated from CPM analysis that was shown in Table 6.1. From Figure 6.2 above, it can be illustrated as cost is the most important KPI that the management is looking at and followed by delivery service. This can be further explained from Table 6.1 that both cost (price competition) and delivery service (delivery) are assigned with relatively high weight age. However, it is also identified that MOX did badly in both of these areas having a gap of 6 and 5 units respectively for cost and delivery performance.

Product quality, has the highest weight age, however not identified as one of the four core areas of KPI for Logistics Operations. Product quality will affect performance if the above KPI's, although not directly, as quality product will reduce the need of running extra trips to deliver substitute product (eliminate rework) which will enhance operational cost usage and improve delivery reliability.

The gap between current achievement and desire achievement was a summary from CPM analysis and also and Internal Factor Evaluation of the 4 main KPI's. The position of current achievement bubble was placed at the average performance rating assigned by management and employee as shown in Table 6.1. The desire achievement rating are being set at:

- 9 – 10: Higher than BOC and industrial standard
- 8: BOC global standard

- 7: Local industry highest standard
- 6: Average standard

In lined with the management strategy to work on cost reduction as well as improve delivery performance, the author will focus in these two areas and work out a more specific performance measurement tools to monitor the performance of these 2 KPI's closely. Later, all 4 KPI's will be integrated into the Overall Performance Matrics to demonstrate the department's overall performance.

6.1.3 Relations Between Key Performance Indicators

In order to study the relation between the department's Key Performance Indicators (KPI's), some historical data has been extracted and a correlation text has been conducted. The result is as in Figure 6.3.

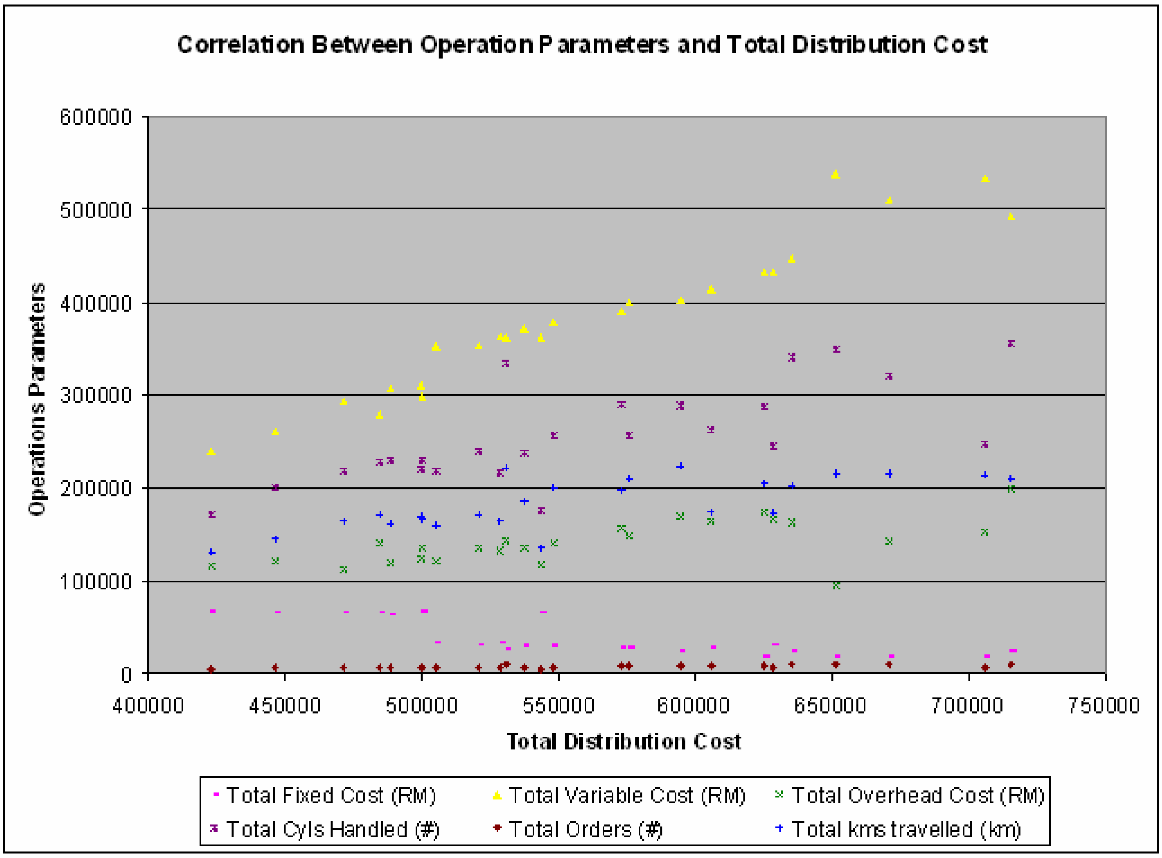

Figure 6.3: Correlation Between Operation Parameters and Total Distribution Cost

The analysis shows that Total Variable Cost, Total Number of Cylinders Handled, Total Distance Traveled and Total Overhead Cost have a positive correlation with Total Distribution Cost. This means, higher number of cylinders being handled and more distance traveled will incurred cost directly to the Total Distribution Cost overall. Among these four parameters, Total Variable Cost has the strongest correlation with Total Distribution Cost. Another observation to be made is that the Total Orders seem to have neutral correlation with Total Distribution Cost while Total Fixed Cost is having negative correlation with Total Distribution Cost. Table 6.2 below list out the correlation factor and R-square value for the relations for the Operations Parameters.

Table 6.2: Summary of Correlation Factor and R^2 Value for MOX Logistics Operations Parameters.

Operation Parameter	**Correlation Factor**	**R^2 Value**
Total Fixed Cost	Y = -0.1923x + 146410	0.6262
Total Variable Cost	Y = 1.0036x - 181642	0.935
Total Overhead Cost	Y = 0.1887x + 35232	0.3974
Total Number of Cylinders Handled	Y = 0.4825 - 13578	0.5377
Total Orders	Y = 0.014x – 468.33	0.5503
Total Distance Traveled	Y = 0.2554x + 40387	0.5427

The reason why Total Fixed Cost is having negative correlation with Total Distribution Cost is when the company started to reduce company assets (vehicle units) by engaging more contractors to manage delivery service. By doing this, the Total Fixed Cost will be reduced while the contractors cost will be charged to Total Variable Cost.

Another correlation analysis done on Service Level Performance and Total Distribution Cost shows that Service Level Performance (Distribution only) has neutral correlation with Total Distribution Cost, i.e. increasing amount of money spent does not guarantee a positive feedback on improving the department service level. The Department Service Level is having almost neutral correlation with Total Distribution Cost. It is also interesting to notice that Company Service Level Performance actually has a negative correlation with Total Distribution Cost. This is at a situation where a service failure caused by other department (example inventory planning mistakes, production delay etc) will cost Distribution extra cost to manage the delivery to customer as it comes under special schedule and out of network arrangement. This is shown in Figure 6.4.

If the service level is having neutral (if not negative) correlation with Total Distribution Cost, what are the factors that actually have an impact on the amount of money spent on delivery service? The answer to this is Safety and Planning component, which will be addressed later part of this chapter.

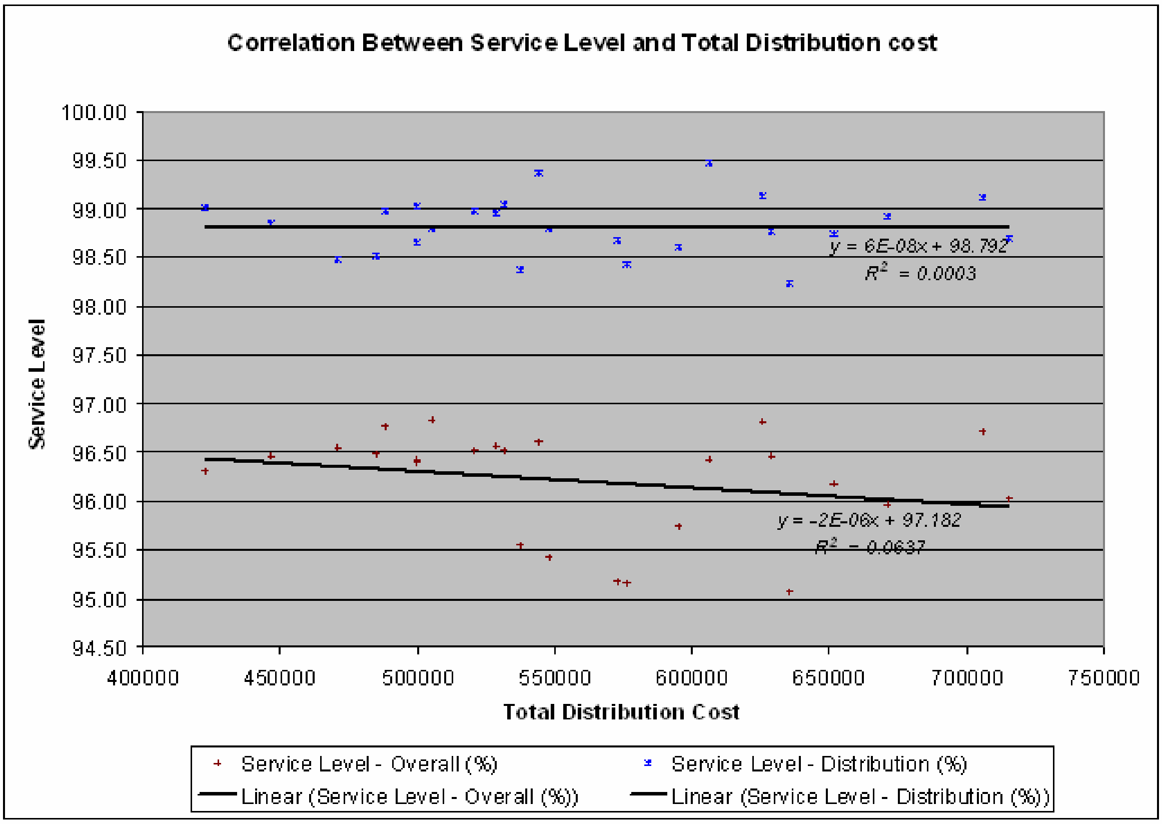

Figure 6.4: Correlation Between Service Level and Total Distribution Cost

6.2 Improving Delivery Service

Delivering goods on time is the essence of just in time manufacturing. In a company making anything other than a very simple product, the delivery of the finished product on time to the customer is the culmination of a long series of steps being done right. These stage include correct scheduling; ensuring high quality; on-time deliveries of raw materials and components, manufacturing at the right time in the right quantity; and shipping the finished product when it is needed. On time deliveries have always been important because early deliveries build inventory and late deliveries cause production disruption and wasteful expediting activities.

The key question that needs to be answered by any company seeking to serve its customers is: "Are we delivering the right products, the right quantities, and on the right date?" Very few companies can affirm that they always deliver the full quantity on time every time. In previous years, it has been strongly argued that most companies should not try to achieve this status because the level of inventory investment required to meet this objective would be prohibitively expensive. A world class manufacturer would view this issue differently, customers deserve a 100-percent level of service, and if they do not get it from one company – they will go to another.

6.2.1 Measuring Customer Service Level

A world class manufacturer puts customers' needs at the top of the agenda. The idea of being "close to the customer" is an important one for any company attempting to compete against global competition. As a means of discussion, the author has categorise customer service to be measured as a subset to reflect delivery service performance.

There are two primary methods of looking at customer service – the first is a quantitative approach, the second is qualitative approach. The quantitative approach will be used here in day-to-day routine measures by comparing the orders placed by customers with the shipments to those customers. The qualitative method is concerned with the customer's perception of the service they are receiving. Because this information is not readily available as it must be obtained from the customers themselves, it can be used as a supplement to comprehend the quantitative measures. However, to obtain the qualitative measures is time consuming and rather subjective.

There are few approach to measure customer service level that can be readily adapted to world class manufacturing.

a) Reports are produced showing the customer orders, their required dates, and quantities. These reports are compared with the shipping dates and quantities intended to fulfill these orders; a percentage is calculated for the product, product group, customer and so forth.
b) Another approach is to measure the percentage of order lines that were shipped complete. This method will give a lower number that the first but, in many industries, will be a more useful way of assessing service level.

c) A more exacting method of measuring service level is to record the percentage of orders that have been delivered in full and on time. An order is considered to be shipped only when the full quantity of every line item on the order has been successfully dispatched.

So far, the discussion has cantered around the quantity being dispatched. But the date of delivery is equally important. The question of how to define an on time delivery varies according to the type of market and the type of products involved. The usual method for defining on time delivery is to set a planned dispatch date; a delivery is considered "on time" if it is dispatched prior to the planned delivery date. However, the planned dispatch day (calculated when order is entered) may be quite different from the customer's required delivery date. A better delivery reliability measurement system would be able to capture and measure service level from the point of view of the customer's stated requirements rather than according to the planned delivery date. Also, during the order entry and dispatch process, particularly for log lead time products, the planned delivery date has to be changed. A more versatile would be able to capture both – original planned delivery date and actual delivery date to provide a clearer assessment of the effectiveness of the entire deliver process.

Most customer service level reporting is based upon the date of dispatch to the customer. This approach assumes that the products are delivered immediately to the customer and there are no delays, breakages or problem in transit. From the customer's point of view, the order is not delivered until the goods have been received, and some companies attempt to measure service level at the time the customer takes delivery, the gathering of this information can be difficult and requires additional data entry and processing, but in some industries it is a vital method for measuring the effectiveness of the process from order entry to customer receipt.

6.2.2 Improved DIFOT Measurement

Table 6.3 suggests that DIFOT failures should be more detailed and categorised systematically. Besides categorising the failures into Delivery In Full Not On Time (IFNOT), Delivery Not In Full On Time (NIFOT) and Delivery Not In Full Not On Time (NIFNOT), it also provides a detailed reason of *why* these orders failed, and then further segregate it into failure code owners (business section) and the operation function belongs to it.

Failure attributes that is related to product availability, but independent from delivery will be categorised as NIFOT; failures attributed by delivery but independent from product availability are considered as IFNOT, and other attributes which cause delivery to be completed late and not complete, will be categorised as NIFNOT. The failure attributes are coded in a alpha-numerical manner, which will indicates the business section and the operational functions it belong to. For example:

C = Customer Service Center

D = Logistics Operations

P = Production and Supply Chain

And,

D, Logistics Operations 01-06 = Transport Operations

D, Logistics Operations 07-09 = Distribution Planning

P, Production 01-04 = Daily Production

P, Supply Chain 08-09 = Asset Planning

P, Supply Chain 10-12 = Inventory Planning

The advantage of the detailed classification of the DIFOT failures is to allow the management to identify the cause of failure in delivery service systematically by zooming in level by level from business sections, operations function, failure category to individual failure attributes. By detailed segregation of service failure attributes at the beginning of data collection (by the time of delivery service confirmed failed), the major cause of failures and its contributors can be easily identified by management by just compiling simple chart report, at any time needed. Effort in reducing the delivery failures can be taken to the main failures contributing areas according to Pareto 80-20 concept. The report is to be complied monthly and presented in the monthly operations group meeting. Action items to eliminate the failures contributing factors will be discussed and executed. These will be revised in the subsequent meeting until the main failures contributing factors is eliminated.

Table 6.3: DIFOT Failure Codes.

Business Section	Operational Functions	Failure Code		Category
C - CSC		C01	Incorrect address details	NIFNOT
		C02	Incorrect delivery time	NIFNOT
		C03	Incorrect shipping point / route	NIFNOT
		C04	Incorrect product ordered	NIFOT
		C05	Incorrect cylinder size ordered	NIFOT
		C06	Duplicate order	NIFNOT
Logistics Operations	Transport Operations	D01	Vehicle unavailable	IFNOT
		D02	Driver unavailable	IFNOT
		D03	Driver error	IFNOT
		D04	Equipment breakdown	IFNOT
		D05	Driver delayed on route	IFNOT
		D06	Missed time window	IFNOT
	Distribution Planning	D07	Incorrect vehicle size/unloading equipment	NIFNOT
		D08	Incorrect time window	NIFNOT
		D09	Vehicle overloaded	NIFNOT
Z - Non-BOC		Z01	Refused by customer	
		Z02	Customer changed order	
		Z03	Customer unable to unload	
		Z04	No customer assistance available	
		Z05	No cash payment	
P - Production	Production	P01	Cylinders not filled	NIFOT
		P02	Cylinders not cleared by lab	NIFOT
		P03	Load not accurate	NIFOT
		P04	Driver delayed in yard	IFNOT
	Eng & Maintenance	P05	Equipment breakdown	NIFOT
	Test Shop	P06	Cylinders not available from test shop	NIFOT
	Production Planning	P07	Production planning error	NIFOT
W - Warehouse (Inventory Stores)		W01	Stock not available	NIFOT
		W02	Substitute product supplied	NIFOT
		W03	Defective product	NIFOT
P - Supply Chain	Asset Planning	P08	Empty cylinders not available	NIFOT
		P09	Pallets not available	NIFOT
	Inventory Planning	P10	Imported cylinders not available	NIFOT
		P11	Raw materials not available	NIFOT
		P12	Bulk product not available	NIFOT
S - Sales		S01	Non-standard product	NIFNOT
		S02	Over Commitment	NIFNOT

As mentioned, the purpose of root cause analysis for DIFOT is to identify cause of failures. The proposed root cause DIFOT Failure Code comprehends enough to explain *why* an order failed. These are segregated into business sections and operational function for improvement action to be taken. Continuous improvement is the main drive behind this

DIFOT failure codes. This failure measurement also prevents general failure comment such as:

- Production failure (but what causes the production failure? Man? Machine? Material?)
- Order Taking error (but error in which field? Customer details or order details?)
- Scheduling error (wrong fleet size or delivery time?)
- Driver error (what causes the driver to make this error?)
- Inventory error (raw material not available or empty cylinder turn around bad?)

The detailed record of failures attributes could be used to generate multi level reports to identify failures and eliminate main failures contributing area using Pareto concept. For example from the first level report in Figure 6.5, it is shown that more than 60% of the failures are contributed by Logistics Operations, Productions and Customer Service Center. There are about 30% of failures are parked under non-BOC related which means customer oriented.

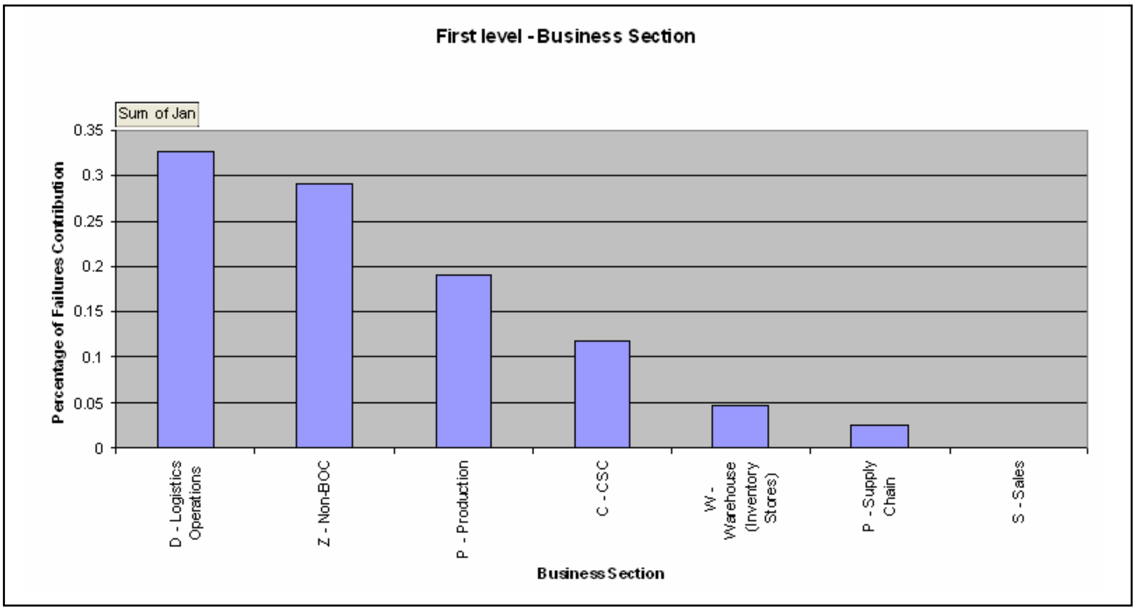

Figure 6.5: DIFOT Failure Contribution – By Business Section

From the second level report in Figure 6.6, Figure 6.7 and Figure 6.8, we can make the following conclusion:

- In Logistics Operations, most of the failures are contributed by delivery missed planned time window (16%) and driver not available for delivery (10%). These usually happened on a heavy load day, after long holiday and after festive season. The Logistics Operations Manager shall come out with a contingency plan to provide the department with a flexible crew and at the same time maintain the utilisation and operational cost as targeted.
- In Production, 100% of the failures are contributed by P1, cylinders not being filled. It seems like production is having an issue on adhering to production schedule. Production team needs to look into this immediately and resolve the issue on not adhering to production plan as schedule.
- In Customer Service Center, service failures are mainly due to errors in order taking, especially on product type, delivery address details and double entering particular order. Error in taking order is unacceptable, corrective and preventive action must be taken here. Duplicate order could have happened when different personnel from customer placed the same order to MOX. However CSC personnel should be able to check and advice customer if there is an outstanding order in system upon receiving order.

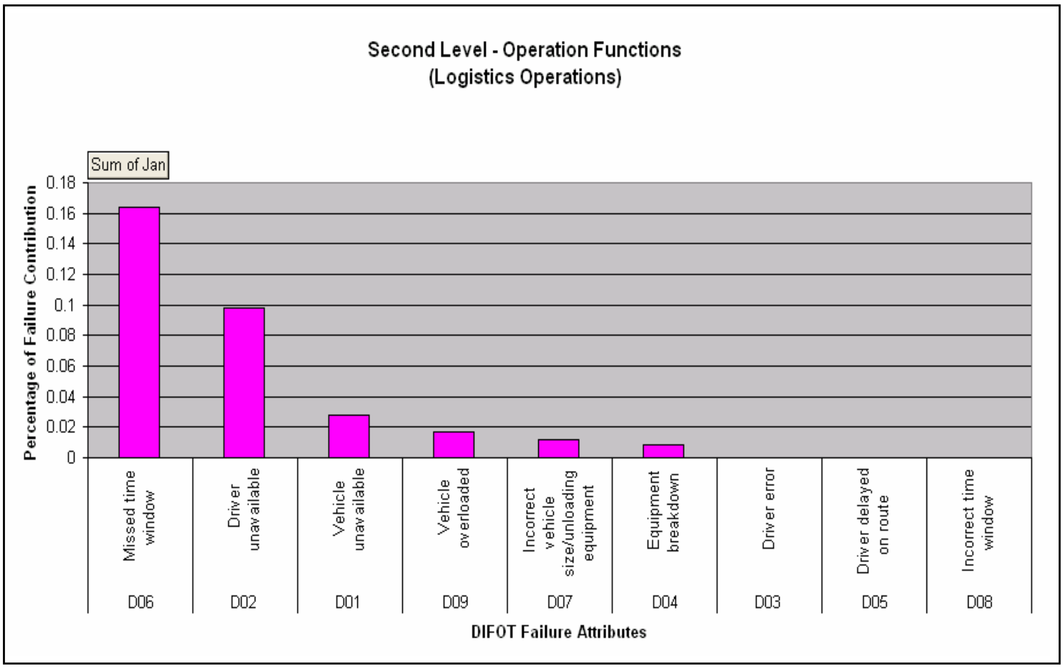

Figure 6.6: DIFOT Failure Attributes Analysis – Logistics Operations.

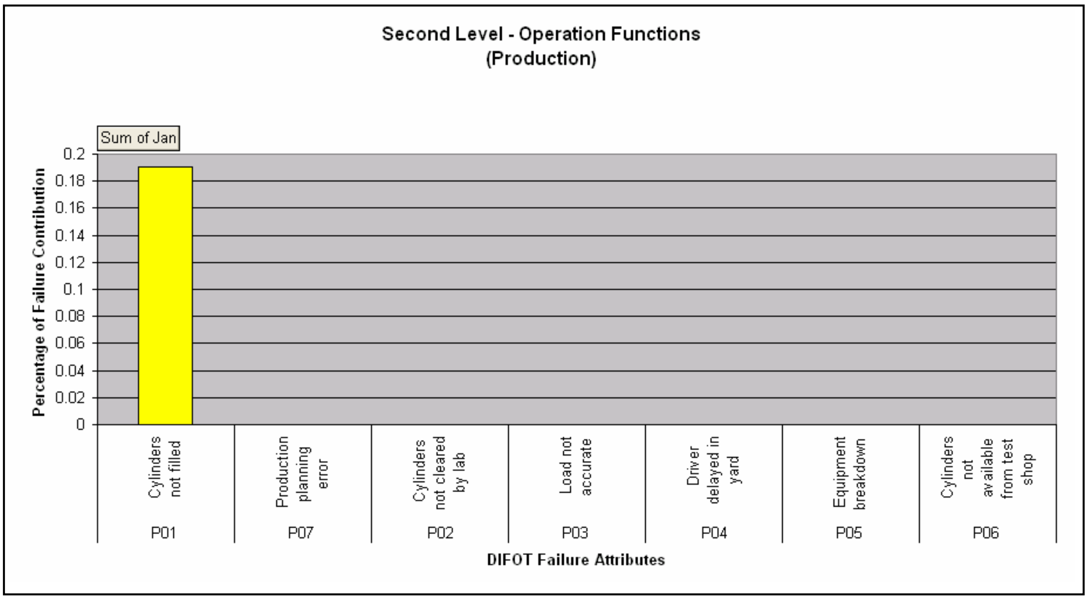

Figure 6.7: DIFOT Failure Attributes Analysis – Production

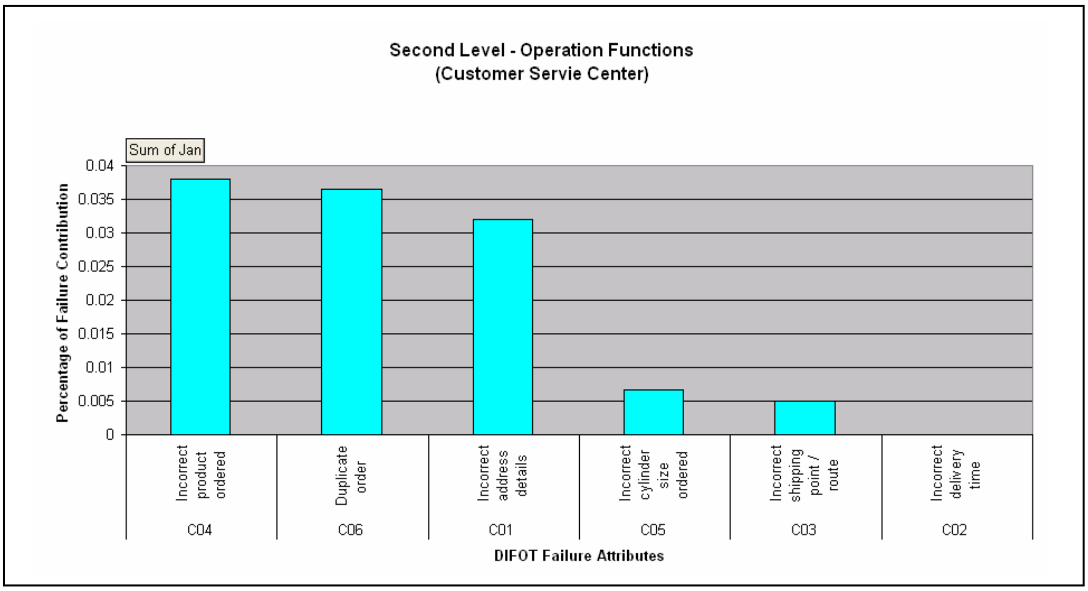

Figure 6.8: DIFOT Failure Attributes Analysis – Customer Service Center

On the other hand, failure attributed by customer is not all irresolvable. In Figure 6.9 shows failures which are customer oriented includes: No customer assistant available (13%), refused by customer (6%), customer changed order but not inform MOX (5%) and unable to unload at customer site (4%). Customer details of these failures should be compiled and a joint task force including Sales, Customer Service and Logistics Operations could visit the customer to iron out the underlying issue.

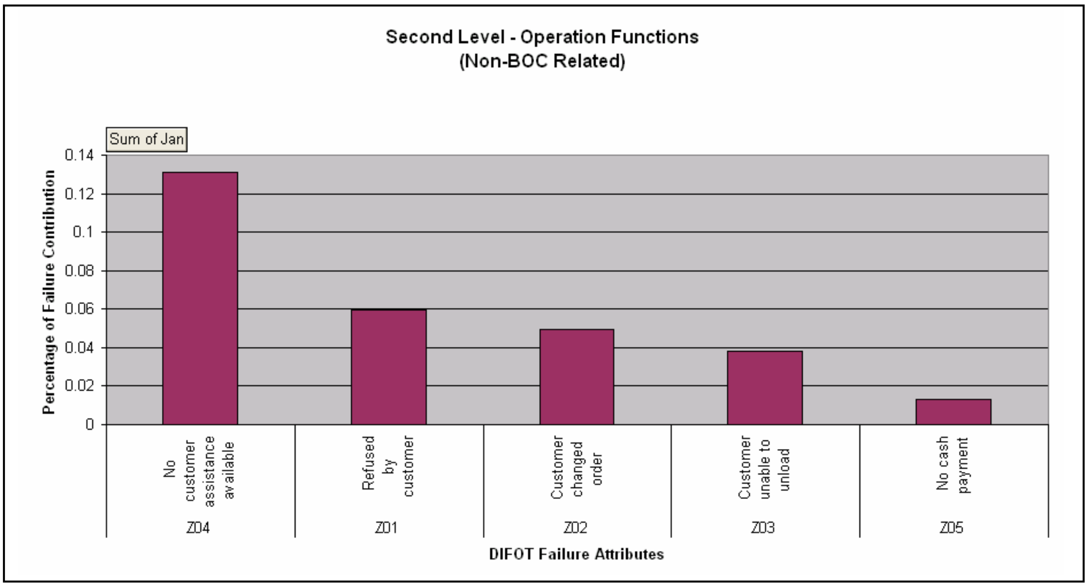

Figure 6.9: Non-BOC Related DIFOT Failure Attributes Analysis.

It is also to be mentioned that this is suppose to be a continuous learning process, where the failures codes could be changed from time to time to reflect the most recent condition. It is believed that but eliminating all the failures contributing factors, an improvement in DIFOT performance could be observed.

6.3 Improving Productivity

The current measurement on productivity – Capacity Utilisation and Vehicle Utilisation should be measured and trace more consistently. It is not surprising at all to notice that Figure 6.10 shows that Delivery Cost per Nominal has a negative correlation with Capacity Utilisation, i.e. the higher utilisation of the fleet will give a lower operational cost in return. This is achieved when all the available space on the trucks are fully utilised, theoretically less “runs” will be needed to deliver all the orders to all the customers. However, higher operational cost will be needed if the fleet is being “over utilised”. This is because of high maintenance fees due to higher wear and tear of the vehicle if it has been loaded with loads above its design capacity.

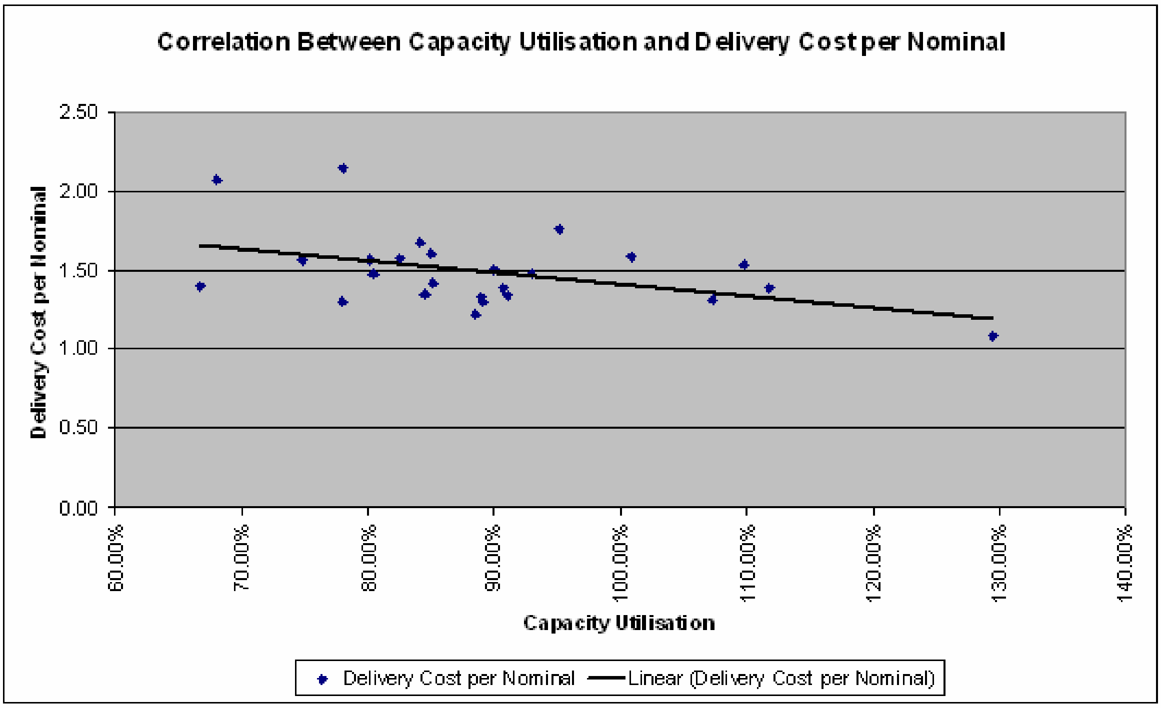

Figure 6.10: Correlation Between Capacity Utilisation and Delivery Cost

While Capacity Utilisation is link to Delivery Cost, Vehicle Utilisation has more impact on Total Fixed Cost. When the utilisation of the fleet is high, it needs lesser unit of vehicle, hence reduce in department's Total Fixed Cost, as shown in Figure 6.11.

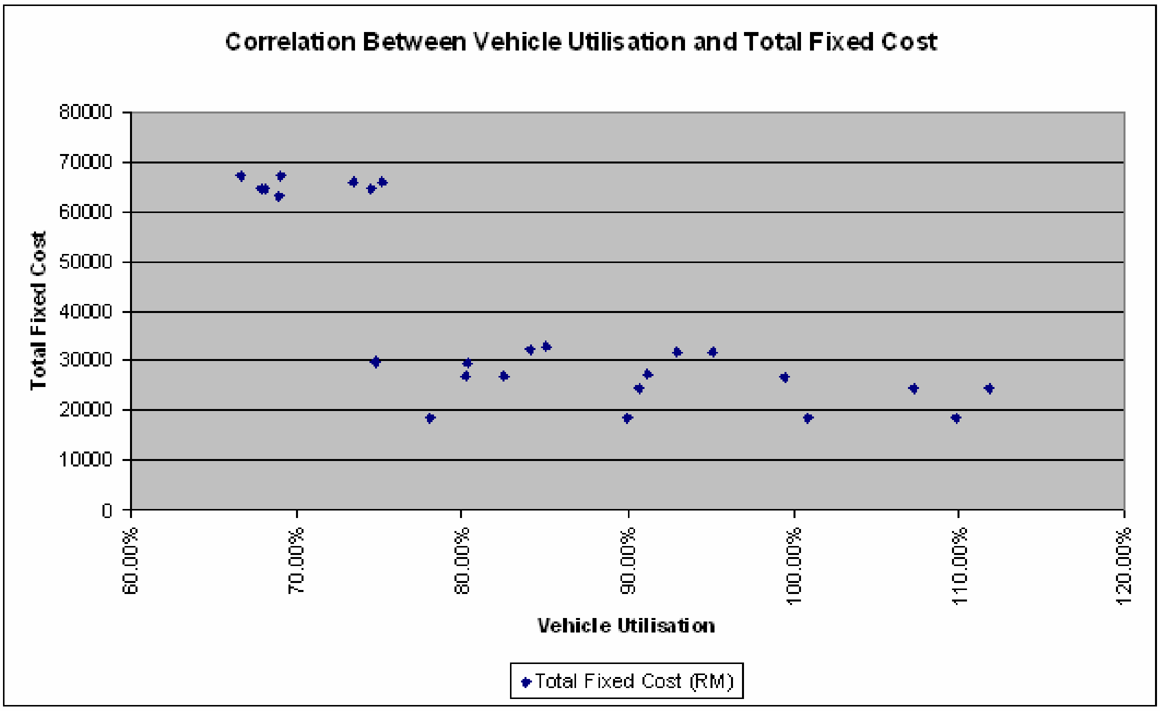

Figure 6.11: Correlation Between Vehicle Utilisation and Total Fixed Cost.

6.3.1 Better Capacity Utilisation

The goal of capacity utilisation is to deliver the maximum amount of product compared to the available loading space on the vehicle. The theory is that increased capacity utilisation will reduce the unit cost of product delivered by reducing the number of trips and distance driven. To continuously improve capacity utilisation managers must:

a) Ensure as much of the load as possible is delivered while maximising volume or nominals per distance travelled. This can be done by:
   - Having the manager work with scheduling to optimise trips/routes.
   - Having the drivers understand and report any issues that may prevent them from delivering all the product from the vehicle.
   - Effectively manage and reduce the gap between planned and actual driver trip activity.

b) Actively work with the drivers and schedulers to reduce the amount of non-value added activity, which can include:
   - Driver time between deliveries
   - Non-productive milk round deliveries

c) Actively counsel and coach the drivers regarding performance standards and use visual aids to indicate progress towards goals posted in conspicuous places in and around the facility.

d) Work with the planning function to improve the units delivered per distance travelled.

e) Aggressively pursue reduction of excess vehicle at the depot / location; following a philosophy of “just-in-time” rather than holding vehicles in reserve “just-in-case”. This can be accomplished by renting vehicles and using contract carriers to cover unplanned peals in customer demand.

f) Work with the planning and asset management functions to fit the vehicles to the trip demand profile. This can be done either during the normal vehicle replacement cycle or by transferring vehicles among locations.

6.3.2 Better Vehicle Utilisation

While capacity utilisation can be improved by suggestions mentioned in Chapter 6.3.1, vehicle utilisation can be improved by targeting assets for removal from the fleet.

Once removed, the overall fleet utilisation will increase if it is meeting the same level of overall demand.

6.3.2.1 Customer Demand Profiles

Customer order and delivery patterns should be thoroughly evaluated with a view to ‘smoothing’ customer demand. This can be achieved through the scheduling function and improved information gathering (demand forecasting) from the customer base. A full evaluation of the service specification, for example, tank refill frequency to given customers can influence vehicle utilisation. The ability to deliver more products to customers on a less frequent basis will ultimately reduce the total trip and subsequent vehicle requirement.

The delivery point features at customer premises also play a major role in vehicle utilisation. Locations which can only receive smaller vehicles due to access constrains and those with small tanks will increase vehicle utilisation. Site should evaluate customer access and work closely with the sales team to develop business ‘trade-offs’.

The ability to utilise vehicles throughout 24 hours and at weekends are of paramount importance to effectively reducing the core fleet and using the remaining assets to their full potential. The central scheduling function should work closely with sales to maximise access at unsociable times.

6.3.2.2 Planned Vehicle Maintenance

The planning of vehicle maintenance is crucial in improving vehicle utilisation. Vehicles should be serviced at periods of lower demand for example, night time hours. Extensive body work and other refurbishments should be conducted during the months of lower demand where appropriate.

Sites with accident damaged vehicles and / or high unplanned maintenance should call upon the possible availability of resources from the neighbouring sites without having to change the profile of the customer base and the service offering to the scheduling centre. Changes should only be necessary where the vehicle is unique to the branch or very highly utilised. Otherwise the separate in vehicle utilisation should be used for maintenance.

6.3.2.3 Driver Profile & Fleet Census

Driver flexibility to cover un-social working patterns is essential. It is the responsibility of the scheduling function to maximise the potential access to customer premises at un-social times. To achieve this, driver resources have to be available and be equivalent to schedule requirements. This will undoubtedly result in more drivers required to work nights and weekends. Greater driver flexibility coupled with increased deliveries into un-social periods will ultimately reduce the number of weekly, daytime peals and enhance vehicle utilisation.

To determine individual site fleet levels it is essential that regular fleet audits are conducted to reconcile actual assets to both the asset register and subsequent depreciation costs within site budgets. This process enables managers to fully understand their current fleet strength and cress check the corresponding costs. To be fully effective this should be carried out by an independent individual or department.

6.4 Managing Distribution Cost

According to Computer Aided Manufacturing – International (CAM-I), the goal of a cost management system is to provide information to help companies use resources profitably to produce services or products that are competitive in terms of cost, quality, functionality and timing in the world market. Within this context, a cost management system can be defined as a management planning and control system with the following objectives:

a) To identify the cost of resources consumed in performing significant activities of the firm.
b) To determine the efficiency and effectiveness of the activities performed.
c) To identify and evaluate new activities that can improve the future performance of the firm.

To aid the management and control process, it is essential that there is a thorough understanding of the lower level measures and their interaction to the overall transport cost per distance travelled. This can be best illustrated through a cost model which can be sub-divided into a number of smaller identifiable elements which when adjusted at the lower level will demonstrate the effect at each level. The model incorporates all of the Performance Indicators (PI's) associated with distribution and links their individual definition as discussed in previous chapter to a live working example which simplifies the measurement processes.

The model in Figure 6.12 is primarily a cost management tool for the Transport Manager. However, it also provides the senior manager with the headline costs and quickly allows them to ascertain where there re either cost inefficiencies or improvements within the operation. The overall KPI is **Total Distribution Cost per Distance Travelled**. This is sub-divided into the following:

a) Total Delivery Cost
- Total Fuel Cost
- Total Driver Cost
- Total Maintenance Cost

b) Total Fixed Cost
- Depreciation Cost
- Licensing Cost
- Insurance Cost

c) Total Overhead Cost

The model will eventually become a fundamental part of the KPI management tool kit and by simply changing a lower level value the manager can trace the effect on each of the relevant cost level. This can otherwise be known as the 'what if' model.

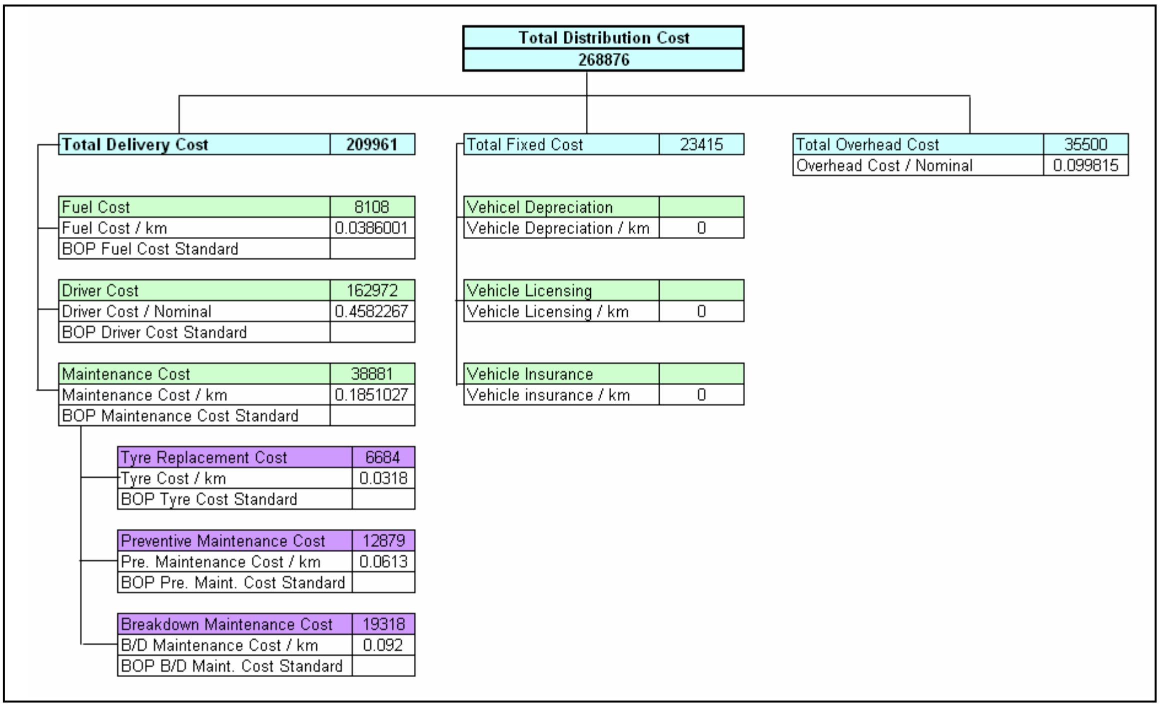

Figure 6.12: "What if" Total Distribution Cost Monitoring Model.

There are many advantages for expressing operational costs as performance indicators:

a) Give a better understanding and awareness of the individual cost drivers to the business. By expressing PI's for the cost components which make up a particular cost, it allows management to focus in these areas.
b) Acts as a tool for managerial development, objective setting and motivation. PI act as a 'yardstick' for setting specific financial targets or objectives within an operations. The training and development of managers in PI's ensures a wider understanding of the financial characteristics which constitute a business profit and loss.
c) Help to produce quantified tactical decision making. It is often necessary to fully evaluate the effect of an operational change within a business by demonstrating the effect of that change on the PI's before the decision is made.
d) Are effective benchmarking tools of an operation.
e) Simplify the process of trend evaluation, allowing management to focus on critical areas. The evaluation of PI's on cost measures enables managers to identify negative trends and formulate early corrective actions.
f) Simplify the budgetary process and target forecasting and re-forecasting. PI's are an effective tool in the budget setting process. They provide realistic targets which can again be diluted into particular measures. Historically, budgets are set from the higher level measure for example total cost. The effective use of PI's means that budgets can be compiled more accurately from cost measures for example cost per distance travelled forming part of total cost.
g) From part of a managerial 'tool kit' aimed at improving the financial skills of managers. The understanding of PI's and their link to financial reports is a critical area of development for managers.
h) Provides first line managers with the 'vision' to their contribution to the company's performance.
i) Aids in the analysis of the customer profitability.

6.4.1 Effective Cost Control

As cost is the most important KPI that management is putting the accent on, it is extremely important to monitor cost down to individual cost element level so that one can have a good idea of where does all the money gone to. Since Fixed Cost and Overhead Cost will be about the same most of the time, unless there is a major change in structure or purchase of new vehicle. Hence the detailed monitoring of Cost expenditure will be done only for Delivery cost, which comprise of three main cost element – driver cost, fuel cost and maintenance cost.

Two charts (Figure 6.13 and Figure 6.14) will be developed, showing monthly trend for Delivery cost and its three cost element against YTD Target and Best Operations Practice respectively. The charts are easy to construct, user friendly and easy to understand. It shows the trend of delivery cost over the year and the specific elements, which contributes to the high cost of the month, allowing the manager to focus on specific area while taking action to reduce expenditure. It also keep a close tracking record of all the coast incurred and the cost elements against planned or budgeted figures, allowing line manager to know when performance has dropped and actions should be taken. With these guided tools, the manager will be able to control the cost more clearly and transparently, avoiding the ‘taking wrong medicine’ situation to occur.

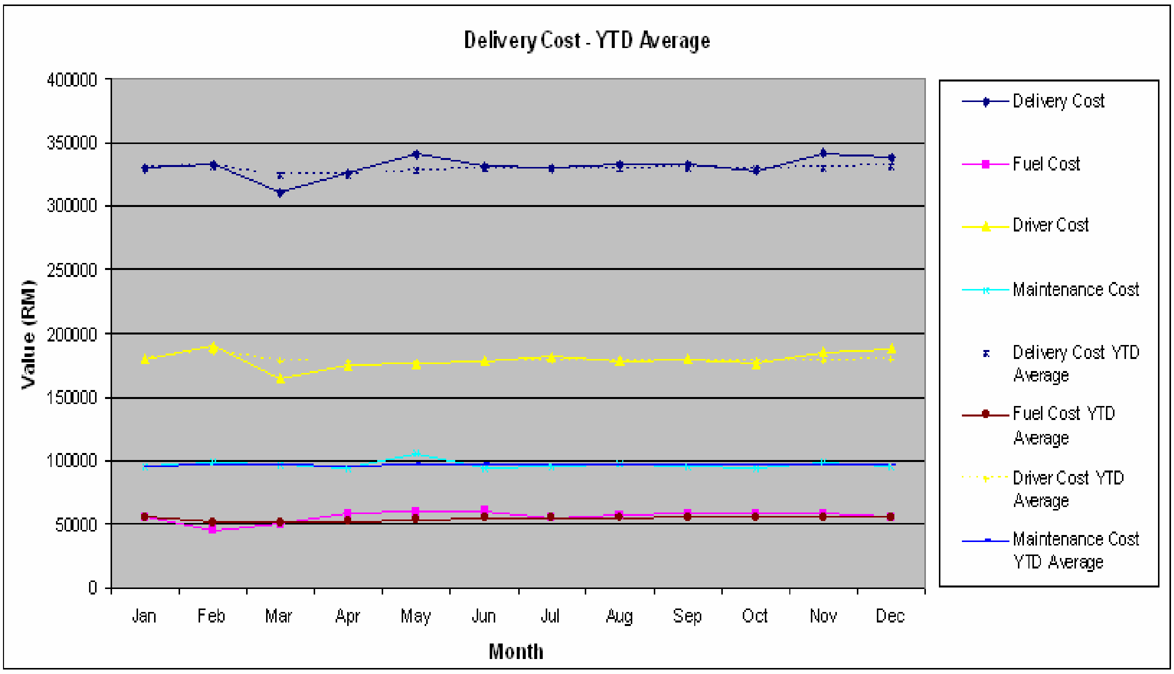

Figure 6.13: Delivery Cost Element Monitoring Chart – Against YTD Average

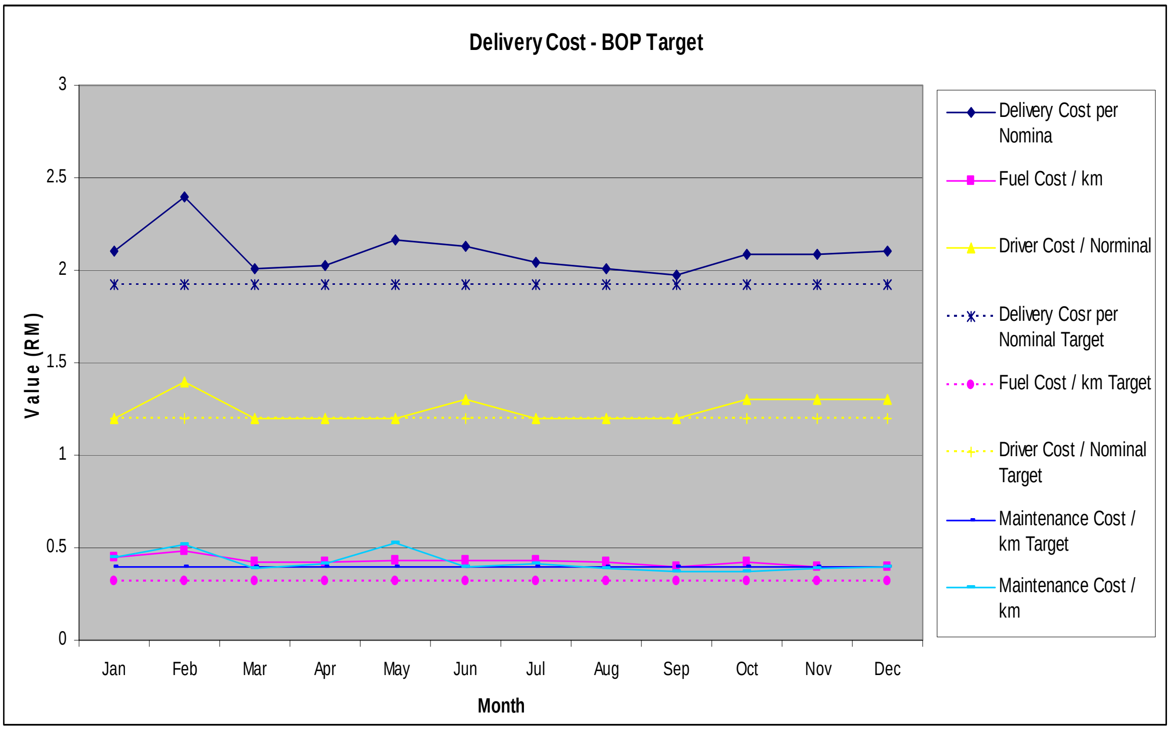

Figure 6.14: Delivery Cost Element Monitoring Chart – Against BOP Target

Effective cost control through better management techniques can help a business in the following areas:

a) Determine the level of profitability of operations and customer accounts.
b) Management information to help the decision making process so that decisions can be made with the full knowledge of costs incurred.
c) Acts as an aid to the overall planning of distribution activities, decisions on vehicles ownership, contract hire, leasing, purchase and replacement policy and so on.
d) Specifically identify negative trends within individual cost components and enables management to take early corrective action.
e) Aids the commercial decision making process when biding for new contracts.
f) Ensures that a sufficient Return of Capital Employed (ROCE) is being achieved through the use of the company's assets.

6.4.1.1 Pool Reserve

With certain operations it may be possible to allocate surplus vehicles to a centralised pool. This is often the case in periods of low demand. This process has the benefit of saving some running costs in the short term and should reduce the overall number of reserve assets required in the fleet to cover peak demand and emergencies, rather than locating reserve vehicles at each location.

There are generally two types of vehicle reserve:

a) Short term loan for the replacement of a fully utilised vehicle for maintenance of say more than 3 days.
b) Strategic requirement for plant failure where a large number of vehicles will be needed to be quickly mobilised.

It is critical to ensure that there are recommended reduced maintenance for these vehicles and that there is identification of how quickly they can be brought back into service. To gain maximum financial benefit from the reserve fleet, the older less efficient vehicles should be those that are identified. For example:

a) Reserve vehicles which are allocated to the central pool mean that the site's total fixed costs will be reduced by both the running and depreciation costs. However, the business central account will bare the depreciation cost (still a cost to the company, however less).
b) By acknowledging spare resources and allocating them into the central pool, this provides the national operation with a wider vision of the spare business' assets. This has the added benefits of possibly moving the 'spare' resource into a site which is either short of vehicles or is paying for the additional use of carriers when it may be more cost effective to use an internal asset which is currently generating an unproductive cost.

6.4.1.2 Better Vehicle Depreciation Control

The straight line method of depreciation calculation is not particularly accurate as vehicles do not depreciate evenly per year. To further improve on the vehicle depreciation calculation, the manager needs to understand the relationship between the expected useful life of the vehicle and the period of depreciation. The period of time that a vehicle is depreciated over varies throughout different businesses. This period of time depends upon the asset type and business policy.

The depreciation period has a relationship with the expected useful life of the vehicle. As a vehicle becomes older the performance of that vehicle will deteriorate. This will result in an increase in maintenance costs, a reduction in fuel efficiency and a reduction in the resale value of the vehicle. This is often referred to as increasing a vehicle “life time cost”. To this end the operator can influence this number by coming to a policy decision regarding the whole lifetime cost of the vehicle. Additionally, decisions are often made to keep a vehicle longer that it’s depreciation life cycle. This will result in no monthly depreciation cost but there will be a trade off with maintenance costs as these will tend to increase at a more rapid rate with vehicle age.

Managers can influence this cost by improving vehicle utilisation to an extent that the operation requires less vehicles to deliver that same level of customer demand. If a vehicle is sold or transferred to another cost centre within the business there will be a reduction in the monthly depreciation cost as well.

6.4.2 Transport Overhead Cost

Lowering overhead costs which are a fixed cost will reduce the total cost of distribution, assuming all other variables remain the same. The few areas below can be looked into to improve the cost. The cost of office personnel salaries are normally the largest percentage of overhead costs. Therefore, it is vital that a site be staffed with the minimum number of personnel needed to manage the location.

A detailed listing of all required tasks that must be performed should be completed. Associated to each task should be the time that is required to complete that task. Factors to be taken into account will be the volume as well as the complexity of the tasks undertaken. For each task that is performed the time for that task would be multiplied by the number of times the task is performed in a month. This gives the required monthly time. By completing this process for every task a total monthly time can be computed. This will allow managers to determine the number of office personnel that would be required.

Another issue is the time of day when certain tasks must be performed. The two key local administrative requirements are delivery confirmation and dispatching.

6.5 Overall Performance Matrics

Department should be managed as a whole and all the KPI's are inter-related, all contributing to the department's performance and at the same time, could be contradicting to each other. Hence, it is irrelevant to manage each and individual KPI separately on their own. Managing the department at a macro view is important. Nevertheless, monitoring the performance at micro level is equally important.

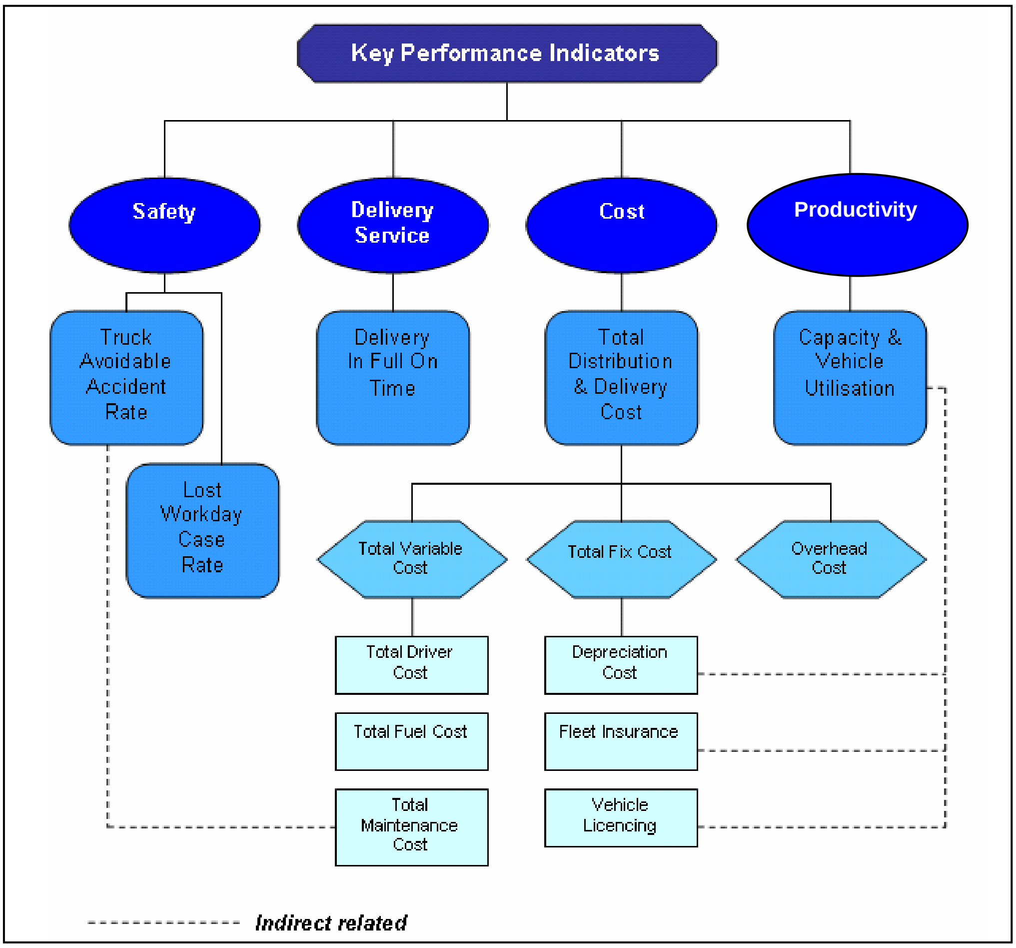

Figure 6.15: Integrated KPI Monitoring Matrics

Figure 6.15 above shows the overview of the integrated KPI Matrics. It shows the link and relationship four main areas of KPI measurement, seven main KPI's, sub-KPI's as well as element contributing to KPI's. These measurement filed will then be measured monthly and converted according to pre-defined weight age as Overall Performance as shown in the Healthcard in Figure 6.17. The Healthcard is a performance monitoring tool which provide the manager both macro and micro view of the department's performance, detailed to individual root cause of failed performance.

Figure 6.16 summarises the four main competency area of MOX Logistics Operations Department and its KPI's. The standard for these KPI's are review and reset annually with the benchmark against sister company and other companies in the similar industry. Every beginning of the year, these KPI's together with its standard (required standard and stretched standard) will be compiled into different levels of Service Level Agreement (SLA) – Department SLA and Individual SLA, better known as Individual Performance Contract. The KPI's are monitored closely monthly, if not weekly. Some critical measurement such as DIFOT will be monitored daily. The reports of these measurement will be complied and submitted monthly (operations level), quarterly (country level) and annually (regional level).

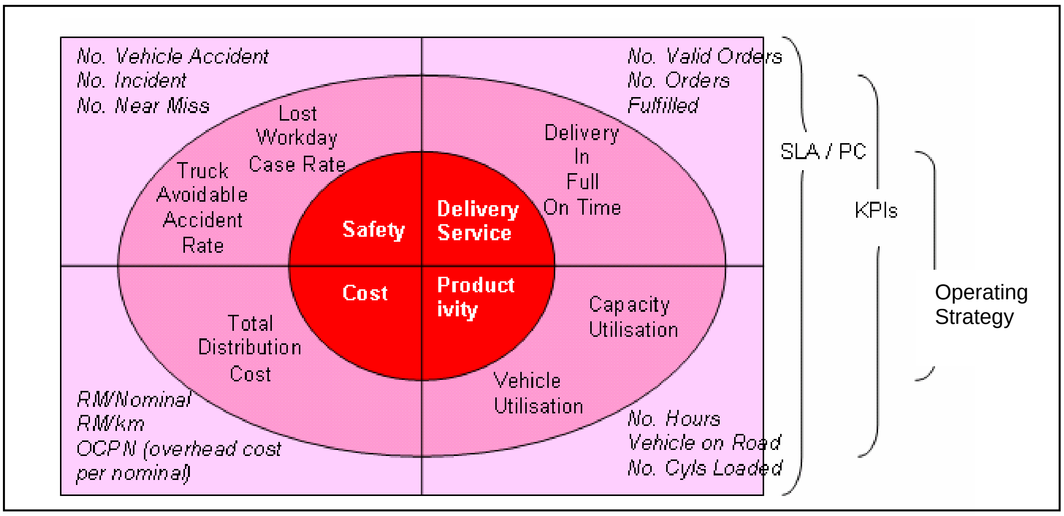

Figure 6.16: Translating Operating Strategy to Service Level Agreement

Monthly performance will be captured into respective filed, and the variance of the month will be computed by benchmarking monthly performance against desire performance (target). For KPI which performance is above target, full weight age percentage will be allocated. Half of the weight age percentage will be allocated for KPI's that is below target within an acceptable range, and 0 percent will be allocated for KPI's that perform below minimum requirement standard.

LOGISTICS OPERATIONS HEALTHCARD

	TARGET	Weitage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD	Variance
Safety																
TAAR	1.7	10.00%	0	0	0	0	4.49	0	5.85	0	0	0			1.034	39.18%
LWCR	5	10.00%	21.08	0	0	0	0	0	21.08	0	0	0			4.216281	15.67%
Delivery																
DIFOT	99.50%	25.00%	98.4%	99.5%	98.7%	98.6%	98.2%	98.7%	98.9%	98.8%	99.1%	99.1%			98.80%	-0.70%
Productivity																
Capacity Utilisation	90.00%	8.00%	80.25%	82.48%	91.14%	90.70%	107.26%	111.76%	100.89%	109.84%	89.99%	78.13%			94.24%	4.24%
Vehicle Utilisation	90.00%	7.00%	85.07%	95.14%	92.94%	84.14%	99.45%	80.39%	74.81%	80.25%	82.48%	91.14%			86.58%	-3.42%
Cost																
Cost/km	1.55	20.00%	1.57	1.58	1.34	1.39	1.31	1.38	1.59	1.59	1.51	2.15			1.541	0.58%
Cost/Nominal	3.15	20.00%	2.73	3.47	2.9	2.67	3.14	3.41	3.12	3.03	3.06	3.29			3.082	2.16%
Overall Performance	90%	100.00%	56%	62%	88%	81%	78%	61%	51%	71%	77%	50%			84%	

Remarks:
For performance above target, full allocation of weithage.
For TAAR, LWCR, Cost/km & Cost/Nominal:

Figure 6.17: Converting Performance into Indicators – Healthcard

6.5.1 Benefits of Using Overall Performance Matrics as Management Tool

Figure 6.15 and Figure 6.16 shall display the overall view of how four identified Key Performance Indicators (safety, cost, productivity and delivery service) are integrated, how they are being translated from company business strategy to performance measures and how these performance are being measured and tracked systematically. By using the Overall Performance Measurement Matrics, the management shall enjoy the following benefits:

1. A better understanding of department's overall performance, where is the strength and where are the weaknesses.
2. A better idea on the integrated performance matrics and how each KPI relates to another KPI.
3. Whole ownership of the department's overall performance for every stakeholder.
4. A systematic track record of previous performance for benchmarking, comparison and future performance projection.

It is here to reiterate that the performance measurement tools introduced are just to assist the manager to manage the department performance in a more systematic and complete manner. It is most important for a manager to keep his mind open to the performance, always wanting to find out more about the performance by asking why, why and why.

CHAPTER 7

IMPLEMENTATION

7.1 From Recommendation to Implementation

For the purpose of categorization, implementation is defined as the phase in which systems and procedures are put in place to collect and process the data that enable the measurements to be made regularly. It is a process of data collection, collation, sorting and distribution. This may involve computer programming to trap data already being used in the system and present them in a more meaningful form. It may involve initiating new procedures, so that information currently not recorded is captured and it may involve completely new initiatives, such as the setting up of a regular customer or employee survey.

The use of performance measures is split into two main subdivisions. First, as the measures are derived from strategy, the initial use to which they should be put is that of measuring the success of implementation of that strategy. Second, the information and feedback from the measures should be used to challenge the assumptions and test the validity of strategy. In fact, authors have argued that they should be used for both purposes. Therefore, "assessing the implementation of strategy" and "challenging the strategic assumptions" are the two main subdivisions of the use of the performance measures.

7.2 Performance Management for Continuous Improvement

Performance measurement is not an end itself, but a tool for more effective management. Results of performance measurement indicate what happened, not what to do about it. In order for an organisation to make effective use if its performance measurement outcome, it must be able to make the transition from measurement to management. Procurement Executives' association defines in Moving From Performance Measurement to Performance Management (2002) that a performance management is the use of performance measurement information to effect positive change in organisational culture, systems and processes, by helping to set agreed-upon performance goals, allocating and prioritising resources, informing managers to either confirm or change policy or programme directions to meet those goals, and sharing results of performance measurement in pursuing those goals.

As the main purpose of performance management is continuous improvement, the process of developing and implementing the new performance measurement is a process of continuous improvement itself. The designed performance measurement matrics provide feedback based on specific rather than generalisations and are based on specific objectives derived from the desired outcome. It provides organisation the opportunity to refine and improve their development activities. To move effectively from performance measurement to performance management, two key components need to be in place:

- The right organisational structure which facilitates the effective use of performance measurement results; and
- The ability to use performance measurement result to bring about change in the organisation.

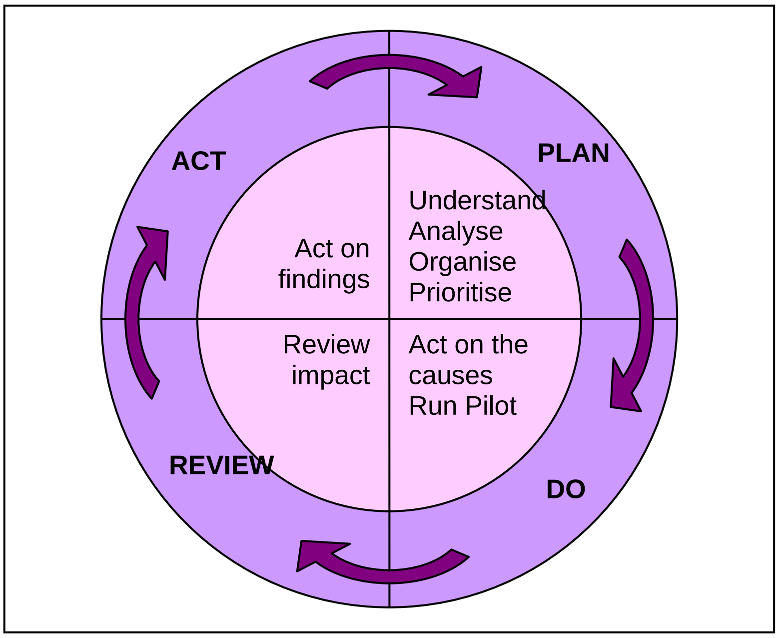

Figure 7.1: The Learning Wheel.

Source: Adapted from Turner Suzanne (2002), Tools For Success, A Manager's Guide, McGraw-Hill Professional, United Kingdom, page 82.

7.2.1 Eight Steps Change Strategy

There is not a rule for change; the only rule for change is to continue changing. However, the author recommends that there should be a systematic approach to manage change. This systematic approach to manage change is just a guideline on how and what to do at certain stage of change, bear in mind that the content of change, what to be changed and how to change is always a change itself.

Approaches to change needed to be matched to the constrains under which an organisation operated, these constrains were themselves amendable to change and in any case could conflict with each other (Burnes, 1996). The author will adopt John P. Kotter (1998), Eight Steps to Transform Your Organisation in implementing the changes in performance measurement in Logistics Operations unit in MOX. They are illustrating and shown by figure 7.2:

1. Establish a sense of urgency
2. Form a powerful guiding coalition
3. Create a vision
4. Communicate the vision
5. Empower others to act on the vision
6. Plan for and create short-term wins
7. Consolidate improvements and produce still more change
8. Institutionalize new approaches

Besides having a good model of change and keeping tracking it while implementing change, there are few soft elements of management which cannot be neglected by the change agent. The author outlined 3 elements, strong visions, communication and managing people as below which he feels is important and worth consider about.

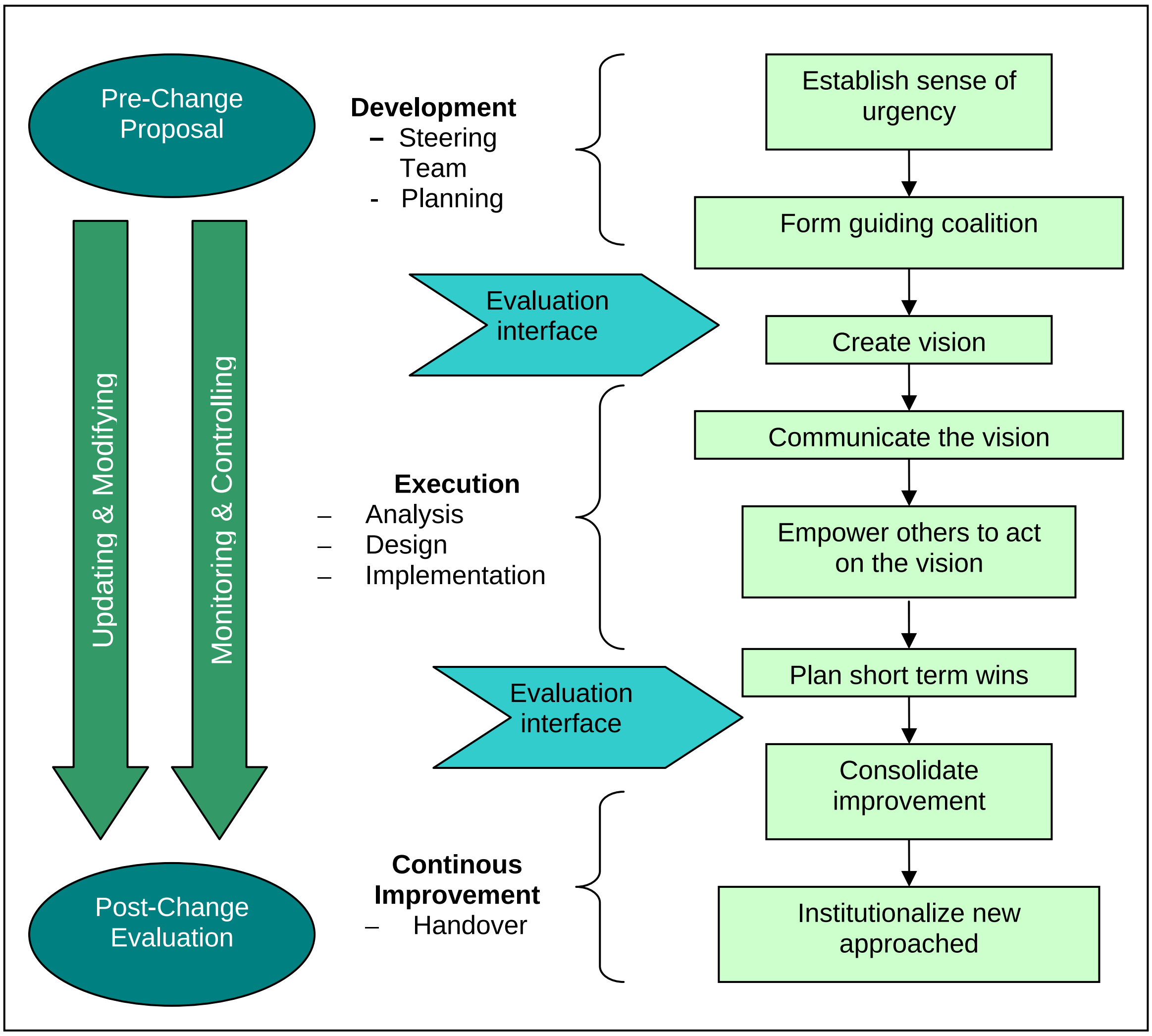

Figure 7.2: The 8 steps change model.

7.2.1.1 Implement Effective Communication

Communication is the most important soft element of all. One can help people through the neutral zone with communication (rather than simple information) that emphasizes connections with and concern for the followers. To keep reiterating the “4 P’s” of transition communications:

- The purpose: Why we have to do this.
- The picture: What it will look like when we reach our goal.
- The plan: Step-by-step, how we will get there.
- The part: What you can (and need to) do to help us move forward.

Through effective communication, it will be possible to sell the change ideas to others and lead them through the change curves. The main idea of communication is to let all parties involved know, understand, accept, adopt and last but not least, live the change ideas. It is important to remember that, in MOX, as most of the people involved in this change are drivers, whom educational level are majority low, communication via simple and direct message is the most effective means.

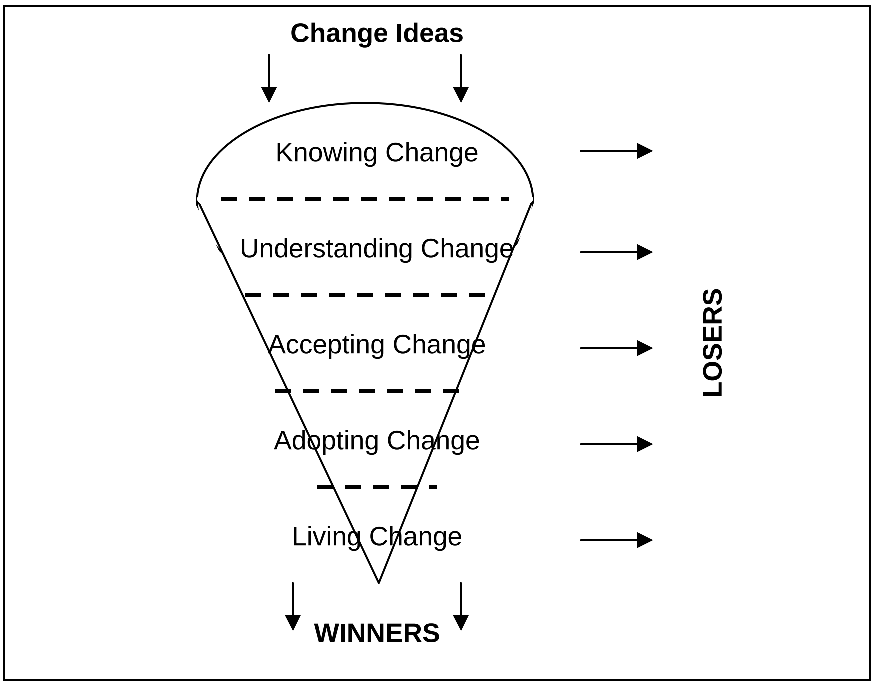

Figure 7.3: 5 stages of change communication

Those who successfully go through these five stages of communicating change are the successful change agent, we called winners. Those who can't manage to sell through five stages will loose out some way in between, and then change will not happen.

When here is communication, conflict will always happen, as communication itself is imperfect. Putting an end to conflict is the last thing leaders should hope to achieve. Conflict should be managed, not eliminate. Leaders must be at the forefront of conflict, managing it – and serving as role models – everywhere in the organisation.

As performance management is a sensitive aspect, especially in the human area. The author foresees the greatest resistance in the implementation of new performance measurement system is managing the conflict. As most people are used to and comfort in being measured in the old ways, it is always difficult to manage them through the change. Advice from the author is to be patient and persistent.

7.2.1.2 Strong Vision

Vision helps people make smart choices because their results are being made with the end results in mind. It takes into account larger picture than the immediate goal. Hence, vision is important for leaders (change agent) as it is about going somewhere.

Without a clear vision, an organisation becomes a self-serving bureaucracy. Once the vision is clarified and shared, the leader can focus on serving and being responsive to the needs of the people. The greatest leaders have mobilised others by coalescing people around a shared vision. When people share and believe in a vision of what the organisation can be, they generate tremendous energy, excitement and passion. They will feel at they can make a difference, and they can make their contribution on their own way towards change.

After having a strong vision, it is important to live the vision. While top management should involve as many people as possible in shaping and communicating vision and direction, the ultimate responsibility for making sure that these are done lies with the hierarchical leadership, i.e. the top team. It takes courage to create a vision and it definitely takes courage to act on it. Two strategies that will support the efforts to live the vision are:

a) always focus on your vision, and
b) show the courage of commitment.

Back to MOX context, as most of the vision (targets) are set from top to down, it is important to get each and everyone on the department to initialise the targets. It is important to publish the monthly performance report for everyone to view, so that they can directly feel the ownership of the measurement. This method can get everyone involve to keep track of their own target, and be responsible for the performance improvement plan. It is also use to create a common understanding on current performance as well as common goal of future target. As mentioned, performance measurement is not only for manager, it is for everyone.

7.2.1.3 Managing People - Driver

Producing change is about 80 percent leadership – establishing direction, aligning, motivating and inspiring people, and about 20 percent management – planning, budgeting, organising and problem solving. (John P. Kotter, 1998)

Managing driver starts with managing their need. Abraham Maslow, an American psychologist, was one of the first to differentiate between and classify different types of human need. There are five distinct forms of demand need which he placed in hierarchical order. He argued that, beginning at the lowest level, a person had to satisfy substantially the needs at one level before he or she could move up the hierarchy and concentrate on 'higher order' needs. In ascending order, the five levels in Maslow's Hierarchy of Needs are:

a) Physiological needs – hunger, thirst, sleep (only when these basic needs have been satisfied do other needs begin to emerge).
b) Safety needs – the desire for security and protection against damage.
c) Social needs – the need to belong, to gain love and affection, to be in the company of others.
d) Esteem needs – these reflect a person's desire to be respected – esteemed – for their achievements.
e) Self-actualisation needs – the need to achieve one's full potential.

Applying Maslow's hierarchy of needs to human behaviour in organisations, it can be seen that most of the driver will first of all be motivated by the desire to satisfy physiological needs through monetary rewards. Once those have been substantially satisfied, however, they will seek to satisfy or be motivated by their safety needs, such as job security and welfare benefits. Most people resist to change is because changes directly impact both of these basic needs. Hence, it is important for a change agent to understand other's hierarchy needs, help the driver to overcome their problem, and from there, lead them towards change.

The annual driver performance evaluation session could be a very good opportunity for a Transport Manager to understand his driver in more detail. However, it is also suggest that the manager should always reach out for their driver and to know each and everyone of his driver well. This is the fundamental of managing driver.

7.3 Driver Management

Drivers are the most important component in a delivery service. The importance of driver’s performance is based on the fact that drivers have direct input into the highest cost areas of labour, fuel and vehicle maintenance cost. Based on figure 5.3, driver’s cost made up to 41% of total distribution cost, and they have high influence on the maintenance and repair cost, tyres cost as well as fuel consumption. It is also a fact that drivers are the frontlines that deals with customer everyday and they carry company’s image the most. A driver’s appearance and behaviours will portray company’s image to the public. That is why drivers management is important and to manage a drier is not an easy task.

7.3.1 Driver Performance Management

The proposed driver performance management seeks to create a two ways communications structure for management and drivers to identified development opportunities against clear performance goal. This will be accomplished y establishing standards of performance, measuring and recording performance, performance review and establishing a development and improvement plan based on performance. High standards of performance will be concise and clearly communicated to all drivers such that the drivers can clearly understand what is expected of them. It is important that all drivers assist the company in setting ever more challenging targets for the future.

Due to the fact that a driver works mainly offsite, communication between management and drivers is more difficult. This difficulty must be overcome on order to keep the driver focused and performing at the expected level. One of the cornerstones of this process will be to provide clear feedback to the driver on the progress being made. It will also provide the environment where continuous improvement can be properly focused towards the increasingly demanding needs of our customer.

All drivers should have performance checks through periodic task observations. The results from task observations, accident analysis or complaints against a driver help check training effectiveness and compliance to the standard. Follow up remedial and rehabilitation efforts should be extensive at the outset until there is evidence of satisfactory performance. Spot checks for all drivers are occasionally needed to disclose "soft spots" in their performance, and to help in training and retraining.

Because driver cannot be personally supervised every minute, a driver must be motivated to police their own work performance. Driver must know what correct performance is. Once they are trained in technique, drivers can then be motivated through pride of workmanship, skill or other factors to do a superior job.

7.3.2 Involving Driver in Overall Performance Measurement

It is important to involve driver in implementing Overall Performance Measurement. As driver comprises 70% of the total headcount in the department, they are the most critical factor to determine successfulness in implementing the new performance measurement system. It is proposed that the implementation team to consider taking following suggestions for smooth implementation.

a) **Proper communication to driver:** Communication to driver should be done in simple language but creatively in order to convey message correctly. Various communication techniques such as verbal, printed and games should be used to make sure message get a crossed. Verbal communication should be done consistently by using drivers' common language if possible. As for printed communications, it is always more effective in replacing words with attractive pictures, as a picture says thousand words.

b) **Proper training to expose driver to the new measurement concept:** It is always the management's responsibility to provide training to drivers before asking them to comply with certain work standard. Training via simple team games and workshops is a good way to make driver aware of their contribution to quality, safety, cost and productivity, as well as the consequences if the company fail in theses areas.

c) **Continuous communication to create awareness:** To change a driver's mind set to accept a new performance measurement concept is not something that can be done overnight. The management must put in effort to make sure a two ways communication is done periodically to deliver message as well as receive feed back. Encourage driver to give feed back and positive ideas for improvement plan. Positive suggestion and successful ideas will be credited to drivers. This is to create an open environment that encourages drivers to voice out their opinion at all time. When a driver feels safe in a open environment, they tends to accept changes more openly.

d) **Evaluation and improvement program:** Driver's performance will be measured through observation of driver's actions that are significant and measurable. This is an event that should be brought to the attention of the driver concerned at the time the event occurred. The purposed is either to record a noteworthy achievement or identify where change in performance is necessary. The performance review process must be maintained transparent throughout and there must be no surprises for the driver at the review meeting. The goal to the evaluation process is to strive to improve performance of the drivers. Through evaluation process, gap between current performance and desire performance will be identified. Once the gap in performance has been agreed then a plan to remove the gap must be created.

e) **Reward on improvement:** Whenever there is an improvement, the drivers should be rewarded to show that their effort is being appreciated. Simple motivation action such as a get together dinner with senior management if the department manages to hit particular target would be good to motivate the drivers. Individual excellence performers could be further developed to become tam leader, drivers' trainer and also as a cover support for management.

7.4 Obstacles to Implementation

According to Bourne, Mills, Wilcox, Neely and Platts in Designing, Implementing and Updating Performance Measurement Systems (2000), there were three main obstacles to the full implementation of the performance measures. These were:

- Resistant to measurement, occurring during design and use phases;
- Computer systems issues, occurring during implementation of the measures;
- Top management commitment being distracted, occurring between the design and implementation phases.

On reflection, the implementation of a new performance measurement system can be seen as “changing the rules of the game” or redistributing power in the organisation. Individuals and groups may see this as not being in their best interest and actively or passively resist the implementation. The process of redistributing access to information can be seen as threatening to senior managers whose power base is altered, therefore it is not surprising the resistance to performance measurement was observed.

Implementation of the individual measures does not create a performance measurement system. Measuring is only one part of using the measures. A forum is needed to review the measures and ideally to agree action. To do this, a regular meeting is required, attended by the directors and managers who have responsibility for the performance being measured. These performance measurement reviews took time to develop. Skills also need to be developed in critiquing and learning from the performance measures in a group. Besides the difficulties with computer systems, causing information on certain measures to be unavailable, it took time to adjust to the correct format.

CHAPTER 8

CONCLUSION

8.1 Conclusion

The growing interest in the Performance Measurement Systems (PMS), due to the broadening of the spectrum of performances required and to the support of programmes for performance improvement (JIT and TQM), has led to, on one hand, an updating of the accounting systems and, on the other hand, an extension to the non-cost performances. These new frameworks placed emphasis on external and future looking performance measures. These have posed the problems of greater complexity and articulation of the PMSs.

This project, thus, was aimed at the identification of the conceptual dimensions and the constructive variables of an improved PMS for MOX. As a result of the study, an Overall Performance Matrics (OPM) is developed to integrate different dimensions of performance – internal and external, cost or non-cost.

8.1.1 Identifying Key Performance Indicators

Through various interviews sessions with senior management team and shop floor employee, it is identified and agreed upon that Operational Cost, Delivery Service Level, Safety and Productivity are the four most important Key Performance Indicators (KPI's) and should be incorporated in the Overall Performance Matrics for measuring and monitoring. An analysis that shows the correlation between these four KPI's is also presented in Chapter 6.

8.1.2 Developing Integrated KPI Matrics

The four identified KPIs are integrated and an Overall Performance Matrics (OPM) is developed. These KPI's are assigned to a weight age, and shall contribute to the overall performance ratings. These weight ages are assigned in a way that it is in lined with the company's business strategy and objectives. The weight assigned shall reflect the emphasis that the company stressed on a certain KPI. The OPM also shows which are the Critical Success Factors (CSF's) of the organisation, and how well are they doing in the area.

This Overall Performance Matrics can also be used as a simulation model during annually planning and budgeting process. It demonstrates to the management the cause and effect on a proposed strategy, helps trouble shooting processes and scenario planning sessions.

8.1.3 Implementing Overall Performance Measurement Systems

Process of implementing overall performance measurement system is much more complicated compare to the process of designing it. The change mode by John P. Kotter (1998), "Eight Steps to Transform Your Organisation" will be adopted in implementing the changes in performance measurement system in Logistics Operations unit in MOX. Besides having a good change model, some soft skills must also not to be neglected. Three important elements in any change implementation process: strong visions, communications and managing people have been discussed about.

Driver management, which is another critical area management must pay attention at, as they are the most important factor in the successfulness of the change. It is crucial to involve driver, and get their buy in, while implementing the new performance measurement system. This can be done by having clear communications to driver, training provided to equipped driver with new skills, creating an open environment, proper evaluation and development process, and last but not least, reward those who contribute in the change.

8.2 Integrating Performance Measurement System with Other Firm Systems

According to Kaydos as mentioned in Performance Measurement Systems – Models, Characteristics and Measures by Toni and Tonchia (2001), the Performance Measurement System (PMS) is not, nor can it be an isolated system. Both because it shares inputs with the other systems and produces outputs for other systems. As a consequence, the PMS has a strategic “position” inside the firm. A PMS must be integrated with at least three other types of systems in the organisation:

a) The accounting system (regarding both the balance sheet accounting, the analytical cost accounting and the budgeting);
b) The operations planning and control system (OPCS);
c) The strategic planning.

As far as integration with the accounting system is concerned, data relative to cost performance are a part of and are elaborated within, the ambit of the analytical cost accounting, which is then link to the traditional indices of the balance sheet accounting, while the budgeting does not normally include performance other than the economical and financial ones. In regard to integration with the strategic planning, precisely with the operations strategy, without doubt the PMS is correlated to it. The integration with the operations planning and control system is, on the other hand, targeted at economy of gathering technical and productive data. The OPCS considers them for the operations planning and control while the PMS considers them for measurement of performance.

8.3 Usage of Performance Measurement System Other Then Measuring Performance

Wisner and Fawcett (1991) have individuated at least two reasons for a Performance Measurement System (PMS): to compare one’s own competitive position with that of the competitors and to check on the accomplishment of one’s own objectives. Neely (1998) also mentioned that three different roles of PMS are to comply, to check and to challenge.

Besides this, Simon R, also mentioned in Performance Measurement System Design (1995) that performance measures can be used to influence behaviour. He argues that it can be used as a means of surveillance, motivation, monitoring performance, stimulating learning, sending signals or introducing constrains.

8.4 Benefits to the Company

The primary function of the performance measurement system is to control organisational operations. It furnishes a language for describing expectations and performance, thus laying the foundation for discussion on how each individual can contribute to fulfilling the organisation's vision. Thus, the performance measurement system provides a basis for determining the appropriate efforts in the overall balance and for communicating such efforts through management control. In this way, the use of performance measurement system facilitates learning by developing participation, awareness, a decentralised decision-making process, and responsibility for achieving the goals which have been formulated. As a consequence, there must be a goal-achievement analysis, in which the organisation draws conclusions about what it is doing well, what is not doing so well, and what can be improved.

The performance measurement matrics also could be used as a tool that lets the logistics organisation track progress and direction towards strategic goals and objectives and should focus on whether the organisation has met its performance goals and targets. By creating this measurement matrics at the center of its management systems, the organisation will be able to evaluate organisational strategy in light of the recent performance. It enables the organisation to modify strategies to reflect real-time learning and the implementation of performance management systems gives organisation the capacity for strategic learning.

8.5 Future Considerations

This study argues that defining and measuring performance in logistics operations is a difficult enterprise. The literature review reveals the nature and limitations of the various designs and measures have been used thus far, and suggested that there are no perfect performance measurement system as yet.

There are issues associated with performance measurement systems which the author thinks should be taken into consideration in the future development of the project:

1. How can performance measures be designed so that they encourage inter-functional co-operation?
2. How can performance measures be integrated both across an organisation's functions and through its hierarchy?
3. How can performance measures, which do not encourage short-term is be designed?
4. How can performance measures be designed so that they encourage appropriate behaviour?
5. How can we ensure that the performance measurement system matches the firm's strategy and culture?
6. How can one ensure that the performance management loop is closed – that corrective action follows measurement?

The final issue, and one which has not yet been touched, is that of predictive performance measurement. Much of work on performance measurement to date, is that managers use measures both to monitor past performance and stimulate future actions. However, people are beginning to look for "predictive" measures, such as statistical process control, which show that something is going out of control, before too much damage has been done.

CHAPTER 1

INTRODUCTION

1.1 History of Malaysian Oxygen Berhad

Malaysian Oxygen Berhad (MOX) is the leader and largest industrial gases company in Malaysia with:

- more than 65% market share
- Employs over 600 people
- Total sales turnover in year 2000 in excess of RM 400 million

Listed since 1981 on the KLSE main board, Malaysian Oxygen Berhad (MOX) is the leading manufacturer and supplier of industrial, medical and specialty gases, welding electrodes and equipment in Malaysia. It has over 40 years of industrial gases manufacturing experience in Malaysia. In its original form as Malayan Oxygen Ltd (MOL), which was incorporated on September 1960, the company, on 1 October 1960, acquired the business and assets of Industrial Gases (Malaya) Ltd., which had been operating in Malaysia and Singapore since 1946. Subsequently, in September 1974, it acquired Malayan Welding Products Sdn Bhd (MWP). November 1978 saw the establishment of MOX as a result of the merger between MOL and Far East Oxygen (FEO). MOX took over the business and operations of FEO in February 1979 and MWP in March 1980, following which the companies were liquidated. The company further expanded and strengthened its organisation by acquiring one of its major competitors

Nissan Industrial Oxygen Incorporated (NIOI) in July 2002. This history of MOX is presented in Figure 1.1.

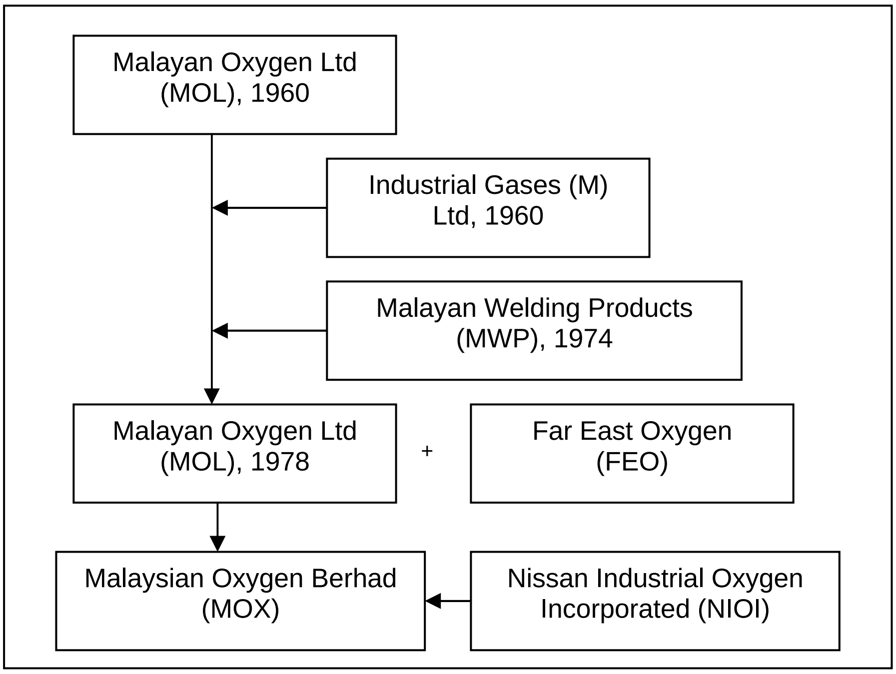

Figure 1.1: Formation of Malaysian Oxygen Berhad

MOX is currently part of the British Oxygen Company (BOC) and Air Liquide Groups where 45% of its share is held by ALBOC Holdings Ltd. a joint venture investment holding company between BOC Group Plc of United Kingdom and L'Air Liquide of France, the two leading industrial gas manufacturers in the world. Having over 200 years of experience, the world number 1 and number 2 industrial gas manufacturing companies leverage off their knowledge, resources, technology and support. These two international gas companies bring to MOX technological, research & development, gas application and operational support from their global base, as well as experienced expertise.

The major shareholders of MOX are:
- Alboc (Jersey) Ltd 45.0%
- Employees Provident Fund Board 10.45%
- Permodalan Nasional Bhd 8.3%

Picture on the left is the corporate logo for MOX. The base colour of the logo is in red, representing BOC Group, while the "roof" like logo below MOX wording is the logo of Air Liquide (AL).

1.1.1 MOX's Business

MOX gases and equipments are widely used by the petrochemical, oleo-chemical, electronic, steel, engineering and fabrication, shipyard, foundry, food and beverage industries, laboratories, hospitals and clinics, and research institutions and other manufacturing industries. The pie chart in Figure 1.2 displays the distribution of its sales income in various industries:

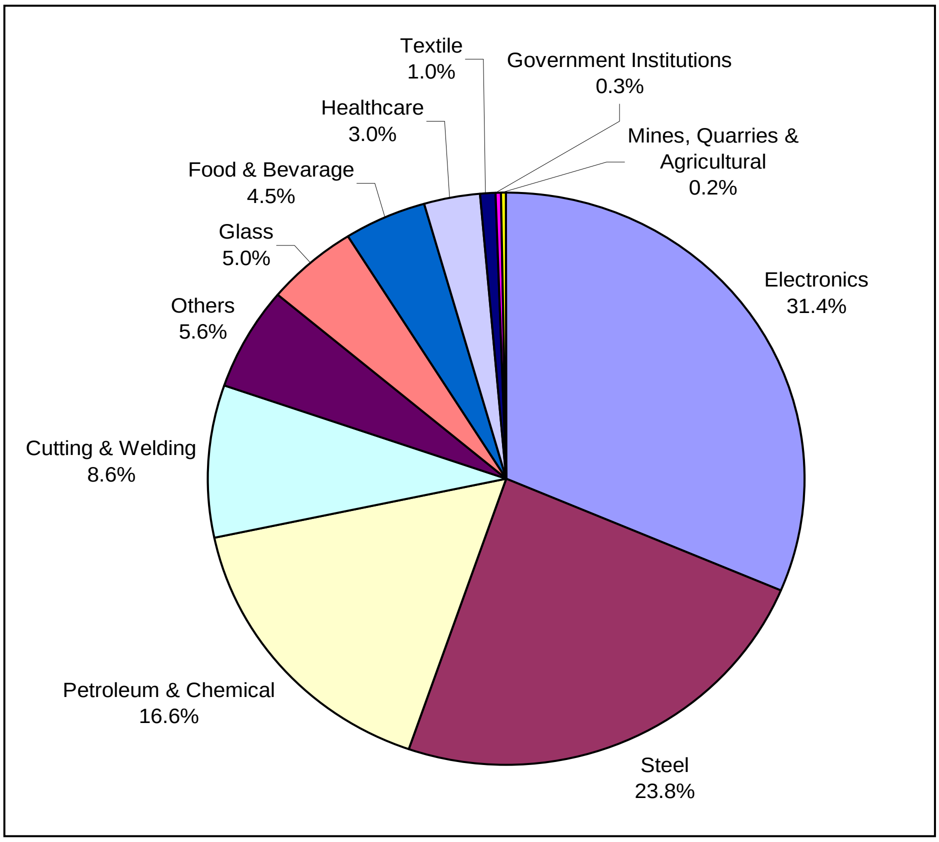

Figure 1.2: Distribution of MOX sales according to Market Sector.

MOX supplies its gases in various forms to customers - via pipeline from a MOX plant, in liquid form to storage tanks or in gaseous form in cylinders. Currently, MOX has production plants in 17 sites, and distributes its products to customers from these 17 locations, 18 sales centres and over 70 distributors throughout Malaysia (refer to Figure 1.3

and 1.4). The gases and electrode production plants are accredited to ISO 9002 and the special gases laboratory to SAMM accreditation.

Figure 1.3: Location of MOX Plants Nationwide

Figure 1.4: Location of MOX Sales Centres Nationwide

In addition to the standard supply of gases, refrigerants, welding electrodes and equipments, MOX also provide total gas solutions to its customers to improve cost, productivity and quality within their operating premises, the company is also in the business of installing gas piping systems to the industrial and medical industries. In addition, it has embarked on providing and installing ultra clean technology piping systems and equipment to the high end electronics industry. The principal activities of the Group companies are complementary. The Company currently holds 66% market share in Malaysia, as shown in Figure 1.5.

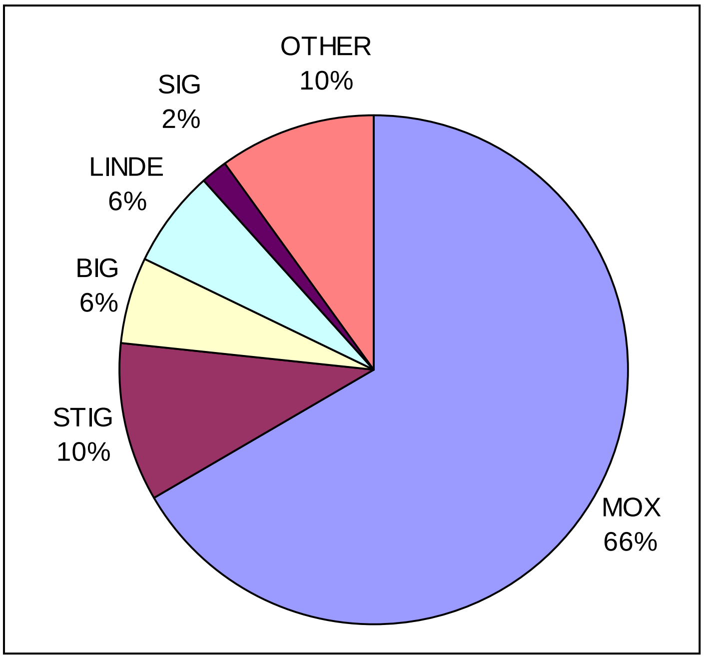

Figure 1.5: MOX's market share and its major competitors.

Tables 1.1 and 1.2 below summarise the range of product and services MOX provide, while Figure 1.6 presents the type of production by sales value.

Table 1.1: Type of products provided by MOX to its customers.

Products	
Industrial gases	nitrogen; oxygen; argon; hydrogen; carbon dioxide; refrigerant; and dissolved acetylene.
Speciality gases	helium; purified gases; gaseous chemicals; laser gases; envirosols; and electronic gases
Equipment and consumables	electrodes; wires; gas equipment and consumables; and special gases equipment

Table 1.2: Type of services provided by to its customers.

Services	
Pipeline installations	industrial; medical; and ultra clean technology (UCT)
On site management	maintenance of on site gas systems for customers

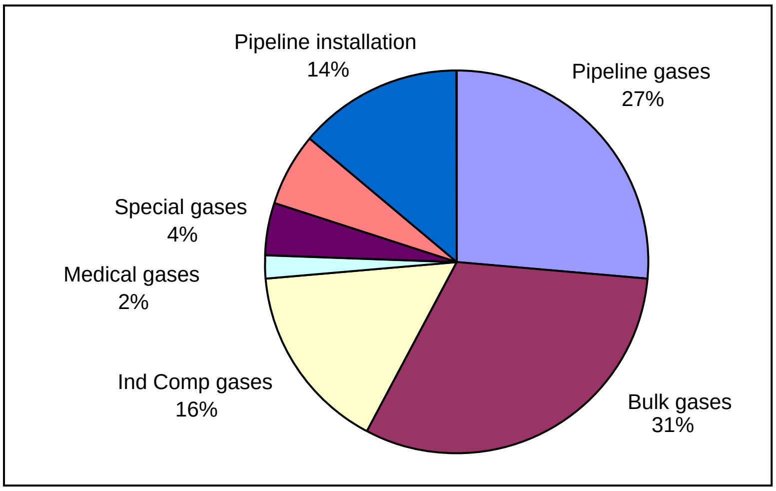

Figure 1.6: Contribution of MOX's sales value by product group.

1.1.2 Corporate Organisation

Adopting the practice of BOC Group, MOX has a corporate structure which is consisted of three Lines of Business (LOB). A LOB is a global organisation created around a set of customers and applications. The three lines of business are:

1. **Process Gas Solutions**: PGS provides global solutions in the tonnage and merchant markets for a range of process industries, notably petrochemicals, metals, food and glass.
2. **Industrial and Special Products**: ISP develops and delivers packaged solutions to markets as diverse as fabrication, medical, scientific and hospitality.
3. **BOC Edwards / Electronic**: BOCE is a market leader in development and delivery of gases, equipment and services to semiconductor, chip packaging and other markets.

The breakdown of the contribution of each LOBs to MOX's turnover are as below and as presented in Figure 1.7.

- Process Gas Solutions : 37% of MOX's total turnover
- Industrial and Special Products : 30% of MOX's total turnover
- Electronics : 33% of MOX's total turnover

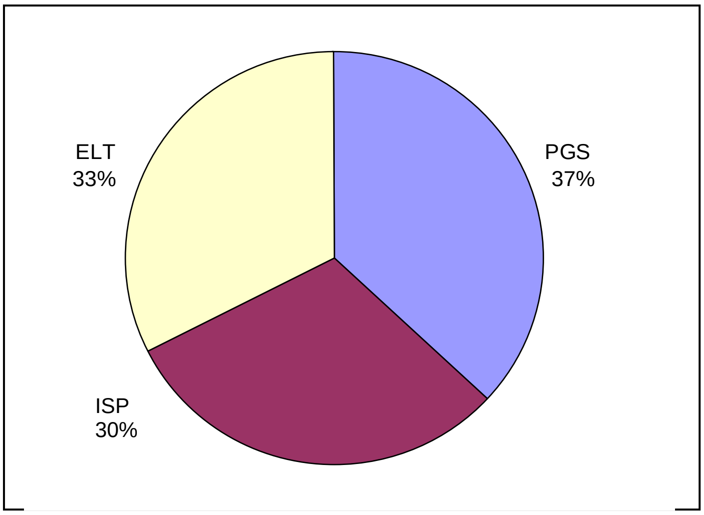

Figure1.7: Contribution of each LOB to MOX's turnover.

The basic principle of MOX organising its business into LOBs is that all customers, field sales team, marketing team and the operational activities are divided into PGS, ISP and BOCE. This segmentation is based on customer application. This is done so that the respective LOB can specialise in understanding and meeting the customers' needs both in terms of buying behaviour and process support. This structure is seen as the optimal way to:

- Best serve the company's customers/markets
- Provide value to the shareholders
- Keep all employees safe and healthy; and
- Protect the community and environment.

The Enabling Functions such as Human Resources Service, Financial Service and Information Management remain stand alone and provide service across all line of business. The role of the enabling functions is to align with Group and Line of Business strategies and:

- Provide high quality support in their area of speciality to the business units; and
- Implement and contribute towards best practice.

The structure of the organisation is presented in Figure 1.8.

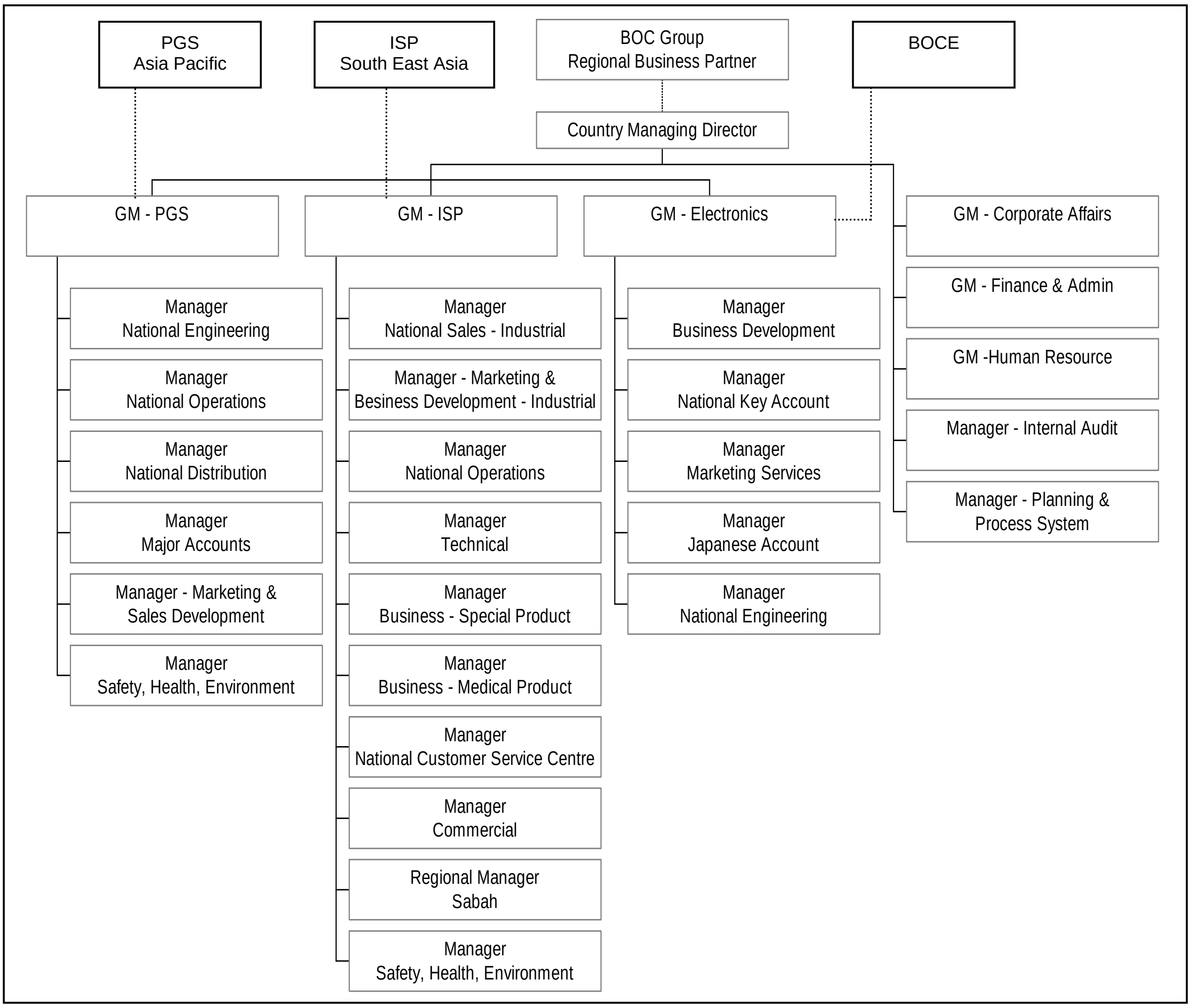

Figure 1.8: MOX's organisation structure

While there are differences in market practices from country to country, basic customer needs around the world are largely the same. The Line of Business structure enables BOC to offer consistent products and services to all the geographies where the organisation do business and provide the following business benefits:

- Customer focus: focusing on distinct groups of customers and applications provides the organisation with a competitive advantage.
- Growth & Efficiency: by setting and executing strategy in a common way globally, the organisation should be able to increase its rate of growth and efficiency.
- Operational excellence: by operating the same line of business globally, it can be more easily identify and share best practice around the world.

1.1.3 Corporate Vision and Mission

BOC Vision is to be recognised as the most customer-focused industrial gases company world wide. They claim that they will achieve this vision through innovation and service created by working together around the globe. With this, the management of MOX has adopted the following vision:

- To be acknowledged as the undisputed market leader and preferred supplier of gases, welding equipment and consumables related product and service for the industrial, healthcare, scientific and electronic markets in Malaysia.
- Recognised as Malaysia’s leading industrial quality service organisation.
- Achieve profitability to meet the aspirations of the shareholders, employees and customers.

In order to achieve the above mentioned visions, MOX has a mission:

“To be the undisputed market leader through excellence in customer service, quality, productivity, safety, environment, innovation and integrity, thereby accelerating Malaysia’s Vision 2020.”

1.1.3.1 MOX Core Values

MOX has a slogan namely “Poised for Growth” showing that MOX is an organisation which urge for improvement. The six common values that drive the team to work towards the ultimate goal can be summarised as CACOWS:

- **C**ommitment and action leading to meeting customer needs and exceeding their expectations.
- **A**chievement of superior results.
- **C**reativity and innovations.
- **O**penness, trust and respect in dealing with people.
- **W**inning as a team.
- **S**afe working practices.

1.1.3.2 MOX Operations Principles

MOX also provides a set of principles outlining how MOX's employees should do their job. These are the principles that should underpin the employees' behaviour, competencies and day-to-day work practices. The principles of ACTS are:

- Believe in **accountability**, where each and everyone knows:
  - What they are responsible for; and
  - What they are empowered to deliver.
- Maximise achievements as a group through **collaboration**, not solely as individuals.
- Expect **transparency** in all dealings, because visible problems can be solved and informed people make better decisions.
- Never be satisfied with mediocrity, aim to **stretch** performance and to push continually the boundaries of what is possible.

1.1.4 Company's Business Performance

Malaysian Oxygen Berhad (MOX) is principally involved in the manufacture and distribution of industrial gases, special gases, medical gases, packaged chemicals, welding product and consumables as well as other related product and services. MOX also provides installation of gas equipment and pipeline system to the industrial, high tech and medical sectors.

MOX is a company with four subsidiaries namely MOX Gases Berhad, MOX Welding Products Sdn Bhd, MOX Shah Alam Industrial Gas Sdn Bhd and MOX Gebeng Industrial Gas Sdn Bhd (refer to Figure 1.9). The principal activities of its subsidiaries are the manufacturing of welding electrodes and industrial gases. The above four subsidiaries are all 100% owned by MOX. Another new subsidiaries which MOX has a 51% of direct holding equity, Duta Ikhtisas Sdn Bhd, is responsible of trading MOX medical products and construction.

Besides, MOX also has business relationship with its four associate companies, which are Eastern Oxygen Industries Sdn Bhd (direct equity holding 49%), Dayamox Sdn Bhd (direct equity holding 40%), Kulim Industrial Gas Sdn Bhd and Johor Industrial Gas Sdn Bhd.

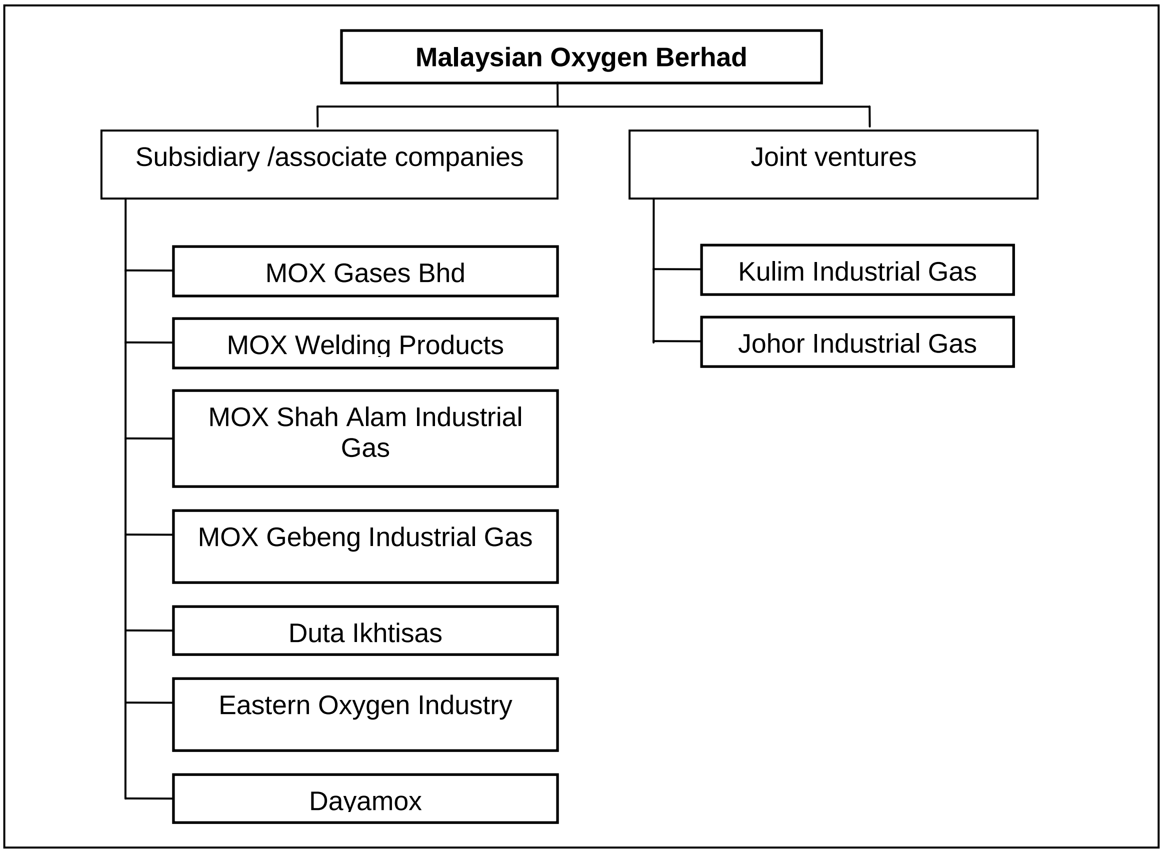

Figure 1.9: MOX and her subsidiaries and joint ventures.

The company has made a significant leap in the year 2002 by acquiring another big market player in the industrial gas industry, i.e. Nissan Industrial Oxygen Incorporated Berhad (NIOI). This represents a business strategy of MOX to strengthen and broaden its customer base through integration. The acquisition was completed 100% on the 17th September 2002 while NIOI was de-listed from KLSE main board and subsequently changed its name to MOX Gases Berhad and become one of the five MOX subsidiaries mentioned above. This total cash purchase consideration was RM217 million @ RM 5.16 per share. With this acquisition, MOX continues to lead in the industrial gas industry by owning 68% of the market share, representing an improvement of 13% from its original 55%.

1.1.5 Company Overall Performance Review

MOX manage to end the year (FY 2003) with revenue of RM 554.5 million, which was about 11% higher than last year. This is another record for MOX, mainly due to the consolidation of NIOI results in the previous year and overall increase in gases revenue. Profit before tax for the year at RM 141.75 million was RM 12 million (9%) higher than last year (2002) and RM 8 million higher than the year before (2001). The low record of profit before tax for year 2002 was mainly due to the one-off expenses associated to the NIOI acquisition and integration. Profit after tax of RM 109.7 million was 22% higher than last year. Both the revenue growth and improvement in profit was largely attributed to both a successful integration of NIOI (now renamed to MOX Gases Berhad) and the company's ability to continue protect, sustain and grow its well balanced portfolio.

Among the revenue gained in year 2002, 85% were contribution from sales of gases while the remaining 15% were project revenue and sales of other product. From the five years financial statistics reported in MOX Financial Report (see Table 1.3), the Profit Retained in the fiscal year 2001 was among the highest in the company's history. This was a step taken by the management to be ready for the acquisition activity in year 2002.

Table 1.3: MOX 5 years Consolidated Financial Performance.

Five Year Consolidated Results:

	1999	**2000**	**2001**	**2002**	**2003**
	RM'000	**RM'000**	**RM'000**	**RM'000**	**RM'000**
Sales	358,871	434,742	476,087	499,733	554,527
Profit from ordinary activities before taxation	96,061	110,992	133,937	129,984	141,753
Taxation	-10,033	-43,975	20,348	-40,291	-32,000
Net profit	86,028	67,017	154,285	89,693	109,753
Dividend	-21,537	-40,306	-47,724	-63,448	-66,714
Retained earnings	64,491	26,711	106,561	26,245	43,039

Despite all national as well as global issues, which made the global economics continue to be weak after the global economy down turn in year 1998, the company managed to have consistent growth in term of sales and net profit since year 1999. Total dividend issued also has increased triple since year 1999 to RM 66.7 million in fiscal year 2003.

Other summaries extracted from the financial highlights are as below:

Table 1.4: MOX 2003 Financial Highlights

Financial Highlights	***RM ' 000***
Capital expenditure	17,769
Shareholder's funds (year-end)	652,825
Capital employed (year end)	915,161
Return on average capital employed (ROCE)	15.4%
Earnings per share	102.41
Dividend per share	51 sen

The trend of the Sales, Profit before tax and Dividend over the years is presented in Figure 1.10 below.

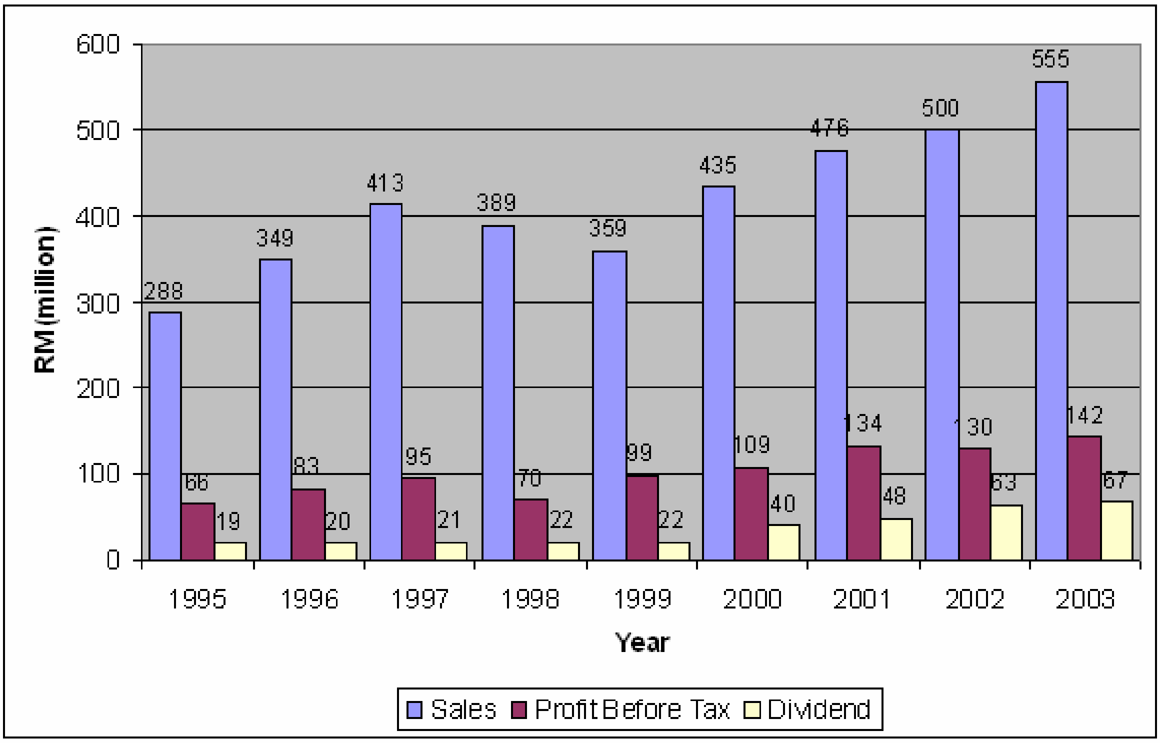

Figure 1.10: MOX's Sales, Profit before tax and Dividend over pass 9 years.

1.2 Project Background

The field of transportation and distribution which once described as the Rodney Dangerfield of the firm, that is, it "couldn't get no respect". The fundamental understanding is that it took engineering genius to produce the product, marketing skill to sell the product, but anyone could get it from point X to point Y. However, in the 1950s, those with foresight planted a seed that field of transportation and distribution was important. A third of a century ago, management guru Peter Drucker even called logistics the last great unexplored continent of business. Since that statement was made, logistics has become a recognised field in many academic institutions. However, since the field is new and just being developed recently, limited research has been done on it. In most of the firm, logistics was viewed as a fragmented and often uncoordinated set of activities spread throughout various organisational functions.

Physical distribution refers to that portion of a logistics system concerned with the outward movement of products from the seller to customer. The prime objective of physical distribution is to ensure that materials and products are available at the right place, at the right time, and in the right quantities to satisfy demand or customers and to give a competitive advantage to the company.

Although Logistics and Supply Chain Management (LSCM) has become common practice across all industries, the topic of Logistics Performance Measurement (LPM) does not receive adequate attention therein. While there are many ongoing research efforts on various aspects and areas of supply chain management as well as performance measurement and management respectively, so far little attention has been given to the performance evaluation, and hence to the measures and matrics of supply chains. In the transportation and distribution sector, as in many others, it is important to have a good performance in operations. As an indispensable management tool, performance measurement provides the necessary assistance for performance improvement in pursuit of supply chain excellence.

The prevailing business model of the new decades was very much based upon the search for greater levels of efficiency in the supply chain. Just-in-time (JIT) practices were widely adopted and organisations became increasingly dependent upon delivery function.

The viability of a firm now depends largely on how well it is capable of responding to customer requirements while becoming lean. Hence, the challenge in today's MOX's distribution service is how best to combine 'lean' practices with an 'agile' delivery response. In order to achieve high performance levels, it is necessary to know which operation factors are critical for success and which are less important. Only then, can management focus on those factors that have an effect on performance.

1.2.1 Objective of the Project

As previously mentioned, a supply chain performance measurement system that consists of a single performance measure is generally inadequate since it is not inclusive. Current supply chain performance measurement systems are also inadequate because they rely heavily on the use of cost as a primary (if not sole) measure. More often than not, they are inconsistent with the strategic goals of the organisation, and do not consider the effects of uncertainty. A good performance measurement system is a necessity for a company to grow and sustain industry leadership.

The objective of this research is to understand and assess the measurement system used in today's logistics operations facilities, identify best practice and areas for improvement.

1.2.1.1 Main Objective

To study and understands the existing performance measurement system in MOX Logistics Operations Management (LOM) and identify its drawbacks and suggest improvements in line with the world class practices. A new concept of Performance of Activity (POA) will be adopted to identify and employ performance measures and matrics.

1.2.1.2 Measurable Objectives

1 To identify and define the elements of Critical Success Process (CSP) and determine the related Key Performance Indicators (KPIs).

2 To examine existing performance measurement system against current business requirement.

3 To establish improved performance control and measurement system.

1.2.2 Scope

The study will be focused on physical distribution activity of the company, i.e. 'cylinder distribution'. The four aspects of performance measurement to look into are:

i. Operation performance
ii. Cost performance
iii. Delivery Service performance
iv. Safety performance

The project scope overview is presented in Figure 1.11.

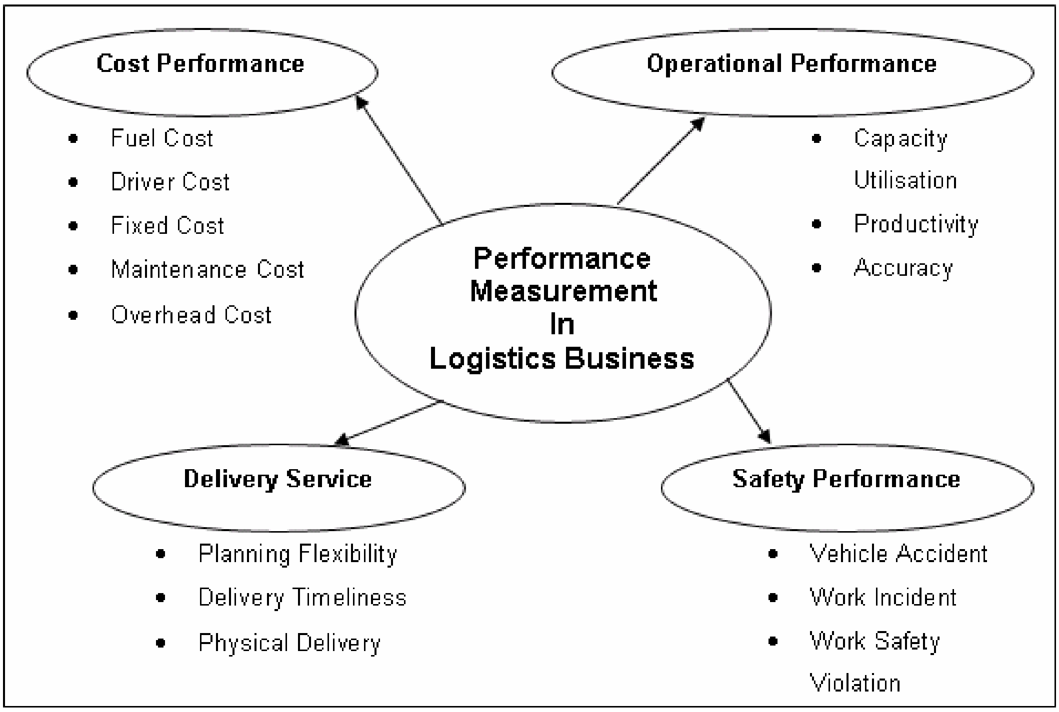

Figure 1.11: Project scope overview.

1.2.3 Benefit to Organisation

As stated earlier, a good performance measurement system supports sound management decisions. A performance measurement system is effective if it provides high quality, reliable, and timely information to influence management decisions and employee behaviour.

A good performance measurement system is a necessity for a company to grow and sustains industry leadership. It is clear that the research will benefit the department as well as company in both short term and long term considerations:

1.2.3.1 Short Term

There are two main short-term benefits to the company after the research has been completed:

1. A complete performance system to provide a better understanding of the department's performance and helps to identify the strength and weaknesses.
2. Better operating performance and enhanced distribution service will help the company to continue to be the market leader of the industry.

1.2.3.2 Long Term

The working culture of continue improvement will be installed into the company which at the end will benefit the company in terms of revenue as well as other aspects.

1.3 Brief Introduction to the Project

The main purpose of this project is to discuss and review current performance measurement system in Logistics Operations Department in MOX. The author has revised the conventional performance measurement system and its areas of improvement via various means including interview with all levels of employees, discussion with senior management, as well as review previous documentations.

The author has identified that the current measurement of department's Key Performance Indicators in Logistics Operations Department is fragmented and incomplete. The department's performance is solely tied to company's financial performance, which the author feels that it is too broad and tends to get distorted. Identifying these shortfalls of current performance measurement system in MOX, the author has suggested an overall performance metrics to consolidate all the Key Performance Indicators to give a complete view of the department's performance. This metrics then be converted in to a Department Performance Healthcard in which the performance of each KPI will be captured and overall department performance comprises of all KPI will be reported.

The author has also arranged the report in a systematic way so that readers can follow through the report just as if they are undertaking the project. After the introduction to the company background and project background in Chapter 1, the literature review is presented in Chapter 2 while methodology of project in Chapter 3. In Chapter 4, MOX's Logistics Operations function is being reviewed followed by MOX's Performance Measurement system focusing on Logistics Operations activities in Chapter 5. The findings of the project are also mentioned in these two chapters while suggestions on areas of improvement are being discussed in Chapter 6. Chapter 7 will consider some important issues related to implementation. The report will then be wrapped up as a complete presentation in Chapter 8, the last chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Supply Chain and Logistics Operations Management

2.1.1 The Management of Supply Chain

Supply chain management is increasingly being recognised as the integration of key business process across the supply chain; hence a well-organised and well-managed supply chain is important.

The Global Supply Chain Forum defined:

> *"Supply Chain Management (SCM) is the integration of key business process from end user through original suppliers that provides product, services, and information that add value for customers and other stakeholders."*

The editor of a new publication defined SCM as "successful coordination and integration of all those activities associated with moving goods from the raw materials stage through to the end user, for sustainable competitive advantage. This includes activities like systems management, sourcing and procurement, production scheduling, order processing, inventory management, transportation, warehousing and customer service. Product development, operations management, manufacturing operations, and customer service management are also included in the implementation of SCM in leading edge companied, such as 3M, Hewlett-Packard and others. (Cooper et al, 1997)

Every business that manufactures or moves tangible products from place to place faces a similar set of demands from customer: to deliver products faster, reduce inventory, lower operating costs, and deal with increasingly complex orders while meeting wide-ranging customer expectations. However, managing the supply chain is a complicated task as product/service flows and related information, from point-of-origin to point-of consumption is very challenging. Location and network efficiency are always used as competitive weapon to drive down overall operating cost and create value in the supply chain. Houlihan, Jones and Riley stated that the objective of SCM is to "lower the total amount of resources required to provide the necessary level of customer service to a specific segment".

According to Cooper, Lambert and Pagh (1997) in their presentation entitled "Supply Chain Management, More Than a New Name for Logistics", the Supply Chain Management framework encompasses the combination of three closely inter-related elements: the structure of the supply chain, the supply chain business processes and the supply chain management components. It is believed that the combination of these three elements captures the essence of SCM. This is shown in Figure 2.1.

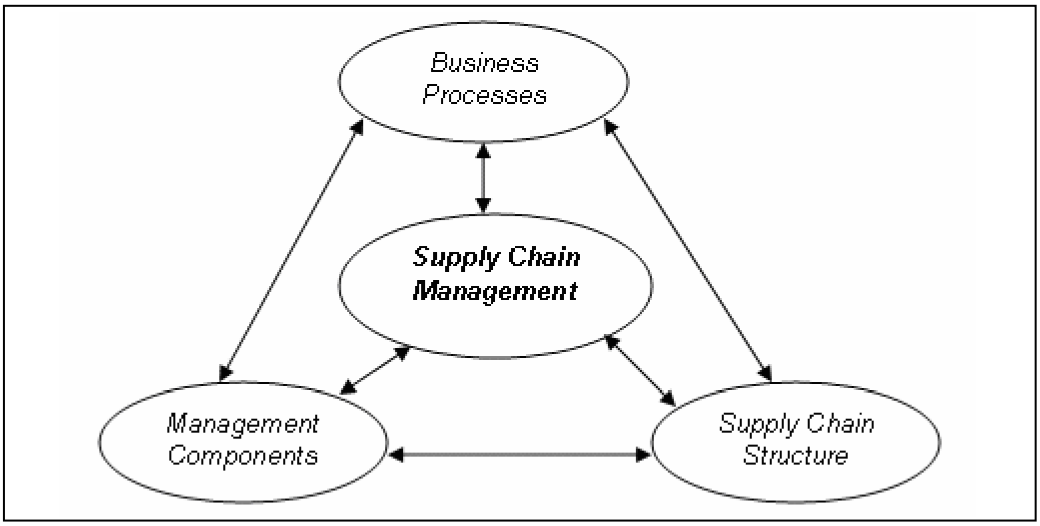

Figure 2.1: The three elements of supply chain management.

Source: Adapted from Cooper, Lambert and Pagh, "Supply Chain Management: More Than a New Name for Logistics," The International Journal of Logistics Management, Vol. 8, No. 1 (1997)

The supply chain structure is the network of members and the links between members of the supply chain. The management components are the managerial variables by which the business processes are integrated and managed across the supply chain while the business processes are the activities that produce a specific output of value to the customer.

a) **Supply Chain Structure:** One key element of managing the supply chain is to have an explicit knowledge and understanding of how the supply chain network structure is conFigured. (Lambert et al, 1998) The three primary structural aspects of a supply chain structure are: 1) the members of the supply chain, 2) the structural dimensions of the network, and 3) the different types of process links across the supply chain.

b) **Management Components:** An essential underlying premise of the SCM framework is that there are certain management components that are common across all business processes and members of the supply chain. These management components can be divided into two groups, which is the 1) physical and technical group, which includes the most visible, tangible, measurable and easy to change components. 2) Managerial and behavioural components which define the organisational behaviour. (Lambert et al, 1998)

c) **Business Processes:** The definition of process by Davenport is a “structured and measured set of activities designed to produce a specific output for a particular customer or market”. A process can also be viewed as a structure of activities designed for action with a focus on end-customers and on the dynamic management of flows involving products, information, cash, knowledge and ideas. In the dynamic world of business, each company had different strategic objectives, hence having different business processes and number of business processes. (Lambert et al, 1998)

The implementation of SCM involves identifying the supply chain members, with whom it is critical to link, what processes need to be linked with each of these key members, and what type/level of integration applies to each processes link. The objective of SCM is to maximise competitiveness and profitability for the company as well as the whole supply chain network including the end customer. (Lambert et al, 1998)

2.1.2 Supply Chain Management Processes

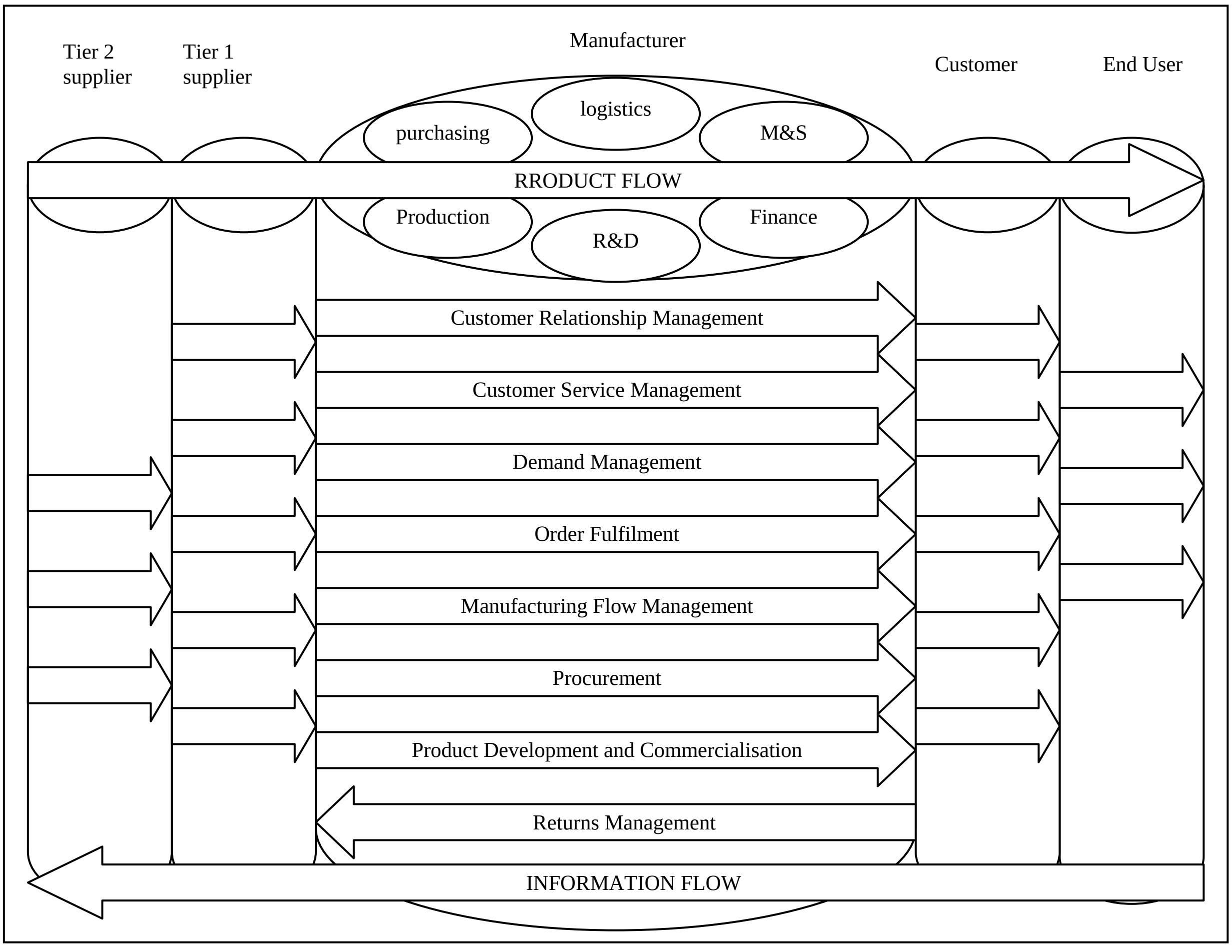

Figure 2.2: Integration of supply chain management processes and organisations functional silos. Source: Adapted from Cooper, Lambert and Pagh, "Supply Chain Management: More Than a New Name for Logistics," The International Journal of Logistics Management, Vol. 8, No. 1 (1997)

The Global Supply Chain Forum identified eight key processes shown in Figure 2.2, that make up the core of supply chain management, i.e. Customer Relationship Management, Customer Service Management, Demand Management, Order Fulfilment, Manufacturing Flow Management, Procurement, Product Development and Commercialisation, Returns Management. (Cooper et al, 1997) This eight key business processes run the length of the supply chain and cut across firms and functional silos within each firm. Functional silos include Marketing, Research and Development, Finance, Production, Purchasing and Logistics. The typical set up is as the Figure above.

Activities in these processes reside inside a functional silo, but an entire process will not be contained within one function. While management of all firms in each supply chain should consider these eight processes, the relative importance of each process and the specific activities may vary. Next, each of the process will be discussed.

a) Customer Relationship Management: The objective of customer relationship management at the strategic level is to identify customer segments, provide criteria for categorising customers, provide customer teams with guidelines for customising the product and service offer, develop a framework for metrics and provide guidelines for the sharing of process improvement benefits with the customers. Meanwhile, at the operational level, CRM process deals with writing and implementing the Product and Service Offers(PSOs). The customer relationship management process provides the structure for how the relationship with the customer is developed and maintained. Customer teams tailor PSO to meet the needs of customer according to market segmentation. Teams work with key accounts to improve on current processes, smoothen demand variability and eliminate demand variability. (Croxton et al, 2001)

b) **Customer Service Management:** The customer service management process is the firm's face to the customer. It provides the single source of customer information, such as product availability, shipping dates and order status. The objective of customer service management at the strategic level is to develop the necessary infrastructure and coordination means for implementing the PSO and providing a key point of contact to the customer. At the operational level, the CSM process is responsible for responding to both internal and external events. (Croxton, et al, 2001)

c) **Demand Management:** The demand management process needs to balance the customers' requirements with the firms supply capabilities. This includes forecasting demand and synchronising it with production, procurement and distribution. The process is also concern with developing and executing contingency plans in the events that disrupt the balance of supply and demand. In order to find ways to increase flexibility and reduce variability, the process team works with the sales, marketing and manufacturing organisations, customers and suppliers. This process interfaces with customer relation management, customer service management, manufacturing flow and supplier relationship management. (Croxton et al, 2001)

d) **Order Fulfillment:** A key to effective supply chain management is to meet customer requirements in terms of order fulfilment. Effective order fulfilment requires integration of the firm's manufacturing, logistics and marketing plans. The process defines the specific steps regarding how customer orders are: generated, communicated, entered, processed, documented, picked, delivered and handled post delivery. (Croxton et al, 2001) According to Croxton and Keely, the design and operation of the network has a significant influence on the cost and performance of the system.

e) **Manufacturing Flow Management**: The manufacturing flow process deals with making the products and establishing the manufacturing flexibility needed to serve the target markets. The process includes all activities necessary for managing the product flow through the manufacturing facilities and for obtaining, implementing and managing flexibility. This could be categorised into Strategic Sub-Processes which are determine degree of manufacturing flexibility, determine push-pull boundaries, identify manufacturing constrains, determine, manufacturing capabilities and Operational Sub-Processes including developing a master production schedule and last but not least synchronised capacity and demand. (Croxton et al, 2001)

f) **Supplier Relationship Management**: Supplier relationship management is the process that determines how a company interacts with its suppliers. It is a mirror image of customer relationship management. Just as a company needs to develop relationships with its customers, it needs to foster relationships with its suppliers too. At the strategic level, the output of the process is an understanding of the levels of relationships the firm will maintain, and the process for segmenting the suppliers and working with them to develop appropriate PSOs. Once the process team determines the criteria for categorisation of suppliers and the levels of customisation, the operational supplier relationship management process develops and manages the PSOs.

g) **Product Development and Commercialisation:** Developing new products quickly and getting them to the marketplace in an efficient manner is a major component of corporate success. Time to market is a critical objective of this process. As product life cycles shorten, the right products must be developed and successfully launched in ever-shorter timeframes in order to remain competitive. This includes the sub-processes of establish new product project guidelines, develop product rollout issues and constraints, design and build prototypes, make/buy decision, determine product distribution channels and etc. (Croxton et al, 2001)

h) **Returns Management:** Effective returns management is a critical part of supply chain management. While many firms neglect the returns process because management does not believe it is important, this process can assist the firm in achieving a sustainable competitive advantage. Effective management of the returns process enables the firm to identify productivity improvement opportunities and breakthrough projects. (Croxton, et al, 2001) At the operational level, the returns management process is about managing the day-to-day returns activities, initiated by a customer. The subsequent sub-processes including analyses of the return and select appropriate dispositions and post-return credit management.

2.1.3 Logistics Operations Management

Logistics is big business. Its consumption of land, labour, capital and information – couple with its impact on the world's standard of living – is enormous. Curiously, it has only been within the past 35 years that the business community has taken a real interest in logistics. However, during that period, logistics has increased in importance from a function that was perceived as barely necessary to (1) an activity where significant cost saving could be generated; (2) an activity that has enormous potential to impact customer satisfaction and hence increase sales; and (3) a marketing weapon that could be effectively utilised to gain a sustainable competitive advantage. The importance if logistics is now being recognised all over the world. (Lambert et al, 1998)

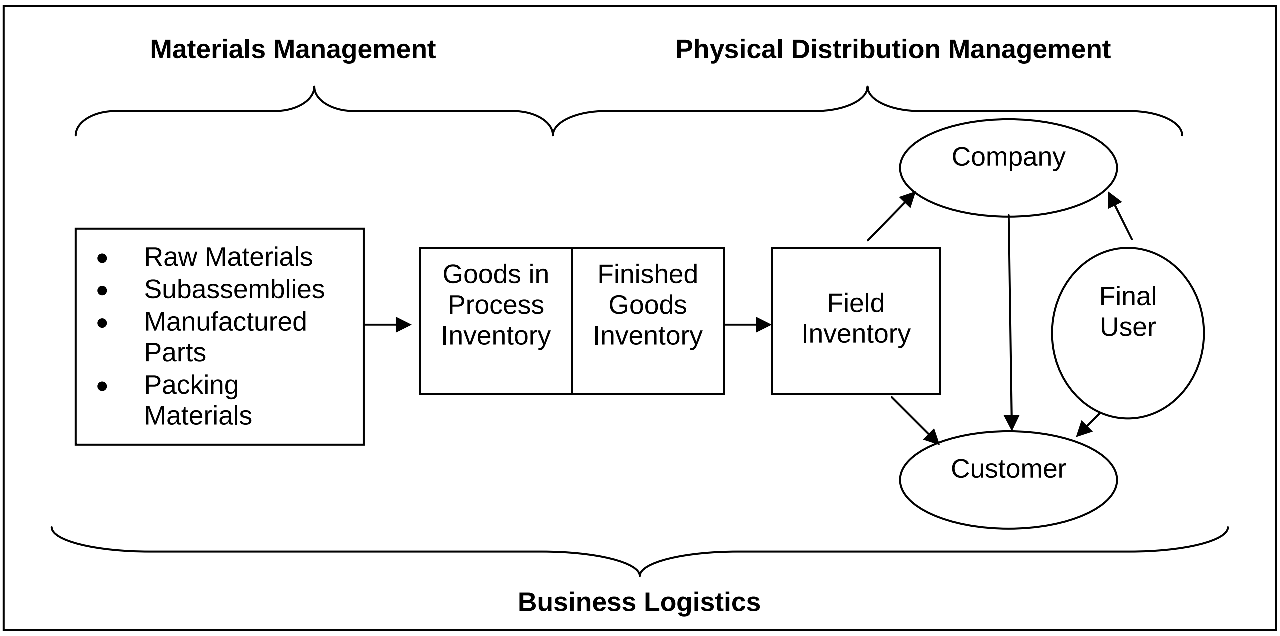

Figure 2.3: About business logistics.

Because logistics is the topic of this dissertation, it is important to establish the meaning of the term. Logistics has been called by many names, including the following:

- Business logistics (refer to Figure 2.3)
- Channel management
- Distribution
- Industrial logistics
- Logistics management
- Material management
- Physical distribution
- Quick-response systems
- Supply chain management
- Supply management

What these terms have in common is that they deal with the management of flow of goods or materials from point of origin to point of consumption, and in some case even to the point of disposal.

The Council of Logistics Management (CLM), one of the leading professional organisations for logistics personnel, uses the term logistics management to describe:

> *"The process of planning, implementing and controlling the efficient, effective flow and storage of goods, service and related information from point of origin to point of consumption for the purpose of conforming to customer requirements."*

Logistics is about getting the right items needed for consumption or production to the right place at the right time and in the right condition at the right cost. These five rights of logistics credited to E. Grosvenor Plowman, are the essence of the two utilities provided by logistics: time and place utility. (Lambert et al, 1998) The component of logistics management is presented in Figure 2.4 below.

Time utility is the value added by having an item when it is needed. This is closely related to place utility, which means having the item or service available where it is needed. Without both time and place utility, which logistics directly supports, a customer could not be satisfied.

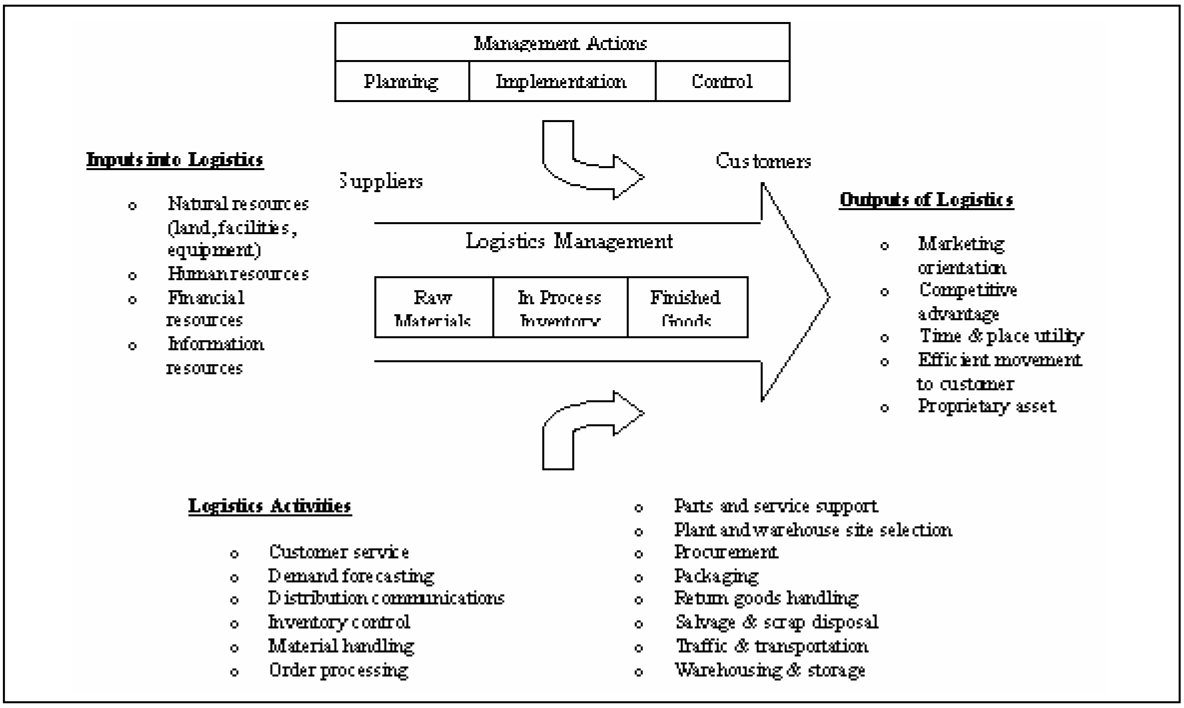

Figure 2.4: Components of Logistics Management

Source: Adapted from Lambert, Stock and Ellram, "Fundamentals of Logistics Management" Pg.5 (1998)

2.1.4 Logistics as a Subset of Supply Chain Management

How is Supply Chain Management different from this definition of Logistics Management? Many of those writing, talking, and offering seminars about SCM are using the words as synonym for logistics. The original use of the term SCM emphasised a reduction on inventory both within and across firms but that initial perspective has been broadening. The CLM definition makes it clear that logistics, properly implemented, was always intended to be from dirt-to-dirt. Other views of SCM include more functions than logistics being integrated across firm boundaries.

In 1998, the Council of Logistics Management modified its definition of logistics to indicate that logistics is a subset of supply chain management and that the two terms are not synonymous. (Cooper et al, 1998) The revised CLM definition is:

> *"Logistics is that part of the supply chain process that plans, implements and controlling the efficient, effective flow and storage of goods, service and related information from point of origin to point of consumption for the purpose of conforming to customer requirements."*

Logistics plays a key role in the economy in two significant ways. First, logistics is one of the major expenditures for businesses, thereby affecting and being affected by other economic activities. Thus, by improving the efficiency of logistics operations, logistics makes an important contribution to the economy as a whole. Second, logistics supports the movement and flow of many economics transactions, it is an important activity in facilitating the sale of virtually all goods and services. (Lambert et al, 1998)

2.1.5 The Outbound Logistics System – Physical Distribution

We will focus our attention upon what was defined as physical distribution or outbound logistics systems. Physical distribution management is an attempt to systematically manage a set of interrelated activities including transportation, distribution, warehousing, finished goods, inventory levels, packaging and materials handling, to ensure the efficiency of delivery of finished goods to customers. (Lancaster) The focus of physical distribution management was to manage finished goods distribution in a way that met customer expectations at the lowest possible cost. In addition to transportation, physical distribution management involves close liaison with production planning, purchasing, order processing, material control and warehousing. All these areas must be managed so that they interact with each other to provide the level of services that the customer demands and at a cost that the company can afford. (Lancaster)

The distribution process begins when a supplier receives an order from a customer. Lead time is the period of time that elapses between the placing of an order and receipt of the goods. This can vary according to the type of product and the type of market and industry being considered. Customer make production plans based on the lead time agreed when the order was placed. Hence a late delivery is no longer acceptable in most purchasing situations.

There were three reasons why most of the logistics operations management focuses on the physical distribution. These reasons are still valid today for firms seeking to begin a logistics evolution. First, finished goods are the largest single segment of inventory to be managed. Second, because of its proximity, visibility, and frequent contact with customers, finished goods distribution most directly impact customer service expectations and performance. Third, management of finished goods allows intervention in an important process without venturing into production processes or other powerful cost centres of the firm. (Waller, 2002) That is, altering physical distribution management is a low-risk, high-gain endeavour relative to altering other functions.

Although today's logistics concepts and practices are advanced beyond those of the physical distribution stage, managers must remain cognisant of the fundamentals that brought about the stage: focus on high-impact finished goods distribution inventories and operations, as well as careful monitoring and control of the cost-service trade-off. The higher the level of service required by the customer, the higher the cost will be. It is never possible to provide maximum service at a minimum cost. (Lancaster) Having decided on the necessary level of service, a company must then consider ways of minimising costs, which should never be at the expense of, or result in, a reduction of the predetermined service level.

2.1.6 Transportation

Transportation physically moves product from where they are produced to where they are needed. This movement across space or distance adds value to products. This value is often referred to place utility. Transportation is also a factor in time utility, it determines how fast and how consistently a product moves from one point to another. (Lambert et al, 1998)

Transportation moves products to markets that are geographically separated and provides added value to customers when the products arrive on time, undamaged, and in the quantities required. In this way, transportation contributes to the level of customer service, which is one of the cornerstones of customer satisfaction: an important component of the marketing concept.

Transportation usually represents the greatest distribution cost. It is usually easy to calculate because it can be related to weight or numbers of units. Costs must be carefully controlled through the mode of transport selected amongst alternatives. And these must be constantly reviewed. The chosen transportation mode should adequately protect goods from damage in transit. Not only do damaged goods erode profits, but also frequent claims increase insurance premiums and customers' inconvenience, endangering future business.

2.1.7 Customer service

This section examines customer service within a logistics supply chain. While customer service has no single widely used definition, customer service is often viewed in three principal ways. We can think of them as three levels of customer service involvement or awareness. (Coyle et al, 1996)

- *Customer service as an activity.* This level treats customer service as a particular task that a firm must accomplish to satisfy the customer's need. Order processing, billing and invoicing, product returns, and claims handling are all typical examples of this level of customer service. Customer service department, which basically handle customer problems and complaints, also represent this level of customer satisfaction.

- *Customer service as performance measures.* This level emphasises customer service in terms of specific performance measures, such as the percentage of orders delivered on time and complete and the number of orders processed within acceptable time limits. Although this level enhances the first one, a firm must look beyond the performance measures themselves to ensure that its service efforts achieve actual customer satisfaction.

- *Customer service as a philosophy.* This level elevates customer service to a firm wide commitment to providing customer satisfaction through superior customer service. This view of customer service is entirely consistent with many firm's contemporary emphasis on quality and quality management.

The focus upon performance measures for customer service is very important because it provides a method of evaluating how well the logistics system is functioning. Over time, such measurement provides benchmarks to gauge improvement, which is especially important when a firm is trying to implement a total quality management program.

Customer service has multifunctional interest for a company, but from the point of view of the logistics function we can view customer service as having four traditional dimensions: time, dependability, communications, and convenience. (Coyle et al, 1996)

- *Time:* the time factor is usually order cycle time, particularly from the perspective of the seller looking at customer service.
- *Dependability:* to some customer, dependability can be more important than lead-time. That is, a customer needs to have 100 percent assurance of the order delivery time/date.
- *Communications:* the two logistics activities vital to order filling are the communication of customer order information to the order filling area and the actual process of picking out of inventory the items ordered.

- *Convenience:* convenience is another way of saying that the logistics service level must be flexible.

Customer service is a vital component of logistics management. While each activity of logistics management contributes to the level of service a company provides to its customers, the impact of transportation on customer service is one of the most significant. (Lambert et al, 1998) The most important transportation service characteristics affecting customer service levels are:

- Dependability – consistency of service
- Time in transit
- Market coverage – the ability to provide door to door service
- Flexibility – handling a variety of products and meeting the special needs of shippers
- Loss and damage performance
- Ability of the carrier to provide more than basic transportation service

2.2 Performance Measurement and Performance Management

The subject of performance measurement is encountering increasing interest in both the academic and managerial ambits. This, for the most part, is due to the broadening spectrum of performances required by the present-day competitive environment and the new production paradigm known as lean production or world class manufacturing. In addition, there is a need to support and verify the performance improvement programmes such as just-in-time, total quality management, concurrent engineering etc. (Toni & Tonchia, 2001)

Well defined performance measure help keep everyone on the same track. A well-defined system of performance measures also improves performance by providing a framework for making decisions. (Kaydos, 1991) When managers clearly understand what is best for the company, the thousands of decisions that must be made every day will be better decisions. Without the proper frame of reference, some of these decisions will be based on false assumptions and personal values.

Objective performance measures help keep everyone honest, even those who may not appreciate it. If increasing performance is seen as an exercise in identifying and solving problems, information must first be available to identify when problems are occurring. (Kaydos, 1991) It is usually easier to ignore problems than solve them but performance measures make it difficult to do that by making them visible.

Performance measures also keep problems in perspective. Consistent measures of performance help managers cut through the clutter and keep them focused on significant problems instead of emotional issues. (Kaydos, 1991) Performance measures can alert managers to opportunities as well as problems, but managers must ask questions and take action to convert opportunities to real benefits.

a) ***Diagnosing problems*****:** The most important step in solving a problem is to identify the causes of the symptoms. Performance measures are the only way to get consistent objective information. (Kaydos, 1991)
b) ***Understanding the process*****:** Performance measures enable managers to see relationships between variables, providing them with insight into how their production system works that cannot be obtained from any other sources. (Kaydos, 1991)
c) ***Allocating resources efficiently*****:** Both subjective and quantitative information is required in making every day's decision to allocate resources, performance measures can be use as useful estimates and will help put the options in perspective. (Kaydos, 1991)
d) ***Defining responsibility*****:** Most job descriptions define responsibilities and tasks but don't say what "good performance" means. Performance measures can make that very clear and also be constant reminder of what matters most. (Kaydos, 1991)
e) ***Identifying when and where action is needed*****:** If managers are going to have good control, they must know when and where to take corrective action. To do this, they need to know (1) how the production system is currently performing and (2) what normal performance looks like. Without performance measurement, deciding what needs attention must be based on subjective judgment. Without timely performance

measures too, problems must often reach catastrophic proportions before they can be seen. (Kaydos, 1991)

f) ***Guiding and changing behaviour*****:** Performance measures accelerate individual and group development by providing constant feedback. Without good performance information, feedback will be infrequent and probably confusing. (Kaydos, 1991)

g) ***Making accomplishment visible*****:** Many jobs simply don't provide the opportunity for people to see their individual achievements. Performance measures can overcome this problem by making visible what is otherwise invisible. (Kaydos, 1991)

h) ***Making delegation easy and effective*****:** Without good feedback, on performance, effective delegation is nearly impossible. Performance measures let managers see what is happening while keeping their distance. (Kaydos, 1991)

i) ***Recognising and rewarding performance*****:** Managers always talk about rewarding performance, but if you're not measuring performance, it is more likely that appearances will be rewarded instead of accomplishment. Having specific performance measures in place helps assure that the right kind of behaviour is recognised, and rewarded. (Kaydos, 1991)

Performance measurement is essential for achieving and maintaining high levels of productivity ad quality, for good management controlling and planning, and for developing and motivation organisation. But all things considered, the most valuable benefit of proper performance measures is a sound understanding of how the production system works and the forces that drive it. (Kaydos, 1991)

Managers without performance measures for their areas of responsibility are like travellers without a map, pilots flying blind, or doctors without a stethoscope. Managers who do not have adequate performance information for their areas of responsibility are working harder and accomplishing less they could. Hence, if you want to manage performance, you must measure performance.

2.2.1 Conventional Performance Measurement

The literature concerning the conventional performance measurement began in the late 1880s and went through the 1980s. In this phase the emphasis was on financial measures such as profit, return on investment and productivity. Of these performance measures productivity has been considered the primary indicator of performance. The above and other traditional performance measures have many limitations that can be classified into two categories: general limitations due to the overall characteristics and limitations specific to certain traditional performance measures such as productivity or cost. Both of these types of limitations make traditional performance measures less applicable in today's competitive market. (Ghalayini & Noble, 1996)

2.2.1.1 Limitations of Traditional Performance Measures

Traditionally, performance measures have been primarily based on management accounting systems. This resulted in most measures focusing on financial data. Of these performance measures productivity has been considered the primary indicator of performance. The traditional notion of productivity which has been a good indicator of the performance and progress of an organisation also has many limitations. However, the simple forms of productivity are misleading while the aggregate ones are complicated and neglected in practice. There are some extend of contradiction within these measures and performance, a handful of them are as below:

a) **Productivity:** Productivity is mostly concerned with direct labour which is longer a significant portion of cost. Thus, decreasing the cost of direct labour and/or increasing direct labour efficiency do not contribute to the overall performance of the company. (Ghalayini & Noble 1996)
b) **Cost:** Customer's demands have changed, low cost is only one and no longer the most important factor for competing in most markets. Other competitive advantages includes quality, reliable delivery, short lead time, customer service, rapid product introduction, flexible capacity and efficient capital deployment are equally important. (Ghalayini & Noble 1996)

c) **Profit:** it is important to realise that when a company is making a profit this does not necessarily imply that its operations, management and control systems are efficient. Therefore profit as a performance measure can only reveal that there is a problem, but provides little about the nature and the reasons for that problem. (Ghalayini & Noble 1996)

Besides the above argument, Gunasekaran, Patel and Tirtiroglu also stated two major shortfall in most of the performance measurement systems in the logistics companies:

a) Lack of a balance approach between financial performance measures and non-financial performance measures. While financial performance measurements are important for strategic decision and external reporting, day-to-day control of manufacturing and distribution operations is better handled with non-financial measures. (Gunasekaran et al, 2001)
b) Lack of a clear distinction between metrics at strategic, tactical and operational levels. Metrics that are used in performance measurement influence the decisions to be made at strategic, tactical and operational level, hence it is important to have such classification in the performance management system. (Gunasekaran et al, 2001)

Traditional performance measures also have many limitations that make them less applicable in today's competitive market. They are based on outdated traditional cost management systems, lagging metrics, not related to corporate strategy, inflexible, expensive and contradict continuous improvement. (Ghalayini & Noble 1996)

a) **Lagging Metrics:** Financial reports are usually closed monthly, as a result, the operations managers will always consider financial reports too old to be useful for operational performance assessment.
b) **Corporate Strategy:** Traditional performance measures have not incorporated strategy.
c) **Relevance to Practice:** Traditional performance measures are often ignored in practice at the factory shop floor level.

d) **Inflexible:** Traditional financial reports are inflexible in that they have a predetermined format which is used across all departments. However, even departments within the same company have their own characteristics and priorities.

e) **Continuous Improvement:** Setting standards for performance measures in general conflicts with continuous improvement, because standards had the effect of setting norms rather than motivating improvement.

f) **Customer Requirements and Management Techniques:** Traditional financial reports used by middle managers do not reflect a more autonomous management approach since more responsibility and authority is given to shopfloor operators in their work nowadays.

As a summary, traditional financial performance measures of local ratios of indirect to direct labour, absorption and volume variance – are harmful and should be eliminated, since they conflict with attempts to improve quality, reduce inventories and increase flexibility. As a result of the traditional performance measures many researchers have suggested that a new set of operational performance measures should be used. These measures should provide managers, supervisors and operators with on-time information that is necessary for daily decision making. These measures should be flexible, primarily non-financial and able to be changed as needed. Globerson from Neely et. al. (1995) has stated that a performance measurement system of an organisation should include: a set of well defined and measurable criteria; procedures to compare actual performance to standards; and procedures for dealing with discrepancies between actual and desired performance.

2.2.2 Defining the New Concept of Performance Measurement

Performance measurement is a topic which is often discussed but rarely defined. Literally, it is the process of quantifying action, where measurement is the process of quantification and action leads to performance, thus:

a) ***Performance measurement*** can be defined as the process of quantifying the efficiency and effectiveness of action.

b) ***A performance measure*** can be defined as a metric used to quantify the efficiency and/or effectiveness of an action.

c) ***A performance measurement system*** can be defined as the set of metrics used to quantify both the efficiency and effectiveness of actions. (Neely et al, 1995)

Even with these definitions, the topic of performance measurement remains a broad topic. Figure 2.5 below shows the framework which highlights the fact that performance measurement system can be examined at three different levels:

a) The individual performance measures;
b) The set of performance measures – the performance measurement system as an entity; and
c) The relationship between the performance measurement system and the environment within it operates. (Neely et al, 1995)

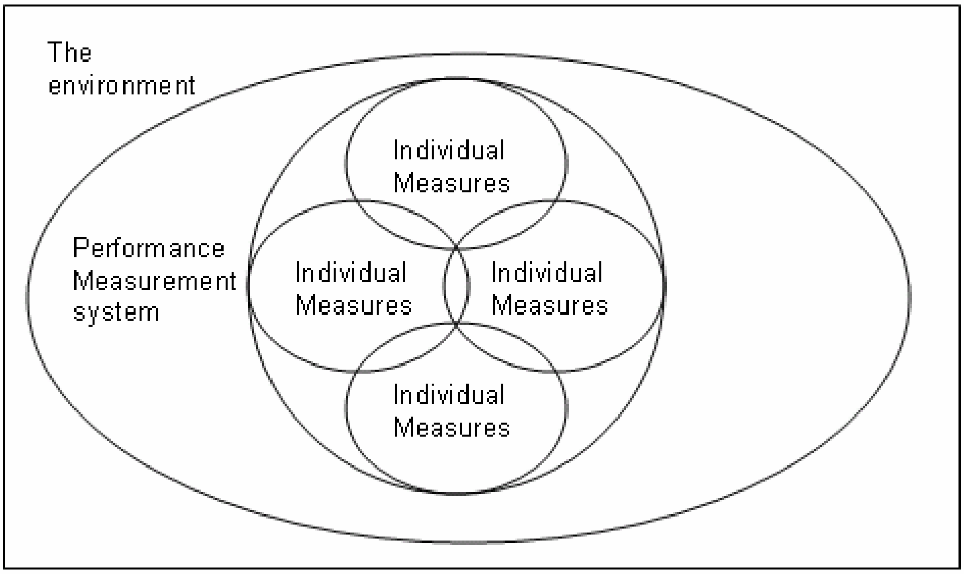

Figure 2.5: A framework for performance measurement system design.
Source: Adapted from: Neely, Gregory and Platts, "Performance Measurement System Design" International Journal of Operations and Production Management, Vol.15, No.4, Pg. 81, (1995)

2.2.2.1 Framework for Individual Performance Measure

The individual performance measures of the operations can be conceptually divided into two:

a) *Cost performance,* including the production costs and the productivity.
b) *Non-cost performance,* regarding the time, flexibility, safety and quality.

There are various ways in which these performance measures can be categorised. The rationale underlying is that performance measures need to be positioned in a strategic context, suits to the environment which it operates. For example, a set of proven relatively good performance measures for a service industry may not be suitable and practicable apply in a manufacturing environment and vice versa.

Table 2.1 below has grouped various individual performance measurement aspects into four generic terms quality, time, cost and flexibility.

Table 2.1: The multiple dimensions of quality, time, cost and flexibility.

Quality	**Time**	**Flexibility**
Q1: Performance	T1: Manufacturing lead time	F1: Material quality
Q2: Features	T2: Rate of production introduction	F2: Output quality
Q3: Reliability	T3: Delivery lead time	F3: New product
Q4: Conformance	T4: Due-date performance	F4: Modify product
Q5: Technical durability	T5: Frequency of delivery	F5: Deliverability
Q6: Serviceability		F6: Volume
Q7: Aesthetics	**Cost**	F7: Mix
Q8: Perceived quality	C1: Manufacturing cost	F8: Resource mix
Q9: Humanity	C2: Value added	
Q10: Value	C3: Selling price	
	C4: Running cost	
	C5: Service cost	
	C6: Operating cost	

2.2.2.2 The Performance Measurement System as An Entity

The previous section focused on the individual measures which together constitute a performance measurement system. To examine the performance measurement system as a whole is nevertheless important. Perhaps the best known performance measurement framework is Kaplan and Norton’s “Balanced Scorecard” which is based on the principle that a performance measurement system should provide managers with sufficient information to address the following questions as addressed in the Figure 2.6:

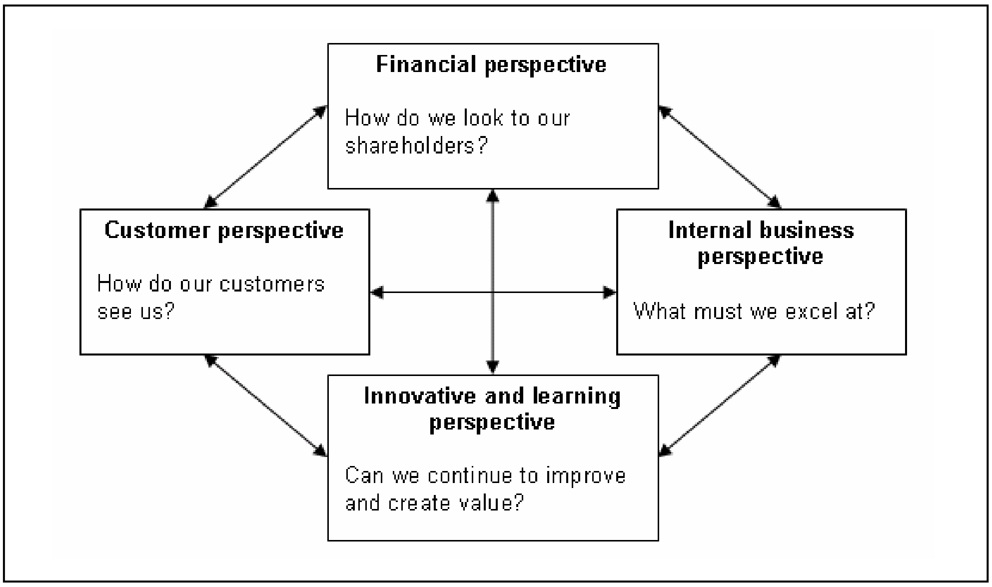

Figure 2.6: The Balance Scorecard

Source: Adapted from Neely, Gregory and Platts "Performance Measurement System Design – A Literature Review and Research Agenda" International Journal of Operations and Production Management, Vol.15, No.4, Pg. 81, (1995)

However, other authors prefer to provide criteria for performance measurement system design. For example, Globerson from Neely et. al. (1995) suggests that the following guidelines can be used to select a preferred set of performance criteria: (Neely et al, 1995)

- Performance criteria must be chosen from the company's objectives.
- Performance criteria must make possible the comparison of organisations which are in the same business.
- The purpose of each performance criterion must be clear.
- Data collection and methods of calculating the performance criterion must be clearly defined.
- Ratio-based performance criteria are preferred to absolute number.
- Performance criteria should be selected through discussions with the people involved (customers, employees, managers).
- Objective performance criteria are preferable to subjective ones.

2.2.3 Comparison between traditional and non-traditional performance measures

The Table 2.2 below summarises the comparison between traditional and non-traditional performance measures as discussed in section 2.2.1 and 2.2.2 respectively.

Table 2.2: Comparison between Traditional and Non-traditional Performance Measures.

Traditional performance measures	Non-traditional performance measures
• Based on outdated traditional accounting system	• Based on company strategy
• Mainly financial measures	• Mainly non-financial measures
• Intended for middle and high managers	• Intended for all employees
• Lagging metrics (weekly or monthly)	• On-time metrics (hourly or daily)
• Difficult, confusing and misleading	• Simple, accurate and easy to use
• Lead to employee frustration	• Lead to employee satisfaction
• Neglected at the shopfloor	• Frequently used at the shopfloor
• Have a fixed format	• Have no fixed format (depends on needs)
• Do not vary between locations	• Vary between locations
• Do not change over time	• Change over time as the need change
• Intended mainly for monitoring performance	• Intended to improve performance
• Not applicable for JIT, TQM, CIM, FMS, RPR, OPT, etc.	• Applicable
• Hinders continuous improvement	• Help in achieving continuous improvement

2.2.4 Integrated Performance Measurement Systems

There are few integrated performance measurement systems in order to give an overall view of companies' performance and to guard against sub-optimisation. These integrated systems are appropriate for world-class manufacturing firm in many aspects. However they have some limitations. The following three such systems will be discussed separately. (Ghalayini & Noble, 1996)

a) ***The "SMART" System***

The strategic measurement analysis and reporting technique (SMART) system was developed by Wang Laboratories Inc. as a result of dissatisfaction with traditional performance measures such as utilisation, efficiency, productivity and other financial variances. The objective was to devise a management control system with performance indicators designed to define and sustain success.

The SMART system can be represented by a four-level pyramid of objectives and measures. At the top is the corporate vision or strategy. At this level management assigns a corporate portfolio role to each business unit and allocates resources to support them. At the second level, objectives for each business unit are defined in market and financial terms. At the third level more tangible operating objectives and priorities can be defined for each business operating system (BOS) in terms of customer satisfaction, flexibility and productivity. At the fourth level, the department level, customer satisfaction, flexibility and productivity are represented by specific operational criteria: quality, delivery, process time and cost. As the foundation of the performance pyramid, these operational measures are the keys to achieve higher level results and ensure successful implementation of the company strategy.

The SMART performance pyramid is presented in Figure 2.7.

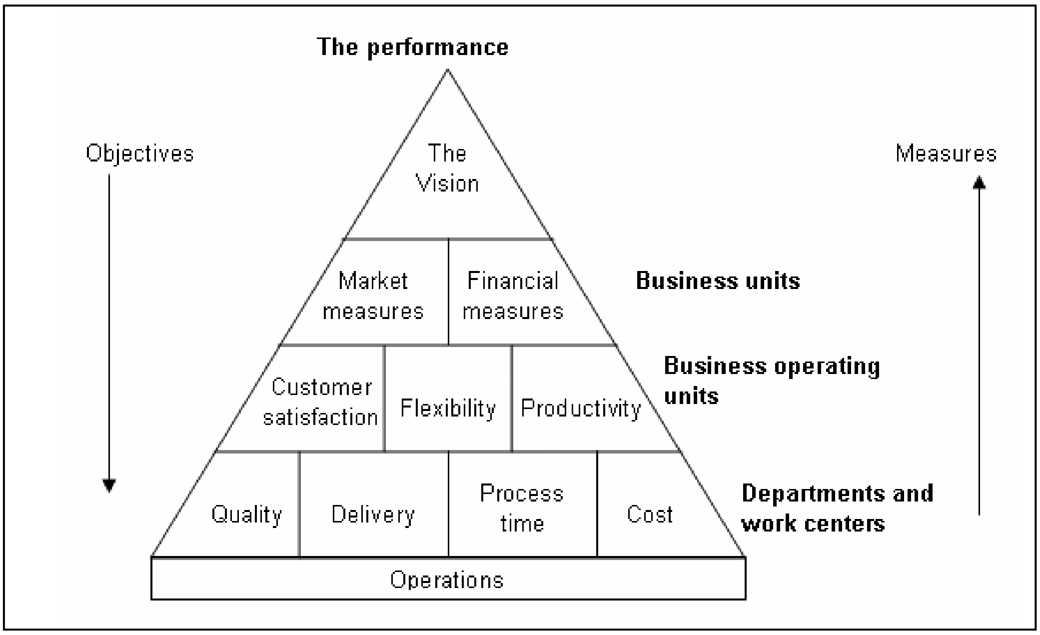

Figure 2.7: SMART Performance Pyramid

Source: Adapted from: Ghalayini & Noble,"The Changing Basis of Performance Measurement", International Journal of Operations and Production Management, Vol 16, No.8, Pg.74, (1996)

b) *The Performance Measurement Questionnaire (PMQ)*

The performance measurement questionnaire was developed to help the managers identify the improvement needs of their organisation, to determine the extent to which the existing performance measures support improvements and to establish an agenda for performance measure improvements.

The PMQ consists of four parts. The first part provides general data to be used to classify the respondents. Part two of the PMQ assesses the companies' competitive priorities and performance measurement system. It consists of items labelled as "improvement areas". The third part of the PMQ is similar to part two except the focus is on performance factors. The final part of the questionnaire asks the respondents to provide performance measures that best evaluate their own performance and any other general comments.

The results of the PMQ are evaluated in four ways: alignment, congruence, consensus and confusion. Alignment analysis is conducted to investigate in general terms how well a company's actions and measures complement its strategy. Congruence analysis is conducted to provide a detailed understanding of how well the measurement system supports and organisation's actions and strategy. Consensus analysis is carried out by grouping the data by management level or by functional group. This analysis shows the effect of communication. The goal of the confusion analysis is to determine the extent of consensus (standard deviation) regarding each improvement area and performance measurement.

c) *The Balance Scorecard*

The Kaplan and Norton's balance scorecard is a framework for an integrated performance measurement system for strategic, operational and financial measures. The balanced scorecard provides answers to four basic questions: How do our customers see us? (customer perspective); What must we excel at? (internal perspective); can we continue to improve and create value? (innovation and learning perspective); and How do we look to shareholders? (financial perspective).

For each of the above perspectives goals are set by the managers. Similarly, specific measures are specified in order to achieve each goal. The balanced scorecard has two main strengths. First, it summarises in one management report many of seemingly disparate elements of a company's competitive agenda. Second, it prevents sub-optimisation by forcing senior management to consider all operational measures at the same time.

2.2.4.1 Analysis of the existing integrated performance measurement systems.

The three integrated performance measurement system discussed have some strengths and weaknesses relative to each other. (Ghalayini & Noble, 1996) These are presented in Table 2.3.

Table 2.3: Strengths and weaknesses of integrated performance measurement system.

	Strengths	Weaknesses
SMART System	• Integrate corporate objectives with operational performance indicators.	• Does not provide any mechanism to identify key performance indicators for quality, cycle time, cost and delivery. • Does not explicitly integrate the concept of continuous improvement
PMQ	• Provides a mechanism to identify the improvement areas of the company and their associated performance measures. • It determines the extent to which the existing measurement system support improvement areas.	• Cannot be considered comprehensive integrated measurement system. • More work is required to link these areas of improvement and performance measures to the factory shopfloor. • Does not explicitly integrate the concept of continuous improvement
Balanced Scorecard	• Integrate four important performance perspectives in one simple and easy-to-use management reports.	• It is primarily designed for senior managers to provide them with an overall view of performance, thus not intended for, nor applicable at, the factory level.

In summary, the existing integrated measurement systems have the following limitations: (Ghalayini & Noble, 1996)

- They are mainly constructed as monitoring and controlling tools rather than improvement tools.
- They do not provide any mechanism for specifying which objective should be met in a specific time horizon.
- They are not dynamic systems. They do not allow any systematic revision of critical areas, performance measures, historical data, decisions and outcomes.
- They do not look ahead to predicting, achieving and improving future performance. They are only concerned with present performance.
- They do not provide any mechanism to achieve global optimisation especially at the operational level.
- Most of these systems do not stress the importance of time as a strategic performance measure.
- They do not provide a specific tool that could be used to model, control, monitor and improve the activities at the shopfloor.

2.2.5 Measuring, Managing and Maximising Performance

Quality and productivity are examined in broad terms and are viewed as two different dimensions of what everyone calls performance. Therefore, the general problem is performance management and improvement. If you are going to manage performance, you must first define what it means. Then by measuring performance and the factors that affect it, a logical approach can be taken to improving it. (Kaydos, 1991)

2.2.5.1 Understanding Productivity

In spite of all the attention given to productivity, the true meaning of the word has been generally overlooked. Most people assume productivity means units per labour hour, and most people are wrong. Taking a narrow-minded viewpoint on productivity or quality ignores other issues which may be far more important. Factors such as short order lead times, on-time deliveries, being able to handle a complex product mix, and high quality can be much more important in the marketplace. Working on the wrong priorities will waste resources and miss opportunities. Any efforts to improve productivity must be directed at increasing the total performance of a business, not just the performance of a few of its parts. (Kaydos, 1991) That must start with the customer.

Productivity is defined as output divided by input. Simple enough, but the big question is: “what output do you want?” a better question is: “what outputs do your customers want?” after all, if you are efficiently making what the market doesn’t want, that can hardly be considered productive. If you want to improve productivity, the first thing to do is make sure you are going after the right outputs – what your customer wants.

2.2.5.2 Understanding Quality

Quality has several meanings depending on the customer’s needs and wants. In the ideal situation, what is delivered conforms to the specification and exceeds the customer’s expectations. These quality factors can be lumped into two broad categories – design quality and execution quality. Design quality reflects the functions, feature and aesthetics of a product. Increasing design quality generally raises product cost because better materials, more materials and more labour are required in the product. Execution or conformance quality reflects how well a product meets its specifications. In our discussion of measuring performance, quality of conformance is the only concern. (Kaydos, 1991) Understanding that quality means conforming to requirements and that the customer is the source of these requirements is the first step on the road to improving the performance of any business function.

2.2.5.3 The Relationship between Quality and Productivity

Quality and productivity are different dimension of a higher level measure that could be called “performance” or “effectiveness”. These two factors are strongly related because they both come from the people and machines that make up a production system. As quality increases, productivity increases – not the other way round.

It is always dangerous to accommodate any quality issue, be it only a small problem. This is because after operating with quality problems for a period of time, the current performance level becomes acceptable unless someone decides better results are possible. It is patently wrong thinking that any problem is not worth the effort to solve it. That kind of thinking only leads to the development of thousands of little problems that slowly bleed a company to death.

All productivity problems are ultimately caused by poor quality. (Kaydos, 1991) Managers who want to improve productivity should not think only in terms of speeding up processes and making people work harder. Those are valid considerations, but managers will get better results if they start working on increasing the quality of raw materials, improving the reliability of equipment, improving the skills of people, and reducing the barriers to doing the job right the first time. When process quality increases, so does product quality and productivity.

2.2.6 Measuring the Performance

Identifying key performance factors is important, but that alone will not give managers the information they need to improve performance.

Like everything that works well, an effective performance measurement system is the result of good initial design and then development through trial and error. Good performance measurement systems are developed, not designed. A good system is one which provides a manager with timely, reliable information which is relevant to the decisions he or she has to make. If an information system doesn’t meet this test, it isn’t worth much no matter how sophisticated it may be. The key to having a cost-effective performance measurement system is to measure everything that matters and not much else.

2.2.6.1 Operational Requirement for an Effective Performance Measurement System

The quality of any decision is limited by the information available when it is made. Managers at all levels need performance information to make good decision about when and where action is needed. Department managers and supervisors especially need timely performance information about their area of responsibility, since that is most often where something can be done to minimise problems and improve the production process.

Unfortunately, meaningful information at the actionable level is always often missing. As a result, management is often blissfully unaware of many problems and potential opportunities.

Accounting system alone cannot fill all of management’s need for information, especially when it comes to improving quality and productivity. By themselves, accounting systems are not complete management information systems even though that misnomer will probably exist forever. It is more than a question of semantic: by no stretch of the imagination can current accounting systems provide managers with all the information they need to make timely and effective decisions. Accounting systems must be supplemented with systems that measure operational performance.

Measuring all the right variables in a production system is the first condition for an effective performance measurement system, but it is not enough. To be effective, it will also have to meet the following requirement: (Kaydos, 1991)

a) *Validity:* The performance measures must be valid. That is, they must measure what counts and be accepted and understood by the users.
b) *Completeness:* the productivity and quality measures must be designed to prevent people from doing the wrong things as much as it will guide them to do the right things. It must be "closed" in the sense that it considers all aspects of the balancing act that have to be performed.
c) *Sufficient detail:* it is no use to have something measured and recorded but the information is not detailed enough to make any conclusion/decision. The purpose of measuring performance is to take action of improvement, hence data recorded must be relevantly sufficient in assisting decision making process.
d) *Accounting for the performance gap:* the measurement system must account for at least 80 percent of the gap (or variation) between actual and desired or normal performance. If you can't explain the gap, you haven't identified all the significant causes of the variations in the output of the production systems.
e) *Sufficient measurement frequency:* if measurements are not taken often enough, a distorted picture results. Increasing the sampling frequency presents a truer picture. There is no disadvantage to measure more frequently than needed, it only increases costs.
f) *Timeliness:* having the right information is one thing, having it when you need it is quite another. Time lag is important because too much delay between a stimulus and the corresponding response makes learning difficult.
g) *Useful accuracy:* highly accurate Figures are generally not required for performance information to be useful. Being consistent and reasonably accurate is all that is needed to have useful performance information.
h) *Easily understood terms:* the measures used must be easily understood by the people using them. Translating quality or production problems into cost, lost wages or benefits can help people appreciate the cost of poor performance, but it is better to use familiar terms for day-to-day communications.
i) *Accountability:* while accountability is not a property of a performance measurement system, the system will not be of much value unless there is strict

accountability for each and every measures. This means that one and only one person is assigned to responsibility for each measure.

j) *Trust and credibility:* the output of an information system can be no better then its input. If the people in an organisation do not trust each other, then the data reported and the information exchanged will be filtered or distorted.

2.2.6.2 Measuring Key Performance Factors

Achieving maximum performance or something close to it should be every company’s objective, but the hard fact of life is that you can’t have it all. No company has the resources to be all things to all people and some desirable objectives are inherently conflicting. Without a clear definition of company strategy and what performance means for each department to support that strategy, there is a real danger of sub-optimisation. This occurs when department objectives are not consistent with the needs of the total company and each other. Maximum performance of the whole does not result from trying to independently maximise the performance of each of the parts.

Achieving maximum performance is a balancing act, not a simple problem of optimising one variable. Management must determine the most important factors for the entire company and assign departmental objectives and performance measures which are consistent with them.

Like companies, departments should also have key performance factors. Poorly defined key performance factors result in goals that keep changing from week to week. Maximising the total productivity of a business is a delicate balancing act that must be accomplished by management. Maximum performance can only be achieved if a department has specific performance measures that reflect the company’s key performance factors. (Kaydos, 1991)

2.3 Logistics Operations Performance Management

Organisational performance can be measured against many criteria. It is vital that management identify the measures of organisational effectiveness it wishes to utilise, and to single out them in order of priority. The selection of particular measures of logistics organisational effectiveness depends on a firm's characteristics and needs. Perhaps the most difficult process is developing the techniques or procedures needed to measure the criteria of effectiveness.

2.3.1 Measuring and Selling the Value of Logistics

In the logistics and transportation sector, as in many others, it is important to have a good performance level in operations. In order to achieve high performance levels, it is necessary to know which operational factors are critical for success and which are less important.

In order to receive adequate rewards for the firm's innovations and performance in logistics, managers also have to measure and sell the value that is being provided to customers. Financial measurements such as total cost analysis only capture part of the value created by logistics. One of the problems faced by logistics professionals over the years is that logistics has been viewed simply as a cost that needs to be reduced.

It cannot be taken for granted that customers will understand the value being provided and be willing to compensate the supplier for it. Customer must be shown on a regular basis the value that is being created by logistics, and so must top management within the organisation. It is easy for management within the firm to ignore logistics and to underestimate its importance when logistics is performing well. For this reason, logistics managers must measure and sell the value created by logistics internally as well as externally throughout the supply chain. (Lambert & Burduroglu 2000)

There are few aspects of logistics performance and will be discussed separately below.

2.3.1.1 Delivery Performance: Definition and Measurement

In any typical delivery distribution mode, the delivery channel, vehicle scheduling, and warehouse location play an important role in delivery performance. An increase in delivery performance is possible by selecting suitable channel, scheduling and location policies. The most important aspect of delivery performance is on-time delivery. This determines whether a perfect delivery has taken place or not, and it acts as a measure of customer service level. (Gunasekaran et al, 2001) The following five aspects are identified as the measures of delivery performance:

- Delivery-to-request date;
- Delivery-to-commit date;
- Order fill lead time;
- Goods in transit;
- Partial delivery; and
- Undelivered

Another aspect of delivery service, which is the flexibility of delivery systems to meet particular customer needs, reflect customer satisfaction, hence is wise to be taken into consideration while developing the measurement metrics. Nowadays, the delivery systems are becoming more flexible towards customer needs. By being flexible, a delivery system can positively influence the decision of customers to place orders, and hence, this can be regarded as a metric for winning and retaining customers.

Like other activities, delivery heavily relies on the quality of information exchanged. Thus, the quality and the way information is presented determine the delivery performance to a large extent, which, therefore, can be used to measure and improve performance.

2.3.1.2 Customer Satisfaction

As customer place demands on suppliers for more value-added service, it is becoming increasingly important to be able to measure the value of these services in terms that are meaningful to the customer. Failure to do so will result in erosion of profitability since it will cost to provide the services to customer, but the firm may not receive adequate compensation for these services. (Lambert & Burduroglu, 2000)

Customer satisfaction occurs when business successfully fulfill their obligations on all components of the marketing mix: product, price, promotion and place. The place component represents the manufactures expenditure for customer service, which can be thought of as the output of the logistics systems. (Lambert & Burduroglu, 2000) There are at least four reasons why companies should focus on customer service:

a) satisfied customers are typically loyal and make repeat purchases;
b) it can be up to five times as costly to attract a new customer as it is to keep an old one;
c) customer who decide to defect are very likely to share their dissatisfaction with others and
d) it is more profitable to sell more to existing customers than it is to find new customers for this same level of sales increase.

Customer satisfaction measures are the less quantitative in financial terms as compared to other performance measurement. However, it is a critical measurement because it allows management to align the company’s service package with customer’s needs. Higher levels of service can have direct impact on customer’s financial performance through higher revenues as well as lower cost as a result of better service.

While there are a number of approaches to the measurement and management of customer satisfaction, it is generally considered best to measure the firm’s performance relative to specific competitors and identify gaps that represent opportunities for differentiating the company. Usually, customer satisfaction measures are collected using surveys. Prior than that, customer service audit can be used by management to identify the elements of service that are important in customers’ purchasing decision, and to evaluate the level of services being provided by each of the major suppliers in the market. (Lambert & Burduroglu, 2000)

2.3.1.3 Total Distribution Cost

Perhaps the most important research concerning logistics that is going on is in the area of designing efficient and cost – effective distribution systems. Therefore, a thorough understanding and a good performance evaluation of total distribution cost are essential. A profile consisting of various distribution cost elements should be developed so that appropriate trade-offs can be applied as a basis of planning and reassessment of distribution systems, and thus, the overall cost effectiveness can be achieved. The total distribution cost is presented in Figure 2.8.

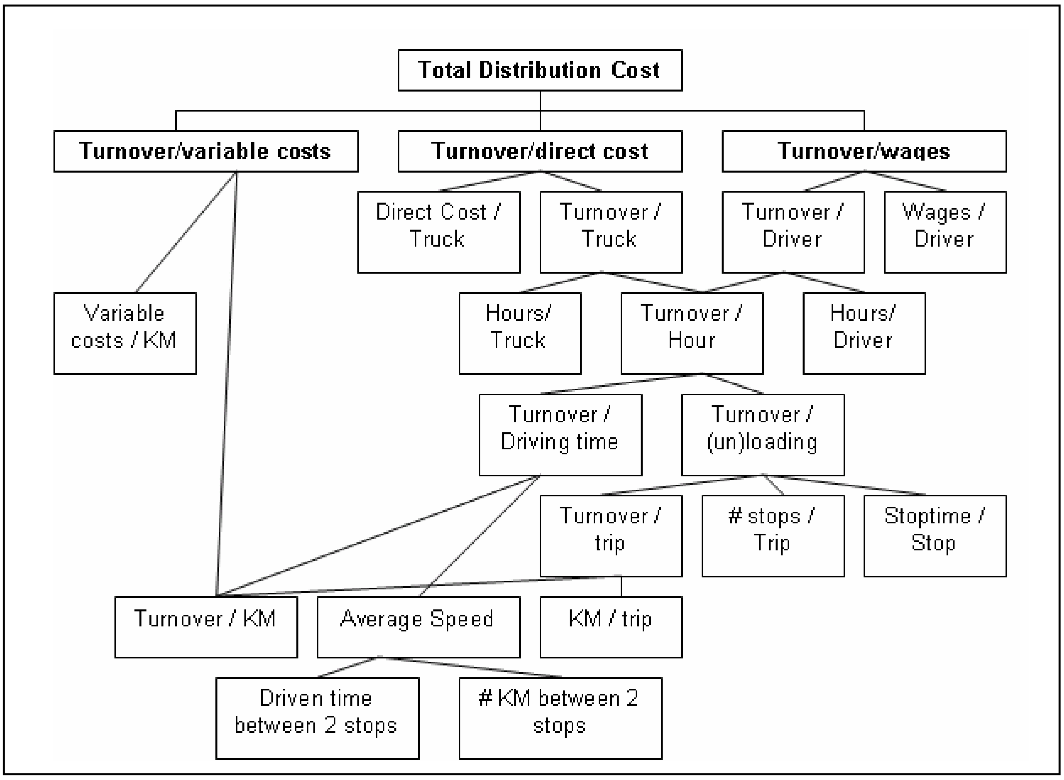

Figure 2.8:Total Distribution Cost Model

Source: Adapted from: Donsellar, Kokke & Allessie, "Performance Measurement in the Transportation and Distribution Sector" (1998)

According to Thomas and Griffin (1996), the single largest cost component of logistics is transportation cost, often comprising more than half of the total logistics cost. To reduce the delivery cost, this total should be treated as a metric id high priority. However, there is an argument that in distribution service, the operational accent lies on stopping and not on driving, which means a large part of the performance is determined by stopping operations such as the number of stops per trip and the stop-time per stop. (Donsellar et al, 1998) The total distribution cost model is shown in Figure above.

2.3.1.4 Productivity standards

Logistics cost can be controlled by the use of productivity ratios. These ratios take the form of:

$$\text{Productivity} = \frac{output}{input}$$

Productivity ratios for transportation might include:

$$\text{Productivity} = \frac{ton\ miles\ transported}{total\ actual\ transport\ \cos t}$$

$$\text{Productivity} = \frac{stops\ served}{total\ actual\ transportation\ \cos t}$$

$$\text{Productivity} = \frac{shipments\ transported\ to\ destination}{total\ actual\ transportation\ \cos t}$$

Productivity measures of this type have been developed for most logistics activities. In the absence of a standard costing system, they are particularly useful with budgetary practices, because they provide guidelines on operating efficiencies. Furthermore, such measures are easily understood by management and employees. However, productivity measures are not without their shortcomings:

1. Productivity measures are expressed in terms of physical units and actual dollar losses caused by inefficiencies, and predictions of future logistics cost cannot be made. This makes it difficult to cost justify any system changes that will result in improved productivity.
2. The actual productivity measure calculated is seldom compared to a productivity standard. Without work measurement or some form of cost estimation, it is

impossible to know what the productivity standard should be in efficient operations.

3. Changes in output levels may in some cases distort measures of productivity. This distortion occurs because the fixed and variable elements are seldom delineated. Consequently, the productivity measure computes utilisation, not efficiency.

2.3.4 Logistics Performance Indicators

Certain performance indicators can serve practically as an impetus for continual improvement. Logistics analysis is therefore based in the main upon appropriate performance indicators. These values are meant to show the degree to which enterprise goals are fulfilled or not fulfilled. Logistics performance indicators analysed the effect of logistics an enterprise goals in the four targets of quality, cost, delivery and flexibility. Whenever possible, a logistics performance indicator will give direct indication of fulfilment of one of the individual goals within a goal area. A performance indicator relates to a logistics object and thus becomes an attribute of that object – and sometimes becomes a logistics object in its own right.

In actual practice, the measuring of logistics performance indicators varies in difficulty and usually requires that certain aspects be counted. It is not always possible to assess these aspects without expending a lot of time and energy. In addition, integrating and compressing the performance indicators of single events into global performance indicators, covering several levels for example, can be very problematic.

The following sums up central problems in terms of the meaning and practical applicability of performance indicators in the form of practical methods. The problems are typical of any quality measurement system and, in part, costing systems as well.

- *General performance indicators:* Simple, measurable performance indicators are often so general and qualitative in meaning that no practical steps can be derived from them without making additional, non-quantitative, and implicit assumptions. An example of such a performance indicator is customer satisfaction.

- *Lack of comprehensive measurement methods:* Simple, applicable performance indicators often cannot be measured directly. They require various, sometimes complicated or inexact measurements that are then combined with non-measured, implicit methods to yield the desired performance indicator. A good example is flexibility potential.
- *Distortion of the process:* Each measurement affects the process being measured. The disturbance can be so great that the process would behave differently under non-measurement conditions.
- *Meaning of the performance indicators:* The absolute value of a performance indicator has little meaning as such. Only repeated comparison of measurement of the same performance indicator over time can make the performance indicator an instrument of a continuous improvement process.
- *Comparability of performance indicators:* Benchmarking, the measuring of a company's products, services, costs etc. against those of competitors, has meaning only if the competitor has used the same bases of measurement. In practice, it is common to find different reference objects, the objects to which certain performance indicators refer. As example is service level.
- *Practical applicability in logistics networks:* All of the important performance indicators can be applied in the total logistics networks as well as in the individual company. Because the companies forming a logistics network follow the same principal goals, logistics performance indicators should be comparable in the main.

It makes sense to weigh the value of the potential application of the measurement against the expenditure in time and effort required by measurement. In the world of practice, a few, simply measured performance indicators have proven worthwhile. Employees then must apply the measurement using a multitude of means that cannot be directly derived from the measurement.

2.3.5 Methods to Control Logistics Performance

Logistics cost may exceed 25 percent of the cost of doing business at the manufacturing level. For this reason, better management of the logistics function offers the potential for large savings, which can contribute to improved corporate profitability.

In the past, various financial performance indicators were seen as relevant management information; today management needs additional performance indicators. Insufficient accounting information is a significant problem in most firms. Many of the problems encountered by manufacturers result from the use of a full costing philosophy that allocates all indirect cost to each product or customer group on some arbitrary basis. As a result, companies use management controls that focus on the wrong targets: direct manufacturing labour or sales volume.

Most managers do not know the true cost of their company's products or services, how to reduce expenses most effectively, or how to allocate resources to the most profitable business segments because of the following factors:

a) Accounting systems are designed to report the aggregate effects of a firm's operations to its stockholders, creditors, and governmental agencies.
b) Accounting costs are computed to provide a historical record of the company's operations. All of the firm's costs are allocated to the various business segments. Because cost common to multiply segments are allocated, the process is necessarily subjective and arbitrary.
c) Accounting systems typically record marketing and logistics cost in aggregates natural accounts, and seldom attempt to attach the cost to functional responsibilities and to individual products or customers.
d) Profitability reports do not show a segments contribution to profitability, but include fixed cost, joint product or service cost, and corporate overhead cos. Top management often encourages this approach because it fears that knowledge of variable cost will lead to unrealistically low price. In most cases, however, prices are set by the marketplace, not on the basis of cost.
e) In most standard cost systems, fixed cost are often treated the same as variable cost, which masks the true behaviour of the fixed costs.

The need for operational performance indicators and information about the connection between these indicators and the financial performance indicators is growing. One of these reasons in the emphasis of many firms on continuous improvement. To improve the economic performance one has to know which factors influence the performance.

Logistics performance measurement selection is a critical step in the design and evaluation of any system. It can be monitored by using standard cost, budgets, productivity standards, statistical process control, and activity-based management. Generally, the larger and more complex the system, the more challenging it becomes to measure effectively. The following categorisation of performance measures for logistics systems in general, i.e. from the aspect of three separate types of performance measures: resource measures, output measures and flexibility measures. (Beamon, 1999)

2.3.5.1 Resource Measures

Resources are generally measured in terms of the minimum requirements or a composite efficiency measure. One general goal of supply chain analysis is resource minimisation. The following is an example list of logistics resource performance measures: (Beamon, 1999)

a) *Total Cost:* Total cost of resources used.
b) *Distribution Cost:* Total cost of distribution, including transportation and handling cost.
c) *Manufacturing Cost:* Total cost of manufacturing, including labour, maintenance and re-work costs.
d) *Inventory:* Cost associated with held inventory.
e) *Return on Investment:* Measures the profitability of an organisation.

2.3.5.2 Output Measures

Output performance measures must not only correspond to the organisation's strategic goals, but must also correspond to the customer' goals and values, since strategic goals generally address meeting customer requirements. (Beamon, 1999)

a) *Sales:* Total revenue
b) *Profit:* Total revenue less expenses

c) *Fill rate:* Proportion of orders filled immediately
d) *On-time deliveries:* Measures item, order or product delivery performance
e) *Backorder/stockout:* Measure item, order or product availability performance
f) *Customer response time:* Amount of time between and order and its corresponding delivery
g) *Manufacturing lead time:* Total amount of time required to produce a particular item or batch
h) *Shipping errors:* Number of incorrect shipments made
i) *Customer complaints:* Number of customer complaints registered.

2.3.5.3 Flexibility Measure

Flexibility, which is seldom used in supply chain analysis, can measure a system's ability to accommodate volume and schedule fluctuations from suppliers, manufacturers and customers. Indeed, flexibility is vital to the success of the supply chain, since the supply chain exists in an uncertain environment nowadays. (Beamon, 1999) There are four types of flexibility:

a) *Volume Flexibility:* Measure the range of volume in which the organisation can run profitably.
b) *Delivery Flexibility:* Ability to move planned deliveries to accommodate rush orders and special orders.
c) *Mix Flexibility:* Measures the range of different product types that may be produced during a particular time period, or the response time between product mix changes.
d) *New Product Flexibility:* The ease with which new products are introduced to the system.

2.3.6 Logistics Operations Standards and Variance management

A standard is an accepted measure of comparison for quantitative or qualitative value. Standards set the realistic optimal performance level, but they are based on the level of activity in the transport operation.

One element of best practice in the management of costs in transport operations is where a system is in place which holds the relevant standards for each location. A report detailing the deviation to standard is then reported monthly to the local transport/distribution manager allowing management actions to be identified. For an activity-based task, a standard can be established based on the completion of a task in a given time frame. The standard time can be established by using a time study for completing the task. In other words, the task is completed and timed to determine how long it takes to complete the task. This procedure is repeated a number of times and the average time can be used as the standard for that task. This standard time can be converted to a cost per distance travelled by multiplying the time by a cost factor and dividing that number by the distance travelled.

Industry or historical based standards - in other areas that are not activity based such as the cost of parts, a standard can be established using an industry standard or a historical based cost. A fuel standard can be established by using a distance travelled per unit of measure based on a target or historical Figure. It is also necessary to have an agreed cost per unit of measure. The cost per unit divided by the distance travelled per unit would equal the standard cost per distance travelled.

A standard tells management the expected cost of performing selected activities and allows management to make comparisons that point out any operating inefficiencies. Once standard has been set, the actual performance is compared to the standard to see if it is acceptable. If so, the system is under control and that is the end of the control process. Where performance differs from the standard, investigation may be warranted. It is most meaningful to judge variances in terms of their practical significance. How significant is the variance in its effects on bottom-line performance? If significant, the next question to ask is whether some action is required.

CHAPTER 3

METHODOLOGY

3.1 Developing Performance Measurement System

Generally, this study focuses on analysing performance measurement systems that are already in use, categorising performance measures and then studying the measures within a category, and building a frameworks by which performance measurement system can be apply to Logistics Operations in MOX.

Besides analysing the measures based on their effectiveness, benchmarking is another important method that is used in evaluation stage. Benchmarking serves as a means of identifying improvement opportunities here. In order to study a large number of performance measures, it is always easier to categorise them. The categorisation of performance measures in this study follows categories suggested by Neely (1995) including: quality, productivity and cost.

One of the most difficult areas of performance measure selection is the development of performance measurement system. Important questions must be addressed here: What to measure? How to measure? How often to measure? How are multiple individual measures integrated into a measurement system?

Although all of the ideas important to examining measurement systems already in place apply, the problem is more difficult since the objective is to create the “best” possible measurement system for the MOX Logistics Operations of interest.

3.2 Phases in Performance Measurement System Implementation

It is proposed here that the development of performance measurement system can be divided into three main phases. These are:

1. the design of the performance measurement,
2. the implementation of the performance measures, and
3. the use of the performance measures.

From the literature, the design phase can be subdivided again into identifying the key objectives to be measured and designing the measures themselves. There is now a strong consensus amongst authors that measures should derived from strategy and the literature is dominated by processes which answer the question “what should we measure?” The importance of designing measures in a way which encourages behaviour which will support the strategy is absent from all but two processes but the benefits of this approach are well documented. Therefore, the two requirements of the design phase are identifying the key objectives to be measured and designing the measures.

However, the purpose of this project is not to develop a new performance measurement system for MOX, but to improve on it. This chapter present a proposal of practical improvement of measurement system for MOX Logistics Operations performance. These measures, in combination of the conventional and the new performance measurement approach, is believe that can be used to monitor the progress of the business as well as detailed enough to track individual and department performance inline with the company’s strategic direction.

These performance measures are not new, in fact, very few performance measures used by world class manufacturers are entirely new. However, these performance measures are construct in a way that it suits MOX business and can reflect its logistics operations department's performance as a whole. The performance measures selected will be able to track the department's performance form various aspects, and this is constructed to a weight that reflects company's strategic emphasis.

Before starting the discussion, it is important to note that it took a considerable length of time to progress from design, through implementation to the measures being used. From a study conducted by Bourne et. al. (2000), entitled Designing, Implementing and Updating Performance Measurement Systems, generally, the initial performance measurement system design could be completed over a period of three to four months. However, it took another 9 to 13 months before the performance measures reached the stage of being regularly measured, reviewed and displayed. Therefore the task of implementing and using the performance measurement metrics is far from complete at this point of time. Hence, due to the limitation of the project scope, the implementation of the performance system will only be briefly discussed in this study.

3.2.1 The Design of the Performance Measurement

The design of a performance measurement system is principally a cognitive exercise, translating views of customer and other stakeholder needs into business objectives and appropriate performance measures. There are three activities to be carried out during the system design phase.

1. Assemble and organise the raw case data. There are three ways to collect data from a system: ask, observe, and use system documentation.
2. Edit data, summarise the case information and eliminate redundant data.
3. Developing a comprehensive performance measurement system. A total performance measurement metrics will be developed.

The objective of this phase is achieved through few interviews (please refer Appendix I) with line management and senior management team to analyse the company's current business. Through the interviews, the organisation's business strategy, company's long term goals and objectives, as well as the department's short term goals and objectives will be discussed. The department's short term goals and objectives will be translated into department key operations and will be illustrated in more detail in Chapter 4 and Chapter 5.

A series of tools such as SWOT Analysis, Gap Analysis, Competitive Profile Matircs (CPM) Analysis, System Thinking and Pareto Analysis were used to facilitate the interview as well as to compile and summarise the results. These tools are important as it helps the author to reassess the company's strategy systematically and identifying both customer and stakeholders' needs before blending these to develop a new set of performance measurement system. These tools provide guided frame works for the author to arrange and organise pieces of raw information collected from interviews, readings as well as other means, into meaningful information.

3.2.1.1 Use of Business Analysis Tools

The SWOT Analysis (attached as Appendix II) was employed to categorised management and employee's opinions on MOX's business environment and it helps to identify company's internal strength and weaknesses; CPM Analysis was used to identify how customer view MOX's performance against other competitors, and the result is presented in Chapter 6; Gap Analysis, as shown in Chapter 6, was employed to measure the improvement gap of the identified key performance indicators between current performance and desired target; System Thinking was practised while organising the results while Pareto Analysis was used to identify the most important factors to be taken care during the improvement process.

An employee opinion survey (please refer to Appendix III) was carried out to identify the Critical Success Factors (CSF's) for gas industry. A total of 25 sets questionnaires were distributed to employees from various departments. Employees were asked to choose 8 of the listed CSF's which they think is most important and applicable to MOX. Then, they were requested to rate the performance of MOX and other competitors for the selected CSF's. a summary will be presented to the management and they are required to assign a weightage to the short listed CSF's. Finally, the combination of weightage assigned and performance rating will be summarised and presented as CPM analysis.

The CSF's which is direct controllable by Logistics Operations Department will be selected and transformed into Key Performance Indicators (KPI's). Again, a weightage will be assigned to each KPI by the management according to the importance of the KPI. Next, the Gap Analysis will be carried out. A discussion will be conducted together with Logistics Operations Manager and Transportation Supervisor to analyse department's current situation and desired performance on these KPI's. Lastly, current score and desired score will be awarded to the KPI and the gap in between will then be identified.

3.2.2 The Implementation and The Use of Performance Measures

The implementation of the performance measures can be viewed as a process of data collection, collation, sorting and distribution. The purpose of qualitative inquiry during this phase is to produce findings through analysis, interpretation and presentation of findings. The challenge in data analysis is to "make sense of massive amounts of data, reduce volume of information, identify significant patterns, and construct framework for communicating the essence of what data reveal".

As suggested by Bourne (2000), the implementation is primarily a mechanistic exercise and should be susceptible to being managed by classic project management tools. This will be briefly discussed in Chapter 7.

3.3 Project Methodology

The study will be conducted in the following phases:

Phase 1: Assemble and organise the raw case data. There are three ways to collect data from a system: ask, observe, and use system documentation. In this research, all of these data collection methods were used.

Phase 2: Edit data, summarise the case information and eliminate redundant data. There are four relevant tests relevant in evaluating the quality of any research study: construct validity, internal validity, external validity, and reliability.

Phase 3: Developing a comprehensive performance measurement system. Most important phase among the five phases throughout research. A total performance measurement metrics will be developed.

Phase 4: Analysing result. The purpose of qualitative inquiry is to produce findings through analysis, interpretation and presentation of findings. It involve making sense of massive amounts of data, reduce volume of information, identify significant patterns, and construct framework for communicating the essence of what data reveal.

Phase 5: Documentation of the study findings. Final write up and presentation on findings.

3.4 Expected Results

From the completed project, a set of Critical Success Factors (CSF) and Key Operational Factors (KOF) of the department, which are important to the organisation's success in the competitive market, will be identified. Once these parts and parcel of the performance factors are identified, they will be benchmarked and put together to develop a complete performance measurement metrics for the department which incorporate all of the identified Critical Success Factors.

CHAPTER 4

MOX's CURRENT LOGISTICS OPERATIONS MODEL

4.1 Operations Management and the Supply Chain

Operations management is not an isolated function. It is an integral part of a complex supply chain, involving the deliveries of inputs from suppliers to the transformation area, movement of materials within the transformation zone and distribution of finished products to the client. In addition to material flow, there is an information supply chain with a reverse sense, communicating product needs, specification and timing. Operations and the supply chain have to be considered as an integrated system, since merely producing a product or service has no meaning to the customer unless it is delivered in a timely manner.

The ultimate driving force behind the operations manager is the client. The customer is expecting to have a product delivered at the right time, right place, at an acceptable quality, at required quantity, at a reasonable price and courteously. And in MOX, the front line body driving these expectations is the Logistics Operations unit.

Since logistics operations is the front line interface of the company with customer, managing its performance is crucial to make the operations is always up to standard and continuous improving to serve customer better. Before looking into the performance management of these logistics operations, it is good to understand how this Logistics Operations unit works and what it does in within the company.

4.2 MOX's Supply Chain Management

MOX is committed in manufacturing and selling high quality products around Malaysia which meet the needs of their customers. A nationwide supply chain management strategy, which aims to improve quality, lower costs, increase productivity and strengthen customer service, has been implemented. This Supply Chain Management Strategy has the visions to make MOX to be recognised as world class by customers, suppliers and other organisations through:

- The implementation of best supply chain management practices throughout MOX and BOC Group.
- Focusing on the development of relationships with "best in class" suppliers, in order to leverage MOX's corporate purchasing volumes by presenting themselves and acting as a single enterprise.
- Working together in these new relationships to develop continuous cycle time reduction, quality, innovation and cost improvements.
- Jointly developing with MOX's strategic suppliers, the new services and products which will differentiate MOX in tomorrow's markets.

A simple model for any operation is a supply chain comprising three basic blocks, inputs, transformation and outputs, which when integrated provide the net work of product flow to clients. Then in the opposite sense, is an information flow network providing all the necessary details of the products demanded. In general:

- **Input** is where the raw materials are received by the operating firm. These may originate locally, nationally or internationally.
- **Transformation** is where the state of the received raw materials is modified according to desired requirements. The transformation may be in a multitude of steps and occur at different locations.
- **Output** is where the desired products is finished and distributed to customers. The customer may be local, national or international.

MOX operates in a typical total supply chain system shown in Figure 4.1:

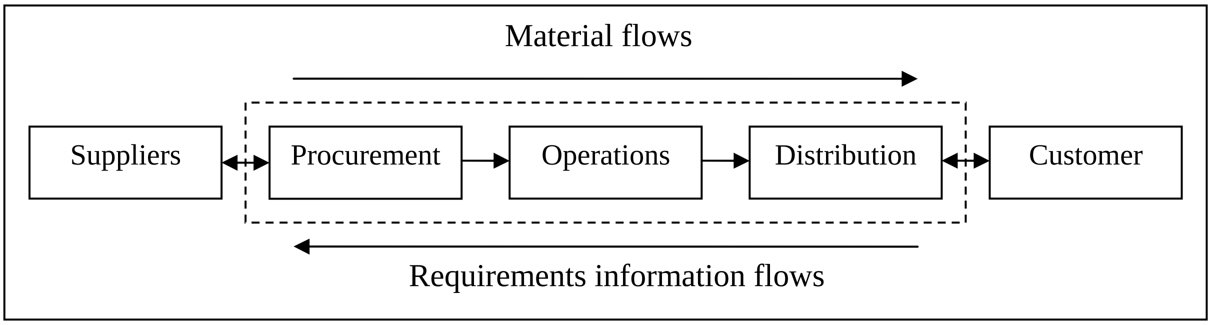

Figure 4.1: Material & Information flow of a typical supply chain.

Management of the supply chain involves rigorous attention to quality, cost and lead or delivery times. It implies teamwork, cooperation and effective coordination throughout the entire organisation. From MOX management point of view, the supply chain in MOX is considered as two distinct activities:

a) Material management is the upstream part of the chain. It covers purchasing of raw material, components and packaging, their storage and the production transformation phases, including internal transfer within the work center.

b) Physical distribution management or better known as logistics operations management, is the downstream portion of the chain and covers storage and inventory control of the finished products, order processing, distribution planning, order picking, transportation of the finished products to the distribution centers and then to customers.

As determined by the scope of the project, the discussion will only focus on the logistics operations management.

4.3 MOX Logistics Operations

MOX recognise excellence logistics management as one of its Core Competencies that distinguish her from other competitors in the market. It is also part of the company's corporate strategy. The prime objective of logistics management is to ensure that materials and products are available at the right place, at the right time, right manner and in the right quantities to satisfy demand or customers. Not forgetting also at the right cost, lower if possible, to give a competitive advantage to the company. It is closely related to the time and place utility.

4.3.1 Logistics Supports Marketing

By the late 1980s and early 1990s, customer service took center stage in many organisations. The trend toward strong customer continues today. As effective logistics management has been recognised as a key opportunity to improve both the profitability and competitive performance of firms, the integration of logistics support into marketing strategy will definitely provide a better and stronger "marketing concept". Figure 4.2 shows the integrated logistics function into a marketing mix.

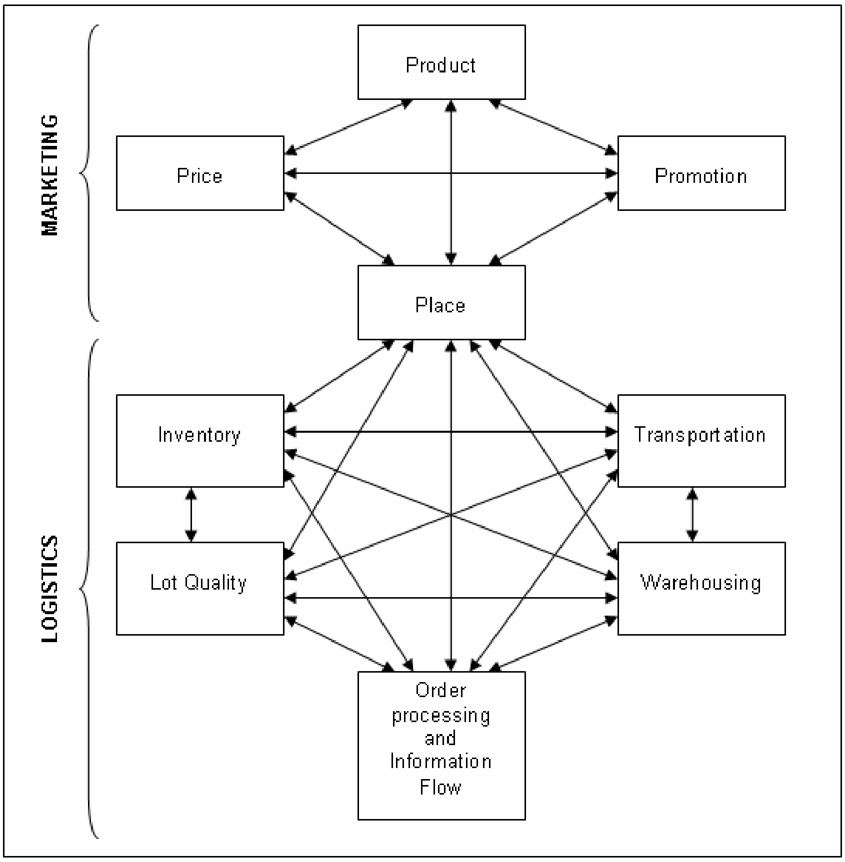

Figure 4.2: Integration of Marketing and Logistics.
Source: Adapted from Douglas M. Lambert, James R. Stock, Lisa M. Ellram (1998), "Fundamental of Logistics Management", IRWIN Mc Graw-Hill, United States of America.

The "marketing concept", as mentioned above, is a "marketing management philosophy which holds that achieving organisational goals depends on determining the needs and wants of target markets and delivering the desired satisfactions more effectively and efficiently than competitors". (Lambert, Stock & Ellram, 1998) Thus, the marketing concept is a "customer-driven" perspective which holds that a business exists to meet customer needs. The "four P's" (Product, Price, Promotion & Place) of the marketing mix are require that for a firm to be successful, any marketing effort must integrate the ideas of having the right product, at the right price, publicised with the proper promotion, and available in the right place. Logistics plays a critical role particularly in support of getting the product to the right place. As discussed in previous chapter in conjunction with utility, a product or service provides customer satisfaction only if it is available to the customer when and where it is needed.

The matrix in Figure 4.3 below shows a different level of distribution services provide to MOX customer base on what kind of service they need. These customised Product Service Offers (PSOs) are developed based on market research. Customers are categorised, or more often than not, customer themselves will opt to select level of service preferred or needed. With this, MOX will be more able to understand customer's desire and meet their requirement by not providing more or less at a cost which is value for service.

<table>
<tr><td></td><td></td><td colspan="3">Preferred Sales Approach</td></tr>
<tr><td></td><td></td><td>Price Focus</td><td>Basic Service Offer</td><td>Expert Advice</td></tr>
<tr><td rowspan="3">Preferred Physical Distribution</td><td>Self Collect</td><td>Discount Shoppers</td><td>Pick up Convenience</td><td>Local Service Shoppers</td></tr>
<tr><td>Base delivery offer</td><td rowspan="2">Price Traders</td><td>Hassle free Service</td><td>Knowledge Seekers</td></tr>
<tr><td>Superior Delivery</td><td>Rapid response</td><td>Total Solution Partners</td></tr>
</table>

Figure 4.3: Level of distribution services provided by MOX.

4.3.2 Logistics Operations Management

MOX practices world class manufacturing practices as suggested by Professor Richard Schonberger (1986) wherein he said that the term world class manufacturing "nicely captures the breadth and essence of the fundamental changes taking place in the industrial enterprises. The term world class manufacturing is a very broad one but will generally include the following:

- A new approach to product quality
- Just-in-time production techniques
- Change in the way the work force is managed
- A flexible approach to customer requirement

A key to effective supply chain management is to meet customer requirements in terms of order fulfilment. Effective order fulfilment requires integration of the firm's manufacturing, logistics and marketing plans, to design the distribution network. The order fulfilment process defines the specific steps regarding how customer orders are: generated and communicated, entered, processed, documented, picked, delivered and handled post delivery. The key activity to effectively managing logistics process in MOX can be categorised into Order to Cash (OTC), Product to Order (PTO) and Delivery In Full On Time (DIFOT).

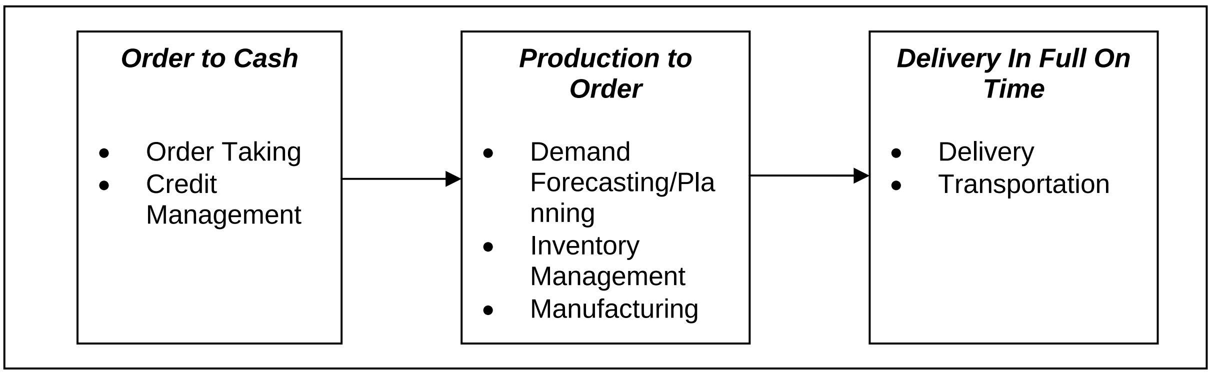

Figure 4.4: MOX's Logistics Operations Activities

4.3.2.1 Order to Cash (OTC)

- Customer service: the firm's face to the customer. It provides the single source of customer information, such as product availability, shipping details and order status. The team needs to have a thorough understanding of the firm's operation, and try to foresee the effects of a given event on the customer and on the internal operations of the firm. They are responsible for responding to both internal and external events.

4.3.2.2 Production to Order (PTO)

- Demand forecasting/planning: the demand management process needs to balance the customers' requirements with the firm's supply capabilities. This includes forecasting demand and synchronising it with production, procurement and distribution. Another important component of the demand management process is developing contingency plans in the event of either internal or external events that disrupt the balance of supply and demand.

- Inventory management: inventory management involves trading off the level of inventory held to achieve high customer service levels with the cost of holding inventory, including capital tied up in inventory, variable storage costs and obsolescence. It is held as protection from uncertainties, that is, to prevent a stock out in the case of variability in the replenishment cycle. Inventory team will also make it possible for the firm's plants to specialise in the products that it manufactures. The finish products will then be shipped to field warehouses where they are mixed to fill customer orders.

- Manufacturing Flow: the manufacturing flow process deals with making the products and establishing the manufacturing flexibility needed to serve the target markets. The team determines the manufacturing capabilities and translates them into deliverables to the customer, provide manufacturing capabilities and constrains, and define the make/buy strategy, leads to the determination of the push-pull boundaries. The team needs to identify the expertise and the changes in the manufacturing technology that are needed to operationalise manufacturing flow, as incompatibility between the manufacturing process and market characteristics may have unfavourable impact on business performance.

4.3.2.3 Delivery In Full On Time (DIFOT)

- Delivery/Transportation: Physical distribution refers to that portion of a logistics system concerned with the outward movement of products from the seller to customer. The prime objective of physical distribution is to ensure that right materials and products are available at the right place, at the right time, and in the right quantities to satisfy demand or customers and also at a right cost to give a competitive advantage to the company. It is closely related to the time and place utility. The basic distribution network can be shown as Figure 4.5 below:

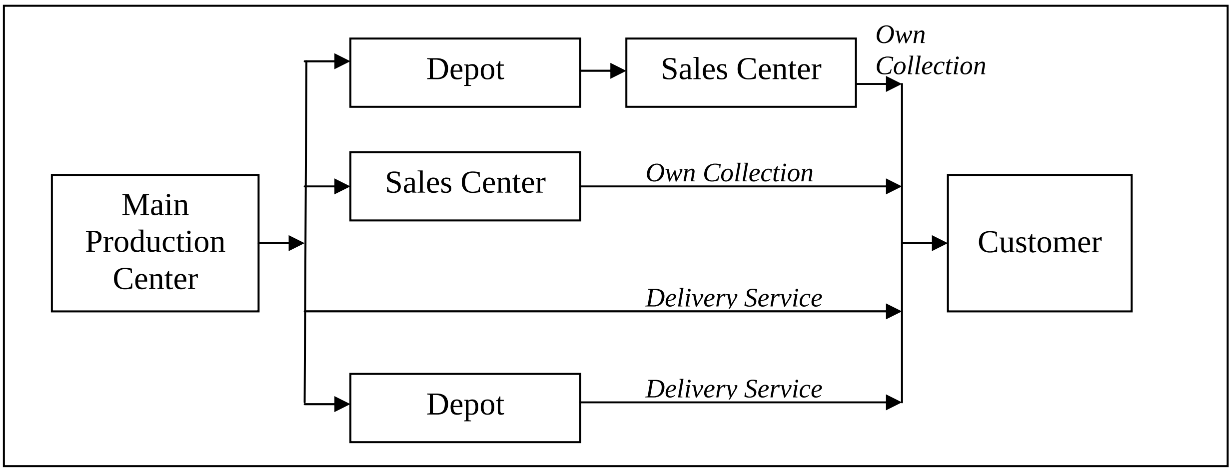

Figure 4.5: MOX's distribution network

The scope of the project will focus on the 3rd stage of the logistics operations activities, i.e. delivery in full on time. A more detailed elaboration of the DIFOT stage activities will be presented.

4.3.3 Daily Order Delivery Flow

The daily operations of the logistics operations department can be summarised as: transforming customer's order into successful deliveries. In a typical manufacturing organisation, nothing is more crucial than this as these are the last activities that bring revenues to the organisation. A product is basically worth nothing if it is not delivered to the customer at the final stage regardless of how many efforts has been put in the early stage. In general, MOX promised 1 day lead time in delivering standard order. The daily operations include: Order Processing, Scheduling, Dispatch, Delivery, Collection and Post delivery data entry. The successful deliveries here refer to both physical goods ordered as well as deliveries information. The Figure 4.6 illustrates the cycle of transforming customers order to deliveries.

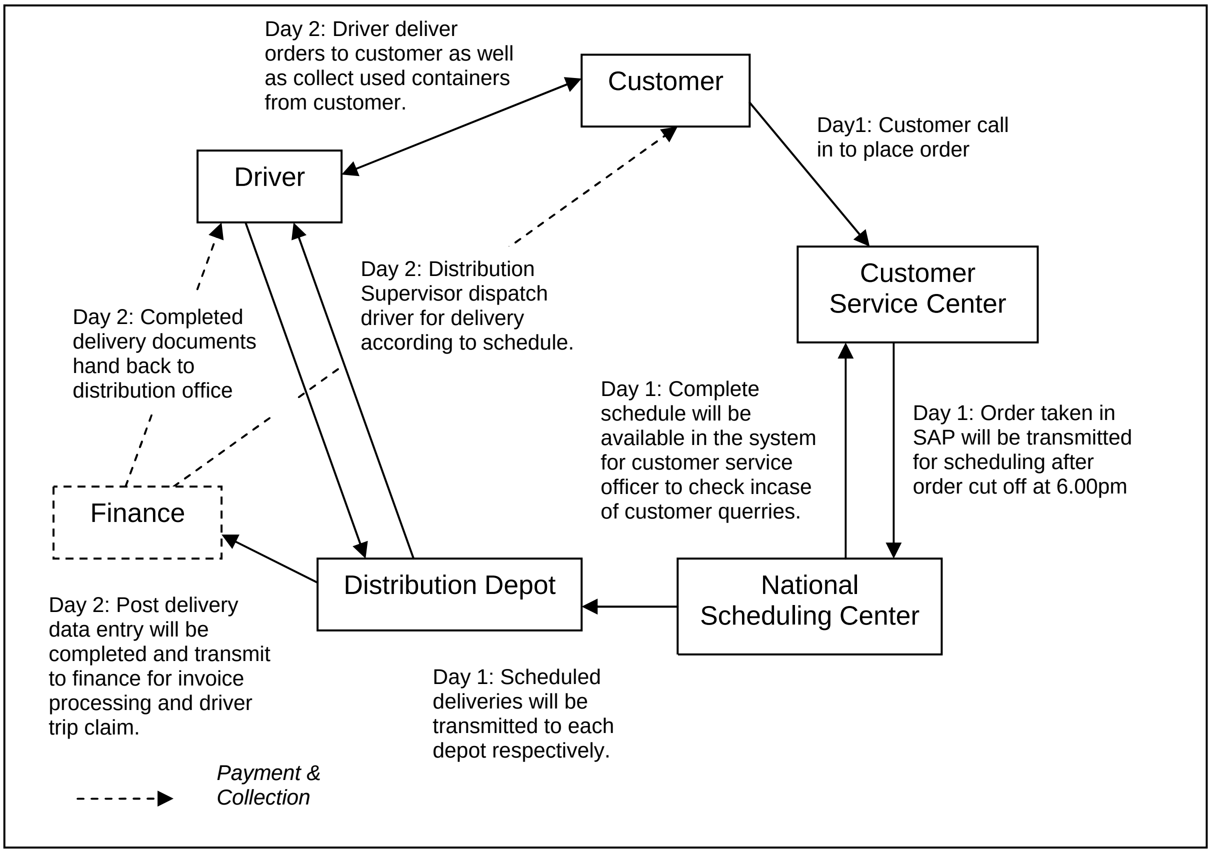

Figure 4.6: MOX Daily Order Realisation Process.

4.3.3.1 Order Taking

Order processing entails the systems that an organisation has for getting orders from customers, checking on the status of orders and communicating to customer about them, and actually filling the order and making it available to the customers. Part of the order processing includes checking inventory status, customer credit, invoicing and accounts receivable.

In MOX, daily order taking is done by the customer service officer in National Customer Service Center from 8.00am to 6.00pm Monday to Saturday. Customer shall call to a toll-free number 1 800 388 388 and place their order to the Customer Service Officer. Orders details are captured on line using SAP system. These details including customer account, name, address, location, order type and order quality are populated in the system, hence updating the order demand interface and scheduling interface.

4.3.3.2 Scheduling

Everyday, order taking cut off by 6.00pm, and from there, daily scheduling starts taking place. All the orders being captured earlier by Customer Service Officer will be downloaded according to required delivery date into the Scheduling interface and then import into an in-house scheduling software called VISIT Plus.

Scheduler will schedule all the orders using pre-defined strategies in VISIT Plus. Orders are clustered into "groups" and assigned to driver and vehicle accordingly. Factors determining the assignment of orders are:

- Customer location
- Order quantity
- Type of products ordered
- Customer receiving time window
- Accessibility of vehicles to customers site
- Availability of loading and unloading equipment at customers site

Scheduled groups are then upload into SAP and all delivery documents are printed and assigned to drivers as "Trips". The scheduling are done centrally by the National

Scheduling Center but the local Distribution Supervisor will extract the delivery documents from respective distribution depot and allocate to drivers according to the schedule.

4.3.3.3 Dispatch, Delivery and Collection

Every morning, drivers are dispatched for delivery according to the scheduled trips. As the driver delivers the cylinders to the customers as ordered, they will also collect the empty cylinders from customers. Problematic deliveries will be feed back to the supervisors. Besides physically delivering the cylinders to customers, drivers are also responsible in filling up delivery sheet and the necessary documents. These documents are used for proof of delivery (Delivery Note) and for trip payment/claims purpose. The drivers will go back to delivery depot after delivering and hand back all the documents to the distribution office. The Distribution Supervisor is responsible in managing these day-to-day operations. He will response to all the inquiry from customer which is forwarded by the customer service officer, answer drivers on their queries and help them to solve the problems, as well as liaise with other depot's personal on ad-hoc or special arrangement of deliveries and collections.

4.3.3.4 Post Delivery Data Entry

Post Delivery Data Entry is another important process in completing delivery cycle to ensure customer are billed correctly and system are updated accurately. Any discrepancy in billing and invoicing will cause customer to be dissatisfied and complaint to the company. The worse scenarios may be the customer will leave and look for another supplier. Hence, the data entry clerk will have to manage this data entry in a fast and accurate manner to ensure the systems are updated and completed deliveries are closed on time to reflect a correct stock level in the system. An accurate post delivery data entry will ensure that:

- Delivered products are captured and write off from stock level. This will allow Material Replenishment Planning (MRP) to generate the daily production demand to replenish the safety stocks.
- Collected empty containers are captured in the return management. As these high pressured containers are company's asset and has a good market value, a good return management is important to prevent loss containers.
- Delivered products and collected containers updated promptly will also allow customer to check and verify on site full stock and empty cylinders. This will help them in their purchase planning which eventually will ease MOX in reducing numbers of urgent requirement and last minutes order.
- Updated delivery will allow billing to be generated accurately.
- Post delivery data entry will also update deliveries by drivers which will allow drivers trip payment to be generated end of the month.

4.4 Logistics Operations Performance Measurement

The logistics and marketing literature rarely focuses on measuring logistics performance or supply chain performance for a number of reasons:

1. Measuring supply chain performance is difficult.
2. Some aspects of supply chain performance are hard to quality, making it difficult to establish a common performance standard.
3. Differences in supply chains make it difficult to establish standards for comparison.

In MOX, each area or level of the company is required to:

- Implement the actions required to achieve their business plan
- Monitor performance against their business plan
- Report performance against their business plan.

To ensure the true performance is accurately assessed, areas in which performance is to be measured should be clearly identified. The performance is to be measured in an objective, transparent and consistent manner. Monitoring of the performance should follow a predetermined plan and it is the responsibility of managers at all levels to agree with their immediate superior on the scope of any required measurements, the frequency of monitoring and how/when they are to be reported.

Figure 4.7 gives a big picture of how MOX business strategies being transformed into business plans, executed in a business processes and being measured by business performance management. General Operating Strategy and Business Plan have been discussed in Chapter 1. The scope of this project will limits the discussion of Business Processes to be done on Operations only, specifically on Logistics Operations, which was also addressed. Hence, the Performance Measurement will also be focused on Logistics Operations, which involves managing:

- deliveries,
- safety,
- productivity and last but not least,
- cost.

4.4.1 Standards, KPI's and SLA's

A standard is an accepted measure of comparison for qualitative value. Standards set the realistic optimal performance level, but they are based on the level of activity in the transport operation. It is more useful to use standards than the budget for assessing a transport manager's performance as standards will be dependent on, for example, the actual distance travelled. The budget costs are based on an assumed level of demand which may vary from what actually occurs. The budget profitability targets are important in an overall business context and clearly still need to be met.

For an activity based task, a standard can be established based on the completion of a task in a given time frame. The standard time can be established by using a time study for completing the task. In other words, the task is completed and timed to determine how long it takes to complete the task. This procedure is repeated a number of times and the average time can be used as the standard for that task. In other areas that are not activity based such as the cost of parts, a standard can be established using an industry standard or a historical based cost.

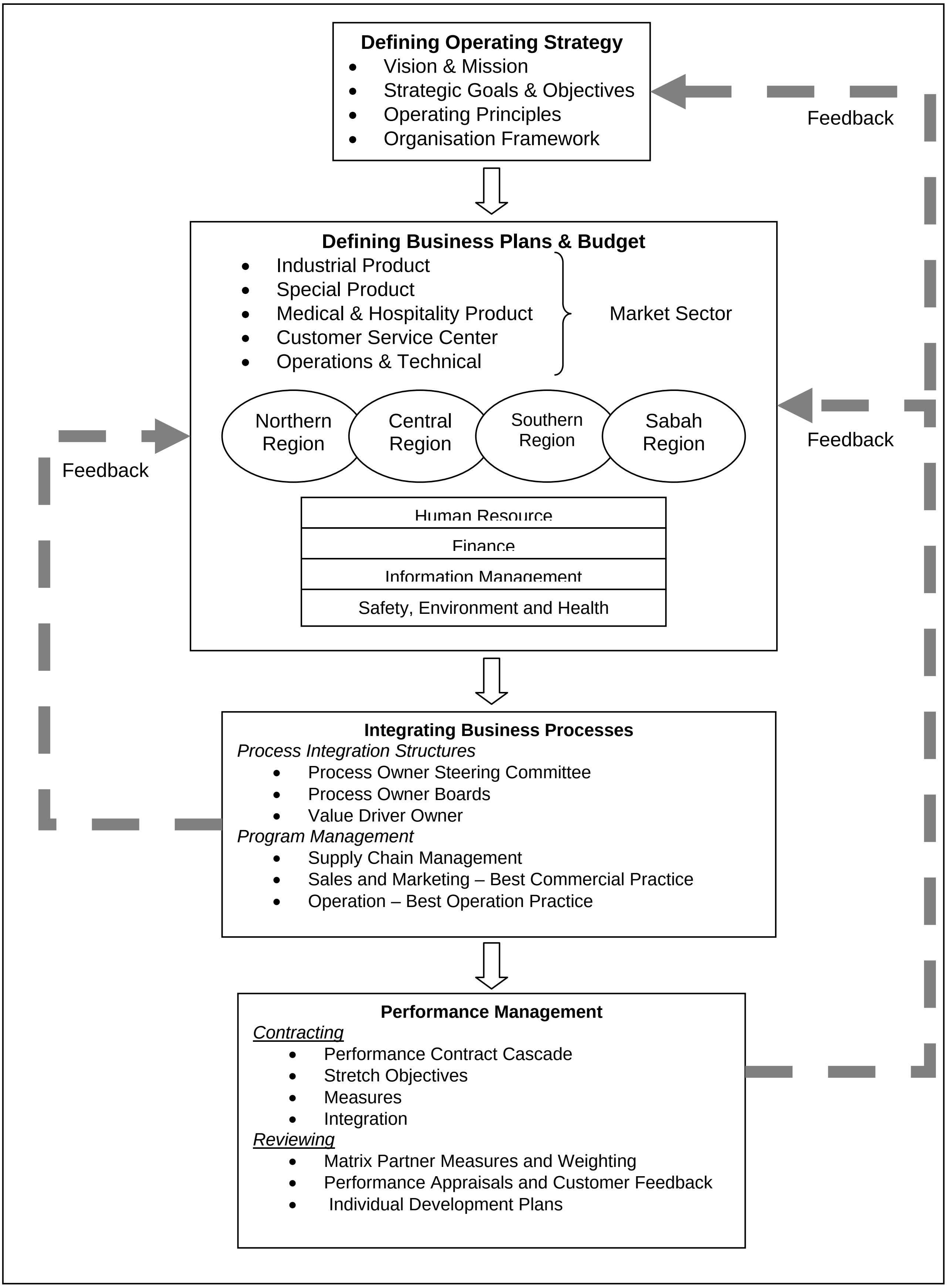

Figure 4.7: From Operating Strategy to Performance Management

In MOX, these standards are set at a benchmark against other sister company in the region, as well as against other company in the similar industry. These standards will then be set as Key Performance Indicators for department or individual. MOX relies on several key performance indicators (KPIs) for measuring the performance of its transport operation and it is these that should be reported to senior management. Hence, these are referred to as *Key* Performance Indicators. The KPIs can be categorised into the following four areas:

- Safety
- Delivery Service
- Cost
- Productivity

In addition there are also KPIs for scheduling activity. Some of these are shared measures, for example, capacity utilisation and delivery service while others address the efficiency of scheduling only. These KPIs will then be compiled as Internal Service Level Agreement. The Internal SLAs are a contract between a relevant enabling function or operation unit and the Business Unit. The SLA outlines the services that will be provided to the business unit to enable it to meet its obligations and should align with the business unit's strategic and implementation plans. The services listed in the SLA will be provided with detailed KPIs and its standards. The method of measurement and reporting is to be agreed by the parties to the SLA. The details of each KPI will address in detail in the following chapter.

CHAPTER 5

REVIEWING MOX PERFORMANCE MEASUREMENT - TRANSPORTATION

5.1 MOX Performance Management

The purpose of having a performance management system is to transform strategic and business plans into individual performance contract and objectives. A performance contract should include four components, i.e. goals, measures development plans and performance ratings.

In MOX, the performance management generally involves the following steps:

a. *Setting individual performance outputs.*
   Line/Unit manager will list the performance outputs that apply to current unit outputs and in conjunction with corporate vision and mission. The line manager will then discuss with their subordinates and together will sign off an agreed performance contract. The performance targets were set at committed desire target and stretch target.

b. *Providing performance resources.*
   Resources, in the most cost effective way, will be provided in order to reach each high priority performance output. These include training and whatever financial, physical, human, technical and information support.

c. *Monitoring individual performance.*

This is to build strong collaborative relationships between manager and subordinates.

d. *Coaching for performance.*

In case performance was not up to expectations, the manager must begin coaching, aimed to help their subordinates back on track. The main reason of disappointing performance (inadequate focus, inadequate support, inadequate capacity and inadequate motivation) must be identified and apply with corrective action.

e. *Planning effective performer development.*

If an individual have proven their ability to consistently reach or exceed their performance output, it becomes important to provide additional challenges so that it benefits both the organisation.

f. *Assessing individual performance.*

This is the last part of managing individual performance. It is to formally evaluate the performance results that an individual has produced during the current assessment period. Typically, this will be the annual review of performance and will require input from both manager and employee, sitting together in a meeting.

5.2 Managing Delivery Service

Delivering goods on time is the essence of just in time manufacturing. In a company making anything other than a very simple product, the delivery of the finished product on time to the customer is the culmination of a long series of steps being done right. These stage include correct scheduling; ensuring high quality; on-time deliveries of raw materials and components, manufacturing at the right time in the right quantity; and shipping the finished product when it is needed. On time deliveries have always been important because early deliveries build inventory and late deliveries cause production disruption and wasteful expediting activities.

The key question that needs to be answered by any company seeking to serve its customers is: "Are we delivering the right products, the right quantities, and on the right date?" Very few companies can affirm that they always deliver the full quantity on time every time. In previous years, it has been strongly argued that most companies should not try to achieve this status because the level of inventory investment required to meet this objective would be prohibitively expensive. A world class manufacturer would view this issue differently, customers deserve a 100-percent level of service, and if they do not get it from one company – they will go to another.

5.2.1 Delivery Reliability

Delivery service is one of the key considerations a customer will make in deciding whether to buy and continue buying company's product. In the case of the gases and equipment industry, it can be major way in which a company can establish market share and differentiates itself from its competitors, thereby contributing to the overall financial success of the company.

Due to the increasingly competitive nature of this industry, if MOX cannot deliver the product in time and in line with customer expectations, surely someone else can.

The service KPI is designed to call attention to the critical nature of the service aspect and to provide for continuous improvement. The measure compares the number of successful deliveries to the total number of deliveries attempted.

It is important to note that success must be defined in the context of the customer, that is, the customer must regard it as successful and not by some internal measure of success. For example, a situation where we arrived at the customer site only to find them to be closed could not be regarded as successful as we did not incorporate the customer opening and closing times into the trip schedule or trip execution. It is also worth nothing that if a single line item on the order is late, the entire order is considered late.

5.2.2 Measuring Delivery Service

There are a number of performance indicators in MOX which can be used to analysed performance and therefore help drive continuous improvement:

a) **On Time Orders:** This is a KPI for operations. It shows the percentage of orders delivered on time in line with customer expectations.
b) **On Time Cylinders:** This is also a KPI for operations. It shows the percentage of cylinders delivered on time in line with customer expectations.
c) **Product Shortages:** Typically a KPI for plant and/or ware house operations. This list would include all products which would normally be defined as "stock" items which were not available to be shipped at the time the trip was dispatched.
d) **Missed Deliveries or Brought-Backs:** Typically a KPI for distribution operations. This list would include all orders scheduled and dispatched on a trip, but not delivered as promised to the customer.

5.2.3 Delivered In Full On Time (DIFOT)

DIFOT is measured by comparing the promised delivery dates and quantities for the different line items in an order, with the actual delivery dates and quantities of the order. If there is any discrepancy, for example the product was delivered late, or the full quantity wasn't delivered, then the order is recorded as a failure. The order is considered failure for DIFOT if it was:

- **Delivered On Time Not In Full (OTNIF) –** Products delivered to customer are more/less than quantity ordered on a promised delivery date.
- **Delivered Not On Time In Full (NOTIF) –** Products delivered to customer are at correct amount but on date earlier/later than agreed delivery date.
- **Delivered Not On Time Not In Full (NOTNIF) –** Products delivered to customer are more/less than quantity ordered on a date earlier/later than agreed delivery date.

DIFOT failure here is measured from the point of view of a customer. An order is only consider successful as and when the customer consider it achieve promised service level. It has to be taken into consideration that delivery early than promised date is considered not on time and more than required quantity is also considered not in full, and both of these criteria are categorised as failure. And if there is an order with more than 1 line items, failing any single line item will cause the whole order to be categorised as unsuccessful order.

$$DIFOT = 1 - \left(\frac{OTNIF + NOTIF + NOTNIF}{Total\ Number\ of\ Order} \right)$$

For DIFOT to work, it relies on the order being taken accurately, as well as correct lead times being attached to all products. The success rate for all orders processed in a warehouse is then accumulated to determine the overall success rate for that warehouse. This could then be accumulated up to company level. The intended service levels will be properly defined once the measure is fully operational.

A failure to meet customer's order in full and on time could be attributed to a number of reasons, including but not limited to the following:

a) Order Taking error - Order incorrectly taken at the Customer Service Centre
b) Inventory error - Stock not available at the supplying warehouse
c) Scheduling error - Delivery not scheduled to the customer
d) Order Picking error - Product not loaded onto the truck
e) Driver error - Delivery not made by the truck

At the moment, DIFOT measurement taken into consideration all orders taken in the system as a base of measurement and the delivery failure could be both MOX controllable and MOX non-controllable, and the 5 five main classification above in incomplete to reflect all situations faced during delivery attempt. For example, customer reject order upon delivery due to changes of their plan but did not inform MOX, this is a situation where MOX is out of control and according to current 5 classification of delivery failure, and there is no appropriate classification to park this failure. The most possible classification the author could think of is *Driver Error* or *Others*. To put the delivery failures as *Driver Error* is being unfair to driver but *Others* is not a better choice as it does not reflect the real situation. The author feels that an improvement could be made here to exclude the MOX non-controllable delivery failure in DIFOT measurement as it is unfair to tie the uncontrollable factor on a personal/department performance. The measurement could be continue as DIFOT is suppose to be used to assist in identifying problems in the supply chain and resolving them in order to provide superior customer service. A more detailed breakdown of DIFOT failure code will also be developed and will be discussed in chapter 6.

5.3 Managing Safety

In most country, companies are required by law to keep detailed information about safety problems within their plants. It is the same in Malaysia. MOX do have a safety procedure that exceeds the minimum requirements of the local law.

5.3.1 Truck Avoidable Accident Rate (TAAR)

The Truck Avoidable Accident Rate (TAAR) is determined by multiplying the number of avoidable accidents by one million and dividing that number by the total distance travelled.

$$Truck\ Avoidable\ Accident\ Rate = \frac{No.of\ avoidable\ truck\ accidents \times 1{,}000{,}000km}{Total\ distance\ travelled}$$

Each year, a standard or target is established for the avoidable accident rate. Continuous improvement is achieved by setting a standard which is a reduction on the current actual avoidable accident rate.

However, a standard by itself cannot prevent accident; it is a goal to achieve through constant training and supervision. Once that standard is set, the employee must be trained to achieve the standard. The definition of an avoidable accident and the expected performance rate must be thoroughly explained to the employee and administered both strictly and fairly. Training in vehicle control, hazard recognition, and safe driving techniques must be adequate.

5.3.2 Lost Workday Case Rate (LWCR)

The lost workday case rate is determined by multiplying the number of lost workday cases by 200,000hrs and dividing this number by the total number of hours worked. In some operations, the lost workday case rate is referred to Lost Time Incident.

$$Lost\,Workday\,Case\,Rate = \frac{No.of\;\;Lost\,Workday\,Cases \times 200{,}000hrs}{Total\;Hours\,Worked}$$

A lost workday case is defined as any personal injury which results in the employee not being able to report for a full work shift at their next regularly schedule work day or future work days, if he absence is a consequence of the injury. Within a transport operation, other work groups such as maintenance will also be covered by this measure.

5.3.3 Managing Safety Standards

The definition of an avoidable accident and personal injury accident and the expected performance rate must be thoroughly explained to the employee and administered both strictly and fairly.

All drivers should have performance checks through periodic observation rides. The results from observations, accident analysis or complaints against a driver help check training effectiveness and compliance to the standard. Usually only those drivers who are known to stretch the rules are checked extensively.

Follow up remedial and rehabilitation efforts should be extensive at the outset until there is evidence of satisfactory performance. Spot checks for all drivers are occasionally needed to disclose “soft spots” in their performance, and to help in training and retraining.

Due to driver cannot be personally supervised every minute, they must be motivated to police their own driving. Driver must know what is correct performance in driving safely. Once they are trained in technique, drivers can then be motivated through pride of workmanship, skill, or other factors to do a superior job.

Any employee with a long accident free record may be lulled into a false sense of security and may develop careless safety habits. Help to overcome this problem through the use of incentive programs, periodic retraining and consistent demonstrations of the importance of safety.

Tracking the total case rate should allow further information on minor accidents to be gathered. Detection of any trends in minor accidents may help to prevent more serious accidents, by implementing corrective actions after completing root cause analysis.

5.4 Managing Productivity

The purpose of this sub-chapter is to provide the reader with an understanding of the costs associate to distribution and the means through which targets can be set to enhance transport operational performance.

5.4.1 Capacity Utilisation

By optimising capacity utilisation, local Transport/Distribution managers are able to improve the productivity of distribution operations. This can be achieved by optimising equipment capacity utilisation and increasing the amount of product delivered per distance travelled. The lower cost is based on the fact that increased capacity utilisation should result in lesser trips. This would result in the need for fewer vehicles and a reduction in fixed costs.

The maximisation of equipment capacity utilisation and increasing the amount of product delivered per distance travelled contributes to lowering the cost per unit of product delivered. Capacity utilisation measures the percentage of the units of product delivered compared to the available carrying space of the vehicle, which varies according to fleet size and total fleet in use. This figure is based on past historical trends.

$$Capacity\,Utilisation = \frac{Nominal\ Delivered}{Maximum\ Nominal\ Capacity} \times 100$$

This is done at the local site and is obtained by reviewing each trip and determining the capacity utilisation for that trip. The site daily average could then be determined by dividing the total amount of nominal delivered by the total nominal capacity of all the vehicles utilised to complete the deliveries. Capacity utilisation should also be tracked by individual vehicle. Changes in these numbers may indicate a maintenance problem that needs to be corrected. Source of data:

- ISP KPI System
- Daily Trip Reports
- VISIT Plus

5.4.2 Vehicle Utilisation

Vehicle utilisation measures the number of productive hours of vehicle use per week divided by the total hours per week and is expressed as a percentage. Productive hours of a vehicle equals time spent driving + time vehicle is used to deliver to customers + standard loading time + any allowances for inspections and paperwork.

$$Vehicle\,Utilisation = \frac{Productive\ Hours\ of\ Vehicle\,Use\ per\,Week}{Total\ Hours\ per\,Week\,(168)}$$

The ability to effectively schedule deliveries and trips can greatly influence vehicle utilisation. The ability to ‘link’ trips or multi-tripping reduces the total vehicle requirement. Some other key elements to be aware of are as follows:

- *Driver Hours Legislation* needs to be managed so drivers are available to meet the needs of the scheduling function. Too many or too few drivers will lead to inefficiency and thus degrade vehicle utilisation.
- *Fleet Composition* affects capacity utilisation and subsequently vehicle utilisation. Trailers which are lighter and have a greater carrying capacity will result in fewer trips and vehicles required. Sites should identify their 'normal' or 'optimum' delivery pattern, customer type, access and so on and derive both the total fleet required and composition.
- *Use of Carriers* at peak periods whether these be weekly or seasonal can also reduce the demand on the MOX fleet. However, a trade-of needs to occur as to whether it is cheaper to continue utilising a company asst or placing it in reverse and using a carrier. In certain cases it will be appropriate to evaluate whether it is financially viable to purchase new equipment or utilise a carrier. This will depend upon the likely requirement for the asset and also the risks of not guaranteeing its availability.
- *Accurate Scheduling Tool* will benefit the scheduling process. The ability to effectively route and determine vehicle return times will enhance vehicle utilisation.
- *Communication of Available Fleet Resources* from sites to the scheduling centre will also enhance performance of the assets. It is essential that sites also have the manpower available for the utilisation of these assets before declaring them for scheduling purposes. In addition to this there should be a constant flow of information regarding fleet level fluctuations, for example, vehicle maintenance (preventive and non-preventive).

5.4.3 Factors Contributing and Contradicting to Productivity

Close analysis of vehicle utilisation will identify those operations where there are issues within vehicle maintenance, specific vehicle type and performance related activity. Improvements in vehicle utilisation leading to reducing the number of vehicles will reflect both on vehicle depreciation costs and running costs. Vehicle purchase costs and subsequent financing costs will reduce depreciation cost. Running cost will reduced in taxation, licensing, maintenance labour, tyres, parts and so on. However, by reducing the number of vehicles, the average distance travelled of the remaining vehicles will increase. This can result in an increase in maintenance cost depends upon vehicle maintenance servicing intervals.

An area that is hard to control and must be discussed with local sales management is customer demand changes. Generally, customer demand patterns fluctuate over time as customers are added and leave for other suppliers. In order to maximise capacity utilisation, the correct amounts must be carried on the vehicle and delivered each time a visit to customer is scheduled. If the amounts loaded and delivered consistently do not match a decision must be made to revise the amounts forecasted.

Demand smoothing is a process which optimises the relationship among delivery day frequency, location delivery boundaries, customer area demand and maximum vehicle load factors. The goal of demand smoothing is to improve productivity by reducing drive, non-value added time and increasing the number of units delivered on a trip. The local transport manager must work with the sales, marketing and logistics planning functions to effectively implement demand smoothing as required.

5.5 Managing Distribution Cost

The running of a business requires a level of expenditure. The value and type of expenditure will vary according to the business type and structure. Expenses which a business incurs are expresses as cost and have a number of individual components. In a competitive environment, cost control has become an integral part of the daily management routine. This has made cost management one of the key competencies in driving business improvement and profitability.

The supply chain costs are high. Figure 5.1 gives a generic breakdown of the supply chain cost, upstream activity accounts for about 29 percent, transformation 7 percent and down stream cost 64 percent. The biggest logistics cost is the transportation cost. This figure will speak for itself, that managing transportation cost is important.

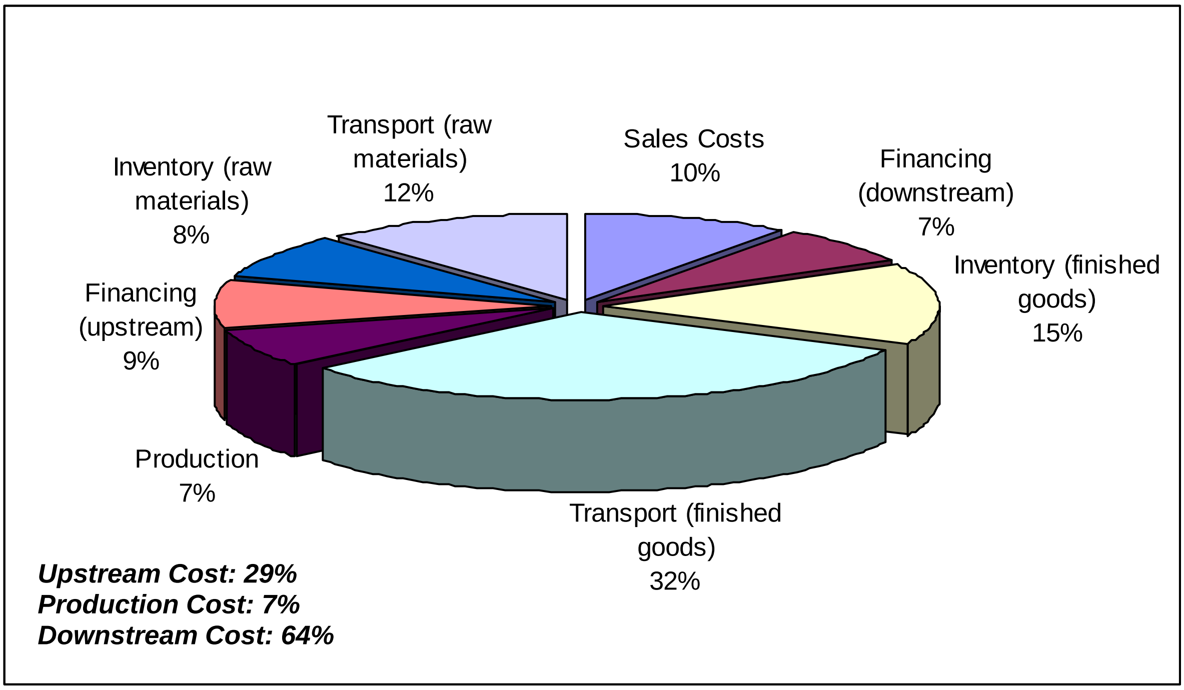

Figure 5.1: Percentage Breakdown of Supply Chain Cost

In a cost focused business (in this case, the logistics operations), Performance Indicators (PI's) are the fundamental link between the operation and the financial impacts of how it is being managed. PIs measure current performance and are a means through which operational targets and budgets are set, in order that financial improvement is achieved whilst maintaining a high level of customer service. Financial improvement may be reflected through greater revenue or a reduced cost base. Within each specific cost elements it is possible to generate a PI. The level of analysis and its reporting frequency will vary according to the type of cost, example, it would be beneficial to identify and manage the total cost per day, but measuring tyre expenditure on a daily basis would not add value as the information gathering would be a difficult task. The content and structure of financial reports also varies throughout the operation and in different geographies. The use of PI's within an organisation links individual cost elements into the overall financial reports of a business. It is essential that both the financial reports and their corresponding links to PI's are understood as they ultimately drive business profitability.

5.5.1 Total Distribution Cost Per Distance Travelled.

Logistics cost may exceed 25 percent of the cost of doing business at the manufacturing level. For this reason, better management of the logistics function offers the potential for large savings, which can contribute to improved corporate profitability. The key to managing the logistics function is Total Cost Analysis. That is, at a given level of customer service, management should minimised total logistics cost, rather than attempt to minimised the cost of individual activities. The major shortcoming of a non-integrative approach to logistics cost analysis is that attempts to reduce specific cost within the logistics function may be less than optimal for the system as a whole, leading to greater total cost.

Similar to the gas industry, the transport industry is extremely competitive. From the perspective of both customers and organisation, it is essential that transport operations are as efficient as possible. In order to operate at the lowest possible cost and to be equal to the best practices in the region that we operate in, MOX has adopted the Activity Based Costing concept to measure total logistics cost for the firm. In the total logistics cost concept, MOX do not respond to cost-cutting techniques individually geared to warehouse, transportation or inventory cost.

To effectively manage the cost of a business there has to be an understanding of the individual cost components, measures to drive improvement within each of those components and an understanding of where the specific costs are allocated within a business profit and loss account. Transport/distribution managers and other personnel who are in position to influence that operation must understand the cost incurred in running a transport operation and how to control these costs from the perspective of overall cost reduction.

The primary measure of transport efficiency in MOX is total distribution cost per unit distance travelled and is reported on a monthly basis due to the considerable data which is required to compile the calculation. Figure 5.2 is an example of a primary measure of transport efficiency.

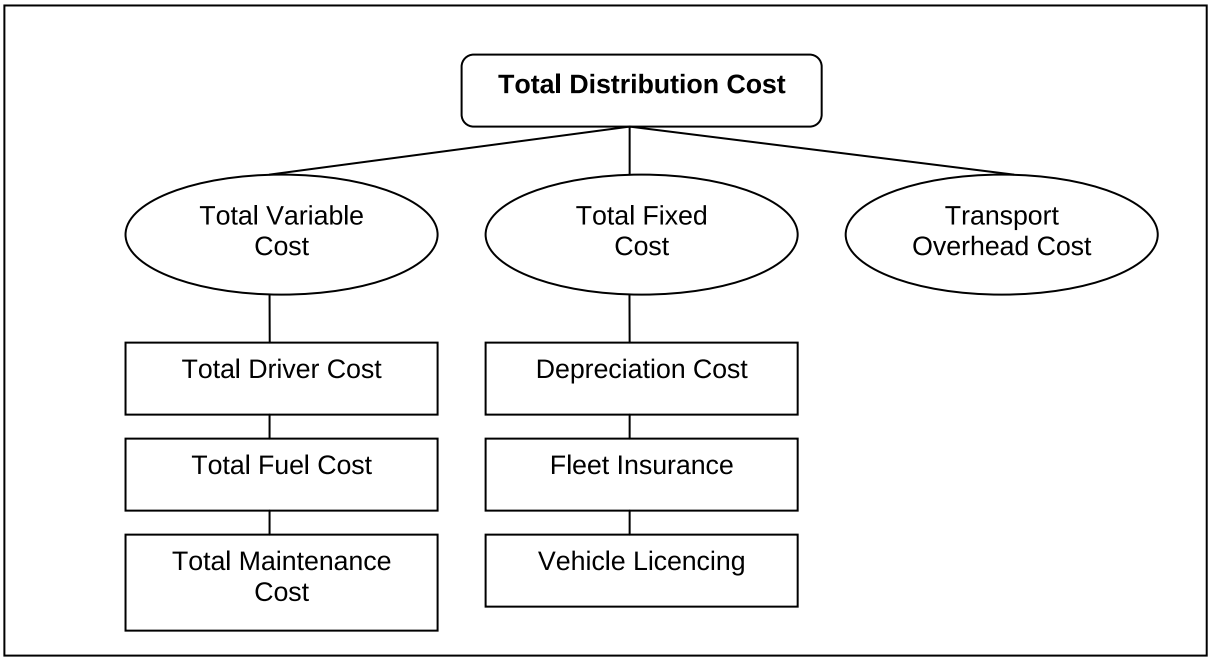

Figure 5.2: Total Distribution Cost structure.

As Total Distribution Cost per distance travelled will vary between sites due to geographic location, customer profile, customer location (stem distance travelled), etc, the purpose of this KPI is not to compare site by site, but to measure a site's performance month on month. It is important however, that the relationship between site performance indicators is understood so that it is possible to establish Best Operations Practice (BOP) in certain aspects of managing the operation where the difference in the geography is not the only reason for the performance.

$$Total\ Distribution\ Cost = \frac{Total\ Fixed\ Cost + Total\ Variable\ Cost + Total\ Overhead\ Cost}{Distance\ Travelled}$$

The breakdown of cost consumption in percentage of the three main cost component are as in Figure 5.3. Total Variable Cost takes up 78 percent of the Total Distribution cost, and Drivers Cost is the main contributor taking up 41 percent followed by Fuel Cost at 21 percent. These three main cost components will be discussed in further detail later.

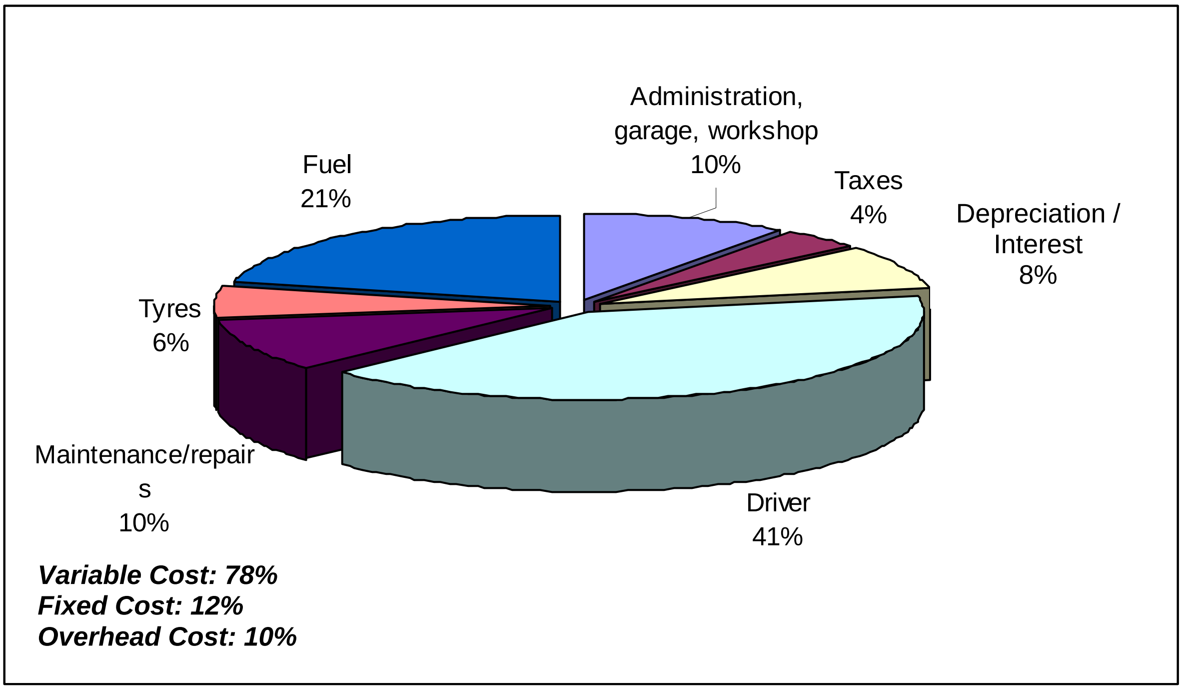

Figure 5.3: Percentage Breakdown of Total Distribution Cost

5.5.2 Total Variable Cost

The Total Variable Cost will vary with the level of output or activity. With variable cost components, expenditure varies but the unit cost remains the same. In MOX transport operations environment, variable costs are often referred to as running cost. Most of the time, Variable Cost will be measured in RM/Cyl. This unit cost depends on two elements, ie. transport efficiency and planning efficiency. The three main contributors to Total Variable Cost are as below:

- **Total Driver Cost:** Generally, driver costs are the largest cost element of variable costs and have the potential for financial savings based on increased management focus and awareness.
- **Total Fuel Cost:** The cost of fuel for distribution vehicles is a significant portion of total variable cost. Fuel cost is expressed as a cost per distance travelled. Fuel cost as a percentage of total cost varies globally mainly due to fuel price differences.
- **Total Maintenance Cost:** Maintenance costs are the costs associated with maintaining the vehicles and equipment in peak operating conditions. It is

categorised as labour costs, parts costs, tyre costs, vendor maintenance costs, accident repair costs and warranties. It is calculated as a cost per distance travelled. Maintenance costs will vary based on the type of equipment and the age of the equipment. Generally, the older the equipment the higher the maintenance costs.

5.5.3 Total Fixed Cost

As a component of total distribution costs, fixed costs are relatively easy to control but the most difficult to reduce. A large proportion of fixed cost is the cost of vehicles. Increasing vehicle utilisation by reducing the total number of vehicles required will reduce fixed costs. These costs are also expressed in per unit travelled.

$$Total\ Fixed\ Cost\ Per\ Distance\ Travelled = \frac{Total\ Fixed\ Cost}{Total\ Distance\ Travelled}$$

Improving fixed costs must be accomplished through improvements in Depreciation Costs, Vehicle Licensing and Vehicle Insurance, which depends heavily on Vehicle Utilisation.

- **Vehicle Depreciation Costs:** Vehicle depreciation is the value of a foxed asset over a period of time and usage. It is calculated to record the real expenses in a business financial account as well as to establish a life cycle, renewal policy and evaluate the required financial provisions for actual renewal. Depreciation is calculated by obtaining the initial purchase cost, the likely resale value and the life of the vehicle. There are two main methods for calculating depreciation: the straight line method and the reducing balance method. Within MOX, it is commonly to calculate vehicle depreciation using the straight line method.
- **Vehicle Licensing:** Vehicle licensing is a small proportion of total fixed costs. In Malaysia, it is a legal requirement to register vehicles to a transport authority. Vehicle registered at different plated weights will be issued with a licence specific to that vehicle and operating authority,
- **Vehicle Insurance:** Vehicle insurance is a legal requirement for vehicle operations. Insurance premiums are generally sourced centrally and the insurance

certificate will cover vehicles throughout an operation. The premium is set yearly and refers to the number of vehicles in the fleet, the monthly charge is fixed. If the fleet is reduced, the benefit will not be evident until the premium is re-quoted the following year. However, minimise vehicle accidents and ensure that the operations in 100% safety compliance will help to control extra loses in vehicle insurance due to third party claims.

5.5.4 Transport Overhead Cost

Transport overhead costs are the costs associated with office facilities, office equipment and staff salaries. These costs are relatively constant and not directly related to the amount of work performed. These indirect costs reflect those costs that support individual activities and are necessary for the operation of the business.

$$Transport\ Overhead\ Costs\ per\ Distance\ Travelled = \frac{Transport\ Overhead\ Cost}{Total\ Distance\ Travelled}$$

$$Transport\ Overhead\ Costs\ (\%) = \frac{Transport\ Overhead\ Cost}{Total\ Distribution\ Cost}$$

The control of Transport Overhead Cost is by measuring the percentage variance of actual cost vs. budgeted / historical cost. It can also be measured by percentage variance from standard percentage of total distribution cost, ie. one of the measures for transport overhead cost is as a percentage of total distribution cost. Once this standard percent is established by each local operation, the actual percentage would be compared to that to determine the variance.

5.6 Systems Approach to Operations

A manufacturing company is constantly confronted with the operations environment. Many firms try to manage these activities by optimising or minimising resource and output. However, the real operations management is about the effective planning, organising and control of all the resources and activities necessary to provide the market with tangible goods and services. In order to achieve the objective, all operations in the firm have to be managed as a whole integrated entity and overall performance is important to provide a big picture on how the firm is performing.

An organisation, be it manufacturing, services or non-profit, can be considered as a system, an approach developed by Jay Forrester. A system is a grouping, perhaps complex, of independent components, variables, activities or subsystems. The objective of the system design is that the final output, performance or appearance is optimised. A business firm is a system and marketing, operations and finance are the principle subsystems. High profits, large market share, low cost and high employee moral would be indicators of an optimum firm. The same analogy applies, the Logistics Operations Department is a system and safety, scheduling and dispatch as well as the transport operations are the subsystems. Fast and prompt delivery, accurate scheduling, high vehicle utilisation, good customer relationship, low cost and high delivery crew moral are the indicators of an optimum firm. It is important to always remember that if we manage the subsystem individually and independently, these optimised subsystems may not mean an optimised system.

- The objectives of work safety unit are to make sure all drivers are well trained, vehicles are installed with safety devices and works are ergonomically to be done.
- Scheduling and dispatch will have to make sure vehicles are fully utilised as well as the deliveries are planned as accurate as possible.
- The objectives of transport operations are making sure all fleet are always good in condition and presentable.

In the real world, optimum system performance may imply suboptimal performance of the subsystem, since it is not possible to satisfy all requirements of the sub-system. And also because of conflicting objectives of each of these subsystems, there is a potential for suboptimality to occur between the three functions:

- The safety unit will wants to retain the drivers for training but the scheduler will wants all of them to be available to perform deliveries at all times.

- The transport operations unit would like to maintain the vehicle at peak performance but these would drives the maintenance cost to ceiling.
- Scheduling and dispatch unit would like to maximise the utilisation of a vehicle by using it 24 hours a day at full capacity if possible, but this would also destroy the vehicle fast at the same time.

Thus, the safety, scheduling and dispatch as well as transport operations unit need to work as a team to ensure that products are delivered on time, conform to customer requirements and are at an acceptable price and the necessary investment is available for their development. The goals of each subsystem must be properly tuned so that the output of the system (whole department) attains the desired objectives.

5.7 Reconsider Measurement / Evaluation System

The last issue which the author wishes to address is to change the unit’s performance measurement system. Most measurement systems were designed not for leaders but for accountants so that companies could report their financial results to shareholders and tax authorities. Same problem occurs in MOX where the performance is judge by the sales revenue.

These systems were then inappropriately pressed into service to support management decision making, where for the most part they are useless. When you see that costs are high, sales are low, and profit is falling, you know that action is necessary, but you do not know what kind. Business are so complex and change so rapidly that gut feel for what is important is extraordinarily difficult to develop and impossible to maintain. There are relentless pressures to improve performance and to do so immediately. An organisation’s measurement system should be able to reveal the sources of performance inadequacies.

The purpose of measurement is not to know how a business is performing but to enable it to perform better. To this end, a contemporary measurement system must have two basic features. First, all data must include a rationale and a purpose; people must know why things are measured, and more important, what they are supposed to do with them. Second, all measurement must be based on a careful analysis of the business, one that links the objectives of the business to the things over which managers and front-line personnel have control.

It is hope that by adopting the new performance measurement system, more staff will feel comfortable and less will feel threatened.

CHAPTER 6

IMPROVEMENT

6.1 A System View of an Organisation's Performance

As defined in Chapter 5, a system is a set of individual components or subsystems, by some form of interaction to achieve some common purposes. A management system according to Turner et. al (1993) is a specific set of components or subsystems, each of which has some relationship to at least one other component or subsystem in the set, working together for the common goals of the organisation, while the management control system will be concerning on processes and procedures related to planning, measuring and controlling all activities within the organisation.

Simply having the common objectives or purposes is insufficient to keep the organisation running on track. Continuous monitoring of the actual performance of organisational unit must be deployed to ensure that objectives and performance goals are being met. It is instructive to visualise a management control system as a feedback control loop as shown in Figure 6.1.

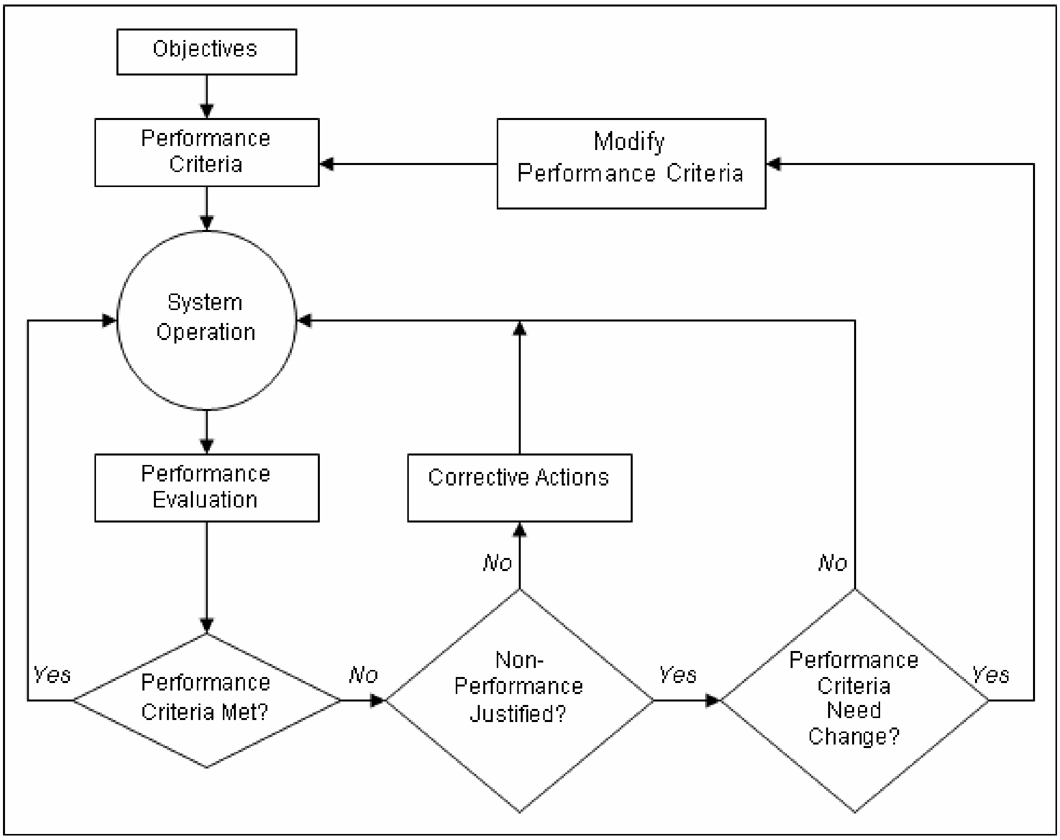

Figure 6.1: Close Loop Performance Management System.

Source: Adapted from Wayne C. Tunner et. al. (1993), Introduction to Industrial and Systems Engineering, Prentice Hall Inc, United States if America, Pg. 451.

6.1.1 Identifying Key Performance Indicators

Most of the literature on performance measurement has suggested that a performance measurement can be study from four distinct dimensions:

a) Cost
b) Productivity
c) Flexibility
d) Quality

The first dimension is that of cost while the other three are non-cost in nature, even though influencing the economic-financial performance. These four distinct classes of performance coincide with the four basic components by means of which the manufacturing strategy of a firm is generally expressed, and these competencies determine the market competition focused on “price”, “product” and “place”.

From the interview and discussions, MOX management has agreed to adopt three out of four dimensions mentioned above, and replaced the dimension of “Flexibility” with “Safety”. As mentioned in Chapter 1, MOX’s core value is to have a safe working practice; measuring safety performance is to make sure that the Performance Measurement System (PMS) is inline with the organisations global strategy of putting safety at the first of its priority on their business. Also, in the Competitive Profile Matrix (CPM) Analysis conducted to evaluate the position of MOX together with three other major competitors, which were said to be the top market player in the industry, has shown in Table 6.1 that MOX did better (by a small margin of 0.5 points) than its major competitor and Product and Operational Safety is one of the Critical Success Factor (CSF) which carries a high weight and contributing to the difference.

Table 6.1: CPM analysis for MOX and its competitors.

Critical Success Factor		Weight	MOX		C1		C2		C3	
			Rating	***Score***	**Rating**	***Score***	**Rating**	***Score***	**Rating**	***Score***
1	Advertising & Marketing	0.15	3	*0.45*	3	*0.45*	3	*0.45*	2	*0.3*
2	Product Quality	0.2	4	*0.8*	4	*0.8*	3	*0.6*	2	*0.4*
3	Price Competition	0.15	2	*0.3*	5	*0.75*	4	*0.6*	4	*0.6*
4	Product and Operational Safety	0.1	5	*0.5*	2	*0.2*	2	*0.2*	2	*0.2*
5	Financial Position	0.05	5	*0.25*	3	*0.15*	3	*0.15*	1	*0.05*
6	Customer Loyalty	0.1	3	*0.3*	4	*0.4*	3	*0.3*	3	*0.3*
7	Global Expansion	0.05	4	*0.2*	2	*0.1*	2	*0.1*	2	*0.1*
8	Market Share	0.05	4	*0.2*	2	*0.1*	1	*0.05*	1	*0.05*
9	Delivery	0.15	3	*0.45*	3	*0.45*	5	*0.75*	5	*0.75*
	TOTAL	**1**		***3.45***		***3.4***		***3.2***		***2.75***

In the CPM analysis, nine CSF’s were identified through an employee opinion survey. These nine CSF’s, were the top nine most favourable CSFs in the employee opinion survey. Total of 25 employees from various departments were invited to participate in the survey. Each of them was required to select eight CSF’s which they think is important to MOX’s business and to assign performance rating for relevant company for the selected CSFs, ranging from 5 to 1 for best to worst performance. Score for each CSF was acquired by multiplying average rating with the weightage assigned by management.

The weightages assigned were based on judgement on the importance of the CSF as well as the emphasis that has to be laid on. Summation of all the scores will then represents the company's overall achievement.

From the CSF's identified in CPM analysis, Price Competition, Product and Operational Safety and Delivery was recognised as direct controllable (to a certain extend if not all) by Logistics Operations Department. At the mean time, high weightage carried by these CSF's shows that management had put the accent on these areas.

As a summary, MOX has adopted cost, productivity, safety and quality as the main dimension of focus in its performance measurement system. These four dimensions of performance measurement will be translated into a model with related Key Performance Indicators suitable to MOX.

a) Cost
    - Total Distribution Cost per Distance Travelled
    - Delivery Cost per Nominal

b) Productivity
    - Capacity Utilisation
    - Vehicle Utilisation

c) Safety
    - Truck Avoidable Accident Rate (TAAR)
    - Lost Workday Case Rate (LWCR)

d) Quality (Delivery reliability)
    - Delivery In Full On Time (DIFOT)

6.1.2 Gap Analysis

A gap analysis is being carried out to identify the gap between current performance and desire performance for the four main identified KPI's. The result is shown in Figure 6.2.

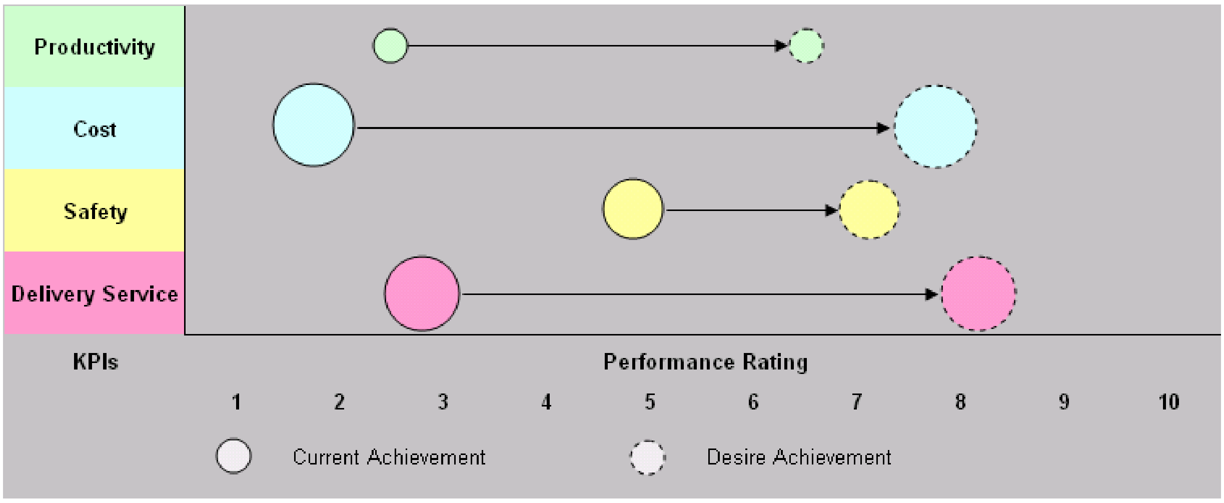

Figure 6.2: Gap Analysis

The size of the bubble represents the weight that the KPI carries, i.e. the bigger the bubble, the management has indicated that it is a relatively important KPI. This is translated from CPM analysis that was shown in Table 6.1. From Figure 6.2 above, it can be illustrated as cost is the most important KPI that the management is looking at and followed by delivery service. This can be further explained from Table 6.1 that both cost (price competition) and delivery service (delivery) are assigned with relatively high weightage. However, it is also identified that MOX did badly in both of these areas having a gap of 6 and 5 units respectively for cost and delivery performance.

Product quality, has the highest weightage, however not identified as one of the four core areas of KPI for Logistics Operations. Product quality will affect performance if the above KPI's, although not directly, as quality product will reduce the need of running extra trips to deliver substitute product (eliminate rework) which will enhance operational cost usage and improve delivery reliability.

The gap between current achievement and desire achievement was a summary from CPM analysis and also and Internal Factor Evaluation of the 4 main KPI's. The position of current achievement bubble was placed at the average performance rating assigned by management and employee as shown in Table 6.1. The desire achievement rating are being set at:

- 9 – 10: Higher than BOC and industrial standard
- 8: BOC global standard

- 7: Local industry highest standard
- 6: Average standard

In lined with the management strategy to work on cost reduction as well as improve delivery performance, the author will focus in these two areas and work out a more specific performance measurement tools to monitor the performance of these 2 KPI's closely. Later, all 4 KPI's will be integrated into the Overall Performance Matrics to demonstrate the department's overall performance.

6.1.3 Relations Between Key Performance Indicators

In order to study the relation between the department's Key Performance Indicators (KPI's), some historical data has been extracted and a correlation text has been conducted. The result is as in Figure 6.3.

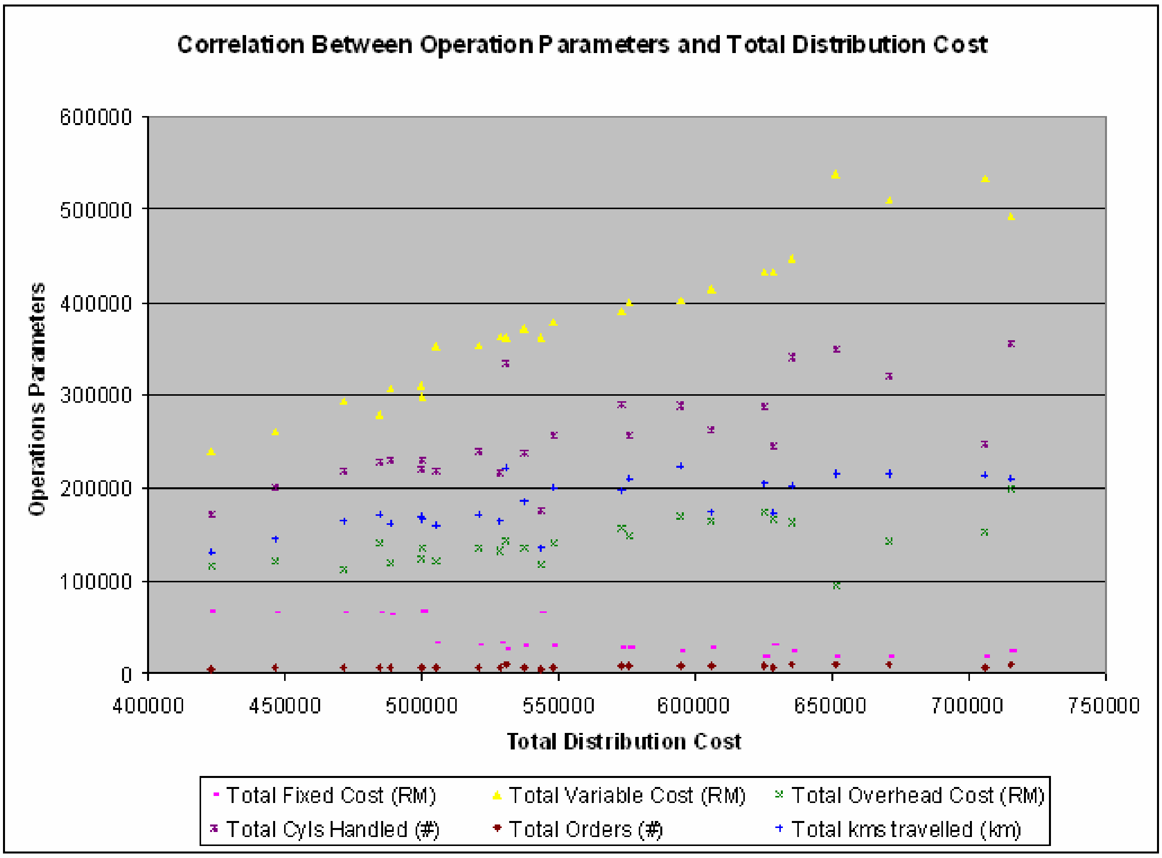

Figure 6.3: Correlation Between Operation Parameters and Total Distribution Cost

The analysis shows that Total Variable Cost, Total Number of Cylinders Handled, Total Distance Traveled and Total Overhead Cost have a positive correlation with Total Distribution Cost. This means, higher number of cylinders being handled and more distance traveled will incurred cost directly to the Total Distribution Cost overall. Among these four parameters, Total Variable Cost has the strongest correlation with Total Distribution Cost. Another observation to be made is that the Total Orders seem to have neutral correlation with Total Distribution Cost while Total Fixed Cost is having negative correlation with Total Distribution Cost. Table 6.2 below list out the correlation factor and R-square value for the relations for the Operations Parameters.

Table 6.2: Summary of Correlation Factor and R^2 Value for MOX Logistics Operations Parameters.

Operation Parameter	**Correlation Factor**	**R^2 Value**
Total Fixed Cost	Y = -0.1923x + 146410	0.6262
Total Variable Cost	Y = 1.0036x - 181642	0.935
Total Overhead Cost	Y = 0.1887x + 35232	0.3974
Total Number of Cylinders Handled	Y = 0.4825 - 13578	0.5377
Total Orders	Y = 0.014x – 468.33	0.5503
Total Distance Traveled	Y = 0.2554x + 40387	0.5427

The reason why Total Fixed Cost is having negative correlation with Total Distribution Cost is when the company started to reduce company assets (vehicle units) by engaging more contractors to manage delivery service. By doing this, the Total Fixed Cost will be reduced while the contractors cost will be charged to Total Variable Cost.

Another correlation analysis done on Service Level Performance and Total Distribution Cost shows that Service Level Performance (Distribution only) has neutral correlation with Total Distribution Cost, i.e. increasing amount of money spent does not guarantee a positive feedback on improving the department service level. The Department Service Level is having almost neutral correlation with Total Distribution Cost. It is also interesting to notice that Company Service Level Performance actually has a negative correlation with Total Distribution Cost. This is at a situation where a service failure caused by other department (example inventory planning mistakes, production delay etc) will cost Distribution extra cost to manage the delivery to customer as it comes under special schedule and out of network arrangement. This is shown in Figure 6.4.

If the service level is having neutral (if not negative) correlation with Total Distribution Cost, what are the factors that actually have an impact on the amount of money spent on delivery service? The answer to this is Safety and Planning component, which will be addressed later part of this chapter.

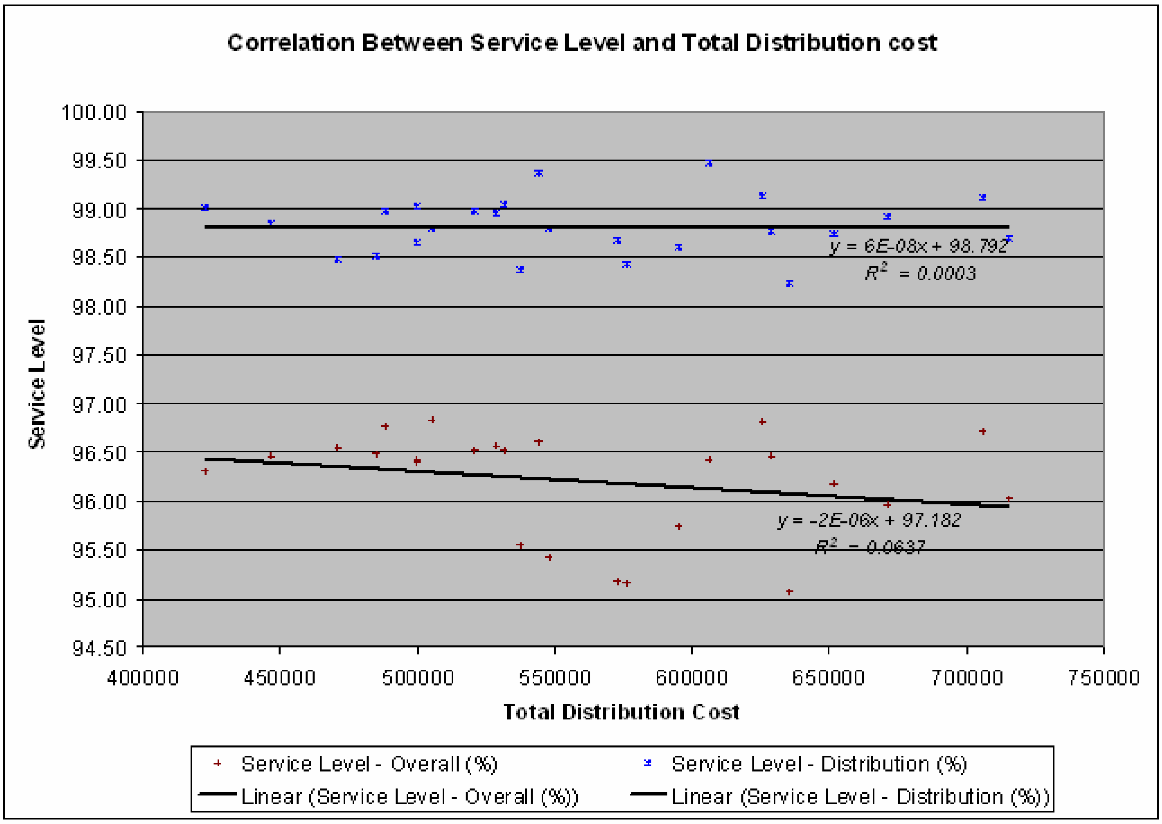

Figure 6.4: Correlation Between Service Level and Total Distribution Cost

6.2 Improving Delivery Service

Delivering goods on time is the essence of just in time manufacturing. In a company making anything other than a very simple product, the delivery of the finished product on time to the customer is the culmination of a long series of steps being done right. These stage include correct scheduling; ensuring high quality; on-time deliveries of raw materials and components, manufacturing at the right time in the right quantity; and shipping the finished product when it is needed. On time deliveries have always been important because early deliveries build inventory and late deliveries cause production disruption and wasteful expediting activities.

The key question that needs to be answered by any company seeking to serve its customers is: “Are we delivering the right products, the right quantities, and on the right date?” Very few companies can affirm that they always deliver the full quantity on time every time. In previous years, it has been strongly argued that most companies should not try to achieve this status because the level of inventory investment required to meet this objective would be prohibitively expensive. A world class manufacturer would view this issue differently, customers deserve a 100-percent level of service, and if they do not get it from one company – they will go to another.

6.2.1 Measuring Customer Service Level

A world class manufacturer puts customers’ needs at the top of the agenda. The idea of being “close to the customer” is an important one for any company attempting to compete against global competition. As a means of discussion, the author has categorise customer service to be measured as a subset to reflect delivery service performance.

There are two primary methods of looking at customer service – the first is a quantitative approach, the second is qualitative approach. The quantitative approach will be used here in day-to-day routine measures by comparing the orders placed by customers with the shipments to those customers. The qualitative method is concerned with the customer’s perception of the service they are receiving. Because this information is not readily available as it must be obtained from the customers themselves, it can be used as a supplement to comprehend the quantitative measures. However, to obtain the qualitative measures is time consuming and rather subjective.

There are few approach to measure customer service level that can be readily adapted to world class manufacturing.

a) Reports are produced showing the customer orders, their required dates, and quantities. These reports are compared with the shipping dates and quantities intended to fulfill these orders; a percentage is calculated for the product, product group, customer and so forth.

b) Another approach is to measure the percentage of order lines that were shipped complete. This method will give a lower number that the first but, in many industries, will be a more useful way of assessing service level.

c) A more exacting method of measuring service level is to record the percentage of orders that have been delivered in full and on time. An order is considered to be shipped only when the full quantity of every line item on the order has been successfully dispatched.

So far, the discussion has cantered around the quantity being dispatched. But the date of delivery is equally important. The question of how to define an on time delivery varies according to the type of market and the type of products involved. The usual method for defining on time delivery is to set a planned dispatch date; a delivery is considered "on time" if it is dispatched prior to the planned delivery date. However, the planned dispatch day (calculated when order is entered) may be quite different from the customer's required delivery date. A better delivery reliability measurement system would be able to capture and measure service level from the point of view of the customer's stated requirements rather than according to the planned delivery date. Also, during the order entry and dispatch process, particularly for log lead time products, the planned delivery date has to be changed. A more versatile would be able to capture both – original planned delivery date and actual delivery date to provide a clearer assessment of the effectiveness of the entire deliver process.

Most customer service level reporting is based upon the date of dispatch to the customer. This approach assumes that the products are delivered immediately to the customer and there are no delays, breakages or problem in transit. From the customer's point of view, the order is not delivered until the goods have been received, and some companies attempt to measure service level at the time the customer takes delivery, the gathering of this information can be difficult and requires additional data entry and processing, but in some industries it is a vital method for measuring the effectiveness of the process from order entry to customer receipt.

6.2.2 Improved DIFOT Measurement

Table 6.3 suggests that DIFOT failures should be more detailed and categorised systematically. Besides categorising the failures into Delivery In Full Not On Time (IFNOT), Delivery Not In Full On Time (NIFOT) and Delivery Not In Full Not On Time (NIFNOT), it also provides a detailed reason of *why* these orders failed, and then further segregate it into failure code owners (business section) and the operation function belongs to it.

Failure attributes that is related to product availability, but independent from delivery will be categorised as NIFOT; failures attributed by delivery but independent from product availability are considered as IFNOT, and other attributes which cause delivery to be completed late and not complete, will be categorised as NIFNOT. The failure attributes are coded in a alpha-numerical manner, which will indicates the business section and the operational functions it belong to. For example:

C = Customer Service Center

D = Logistics Operations

P = Production and Supply Chain

And,

D, Logistics Operations 01-06 = Transport Operations

D, Logistics Operations 07-09 = Distribution Planning

P, Production 01-04 = Daily Production

P, Supply Chain 08-09 = Asset Planning

P, Supply Chain 10-12 = Inventory Planning

The advantage of the detailed classification of the DIFOT failures is to allow the management to identify the cause of failure in delivery service systematically by zooming in level by level from business sections, operations function, failure category to individual failure attributes. By detailed segregation of service failure attributes at the beginning of data collection (by the time of delivery service confirmed failed), the major cause of failures and its contributors can be easily identified by management by just compiling simple chart report, at any time needed. Effort in reducing the delivery failures can be taken to the main failures contributing areas according to Pareto 80-20 concept. The report is to be complied monthly and presented in the monthly operations group meeting. Action items to eliminate the failures contributing factors will be discussed and executed. These will be revised in the subsequent meeting until the main failures contributing factors is eliminated.

Table 6.3: DIFOT Failure Codes.

Detailed Breakdown of DIFOT Failure Code				
Business Section	**Operational Functions**	**Failure Code**		**Category**
C - CSC		C01	Incorrect address details	NIFNOT
		C02	Incorrect delivery time	NIFNOT
		C03	Incorrect shipping point / route	NIFNOT
		C04	Incorrect product ordered	NIFOT
		C05	Incorrect cylinder size ordered	NIFOT
		C06	Duplicate order	NIFNOT
Logistics Operations	Transport Operations	D01	Vehicle unavailable	IFNOT
		D02	Driver unavailable	IFNOT
		D03	Driver error	IFNOT
		D04	Equipment breakdown	IFNOT
		D05	Driver delayed on route	IFNOT
		D06	Missed time window	IFNOT
	Distribution Planning	D07	Incorrect vehicle size/unloading equipment	NIFNOT
		D08	Incorrect time window	NIFNOT
		D09	Vehicle overloaded	NIFNOT
Z - Non-BOC		Z01	Refused by customer	
		Z02	Customer changed order	
		Z03	Customer unable to unload	
		Z04	No customer assistance available	
		Z05	No cash payment	
P - Production	Production	P01	Cylinders not filled	NIFOT
		P02	Cylinders not cleared by lab	NIFOT
		P03	Load not accurate	NIFOT
		P04	Driver delayed in yard	IFNOT
	Eng & Maintenance	P05	Equipment breakdown	NIFOT
	Test Shop	P06	Cylinders not available from test shop	NIFOT
	Production Planning	P07	Production planning error	NIFOT
W - Warehouse (Inventory Stores)		W01	Stock not available	NIFOT
		W02	Substitute product supplied	NIFOT
		W03	Defective product	NIFOT
P - Supply Chain	Asset Planning	P08	Empty cylinders not available	NIFOT
		P09	Pallets not available	NIFOT
	Inventory Planning	P10	Imported cylinders not available	NIFOT
		P11	Raw materials not available	NIFOT
		P12	Bulk product not available	NIFOT
S - Sales		S01	Non-standard product	NIFNOT
		S02	Over Commitment	NIFNOT

As mentioned, the purpose of root cause analysis for DIFOT is to identify cause of failures. The proposed root cause DIFOT Failure Code comprehends enough to explain *why* an order failed. These are segregated into business sections and operational function for improvement action to be taken. Continuous improvement is the main drive behind this DIFOT failure codes. This failure measurement also prevents general failure comment such as:

- Production failure (but what causes the production failure? Man? Machine? Material?)
- Order Taking error (but error in which field? Customer details or order details?)
- Scheduling error (wrong fleet size or delivery time?)
- Driver error (what causes the driver to make this error?)
- Inventory error (raw material not available or empty cylinder turn around bad?)

The detailed record of failures attributes could be used to generate multi level reports to identify failures and eliminate main failures contributing area using Pareto concept. For example from the first level report in Figure 6.5, it is shown that more than 60% of the failures are contributed by Logistics Operations, Productions and Customer Service Center. There are about 30% of failures are parked under non-BOC related which means customer oriented.

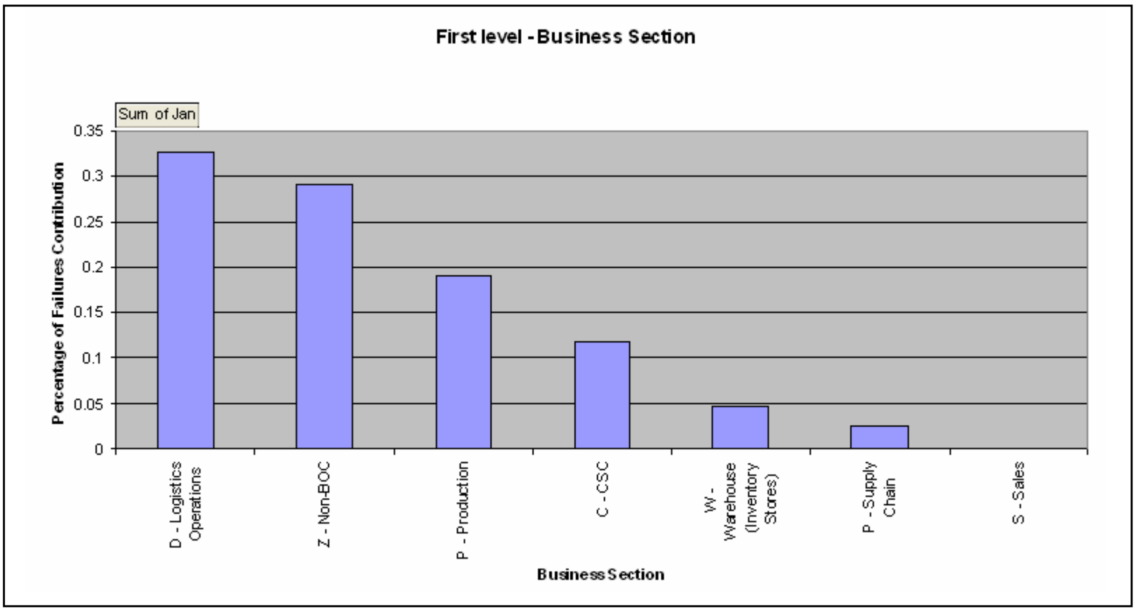

Figure 6.5: DIFOT Failure Contribution – By Business Section

From the second level report in Figure 6.6, Figure 6.7 and Figure 6.8, we can make the following conclusion:

- In Logistics Operations, most of the failures are contributed by delivery missed planned time window (16%) and driver not available for delivery (10%). These usually happened on a heavy load day, after long holiday and after festive season. The Logistics Operations Manager shall come out with a contingency plan to provide the department with a flexible crew and at the same time maintain the utilisation and operational cost as targeted.
- In Production, 100% of the failures are contributed by P1, cylinders not being filled. It seems like production is having an issue on adhering to production schedule. Production team needs to look into this immediately and resolve the issue on not adhering to production plan as schedule.
- In Customer Service Center, service failures are mainly due to errors in order taking, especially on product type, delivery address details and double entering particular order. Error in taking order is unacceptable, corrective and preventive action must be taken here. Duplicate order could have happened when different personnel from customer placed the same order to MOX. However CSC personnel should be able to check and advice customer if there is an outstanding order in system upon receiving order.

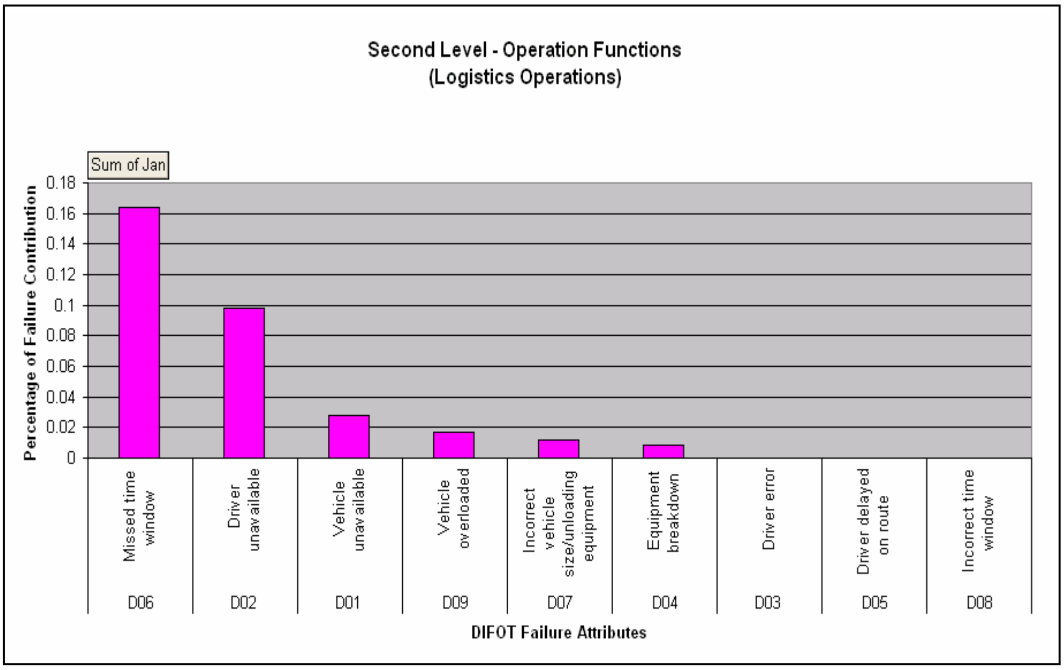

Figure 6.6: DIFOT Failure Attributes Analysis – Logistics Operations.

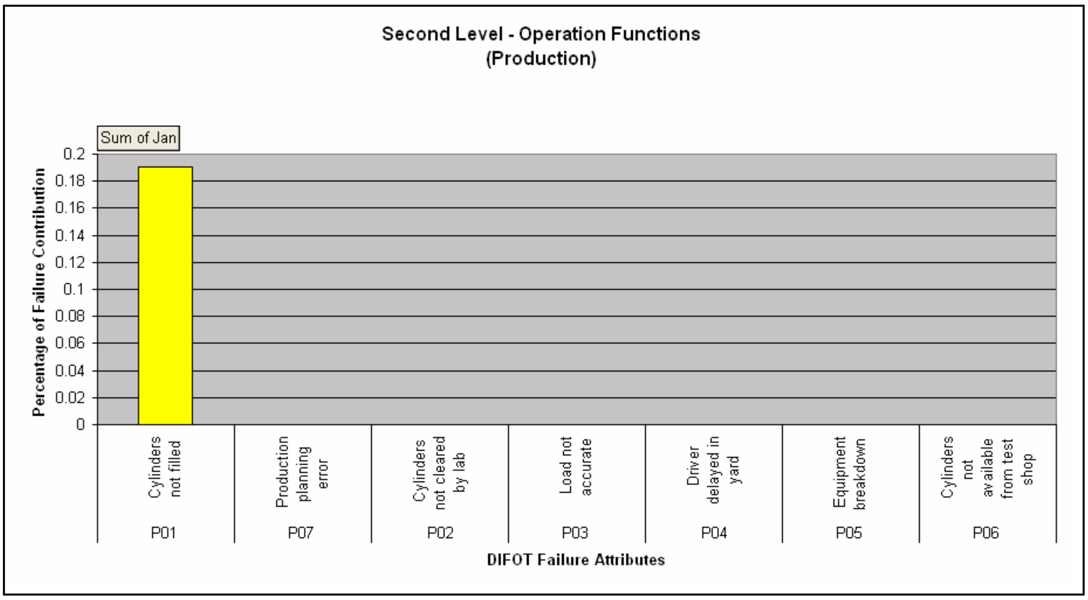

Figure 6.7: DIFOT Failure Attributes Analysis – Production

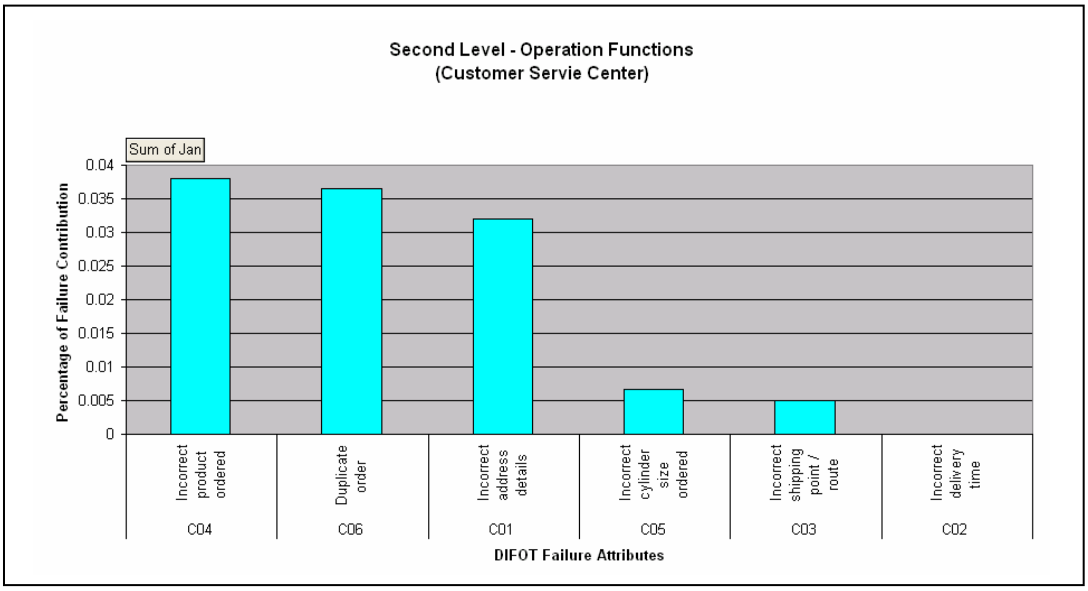

Figure 6.8: DIFOT Failure Attributes Analysis – Customer Service Center

On the other hand, failure attributed by customer is not all irresolvable. In Figure 6.9 shows failures which are customer oriented includes: No customer assistant available (13%), refused by customer (6%), customer changed order but not inform MOX (5%) and unable to unload at customer site (4%). Customer details of these failures should be compiled and a joint task force including Sales, Customer Service and Logistics Operations could visit the customer to iron out the underlying issue.

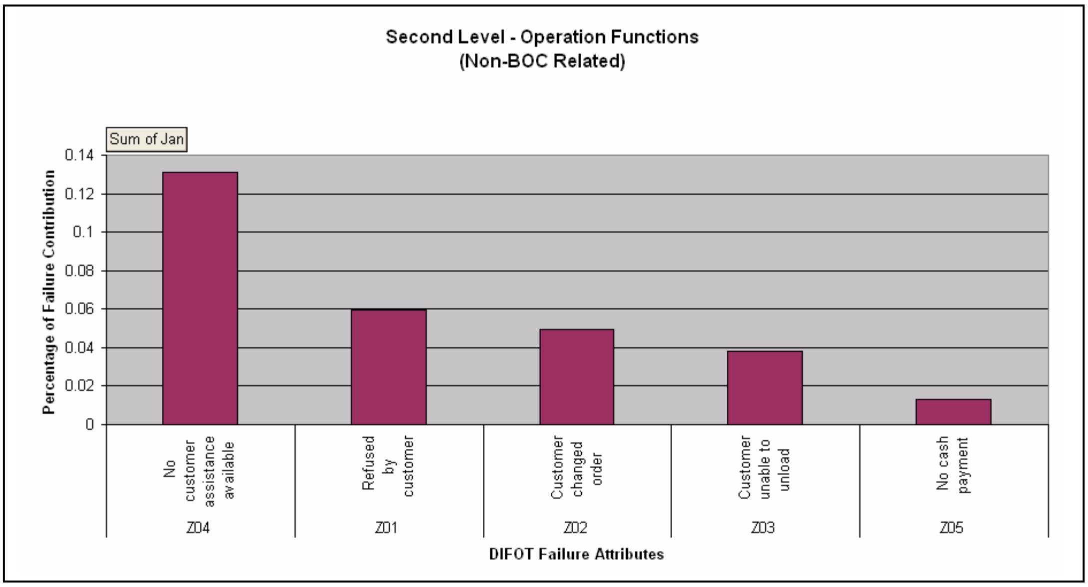

Figure 6.9: Non-BOC Related DIFOT Failure Attributes Analysis.

It is also to be mentioned that this is suppose to be a continuous learning process, where the failures codes could be changed from time to time to reflect the most recent condition. It is believed that but eliminating all the failures contributing factors, an improvement in DIFOT performance could be observed.

6.3 Improving Productivity

The current measurement on productivity – Capacity Utilisation and Vehicle Utilisation should be measured and trace more consistently. It is not surprising at all to notice that Figure 6.10 shows that Delivery Cost per Nominal has a negative correlation with Capacity Utilisation, i.e. the higher utilisation of the fleet will give a lower operational cost in return. This is achieved when all the available space on the trucks are fully utilised, theoretically less “runs” will be needed to deliver all the orders to all the customers. However, higher operational cost will be needed if the fleet is being “over utilised”. This is because of high maintenance fees due to higher wear and tear of the vehicle if it has been loaded with loads above its design capacity.

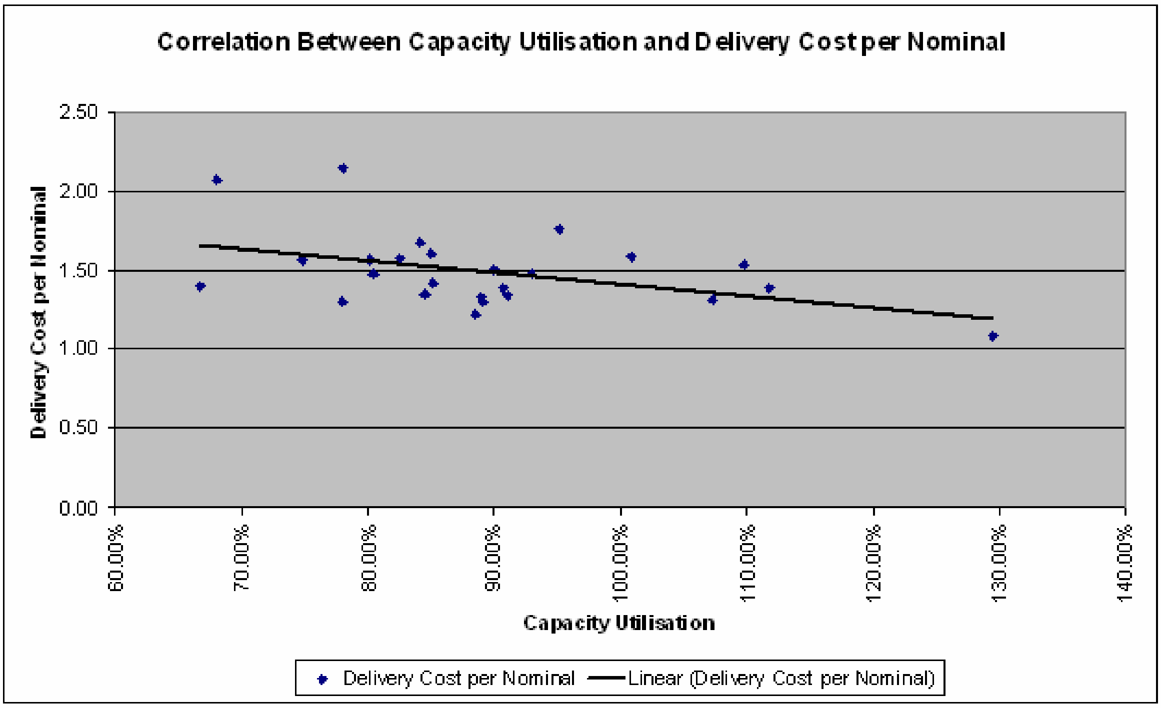

Figure 6.10: Correlation Between Capacity Utilisation and Delivery Cost

While Capacity Utilisation is link to Delivery Cost, Vehicle Utilisation has more impact on Total Fixed Cost. When the utilisation of the fleet is high, it needs lesser unit of vehicle, hence reduce in department's Total Fixed Cost, as shown in Figure 6.11.

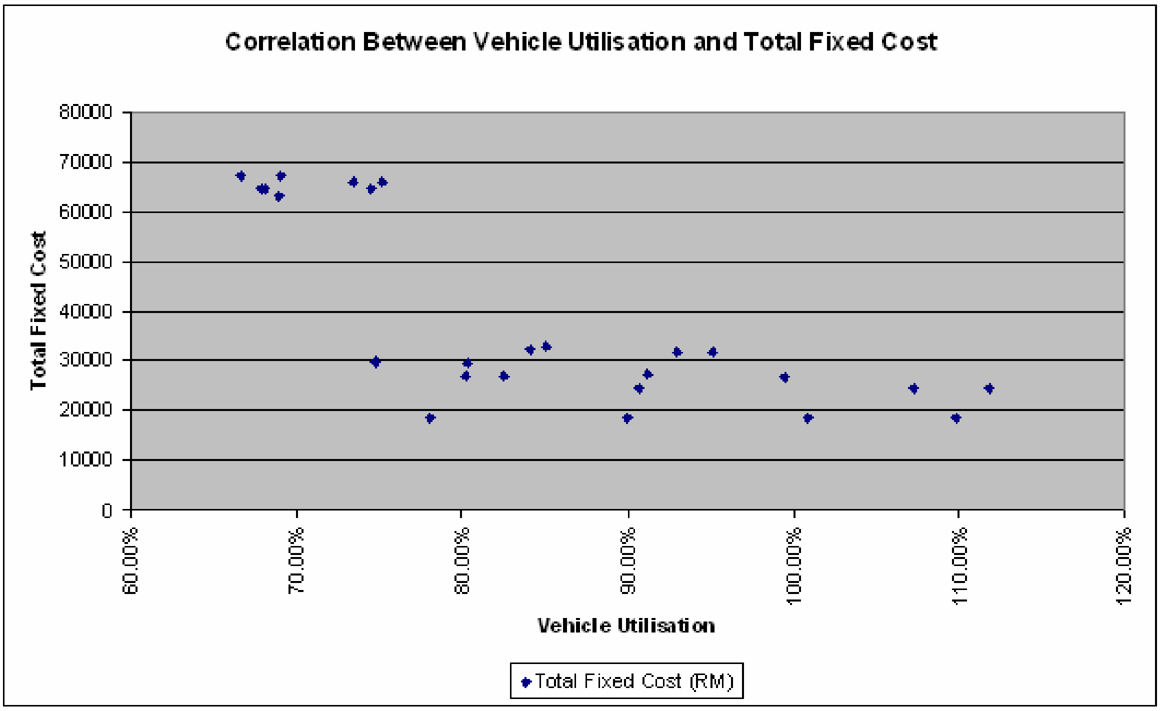

Figure 6.11: Correlation Between Vehicle Utilisation and Total Fixed Cost.

6.3.1 Better Capacity Utilisation

The goal of capacity utilisation is to deliver the maximum amount of product compared to the available loading space on the vehicle. The theory is that increased capacity utilisation will reduce the unit cost of product delivered by reducing the number of trips and distance driven. To continuously improve capacity utilisation managers must:

a) Ensure as much of the load as possible is delivered while maximising volume or nominals per distance travelled. This can be done by:
   - Having the manager work with scheduling to optimise trips/routes.
   - Having the drivers understand and report any issues that may prevent them from delivering all the product from the vehicle.
   - Effectively manage and reduce the gap between planned and actual driver trip activity.

b) Actively work with the drivers and schedulers to reduce the amount of non-value added activity, which can include:
   - Driver time between deliveries
   - Non-productive milk round deliveries

c) Actively counsel and coach the drivers regarding performance standards and use visual aids to indicate progress towards goals posted in conspicuous places in and around the facility.

d) Work with the planning function to improve the units delivered per distance travelled.

e) Aggressively pursue reduction of excess vehicle at the depot / location; following a philosophy of "just-in-time" rather than holding vehicles in reserve "just-in-case". This can be accomplished by renting vehicles and using contract carriers to cover unplanned peals in customer demand.

f) Work with the planning and asset management functions to fit the vehicles to the trip demand profile. This can be done either during the normal vehicle replacement cycle or by transferring vehicles among locations.

6.3.2 Better Vehicle Utilisation

While capacity utilisation can be improved by suggestions mentioned in Chapter 6.3.1, vehicle utilisation can be improved by targeting assets for removal from the fleet. Once removed, the overall fleet utilisation will increase if it is meeting the same level of overall demand.

6.3.2.1 Customer Demand Profiles

Customer order and delivery patterns should be thoroughly evaluated with a view to ‘smoothing’ customer demand. This can be achieved through the scheduling function and improved information gathering (demand forecasting) from the customer base. A full evaluation of the service specification, for example, tank refill frequency to given customers can influence vehicle utilisation. The ability to deliver more products to customers on a less frequent basis will ultimately reduce the total trip and subsequent vehicle requirement.

The delivery point features at customer premises also play a major role in vehicle utilisation. Locations which can only receive smaller vehicles due to access constrains and those with small tanks will increase vehicle utilisation. Site should evaluate customer access and work closely with the sales team to develop business ‘trade-offs’.

The ability to utilise vehicles throughout 24 hours and at weekends are of paramount importance to effectively reducing the core fleet and using the remaining assets to their full potential. The central scheduling function should work closely with sales to maximise access at unsociable times.

6.3.2.2 Planned Vehicle Maintenance

The planning of vehicle maintenance is crucial in improving vehicle utilisation. Vehicles should be serviced at periods of lower demand for example, night time hours.

Extensive body work and other refurbishments should be conducted during the months of lower demand where appropriate.

Sites with accident damaged vehicles and / or high unplanned maintenance should call upon the possible availability of resources from the neighbouring sites without having to change the profile of the customer base and the service offering to the scheduling centre. Changes should only be necessary where the vehicle is unique to the branch or very highly utilised. Otherwise the separate in vehicle utilisation should be used for maintenance.

6.3.2.3 Driver Profile & Fleet Census

Driver flexibility to cover un-social working patterns is essential. It is the responsibility of the scheduling function to maximise the potential access to customer premises at un-social times. To achieve this, driver resources have to be available and be equivalent to schedule requirements. This will undoubtedly result in more drivers required to work nights and weekends. Greater driver flexibility coupled with increased deliveries into un-social periods will ultimately reduce the number of weekly, daytime peals and enhance vehicle utilisation.

To determine individual site fleet levels it is essential that regular fleet audits are conducted to reconcile actual assets to both the asset register and subsequent depreciation costs within site budgets. This process enables managers to fully understand their current fleet strength and cress check the corresponding costs. To be fully effective this should be carried out by an independent individual or department.

6.4 Managing Distribution Cost

According to Computer Aided Manufacturing – International (CAM-I), the goal of a cost management system is to provide information to help companies use resources profitably to produce services or products that are competitive in terms of cost, quality, functionality and timing in the world market. Within this context, a cost management system can be defined as a management planning and control system with the following objectives:

a) To identify the cost of resources consumed in performing significant activities of the firm.
b) To determine the efficiency and effectiveness of the activities performed.
c) To identify and evaluate new activities that can improve the future performance of the firm.

To aid the management and control process, it is essential that there is a thorough understanding of the lower level measures and their interaction to the overall transport cost per distance travelled. This can be best illustrated through a cost model which can be sub-divided into a number of smaller identifiable elements which when adjusted at the lower level will demonstrate the effect at each level. The model incorporates all of the Performance Indicators (PI's) associated with distribution and links their individual definition as discussed in previous chapter to a live working example which simplifies the measurement processes.

The model in Figure 6.12 is primarily a cost management tool for the Transport Manager. However, it also provides the senior manager with the headline costs and quickly allows them to ascertain where there re either cost inefficiencies or improvements within the operation. The overall KPI is **Total Distribution Cost per Distance Travelled**. This is sub-divided into the following:

a) Total Delivery Cost
    - Total Fuel Cost
    - Total Driver Cost
    - Total Maintenance Cost
b) Total Fixed Cost
    - Depreciation Cost
    - Licensing Cost
    - Insurance Cost
c) Total Overhead Cost

The model will eventually become a fundamental part of the KPI management tool kit and by simply changing a lower level value the manager can trace the effect on each of the relevant cost level. This can otherwise be known as the 'what if' model.

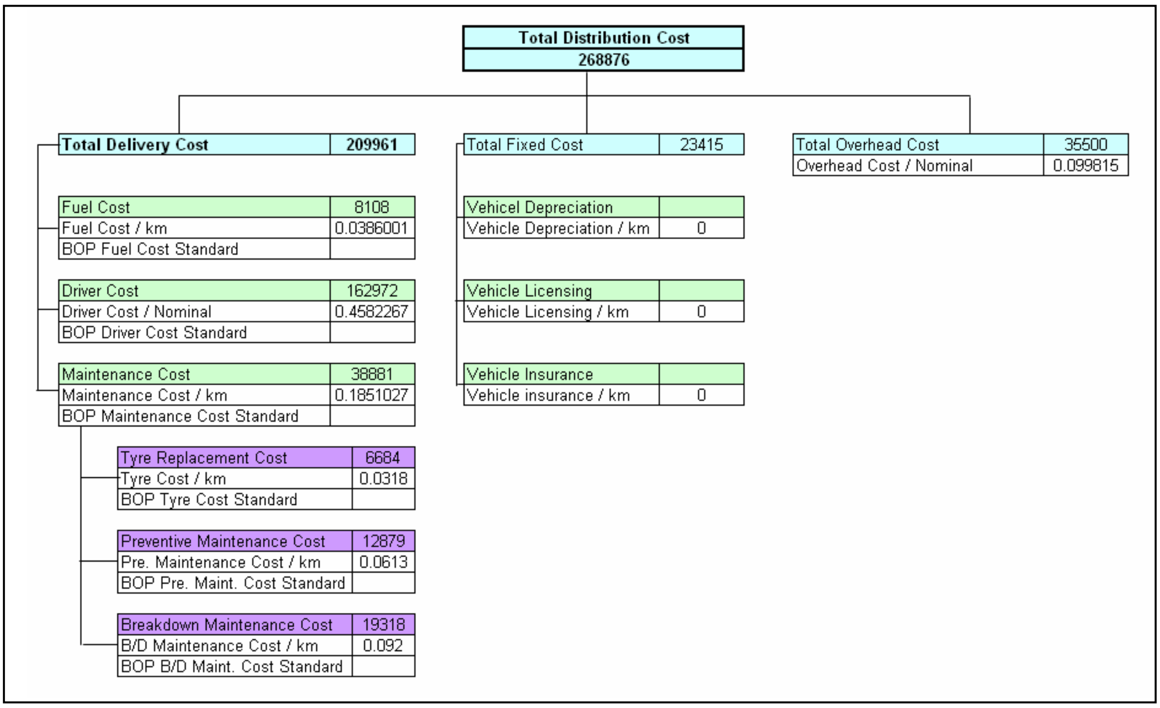

Figure 6.12: "What if" Total Distribution Cost Monitoring Model.

There are many advantages for expressing operational costs as performance indicators:

a) Give a better understanding and awareness of the individual cost drivers to the business. By expressing PI's for the cost components which make up a particular cost, it allows management to focus in these areas.

b) Acts as a tool for managerial development, objective setting and motivation. PI act as a 'yardstick' for setting specific financial targets or objectives within an operations. The training and development of managers in PI's ensures a wider understanding of the financial characteristics which constitute a business profit and loss.

c) Help to produce quantified tactical decision making. It is often necessary to fully evaluate the effect of an operational change within a business by demonstrating the effect of that change on the PI's before the decision is made.

d) Are effective benchmarking tools of an operation.

e) Simplify the process of trend evaluation, allowing management to focus on critical areas. The evaluation of PI's on cost measures enables managers to identify negative trends and formulate early corrective actions.

f) Simplify the budgetary process and target forecasting and re-forecasting. PI's are an effective tool in the budget setting process. They provide realistic targets which can again be diluted into particular measures. Historically, budgets are set from the higher level measure for example total cost. The effective use of PI's means that budgets can be compiled more accurately from cost measures for example cost per distance travelled forming part of total cost.

g) From part of a managerial 'tool kit' aimed at improving the financial skills of managers. The understanding of PI's and their link to financial reports is a critical area of development for managers.

h) Provides first line managers with the 'vision' to their contribution to the company's performance.

i) Aids in the analysis of the customer profitability.

6.4.1 Effective Cost Control

As cost is the most important KPI that management is putting the accent on, it is extremely important to monitor cost down to individual cost element level so that one can have a good idea of where does all the money gone to. Since Fixed Cost and Overhead Cost will be about the same most of the time, unless there is a major change in structure or purchase of new vehicle. Hence the detailed monitoring of Cost expenditure will be done only for Delivery cost, which comprise of three main cost element – driver cost, fuel cost and maintenance cost.

Two charts (Figure 6.13 and Figure 6.14) will be developed, showing monthly trend for Delivery cost and its three cost element against YTD Target and Best Operations Practice respectively. The charts are easy to construct, user friendly and easy to understand. It shows the trend of delivery cost over the year and the specific elements, which contributes to the high cost of the month, allowing the manager to focus on specific area while taking action to reduce expenditure. It also keep a close tracking record of all the coast incurred and the cost elements against planned or budgeted figures, allowing line manager to know when performance has dropped and actions should be taken. With these guided tools, the manager will be able to control the cost more clearly and transparently, avoiding the 'taking wrong medicine' situation to occur.

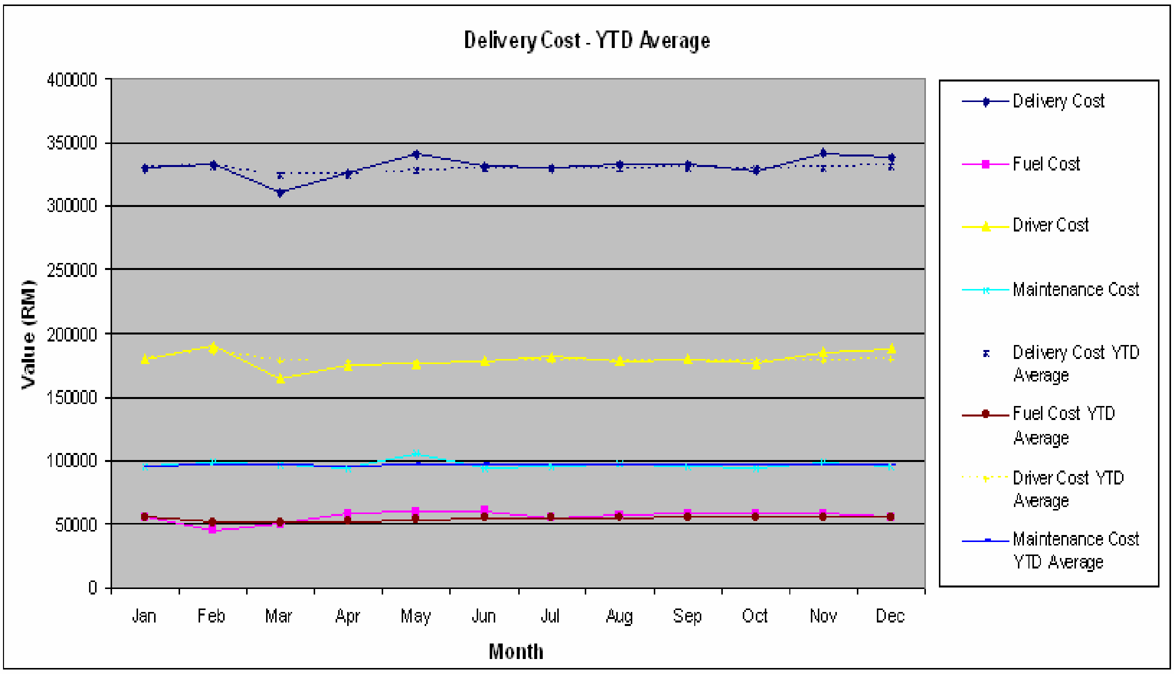

Figure 6.13: Delivery Cost Element Monitoring Chart – Against YTD Average

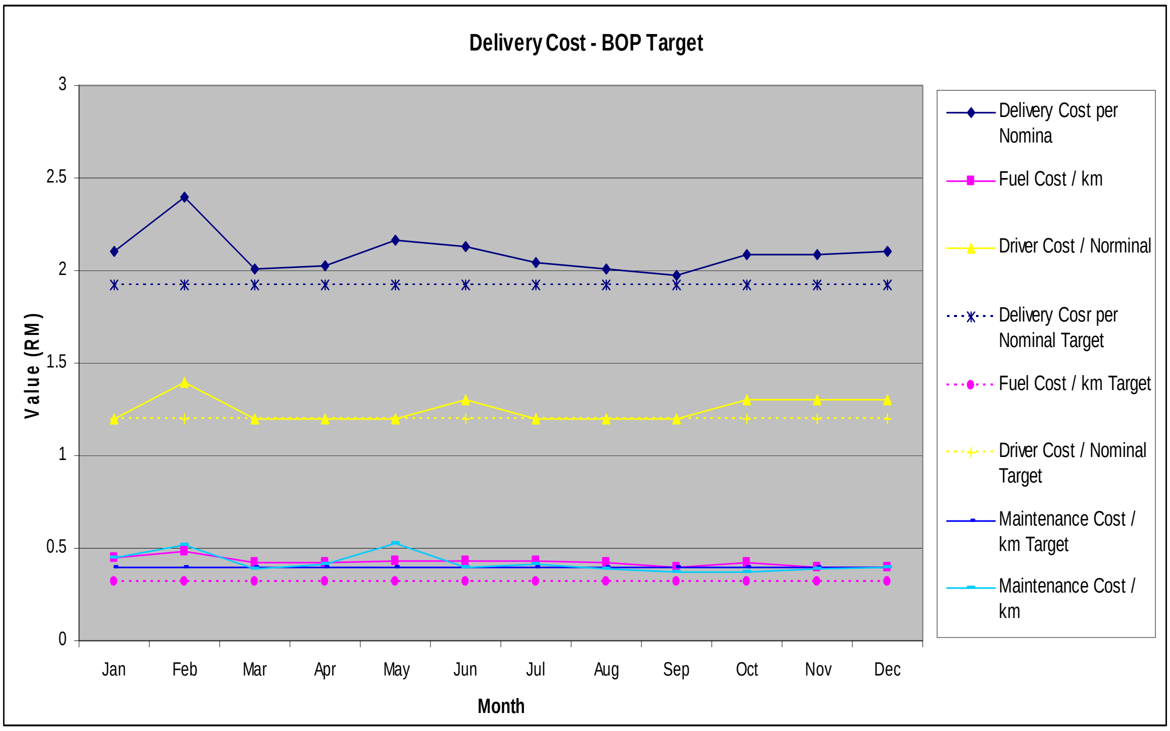

Figure 6.14: Delivery Cost Element Monitoring Chart – Against BOP Target

Effective cost control through better management techniques can help a business in the following areas:

a) Determine the level of profitability of operations and customer accounts.
b) Management information to help the decision making process so that decisions can be made with the full knowledge of costs incurred.
c) Acts as an aid to the overall planning of distribution activities, decisions on vehicles ownership, contract hire, leasing, purchase and replacement policy and so on.
d) Specifically identify negative trends within individual cost components and enables management to take early corrective action.
e) Aids the commercial decision making process when biding for new contracts.
f) Ensures that a sufficient Return of Capital Employed (ROCE) is being achieved through the use of the company's assets.

6.4.1.1 Pool Reserve

With certain operations it may be possible to allocate surplus vehicles to a centralised pool. This is often the case in periods of low demand. This process has the benefit of saving some running costs in the short term and should reduce the overall number of reserve assets required in the fleet to cover peak demand and emergencies, rather than locating reserve vehicles at each location.

There are generally two types of vehicle reserve:

a) Short term loan for the replacement of a fully utilised vehicle for maintenance of say more than 3 days.
b) Strategic requirement for plant failure where a large number of vehicles will be needed to be quickly mobilised.

It is critical to ensure that there are recommended reduced maintenance for these vehicles and that there is identification of how quickly they can be brought back into service. To gain maximum financial benefit from the reserve fleet, the older less efficient vehicles should be those that are identified. For example:

a) Reserve vehicles which are allocated to the central pool mean that the site’s total fixed costs will be reduced by both the running and depreciation costs. However, the business central account will bare the depreciation cost (still a cost to the company, however less).
b) By acknowledging spare resources and allocating them into the central pool, this provides the national operation with a wider vision of the spare business’ assets. This has the added benefits of possibly moving the ‘spare’ resource into a site which is either short of vehicles or is paying for the additional use of carriers when it may be more cost effective to use an internal asset which is currently generating an unproductive cost.

6.4.1.2 Better Vehicle Depreciation Control

The straight line method of depreciation calculation is not particularly accurate as vehicles do not depreciate evenly per year. To further improve on the vehicle depreciation calculation, the manager needs to understand the relationship between the expected useful life of the vehicle and the period of depreciation. The period of time that a vehicle is depreciated over varies throughout different businesses. This period of time depends upon the asset type and business policy.

The depreciation period has a relationship with the expected useful life of the vehicle. As a vehicle becomes older the performance of that vehicle will deteriorate. This will result in an increase in maintenance costs, a reduction in fuel efficiency and a reduction in the resale value of the vehicle. This is often referred to as increasing a vehicle “life time cost”. To this end the operator can influence this number by coming to a policy decision regarding the whole lifetime cost of the vehicle. Additionally, decisions are often made to keep a vehicle longer that it’s depreciation life cycle. This will result in no monthly depreciation cost but there will be a trade off with maintenance costs as these will tend to increase at a more rapid rate with vehicle age.

Managers can influence this cost by improving vehicle utilisation to an extent that the operation requires less vehicles to deliver that same level of customer demand. If a vehicle is sold or transferred to another cost centre within the business there will be a reduction in the monthly depreciation cost as well.

6.4.2 Transport Overhead Cost

Lowering overhead costs which are a fixed cost will reduce the total cost of distribution, assuming all other variables remain the same. The few areas below can be looked into to improve the cost. The cost of office personnel salaries are normally the largest percentage of overhead costs. Therefore, it is vital that a site be staffed with the minimum number of personnel needed to manage the location.

A detailed listing of all required tasks that must be performed should be completed. Associated to each task should be the time that is required to complete that task. Factors to be taken into account will be the volume as well as the complexity of the tasks undertaken. For each task that is performed the time for that task would be multiplied by the number of times the task is performed in a month. This gives the required monthly time. By completing this process for every task a total monthly time can be computed. This will allow managers to determine the number of office personnel that would be required.

Another issue is the time of day when certain tasks must be performed. The two key local administrative requirements are delivery confirmation and dispatching.

6.5 Overall Performance Matrics

Department should be managed as a whole and all the KPI's are inter-related, all contributing to the department's performance and at the same time, could be contradicting to each other. Hence, it is irrelevant to manage each and individual KPI separately on their own. Managing the department at a macro view is important. Nevertheless, monitoring the performance at micro level is equally important.

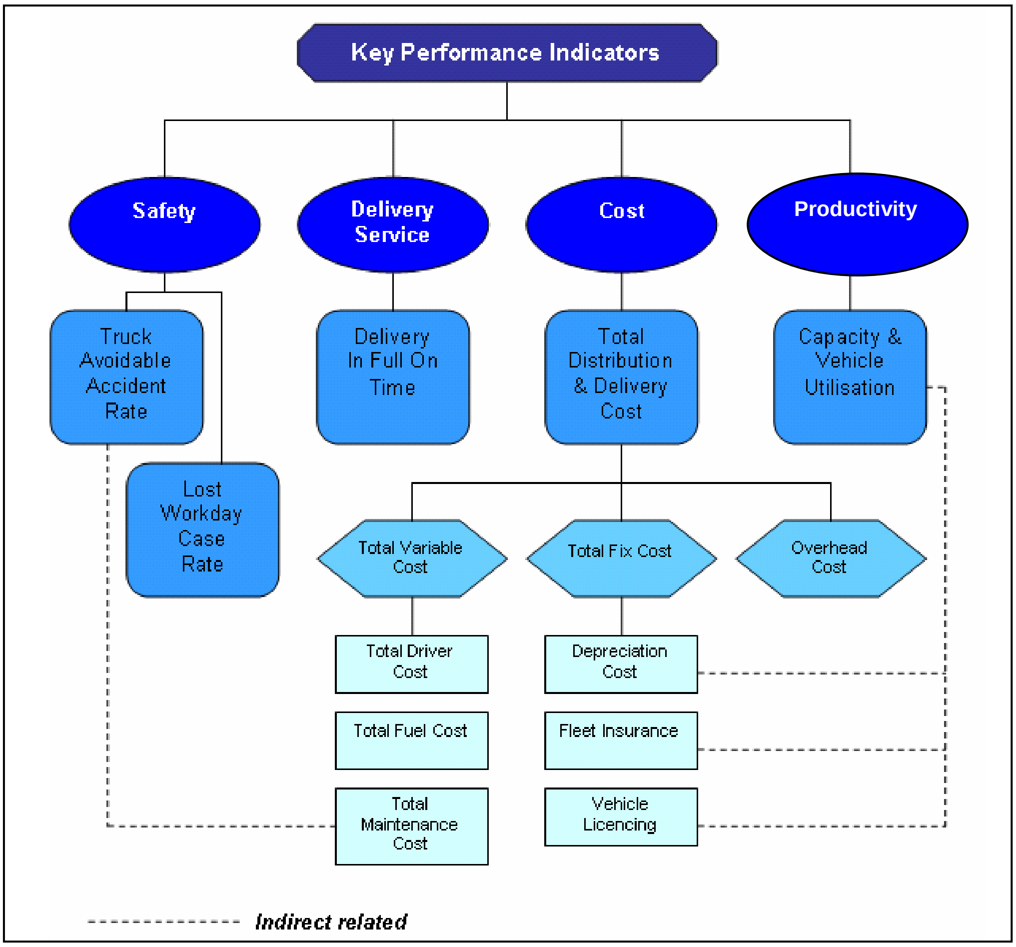

Figure 6.15: Integrated KPI Monitoring Matrics

Figure 6.15 above shows the overview of the integrated KPI Matrics. It shows the link and relationship four main areas of KPI measurement, seven main KPI's, sub-KPI's as well as element contributing to KPI's. These measurement filed will then be measured monthly and converted according to pre-defined weithage as Overall Performance as shown in the Healthcard in Figure 6.17. The Healthcard is a performance monitoring tool which provide the manager both macro and micro view of the department's performance, detailed to individual root cause of failed performance.

Figure 6.16 summarises the four main competency area of MOX Logistics Operations Department and its KPI's. The standard for these KPI's are review and reset annually with the benchmark against sister company and other companies in the similar industry. Every beginning of the year, these KPI's together with its standard (required standard and stretched standard) will be compiled into different levels of Service Level Agreement (SLA) – Department SLA and Individual SLA, better known as Individual

Performance Contract. The KPI's are monitored closely monthly, if not weekly. Some critical measurement such as DIFOT will be monitored daily. The reports of these measurement will be complied and submitted monthly (operations level), quarterly (country level) and annually (regional level).

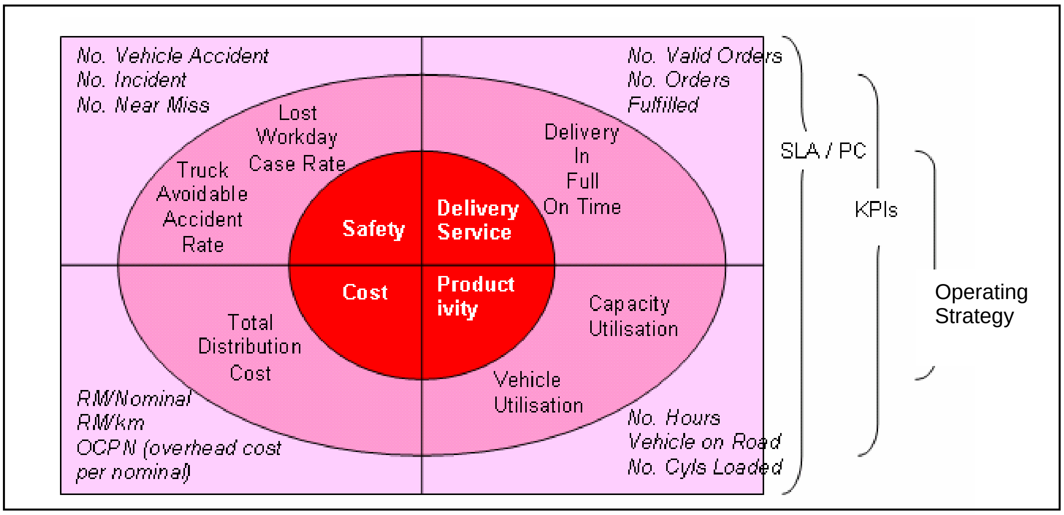

Figure 6.16: Translating Operating Strategy to Service Level Agreement

Monthly performance will be captured into respective filed, and the variance of the month will be computed by benchmarking monthly performance against desire performance (target). For KPI which performance is above target, full weightage percentage will be allocated. Half of the weightage percentage will be allocated for KPI's that is below target within an acceptable range, and 0 percent will be allocated for KPI's that perform below minimum requirement standard.

LOGISTICS OPERATIONS HEALTHCARD

	TARGET	Weitage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD	Variance
Safety																
TAAR	1.7	10.00%	0	0	0	0	4.49	0	5.85	0	0	0			1.034	39.18%
LWCR	5	10.00%	21.08	0	0	0	0	0	21.08	0	0	0			4.216281	15.67%
Delivery																
DIFOT	99.50%	25.00%	98.4%	99.5%	98.7%	98.6%	98.2%	98.7%	98.9%	98.8%	99.1%	99.1%			98.80%	-0.70%
Productivity																
Capacity Utilisation	90.00%	8.00%	80.25%	82.48%	91.14%	90.70%	107.26%	111.76%	100.89%	109.84%	89.99%	78.13%			94.24%	4.24%
Vehicle Utilisation	90.00%	7.00%	85.07%	95.14%	92.94%	84.14%	99.45%	80.39%	74.81%	80.25%	82.48%	91.14%			86.58%	-3.42%
Cost																
Cost/km	1.55	20.00%	1.57	1.58	1.34	1.39	1.31	1.38	1.59	1.59	1.51	2.15			1.541	0.58%
Cost/Nominal	3.15	20.00%	2.73	3.47	2.9	2.67	3.14	3.41	3.12	3.03	3.06	3.29			3.082	2.16%
Overall Performance	90%	100.00%	56%	62%	88%	81%	78%	61%	51%	71%	77%	50%			84%	

Remarks:
For performance above target, full allocation of weithage.
For TAAR, LWCR, Cost/km & Cost/Nominal:

Figure 6.17: Converting Performance into Indicators - Healthcard

6.5.1 Benefits of Using Overall Performance Matrics as Management Tool

Figure 6.15 and Figure 6.16 shall display the overall view of how four identified Key Performance Indicators (safety, cost, productivity and delivery service) are integrated, how they are being translated from company business strategy to performance measures and how these performance are being measured and tracked systematically. By using the Overall Performance Measurement Matrics, the management shall enjoy the following benefits:

1. A better understanding of department's overall performance, where is the strength and where are the weaknesses.
2. A better idea on the integrated performance matrics and how each KPI relates to another KPI.
3. Whole ownership of the department's overall performance for every stakeholder.
4. A systematic track record of previous performance for benchmarking, comparison and future performance projection.

It is here to reiterate that the performance measurement tools introduced are just to assist the manager to manage the department performance in a more systematic and complete manner. It is most important for a manager to keep his mind open to the performance, always wanting to find out more about the performance by asking why, why and why.

CHAPTER 7

IMPLEMENTATION

7.1 From Recommendation to Implementation

For the purpose of categorization, implementation is defined as the phase in which systems and procedures are put in place to collect and process the data that enable the measurements to be made regularly. It is a process of data collection, collation, sorting and distribution. This may involve computer programming to trap data already being used in the system and present them in a more meaningful form. It may involve initiating new procedures, so that information currently not recorded is captured and it may involve completely new initiatives, such as the setting up of a regular customer or employee survey.

The use of performance measures is split into two main subdivisions. First, as the measures are derived from strategy, the initial use to which they should be put is that of measuring the success of implementation of that strategy. Second, the information and feedback from the measures should be used to challenge the assumptions and test the validity of strategy. In fact, authors have argued that they should be used for both purposes. Therefore, “assessing the implementation of strategy” and “challenging the strategic assumptions” are the two main subdivisions of the use of the performance measures.

7.2 Performance Management for Continuous Improvement

Performance measurement is not an end itself, but a tool for more effective management. Results of performance measurement indicate what happened, not what to do about it. In order for an organisation to make effective use if its performance measurement outcome, it must be able to make the transition from measurement to management. Procurement Executives' association defines in Moving From Performance Measurement to Performance Management (2002) that a performance management is the use of performance measurement information to effect positive change in organisational culture, systems and processes, by helping to set agreed-upon performance goals, allocating and prioritising resources, informing managers to either confirm or change policy or programme directions to meet those goals, and sharing results of performance measurement in pursuing those goals.

As the main purpose of performance management is continuous improvement, the process of developing and implementing the new performance measurement is a process of continuous improvement itself. The designed performance measurement matrics provide feedback based on specific rather than generalisations and are based on specific objectives derived from the desired outcome. It provides organisation the opportunity to refine and improve their development activities.

To move effectively from performance measurement to performance management, two key components need to be in place:

- The right organisational structure which facilitates the effective use of performance measurement results; and
- The ability to use performance measurement result to bring about change in the organisation.

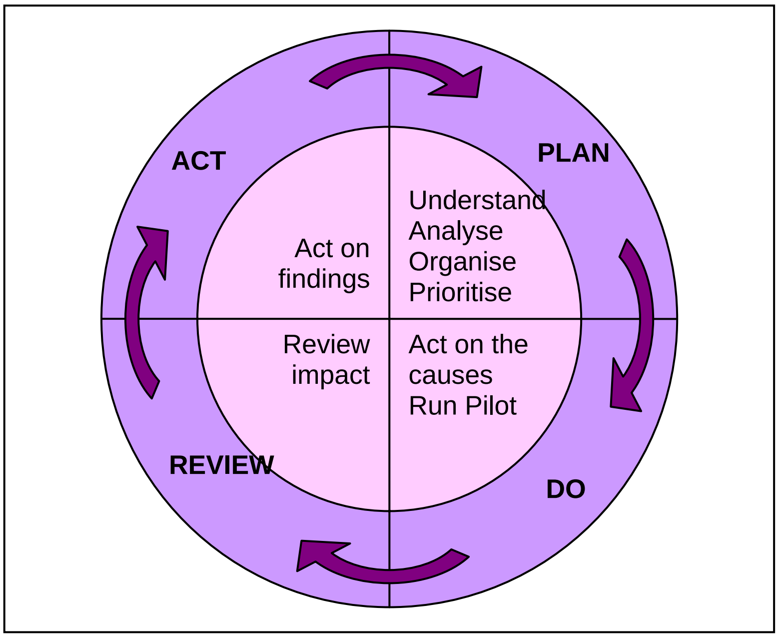

Figure 7.1: The Learning Wheel.

Source: Adapted from Turner Suzanne (2002), Tools For Success, A Manager's Guide, McGraw-Hill Professional, United Kingdom, page 82.

7.2.1 8 Steps Change Strategy

There isn't a rule for change; the only rule for change is to continue changing. However, the author recommends that there should be a systematic approach to manage change. This systematic approach to manage change is just a guideline on how and what to do at certain stage of change, bear in mind that the content of change, what to be changed and how to change is always a change itself.

Approaches to change needed to be matched to the constrains under which an organisation operated, these constrains were themselves amendable to change and in any case could conflict with each other (Burnes, 1996). The author will adopt John P. Kotter (1998), Eight Steps to Transform Your Organisation in implementing the changes in performance measurement in Logistics Operations unit in MOX.

1. Establish a sense of urgency
2. Form a powerful guiding coalition
3. Create a vision

4. Communicate the vision
5. Empower others to act on the vision
6. Plan for and create short-term wins
7. Consolidate improvements and produce still more change
8. Institutionalize new approaches

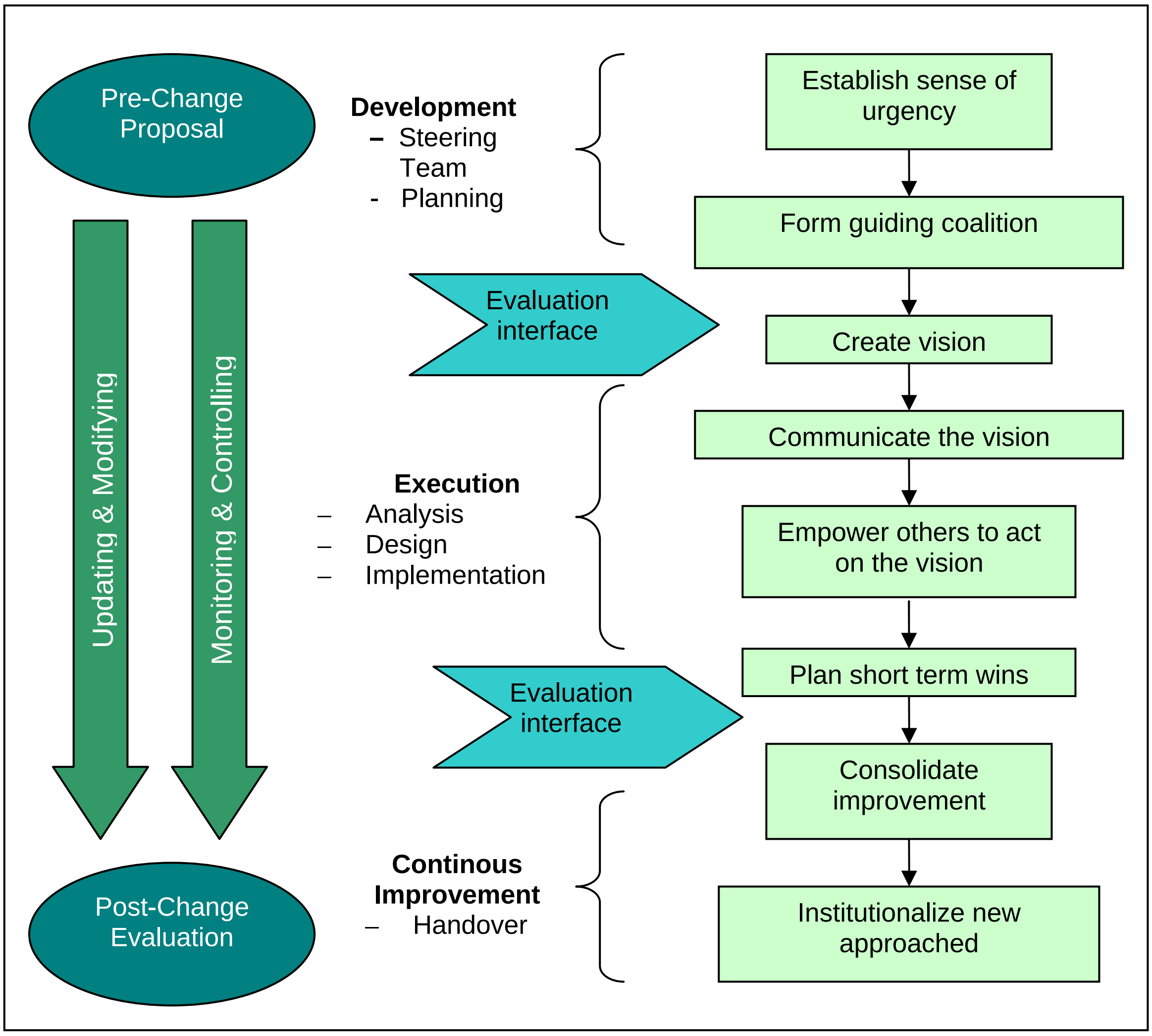

Figure 7.2: The 8 steps change model.

Besides having a good model of change and keeping tracking it while implementing change, there are few soft elements of management which cannot be neglected by the change agent. The author outlined 3 elements, strong visions, communication and managing people as below which he feels is important and worth consider about.

7.2.1.1 Implement Effective Communication

Communication is the most important soft element of all. One can help people through the neutral zone with communication (rather than simple information) that emphasizes connections with and concern for the followers. To keep reiterating the "4 P's" of transition communications:

- The purpose: Why we have to do this.
- The picture: What it will look like when we reach our goal.
- The plan: Step-by-step, how we will get there.
- The part: What you can (and need to) do to help us move forward.

Through effective communication, it will be possible to sell the change ideas to others and lead them through the change curves. The main idea of communication is to let all parties involved know, understand, accept, adopt and last but not least, live the change ideas. It is important to remember that, in MOX, as most of the people involved in this change are drivers, whom educational level are majority low, communication via simple and direct message is the most effective means.

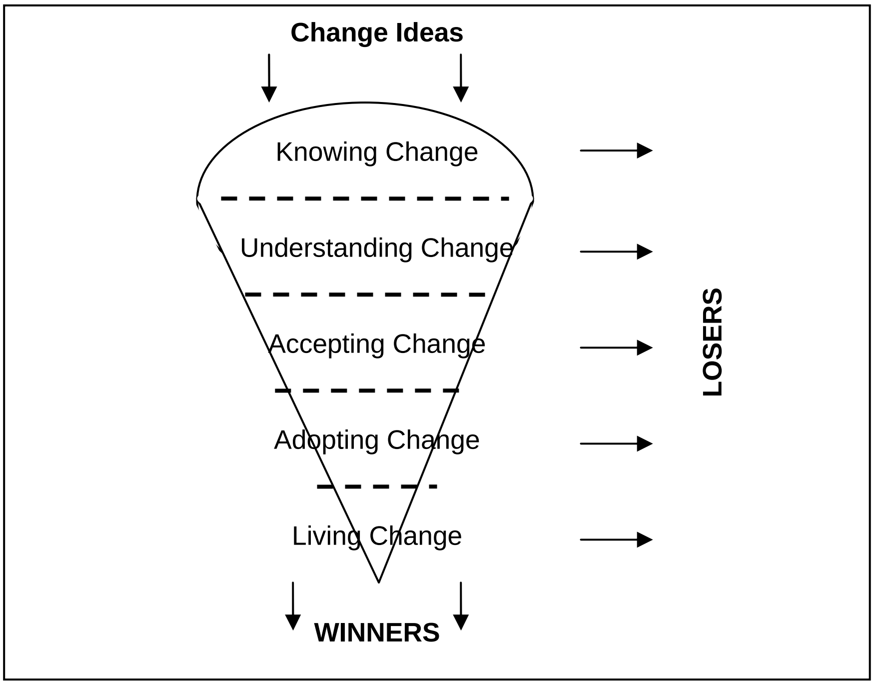

Figure 7.3: 5 stages of change communication

Those who successfully go through these five stages of communicating change are the successful change agent, we called winners. Those who can't manage to sell through five stages will loose out some way in between, and then change will not happen.

When here is communication, conflict will always happen, as communication itself is imperfect. Putting an end to conflict is the last thing leaders should hope to achieve. Conflict should be managed, not eliminate. Leaders must be at the forefront of conflict, managing it – and serving as role models – everywhere in the organisation.

As performance management is a sensitive aspect, especially in the human area. The author foresees the greatest resistance in the implementation of new performance measurement system is managing the conflict. As most people are used to and comfort in being measured in the old ways, it is always difficult to manage them through the change. Advice from the author is to be patient and persistent.

7.2.1.2 Strong Vision

Vision helps people make smart choices because their results are being made with the end results in mind. It takes into account larger picture than the immediate goal. Hence, vision is important for leaders (change agent) as it is about going somewhere.

Without a clear vision, an organisation becomes a self-serving bureaucracy. Once the vision is clarified and shared, the leader can focus on serving and being responsive to the needs of the people. The greatest leaders have mobilised others by coalescing people around a shared vision. When people share and believe in a vision of what the organisation can be, they generate tremendous energy, excitement and passion. They will feel at they can make a difference, and they can make their contribution on their own way towards change.

After having a strong vision, it is important to live the vision. While top management should involve as many people as possible in shaping and communicating vision and direction, the ultimate responsibility for making sure that these are done lies with the hierarchical leadership, i.e. the top team. It takes courage to create a vision and it definitely takes courage to act on it. Two strategies that will support the efforts to live the vision are:

a) always focus on your vision, and
b) show the courage of commitment.

Back to MOX context, as most of the vision (targets) are set from top to down, it is important to get each and everyone on the department to initialise the targets. It is important to publish the monthly performance report for everyone to view, so that they can directly feel the ownership of the measurement. This method can get everyone involve to keep track of their own target, and be responsible for the performance improvement plan. It is also use to create a common understanding on current performance as well as common goal of future target. As mentioned, performance measurement is not only for manager, it is for everyone.

7.2.1.3 Managing People - Driver

Producing change is about 80 percent leadership – establishing direction, aligning, motivating and inspiring people, and about 20 percent management – planning, budgeting, organising and problem solving. (John P. Kotter, 1998)

Managing driver starts with managing their need. Abraham Maslow, an American psychologist, was one of the first to differentiate between and classify different types of human need. There are five distinct forms of demand need which he placed in hierarchical order. He argued that, beginning at the lowest level, a person had to satisfy substantially the needs at one level before he or she could move up the hierarchy and concentrate on 'higher order' needs. In ascending order, the five levels in Maslow's Hierarchy of Needs are:

a) Physiological needs – hunger, thirst, sleep (only when these basic needs have been satisfied do other needs begin to emerge).
b) Safety needs – the desire for security and protection against damage.

c) Social needs – the need to belong, to gain love and affection, to be in the company of others.
d) Esteem needs – these reflect a person's desire to be respected – esteemed – for their achievements.
e) Self-actualisation needs – the need to achieve one's full potential.

Applying Maslow's hierarchy of needs to human behaviour in organisations, it can be seen that most of the driver will first of all be motivated by the desire to satisfy physiological needs through monetary rewards. Once those have been substantially satisfied, however, they will seek to satisfy or be motivated by their safety needs, such as job security and welfare benefits. Most people resist to change is because changes directly impact both of these basic needs. Hence, it is important for a change agent to understand other's hierarchy needs, help the driver to overcome their problem, and from there, lead them towards change.

The annual driver performance evaluation session could be a very good opportunity for a Transport Manager to understand his driver in more detail. However, it is also suggest that the manager should always reach out for their driver and to know each and everyone of his driver well. This is the fundamental of managing driver.

7.3 Driver Management

Drivers are the most important component in a delivery service. The importance of driver's performance is based on the fact that drivers have direct input into the highest cost areas of labour, fuel and vehicle maintenance cost. Based on figure 5.3, driver's cost made up to 41% of total distribution cost, and they have high influence on the maintenance and repair cost, tyres cost as well as fuel consumption. It is also a fact that drivers are the frontlines that deals with customer everyday and they carry company's image the most. A driver's appearance and behaviours will portray company's image to the public. That is why drivers management is important and to manage a drier is not an easy task.

7.3.1 Driver Performance Management

The proposed driver performance management seeks to create a two ways communications structure for management and drivers to identified development opportunities against clear performance goal. This will be accomplished y establishing standards of performance, measuring and recording performance, performance review and establishing a development and improvement plan based on performance. High standards of performance will be concise and clearly communicated to all drivers such that the drivers can clearly understand what is expected of them. It is important that all drivers assist the company in setting ever more challenging targets for the future.

Due to the fact that a driver works mainly offsite, communication between management and drivers is more difficult. This difficulty must be overcome on order to keep the driver focused and performing at the expected level. One of the cornerstones of this process will be to provide clear feedback to the driver on the progress being made. It will also provide the environment where continuous improvement can be properly focused towards the increasingly demanding needs of our customer.

All drivers should have performance checks through periodic task observations. The results from task observations, accident analysis or complaints against a driver help check training effectiveness and compliance to the standard. Follow up remedial and rehabilitation efforts should be extensive at the outset until there is evidence of satisfactory performance. Spot checks for all drivers are occasionally needed to disclose “soft spots” in their performance, and to help in training and retraining.

Because driver cannot be personally supervised every minute, a driver must be motivated to police their own work performance. Driver must know what correct performance is. Once they are trained in technique, drivers can then be motivated through pride of workmanship, skill or other factors to do a superior job.

7.3.2 Involving Driver in Overall Performance Measurement

It is important to involve driver in implementing Overall Performance Measurement. As driver comprises 70% of the total headcount in the department, they are the most critical factor to determine successfulness in implementing the new performance measurement system. It is proposed that the implementation team to consider taking following suggestions for smooth implementation.

a) **Proper communication to driver:** Communication to driver should be done in simple language but creatively in order to convey message correctly. Various communication techniques such as verbal, printed and games should be used to make sure message get a crossed. Verbal communication should be done consistently by using drivers' common language if possible. As for printed communications, it is always more effective in replacing words with attractive pictures, as a picture says thousand words.

b) **Proper training to expose driver to the new measurement concept:** It is always the management's responsibility to provide training to drivers before asking them to comply with certain work standard. Training via simple team games and workshops is a good way to make driver aware of their contribution to quality, safety, cost and productivity, as well as the consequences if the company fail in theses areas.

c) **Continuous communication to create awareness:** To change a driver's mind set to accept a new performance measurement concept is not something that can be done overnight. The management must put in effort to make sure a two ways communication is done periodically to deliver message as well as receive feed back. Encourage driver to give feed back and positive ideas for improvement plan. Positive suggestion and successful ideas will be credited to drivers. This is to create an open environment that encourages drivers to voice out their opinion at all time. When a driver feels safe in a open environment, they tends to accept changes more openly.

d) **Evaluation and improvement program:** Driver's performance will be measured through observation of driver's actions that are significant and measurable. This is an event that should be brought to the attention of the driver concerned at the time the event occurred. The purposed is either to record a noteworthy achievement or identify where change in performance is necessary. The performance review process must be maintained transparent throughout and there must be no surprises for the driver at the review meeting. The goal to the evaluation process is to strive to improve performance of the drivers. Through evaluation process, gap between current performance and desire performance will be identified. Once the gap in performance has been agreed then a plan to remove the gap must be created.

e) **Reward on improvement:** Whenever there is an improvement, the drivers should be rewarded to show that their effort is being appreciated. Simple motivation action such as a get together dinner with senior management if the department manages to hit particular target would be good to motivate the drivers. Individual excellence performers could be further developed to become tam leader, drivers' trainer and also as a cover support for management.

7.4 Obstacles to Implementation

According to Bourne, Mills, Wilcox, Neely and Platts in Designing, Implementing and Updating Performance Measurement Systems (2000), there were three main obstacles to the full implementation of the performance measures. These were:

- Resistant to measurement, occurring during design and use phases;
- Computer systems issues, occurring during implementation of the measures;
- Top management commitment being distracted, occurring between the design and implementation phases.

On reflection, the implementation of a new performance measurement system can be seen as "changing the rules of the game" or redistributing power in the organisation.

Individuals and groups may see this as not being in their best interest and actively or passively resist the implementation. The process of redistributing access to information can be seen as threatening to senior managers whose power base is altered, therefore it is not surprising the resistance to performance measurement was observed.

Implementation of the individual measures does not create a performance measurement system. Measuring is only one part of using the measures. A forum is needed to review the measures and ideally to agree action. To do this, a regular meeting is required, attended by the directors and managers who have responsibility for the performance being measured. These performance measurement reviews took time to develop. Skills also need to be developed in critiquing and learning from the performance measures in a group. Besides the difficulties with computer systems, causing information on certain measures to be unavailable, it took time to adjust to the correct format.

CHAPTER 8

CONCLUSION

8.1 Conclusion

The growing interest in the Performance Measurement Systems (PMS), due to the broadening of the spectrum of performances required and to the support of programmes for performance improvement (JIT and TQM), has led to, on one hand, an updating of the accounting systems and, on the other hand, an extension to the non-cost performances. These new frameworks placed emphasis on external and future looking performance measures. These have posed the problems of greater complexity and articulation of the PMSs.

This project, thus, was aimed at the identification of the conceptual dimensions and the constructive variables of an improved PMS for MOX. As a result of the study, an Overall Performance Matrics (OPM) is developed to integrate different dimensions of performance – internal and external, cost or non-cost.

8.1.1 Identifying Key Performance Indicators

Through various interviews sessions with senior management team and shopfloor employee, it is identified and agreed upon that Operational Cost, Delivery Service Level, Safety and Productivity are the four most important Key Performance Indicators (KPI's) and should be incorporated in the Overall Performance Matrics for measuring and monitoring. An analysis that shows the correlation between these four KPI's is also presented in Chapter 6.

8.1.2 Developing Integrated KPI Matrics

The four identified KPIs are integrated and an Overall Performance Matrics (OPM) is developed. These KPI's are assigned to a weightage, and shall contribute to the overall performance ratings. These weightages are assigned in a way that it is in lined with the company's business strategy and objectives. The weight assigned shall reflect the emphasis that the company stressed on a certain KPI. The OPM also shows which are the Critical Success Factors (CSF's) of the organisation, and how well are they doing in the area.

This Overall Performance Matrics can also be used as a simulation model during annually planning and budgeting process. It demonstrates to the management the cause and effect on a proposed strategy, helps trouble shooting processes and scenario planning sessions.

8.1.3 Implementing Overall Performance Measurement Systems

Process of implementing overall performance measurement system is much more complicated compare to the process of designing it. The change mode by John P. Kotter (1998), "Eight Steps to Transform Your Organisation" will be adopted in implementing the changes in performance measurement system in Logistics Operations unit in MOX. Besides having a good change model, some soft skills must also not to be neglected. Three important elements in any change implementation process: strong visions, communications and managing people have been discussed about.

Driver management, which is another critical area management must pay attention at, as they are the most important factor in the successfulness of the change. It is crucial to involve driver, and get their buy in, while implementing the new performance measurement system. This can be done by having clear communications to driver, training provided to equipped driver with new skills, creating an open environment, proper evaluation and development process, and last but not least, reward those who contribute in the change.

8.2 Integrating Performance Measurement System with Other Firm Systems

According to Kaydos as mentioned in Performance Measurement Systems – Models, Characteristics and Measures by Toni and Tonchia (2001), the Performance Measurement System (PMS) is not, nor can it be an isolated system. Both because it shares inputs with the other systems and produces outputs for other systems. As a consequence, the PMS has a strategic “position” inside the firm. A PMS must be integrated with at least three other types of systems in the organisation:

a) The accounting system (regarding both the balance sheet accounting, the analytical cost accounting and the budgeting);
b) The operations planning and control system (OPCS);
c) The strategic planning.

As far as integration with the accounting system is concerned, data relative to cost performance are a part of and are elaborated within, the ambit of the analytical cost accounting, which is then link to the traditional indices of the balance sheet accounting, while the budgeting does not normally include performance other than the economical and financial ones. In regard to integration with the strategic planning, precisely with the operations strategy, without doubt the PMS is correlated to it. The integration with the operations planning and control system is, on the other hand, targeted at economy of gathering technical and productive data. The OPCS considers them for the operations planning and control while the PMS considers them for measurement of performance.

8.3 Usage of Performance Measurement System Other Then Measuring Performance

Wisner and Fawcett (1991) have individuated at least two reasons for a Performance Measurement System (PMS): to compare one's own competitive position with that of the competitors and to check on the accomplishment of one's own objectives. Neely (1998) also mentioned that three different roles of PMS are to comply, to check and to challenge.

Besides this, Simon R, also mentioned in Performance Measurement System Design (1995) that performance measures can be used to influence behaviour. He argues that it can be used as a means of surveillance, motivation, monitoring performance, stimulating learning, sending signals or introducing constrains.

8.4 Benefits to the Company

The primary function of the performance measurement system is to control organisational operations. It furnishes a language for describing expectations and performance, thus laying the foundation for discussion on how each individual can contribute to fulfilling the organisation's vision. Thus, the performance measurement system provides a basis for determining the appropriate efforts in the overall balance and for communicating such efforts through management control. In this way, the use of performance measurement system facilitates learning by developing participation, awareness, a decentralised decision-making process, and responsibility for achieving the goals which have been formulated. As a consequence, there must be a goal-achievement analysis, in which the organisation draws conclusions about what it is doing well, what is not doing so well, and what can be improved.

The performance measurement matrics also could be used as a tool that lets the logistics organisation track progress and direction towards strategic goals and objectives and should focus on whether the organisation has met its performance goals and targets.

By creating this measurement matrics at the center of its management systems, the organisation will be able to evaluate organisational strategy in light of the recent performance. It enables the organisation to modify strategies to reflect real-time learning and the implementation of performance management systems gives organisation the capacity for strategic learning.

8.5 Future Considerations

This study argues that defining and measuring performance in logistics operations is a difficult enterprise. The literature review reveals the nature and limitations of the various designs and measures have been used thus far, and suggested that there are no perfect performance measurement system as yet.

There are issues associated with performance measurement systems which the author thinks should be taken into consideration in the future development of the project:

1. How can performance measures be designed so that they encourage inter-functional co-operation?
2. How can performance measures be integrated both across an organisation's functions and through its hierarchy?
3. How can performance measures which do not encourage short-termism be designed?
4. How can performance measures be designed so that they encourage appropriate behaviour?
5. How can we ensure that the performance measurement system matches the firm's strategy and culture?
6. How can one ensure that the performance management loop is closed – that corrective action follows measurement?

The final issue, and one which has not yet been touched, is that of predictive performance measurement. Much of work on performance measurement to date, is that managers use measures both to monitor past performance and stimulate future actions.

However, people are beginning to look for "predictive" measures, such as statistical process control, which show that something is going out of control, before too much damage has been done.