TOTAL QUALITY MANAGEMENT
IN
THE SAUDI MANUFACTURING SECTOR

PROSPECTS AND DIFFICULTIES

A thesis submitted for the degree of
Doctor of Philosophy
at the University of Leicester

by

HANI ABDUL RAHMAN ALAMRI

Management Centre
Leicester University
Leicester
United Kingdom

August 1995

ACKNOWLEDGEMENTS

First of all, I should like to offer my thanks to the Almighty God, without Whose guidance and benevolence none of this would have been possible. Praise be to Him.

I should like to thank Professor P.M. Jackson, Director of the Management Centre and Dr Costas Bourlakis, my academic supervisor. I am grateful and indebted to him for his guidance and support throughout the period during which this thesis was being prepared.

I should also like to express my gratitude to my parents and to my wife and daughter for their encouragement and for the understanding and patience they have shown during my period of study.

I should like to thank the Saudi Arabian Standards Organisation, the Saudi Ministry of Industry and Commerce, the Jeddah Chamber of Commerce and the Director of the Jeddah Industrial City for their help and for providing me with all the facilities I needed to carry out the field survey.

I should also like to thank the academic staff of the Business Administration Department at King Abdulaziz University, Jeddah, for their help during the preparation of the survey questionnaire.

My thanks also go to the managers of the various manufacturing companies included in the field survey for their cooperation and for giving their time to complete the survey questionnaire. I hope that they will find the present work of benefit to them and to their companies.

ABSTRACT

Total Quality Management is considered in this study within the context of Saudi Arabia's industrial diversification strategy and the efforts of the Kingdom to reduce its dependence on oil as the main source of its income. The private sector is expected to play a major role in bringing this about through the development of a sound manufacturing base, capable of satisfying local demand and, in the long run, of gaining access to export markets. However, the success of this policy will, to a large extent, depend on the ability of the private sector to deliver quality products which meet the requirements of local consumers and, more generally, of the present day market.

Against this background, we attempt to examine the extent of TQM awareness in Saudi manufacturing and the prospects and difficulties facing its implementation in this industry.

The research is based on data obtained through a questionnaire distributed to 282 manufacturing companies established in or around the city of Jeddah and representing seven industrial categories.

Analysis of the data revealed that major difficulties remain to be overcome before Saudi manufacturing can be said to have reached the degree of maturity necessary for TQM implementation. These difficulties include a general lack of awareness as to the strategic importance of quality, lack of technical and management know-how, inadequate provision for training and human resource development as well as shortcomings in the organisational systems in place.

The policy implications of this situation are then discussed in relation to the Kingdom's overall economic development, highlighting the need for long-term solutions to be provided through the concerted efforts of both the government and the Saudi producers and for greater cooperation between them.

Available data on Saudi Arabia relate almost exclusively to the Kingdom's role as an oil exporting giant and to the associated problems of its situation as a single commodity economy. This study can be seen as a modest attempt to redress the balance by concentrating on the non-oil manufacturing sector and on the prospects for its future development.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

Quality is increasingly being regarded as the key to success in a world economy which is becoming more and more competitive. This trend of increased global competition, boosted by the lowering of trade barriers recently agreed under the GATT Uruguay Round, has led to ever growing attention to Total Quality Management.

Whether in the US, Japan or Europe, there is a growing awareness of the need for constant improvement as a means of remaining competitive, particularly in the manufacturing sector whose market share has recently been losing ground to the emerging economies of Asia and Latin America.

Thus, in addition to concentrating on the advanced technologies of the post-industrial era, many Western businesses are turning to Total Quality Management (TQM) as a means of keeping one step ahead of the competition through increased management efficiency and the provision of value to the customer.

In TQM, quality is viewed not simply in terms of product or service but also as a key to the cost-effective management of the material and human resources used in the delivery of that product or service. As such, it is seen as a better alternative to traditional approaches to management in ensuring the competitiveness of the business while, at the same time, delivering quality and value to customers whose purchasing decisions are often made primarily on this basis.

Although most keenly felt in the economically advanced countries of Western Europe and America, this trend towards more stringent customer expectations with regard to quality is beginning to apply worldwide, especially in countries where the purchasing power of consumers and the freedom of choice offered by a free market is greatest. Moreover, it is our belief that the application of sound quality management systems is just as relevant to developing economies as it is to the more advanced industrial countries, particularly where locally manufactured products are not protected from competition through tariff barriers against imports and where consumers benefit from sufficient purchasing power to consider factors other than price when it comes to choosing between competing products.

In Saudi Arabia, as well as in the other countries of the Gulf Cooperation Council (GCC), the producing sectors of the economy are operating in a context where the oil wealth of the previous two decades has given consumers easy access to and the ability to chose from a wide range of quality goods. As these trends are now firmly entrenched and difficult to reverse, it is essential for local businesses to address the issue of quality and to search for the best means to guarantee that it is delivered.

With reference to Saudi Arabia, in particular, the relevance of TQM can further be seen within the context of the Kingdom's industrial diversification policy and its efforts to establish a broadly based economy. As will be seen from a review of the main characteristics of the Kingdom's industrial development efforts and the goals set for its economy, much will depend on the ability of the private sector to take up the challenge of stimulating economic growth through, among other things, the manufacture of products which meet the requirements of the local consumers and, more generally, the conditions of the present day markets.

However, little research has been carried out to find out just how ready the manufacturing sector is to meet the objectives set for it in the Kingdom's overall policy or how aware it is of the issue of quality as a strategic factor in meeting these objectives. A first step in closing this gap consists, in our view, in carrying out field surveys to assess the current situation of this sector and to identify the nature and magnitude of the problems facing it, particularly with regard to product quality. This is because, unless Saudi manufacturing is able to withstand competition through improved product quality, it is unlikely to acquire the stimulus and confidence necessary for expansion at home and abroad.

The aim of the present thesis, therefore, is to assess the state of readiness of the Saudi manufacturing sector to take up the challenge of improving its efficiency, productivity and competitiveness. This assessment is carried out on the basis of data obtained through a questionnaire designed and distributed by the researcher to 314 manufacturing firms operating in and around the city of Jeddah. The aim of the questionnaire is to discover the degree of awareness of the TQM concept and the extent to which various constituent aspects of this approach are present in the sample, including the means used in controlling quality and the account taken of modern quality management methods.

A study of this type, concentrating as it does on the non-oil manufacturing sector of the Saudi economy is particularly relevant when we consider that, while oil is still the predominant source of Saudi Arabia's income, major efforts have been made to create the necessary conditions for the successful establishment of a whole range of industries so as to reduce the country's dependence on this valuable but non-renewable resource.

While the government has so far provided the main impetus for this transformation process, the private sector is now expected to assume a greater role in the Kingdom's policy of industrial diversification, particularly in non-oil industries such as manufacturing. As the 1990-1995 development plan indicates,

> The goal of private sector development in the Fifth Plan is not just to achieve faster growth; more importantly, it is to build the foundations to support a much more broadly based, stronger, efficient and competitive sector for the future. (Plan V, p. 137)

Thus, the significance of the present study lies in the fact that it is an attempt to address the issue of quality from the perspective of Saudi Arabia's development objective of moving away from an over-dependence on oil to a more broadly based and efficient economy. Moreover, available data on Saudi Arabia almost exclusively relates to the Kingdom's role as an oil exporting giant and to the associated problems of its situation as a single commodity economy. On the other hand, little research has been undertaken to shed light on the other emerging sectors of its economy and manufacturing in particular.

As such, this study can be seen as a modest attempt to redress the balance by focusing on a non-oil sector of the economy. It also breaks new ground by being the first study on Saudi Arabia to attempt an empirical examination of the quality aspects of the Saudi manufacturing sector in the Western region of the country and should, therefore, add to the growing body of literature on the subject of TQM. More specifically, it is hoped that this research will contribute to the following:

a. filling the gap in the literature on developing countries and Saudi Arabia in particular,
b. shedding further light on the quality aspects of Saudi manufacturing and the methods and processes applied in this regard,
c. assessing the obstacles facing the implementation of TQM in Saudi manufacturing,

d. providing empirical evidence on the need for the Saudi producers to adopt a TQM approach in the management of industry,

e. suggesting ways in which TQM can help advance the Kingdom's objectives for the manufacturing sector

f. providing information on the state of readiness of Saudi factories to embark on the road to quality and efficient management and the implications this has on the aspirations of the Saudi producing sector, the Saudi government and society as a whole.

This last point is particularly relevant when we consider the crucial role of information in decision making, planning and research. This is an aspect recognised as requiring urgent attention on the part of both the government and the private sector. As noted in the fifth development plan (p. 250), issues needing to be addressed in this connection include:

- Gaps in information coverage: A number of fields and topics with urgent information requirements are not yet covered.
- Quality of information: There is much scope for quality improvement in various statistical fields.

- Discontinuity of data collection: Data collection activities tend to take place on an irregular basis, thus creating information gaps on economic and social trends.
- Timeliness of data: In some statistical fields, there is a need to reduce the time that elapses between the completion of the data collection and the availability of the information to users.
- Access to information: The dissemination of statistical information should be expanded and access made more widely available to the private sector and other concerned agencies.

In addition to the present introductory chapter, the thesis is developed over 8 chapters. Chapter 2 consists of a brief review of the development of modern manufacturing and the provisions made for it in national policy, together with the general context of the research.

Chapter 3 presents the theoretical background for the research and begins with a discussion of the concepts of quality and TQM, followed by a brief review of the historical background to the emergence of TQM and of some of the pioneering work most associated with this approach. A further section deals with product quality control and the various techniques and procedures it involves.

In chapter 4, we present the rationale underpinning the research hypotheses, together with the method adopted in designing and implementing the research instrument. This is followed by an examination of the structure and type of questions used in the survey and the statistical techniques applied for analysis and interpretation of the data. The chapter also gives a brief overview of the geographical scope of the survey and the various industrial categories included in the sample.

The data obtained as a result of the field research are discussed over chapters five, six and seven, each chapter dealing with a set of closely related aspects of quality management.

The main findings of the research are discussed in chapter 8 in the light of the research hypotheses, together with recommendations for further research on quality in the Saudi manufacturing sector.

Chapter 9 consists of a general conclusion and considers the policy implications of the research findings.

CHAPTER TWO

OVERVIEW OF MANUFACTURING IN SAUDI ARABIA

2.1 INTRODUCTION

Aware of the non-renewable nature of its main source of income, Saudi Arabia[1] has invested major efforts and resources in an attempt to reduce its over-reliance on oil and to establish a more broadly based economy. Strong emphasis is placed on manufacturing as a basic component of an overall industrialisation strategy formulated and developed through a series of five-year plans, the latest of which covering the period 1990-1995.

A review of this strategy is given in this chapter, together with an analysis of the relevant aspects of the Kingdom's five-year plans, as they serve to shed light on the development of the Saudi manufacturing sector and the role it is expected to play in the overall efforts of the country to reduce its dependence on oil. This is followed by a presentation of the various institutions involved in the promotion and development of manufacturing, together with the role of the private sector in this regard. A brief description of industrial activity in the city of Jeddah is also given, as it is the context in which all of the firms included in the sample operate.

2.2 SAUDI ARABIA'S INDUSTRIAL DEVELOPMENT

The Kingdom's political will to create a viable and modern Islamic state has meant that a large proportion of its oil revenues were invested in building the country's social and physical infrastructure, developing its human resources and laying the foundations necessary for the proper functioning of a modern industry, which is seen as a key component of the Kingdom's diversification strategy. Efforts have proceeded in this regard along the two parallel lines of establishing a petro-chemical industry in joint venture partnerships between the government and major international firms and of promoting private investment in manufacturing through a variety of incentives, including the establishment of industrial parks around the main cities, tax holidays, credit facilities, etc.

2.2.1 Background to Saudi Arabia's industrialisation strategy

Conceptualization of Saudi Arabia's development strategy was carried out in the face of obstacles which can easily be appreciated when we consider the embryonic nature of the Kingdom's economic base well into the 1960s and the primitive background against which formal planning was first introduced. As Johany (1982, p. 1) states,

> prior to the unification of Saudi Arabia in 1932, an integrated national economy did not even exist. Economic activity outside Hijaz (where the holy cities are located) was confined to livestock raising by Bedouins, primitive agriculture and production of simple tools by craftsmen who lived in small towns concentrated around sources of water.

Even in the early 70s, industrial activity was still on a very modest scale and was dominated by firms in trade and commerce. According to an industrial survey carried out in 1971, about 66% of all firms were engaged in commerce, with manufacturing accounting for just 16%. Most of the firms engaged in this sector were family-run businesses employing not more than 9 people. The range of activities carried on by these firms was limited to traditional occupations such as smiths, carpenters, bookbinders, handloom weavers, etc. (Looney, 1982)

Moreover, the traditional reluctance of Saudi private entrepreneurs[2] to invest in modern manufacturing was compounded by the underdeveloped nature of the country's physical infrastructure, inadequate supply of manpower and such vital facilities as electricity, roads and means of communication.

2.2.2 Role of industry in the Kingdom's development strategy

The vulnerable nature of an economy dependent on a single source for its income has been recognised and addressed very early on in the Kingdom's development process. The recent downturn in oil prices brings into sharp relief the 1990-1995 plan's statement that:

> while oil revenues have provided Saudi Arabia with the financial base to achieve rapid economic and social progress, they have also exposed the Kingdom to the highly volatile conditions of oil markets. The need to establish other strong economic sectors and income sources to meet the needs of a rapidly growing population has been recognised throughout the development plans. (Plan V, p. 4)

Thus, Saudi Arabia's industrial policy derives from the Kingdom's concern to diversify its economy away from the export of crude oil through the development of a wide range of industries capable of satisfying local demand as well as gaining access to the export markets. Industry is, therefore, a major component of the Kingdom's overall development strategy, its role being recalled in the 1990-

1995 development plan as follows:

> Industrial development is a key component of the economic development of Saudi Arabia, contributing to the achievement of some of the most important of the strategy's objectives: higher GDP growth rates; the diversification and expansion of the production base; the development of non-oil sources of income; the achievement of an adequate level of self-sufficiency; the transfer of modern technology contributing to increased production efficiency; the generation of job opportunities beyond traditional occupations; and, finally, the development of a balanced economy that can weather world economic fluctuations. (Plan V, p. 209)

The underlying strategy for the achievement of these goals, as summarized by Crane (1978, p. 145), has been to:

- rely on free enterprise as an economic dynamo and concert all governmental policies to promote healthy free enterprise;
- focus government efforts on exploiting Saudi Arabia's natural resources and encourage private industry also to do so;

- develop Saudi Arabia's own human potential as a major economic resource;
- marshal capital and manpower to work with private industry to develop the physical infrastructure of a modern economy.

2.2.3 Industrial development planning and achievements

As will be seen from the following review of Saudi Arabia's development plans up to 1995, the ultimate goal of securing an independent economy is being pursued through the targeting of various aspects of the key sectors of the economy and the gradual reduction of the country's vulnerability to foreign manipulation of a one-product oil economy.

In the Kingdom's first five-year economic development plan (1970-1975), the government stressed the values of Saudi society and the general principles which should underpin the aims of the plan. Within the context of the country's Islamic mission, the following needs were highlighted:

1. to safeguard the Kingdom's cultural and moral traditions and values;
2. to achieve a high level of social welfare and ensure the availability of services required by the citizens;

3. to consolidate the principles of a free economy within the framework of the public interest;
4. to continue to adopt a balanced approach to economic development;
5. to pay particular attention to the laying down and development of the basic infrastructure;
6. to improve government services.

The tangible results of this plan included the development of certain non-oil sectors, such as construction, transport, trade and government services. This, in turn, led to developments in the industrial sector, with the emergence of new industrial cities and the establishment of a variety of industries around the Kingdom's main growth centres.

In the 1975-1980 plan, special emphasis was given to the following aims:

1. development of the economic and social infrastructure;
2. optimum use of the Kingdom's industrial, agricultural and mineral resources;
3. diversification of sources of income, so as to reduce dependence on oil;
4. reducing the country's reliance on imports;

The aims laid down for the industrial sector included the following:

1. completing the task of establishing industrial cities;
2. preparing studies designed to stimulate industrial activity in the least developed regions;
3. establishing an industrial database;
4. paying special attention to industries whose activities are consistent with the general aims of the Kingdom, particularly those which can be supplied with raw materials from local sources.

The third five-year development plan for 1980-1985 can be seen as marking the beginning of a drive for comprehensive economic development, concentrating on the development of productive resources by greater involvement of the productive sectors in the generation of the country's GNP. With regard to industry, the main aims of the third five-year plan were as follows:

1. to take advantage of industrial development opportunities afforded by the resources available, whether natural or financial;
2. to consolidate the geographical spread of industries;
3. to continue to assign to the private sector the basic role in the implementation of industrial projects;

4. to work towards achieving self-sufficiency in products which are essential for national security and the public interest;
5. to continue to pay special attention to involving Saudi nationals in the industrial sectors and training them for this purpose;
6. to improve industrial capacity.

The fourth five-year plan covering the period 1985-1990 stressed the need to continue efforts to bring about real change in the country's economic structure and to concentrate on industry and agriculture as a means of diversifying the economy. As well as focusing on the completion of works to lay down the basic infrastructure, the plan also sought to encourage Saudi citizens to invest in industry in general and, in particular, industries which rely on local raw materials.

In addition to the foregoing, the main aims of the plan were as follows:

1. to consolidate existing industries and to make full use of their production capacity;
2. to emphasise the need for new technology and equipment and the modernisation of existing production plant and methods;

3. to encourage industrialists to promote marketing;
4. to reduce reliance on foreign labour as far as possible;
5. to emphasise the role of banks and development institutions in the financing of export operations;
6. to give priority to locally manufactured products in government purchasing;
7. to stress the role of the chambers of commerce and industry in promoting national industry, in solving the problems it faces and in coordinating commercial and industrial activities;
8. to underline the need for national industries to cooperate with and complement each other.

The fifth development plan (1990-1995) confirmed the importance of the part played by the industrial sector and the hopes of completing the policy of continuous and sustained support. Thus, the fifth plan included the following fundamental objectives for the industrial sector:

1. to maximize the domestic transformation of domestically produced raw materials and intermediate products, particularly oil derivatives and petrochemicals;
2. to encourage import substitution industries whenever it is economic to do so, in order to achieve a

reasonable level of self-sufficiency;

3. to encourage export-oriented industries which have a comparative advantage, and to provide adequate means and incentives required for their development;
4. to achieve integration and inter-linkages among activities in the industrial as well as other economic sectors;
5. to improve labour productivity;
6. to strengthen industrial cooperation among the Gulf countries and develop joint GCC industrial projects, within the framework of the joint economic agreement and the joint industrial strategy of the GCC;
7. to strengthen industrial cooperation between the Kingdom and other Arab and Islamic countries and to promote the Kingdom's role in joint Arab and Islamic industrial projects;
8. to develop industrial cooperation with foreign countries for the prudent and well studied transfer of technology and to attract foreign capital.

From an examination of the five development plans briefly reviewed above, it can be seen that they follow a logical sequence (Badawi, 1989): the first five-year plan laid the foundations; the second five-year plan saw the work of installation take place; the third was concerned with commissioning and the fourth with the production stage.

The fifth development plan, on the other hand, marks a transition from previous plans in that, in addition to consolidating the achievements of the last four plans, it seeks to lay the foundations for the future direction of the economy now that most of the infrastructure is in place. As such, the 1990-1995 development plan can be seen as marking a new phase in Saudi Arabia's economic development in which progress is to be achieved "as much through private sector initiative, as through government expenditure". (Plan V, p. 47)

To illustrate the underlying logic of this approach, we can take one of the aims of the first-five year plan and consider how this was developed in subsequent plans. For example, whereas the first plan sought to consolidate and expand existing industrial cities, the emphasis of the second shifted to consolidating the geographical spread of industries and to establishing new industrial cities in various parts of the Kingdom. Another example: while the stated aim of the first five-year plan was to make use of local resources and existing industries, the third and fourth plans emphasised the improvement of manufacturing capacity and encouraged the trend towards advanced technology industries. The shift of emphasis is justified by the fact that "the physical infrastructure has been largely completed and the process of economic diversification and of restructuring are well under way. High living standards and a healthy quality of life have been largely secured and the private sector is now ready to absorb more of the tasks which have previously been handled by central government agencies". (Plan V, p. 47)

2.2.5 The role of the private sector

Private sector involvement in the development of the Kingdom's industrial base derives from the firm belief that:

> economic and social change cannot be imposed on the country by the actions of the government alone, but must come about through increasing participation of all elements of society in both the process of development and its benefits. Only by continuously encouraging private enterprise - large and small companies, family businesses and individuals - to pursue these activities that they can undertake more effectively than government agencies, will the economy be able to benefit to the full from the ability and initiative of all its people. (Plan I, p. 21)

With most of the essential infrastructure in place, the private sector is now expected to take the lead in stimulating economic growth by extending and strengthening its existing productive and export capacities and by taking on new roles traditionally assumed by the government, particularly in the non-oil manufacturing sector, which is expected in the latest development plan to achieve growth rates of some 7.5% per annum. (Plan V, p. 87).

To this end, greater emphasis is given in the 1990-1995 development plan to encouraging competitiveness among Saudi producers. More particularly, the plan states as follows:

> The private sector must strengthen its competitiveness in the producing sectors. Adequate growth in these sectors cannot be achieved through expansion of the overall economy alone. Saudi producers must be able to compete more successfully against imports in a wider range of products in both the domestic and GCC markets. In addition, Saudi producers must also enhance their ability to produce a more diversified range of quality goods for export to regional and global markets. (Plan V, p. 142)

The private sector's perceived ability to provide the necessary stimulus for future economic growth comes largely as a result of the comprehensive package of incentives devised by the government to encourage private sector involvement in the establishment of local industries.

These measures include the following:

1. The provision of land at nominal cost for various projects, especially industry, and the supply to them of electricity and other essential services, together with subsidies for electricity and industrial consumption.
2. The exemption of all imported plant, equipment and raw materials from customs duty and other taxes throughout the life of the project (tax holidays were also granted to foreign companies for the first five years of production).
3. The establishment of an Industrial Development Fund to provide loans of up to 50% of the total costs of industrial projects.
4. The provision of information and data relating to various investment projects.
5. The preferential treatment of national products in government purchasing programmes.

In addition to this incentives package, the government also encouraged foreign investment in order to promote an inflow of the technology and expertise lacking in many local industries. This use of foreign expertise and the encouragement given to the establishment of joint venture projects were seen as a way to speed up the transfer of technology and to secure a variety of market outlets for Saudi products.

Foreign companies were encouraged to contribute to the industrial development of the country and to assist in the provision of expertise in the administrative and technical fields and in management training. The main countries involved in these projects are the United States of America and Britain, followed by Germany. The tremendous progress achieved as a result of all these measures as well as more recent initiatives is confirmed in the 1990-1995 plan which states as follows:

> The earlier concentration of private businesses in the construction and trade sectors has widened to include major agricultural enterprises and a proliferating array of manufacturing firms. Assisting the establishment of these new manufacturing companies has been the creation in recent years of a number of new investment companies which pool the resources of individual businessmen and combine aspects of venture capital, portfolio investment and project

development. Four such companies are the National Industrialization Company (NIC), the Saudi Advanced Industries Company (SAIC), the Saudi Venture Capital Group (SVCG) and the Saudi Industrial Development Company (SIDC).
(Plan V, p. 135)

A measure of the achievements made during the last two decades can also be seen in the huge increase in the number of manufacturing factories which jumped from 199 in 1970 to well over 2 300 in 1991 involving a capital investment of 97.7 billion Saudi Riyals, compared to less than SR 3 billion in 1970. (Ministry of Planning, 1992)

As was pointed out earlier, the growth and development of the industrial sector was helped in no small measure by the Kingdom's political and economic stability and by its policy of support for the free market and competition.

The combination of all of these factors has led to an increase in industrial activity and to great diversity in both production and services. Thus, industrial activity now covers a wide range of sectors, with factories engaged in the production of the following:

1. Foodstuffs such as drinks, meat products, canned vegetables and dairy products,
2. Textiles and ready-made clothing,
3. Leather goods,
4. Wood products such as domestic and office furniture and fittings,
5. Paper and paper products, printing and publishing,
6. Chemicals such as fertilisers and plastics, industrial gases, rubber products, medicines, detergents, cosmetics, paints, solvents, etc.
7. Mining - non-metal products, such as china, ceramics, building materials, etc. (excluding oil and coal)
8. Metal products, such as plant and machinery.

It will be seen from table 2.1 overleaf that, for the period between 1978 and 1993 alone, the number of factories established in the Kingdom increased from 1 017 to 2 354; the workforce grew from 67 531 to 140 542 and that total investment capital rose from SR 25.594 million to SR 294.436 million.

Table 2.1

Factories in Production in the Kingdom of Saudi Arabia arranged according to Industrial Activity and Period, showing Number of Factories, Manpower and Total Invested Capital during the period 1975-1993 . (Capital in SR.Million)

	Industrial Sector	1975 - 1978			1979 - 1982			1983 - 1987			1988 - 1989			1990 - 1993			Total		
		No. of Fact-ories	Man-power	Total Inv. Cap.	No. of Fact-ories	Man-power	Total Inv. Cap.	No. of Fact-ories	Man-power	Total Inv. Cap.	No. of Fact-ories	Man-power	Total Inv. Cap.	No. of Fact-ories	Man-power	Total Inv. Cap.	No. of Fact-ories	Man-power.	Total Inv. Cap.
1	Foodstuffs and Drinks	172	11421	3592	105	6706	1976	52	2897	1027	13	445	20359	23	934	384377	365	22341	411331
2	Ready-made Clothes and Textiles	16	1062	331	13	819	289	13	724	82	2	37	6900	16	1122	115210	60	3764	122812
3	Leather Products	3	200	23	4	256	23	2	112	25	1	37	1200	5	353	58900	15	958	60171
4	Wood Products	33	2191	290	27	1723	201	7	389	79	4	138	30960	14	1108	164240	85	5549	195770
5	Paper, Printing and Publishing	72	4781	90	38	2425	770	15	836	207	5	183	68913	12	582	162990	142	8807	232970
6	Manufacture of Chemicals and Petroleum, Coal, Rubber and Plastic Products	128	8500	2746	123	7848	41466	51	2840	7477	21	1241	254032	36	1614	475510	359	22043	781231
7	Manufacture of non-metallic mineral products, except Petroleum and Coal	297	19721	14356	173	11038	3133	68	3787	163	7	340	60600	35	1630	327642	580	36516	405894
8	Manufacture of fabricated metal products, machinery and equipment	275	18260	3773	215	13717	6551	91	2069	143	27	219	265122	61	1569	78827	669	35834	354416
9	Other Industries	21	1395	393	26	1658	230	20	1114	176	5	366	51400	6	197	327642	78	4730	379841
	TOTAL	1017	67531	25594	724	46190	54639	319	14768	9388	85	2944	759486	208	9109	2095338	2354	140542	2944436

Source: Industrial Statistical Publication,(1975-1993)

2.3 GOVERNMENT AUTHORITIES AND DEPARTMENTS RELEVANT TO THE INDUSTRIAL SECTOR

Industrial development in the Kingdom of Saudi Arabia has been accompanied by the establishment of the necessary institutions and regulatory framework to follow up and direct the national industry. The authorities and departments closely linked to this process are: the Ministry of Industry, the Saudi Industrial Development Fund, the Saudi Arabian Authority for Specification and Standardization and quality control laboratories.

2.3.1 Ministry of Industry and Electricity

Since its establishment in 1965, the major functions of the Ministry of Industry and Electricity have been: to ensure steady and balanced industrial development in the Kingdom, to create a suitable environment for the maintenance and encouragement of domestic industries in a manner that fully achieves the targets of the country's industrial strategy and, finally, to design policies and take appropriate action to enable less developed regions to attain sufficient industrial growth (Ministry of Industry and Electricity, 1965). The Deputy Minister for Industrial Affairs supervises the following departments:

1. The Foreign Capital Investment Committee, which is responsible for processing foreign investment applications for the purpose of licensing.
2. The Industrial Cities department, which is responsible for the supervision of existing cities as well as those to be set up in the future. It is also involved in assessing investors' applications to obtain land in the industrial cities.
3. The industrial licensing department, which is in charge of examining and evaluating applications for industrial licenses, whether these are for establishing new industries or expanding existing ones.
4. The Projects and Engineering Department, which is responsible for the provision of engineering and technical services to the Ministry's various departments and for assuming the technical supervision of the Ministry's projects.

2.3.2 Industrial cities

One of the most tangible incentives to encourage private investment in industry was the establishment of industrial cities where land plots are allocated to qualifying investors at nominal rates. They are built around the main towns, beginning with the cities of Riyadh, Jeddah and

Dammam and, as can be seen in table 2.2, page 32 below, work is still in progress to further expand existing cities and to establish new ones throughout the Kingdom.

Administered by the Ministry of Industry and Electricity, the industrial cities are equipped with all the essential facilities such as the supply of water, electricity, telephones, banks, offices, police and fire stations, health centres, parks, maintenance workshops and road networks inside and outside the cities. (Industrial Cities, 1987)

2.3.3 Saudi Industrial Development Fund (SIDF)

The establishment of the Fund in 1974 was the result of the directions issued by the Saudi government in order to provide private entrepreneurs wishing to invest in industry with the necessary finance in the way of soft loans and participation in share capital.

The total loans approved by the SIDF for industrial projects rose from SR 150 million in 1974-75 to the cumulative sum of SR 18.1 billion in 1989-90 with the industrial projects to benefit from these loans numbering approximately 1112. (Ministry of Planning, 1992)

Table 2.2 Industrial Cities in Saudi Arabia

Industrial city	Phase	Total area in square metres	No. of licensed factories	Remarks
Riyadh 1st city		451,000	59	Developed
Riyadh 2nd city	1st	4,700,000	251	Developed
	2nd	7,300,000	246	Developed
	Housing	3,000,000		To be developed
	3rd	4,000,000		
Jeddah	1st	498,000	37	Developed
	2nd	1,044,000	57	Developed
	3rd	3,228,000	121	Developed
	4th	4,002,000	118	Developed
	5th	2,664,000	5	To be developed
	Housing	924,000		
Dammam 1st city		2,704,000	133	Developed
2nd city	1st	3,100,000	117	Developed
	2nd	3,600,000	48	Developed
	3rd	4,000,000		To be developed
	Housing	2,676,000		
Al-Qassim	1st	675,000	23	Developed
	2nd	478,000	20	Developed
	3rd	346,000	13	To be developed
Al-Hasa	1st	538,000	24	Developed
	2nd	515,000	10	Developed
	3rd	456,000		To be developed
Makka		760,000	25	Being developed
Madina	1st	500,000	5	To be developed
	Remains	2,500,000		
Asir	1st	500,000	11	To be developed
	Remains	2,023,000		
Hail		3,000,000		To be developed
Al-jouf		3,000,000		To be developed
Tabuk		4,000,000		To be developed

Source: Kingdom of Saudi Arabia, Saudi Consulting House, 7th Edition, Riyadh, 1986.

The aim of the fund is to support industrial development through the provision of the following:

1. Interest-free medium and long-term loans to the new industrial establishments to be set up in the Kingdom.
2. Interest-free medium and long-term loans to existing industries for the purpose of expanding their activities, upgrading their equipment and introducing up-to-date technology.
3. Economic, technical and administrative advice for the industrial establishments.

2.3.4 The Saudi Arabian Standards Organisation (SASO)

Prior to the introduction of state planning in 1970, institutions to promote business reliability in Saudi Arabia were rudimentary or virtually non-existent, unlike the situation in the developed countries where such institutions have evolved over a long time in response to the concern of various businesses and professional bodies to protect their interests and those of their customers. (Crane, 1978)

It is against this background that the government became actively involved in the establishment of the various institutions and agencies necessary to promote business reliability and sound commercial foundations for the Kingdom's economy. The government's awareness of the role of quality standards in promoting business reliability and, more especially, of their importance in trade relations with other countries is evident in the country's first development plan which states that:

> standard specifications are essential prerequisites for more intensive trade and economic cooperation between countries and are important ingredients of any commercial policy. (Plan I, p. 275)

The importance of enforcing quality standards is further highlighted in the 1974-1980 plan in the following terms:

> there is a need for improved commercial codes and enforcement of quality standards so that people will gradually become accustomed to buying locally made products. (Plan II, p. 124)

SASO was thus established by the Ministry of Commerce in 1972 and, in addition to representing the Kingdom in the regional, Arab and international associations concerned with quality matters, the Organisation's functions as specified in the 1975-1980 plan are as follows:

> [SASO] will formulate, adopt, revise and promote national standards of all kinds; develop sampling and testing methods; formulate codes of practice; calibrate and verify measures and measuring instruments; administer quality marks; and disseminate the principles of standardization. (Plan II, p. 74)

The steps taken by the Organisation to spread awareness of the importance of quality standards include the following:

1. Launching quality awareness campaigns through the media.
2. Participating in exhibitions and conferences.
3. Providing consultancy services to industry.
4. Carrying out research studies[3] and organising quality-related training courses.
5. Providing and circulating books and other publications on specifications.
6. Publishing magazines for regular information on standards and specifications.

In addition to certification of the laboratories and information centres set up by the national industries, SASO also encourages manufacturing companies to improve quality by granting quality marks and certificates of conformity to industries with products meeting the requirements of Saudi standards.

2.3.5 Laboratories for quality control and assurance

Quality control and assurance laboratories, which come under the aegis of the Ministry of Trade, were first established in 1972 and can now be found in all the major ports of entry into the Kingdom. They are used to test and control the various materials and components intended for use in production by Saudi industry. Imports are sampled and tested to ensure that they conform to the relevant specifications laid down by the Saudi Arabian Standards Organisation. A decision is then made as to the suitability of the imported product for use by industry and/or the final consumer.

2.4 INDUSTRIAL ACTIVITY IN THE CITY OF JEDDAH

2.4.1 Location and strategic significance

The location of Jeddah on the Red Sea and its close proximity to the Holy Cities of Mecca and Medina made it a natural access and congregation point for the thousands of pilgrims who have flocked over the centuries to the Kingdom from all corners of the world. This explains to a large extent Jeddah's traditional reputation as a thriving commercial centre, well before the oil era and its subsequent position as the diplomatic capital of the Kingdom until the late 1980s, when the diplomatic corps was moved to Riyadh, the Royal capital. The city covers an area of approximately 3 810 square kilometres and its seaport is by far the most important for non-oil trade with the Kingdom. In addition, the headquarters of most of the major banks operating in the Kingdom were, until very recently, located in Jeddah. The same also applies to most of the main newspapers and magazines and business corporations of all kinds.

2.4.2 Economic development

Commercial activity in Jeddah first flourished in the 15th century when it became a trade centre between Egypt and India. After the opening of the Suez Canal, it acquired strategic importance as a link for the continents of Asia, Africa and Europe.

However, despite its strategic location for international trade and its significance as a point of entry for Muslim pilgrims, Jeddah's development into what it is today could not have happened without the security provided by the unification of the country and the massive injection of capital made possible by the Kingdom's substantial oil revenues during the 1970s and 1980s.

The economic opportunities which existed in the Jeddah region were hampered by the lack of security which characterized the whole of the Arabian Peninsula in the early part of this century. The removal of the security problem and the consequent increase in the movement of people and goods between Jeddah and other population centres in the Kingdom soon put the city in a privileged position for investment in all kinds of industries and business ventures. The increased oil revenues of the 1970s and early 1980s gave further impetus to this development, with Jeddah receiving the lion share of investments of all kinds, especially in trade and industry. (Al-Farsy, 1981)

Jeddah thus became a major pole of attraction for the large number of foreigners brought into the country to work on the extensive development projects undertaken by the government as well as the private sector. In turn, this led to a dramatic increase in demand for goods of all kind and to the proliferation of trading establishments, commercial centres, shopping malls, etc.

2.4.3 Development of industry in Jeddah

Much of Jeddah's current prominence as an industrial centre is due to the head-start it enjoyed at the beginning of the Kingdom's development process. Describing the state of Saudi industry in the early 1970s, Looney (1982) points out that more than one half of Saudi medium and small-scale industry was located in the Hijaz and northern Asir region.

The implementation of the Kingdom's successive development plans, especially during the period of rapid growth which took place between the mid-1970s to the mid-1980s led to the expansion of a hole host of industries, particularly within the industrial cities described earlier in this chapter.

Tremendous progress has been achieved in promoting domestic manufacturing in the city, with increased emphasis placed on consumer goods such as "foodstuffs (represented by modern dairies, bakeries, soft drink plants, date-packing and meat processing facilities), household goods (plastic bags, containers, detergents, insecticides and other chemicals, furniture and furnishings), and household appliances (such as refrigerators). (Looney 1982, p. 175)

Construction of the first phase of the industrial cities' programme in Jeddah began as early as 1969 and involved an area of about half a million square metres. Building of subsequent stages of the programme continued throughout the development plan periods and involved a total surface area of approximately 11 436 square metres.

By 1994, the combined total of manufacturing plants established in Jeddah amounted to 408 factories. Of these, 239 were located in the Jeddah industrial city and 169 plants within the city of Jeddah itself.

2.5 CONCLUSION

It will be seen from this examination of the development of Saudi manufacturing that it is of relatively recent origin and, as such, suffers from several of the constraints generally facing nascent industries, including the lack of technological and management know-how. Being mostly in the hands of the private sector, manufacturing has benefited to a lesser extent from the policy of technology transfer and know-how more actively pursued in the Kingdom's rapidly growing petro-chemical industry. In addition, the recent downturn in oil prices and the reduction in development expenditure now that most of the major infrastructure has been built has resulted in less favourable market conditions. These have been described by Hajjar (1992) as being characterized by the following:

- a decline in government orders,
- intense competition,
- a tightened lending policy on the part of banks and development funds,
- the disappearance of the abnormal profits associated with the oil boom era.

Against this background, TQM can be viewed as an important aspect of management know-how and a potentially critical factor in the ability of the manufacturing sector to adapt and develop[4]. Taking the wider context of the Kingdom's overall economic development, TQM can offer a fresh approach to the management of its productive capacities and an efficient means of ensuring that it achieves its development objectives. In this sense, there is much to recommend the parallel drawn by Alexander Hiam (1992, p. 348) between the quality revolution and the industrial revolution when he concludes:

> History tells us, by way of example, that countries not participating in the Industrial Revolution fell dramatically behind those that did. In fact, the Industrial Revolution marked

> the beginning of the now familiar division between first-world and third-world nations. [...] This gap proved extremely hard to close and it seems important now, not only that industrial development continue to be pursued by Third World countries, but that they not miss the boat on the quality revolution as well.

For these reasons, attention to implementation of a quality system in the Saudi factories has become a necessity which can no longer be ignored. The need to address the issue of quality is all the more pressing when we consider that, while every encouragement is given to the promotion of private investment in manufacturing, there are virtually no import barriers to protect locally produced goods from competition. Indeed, as Looney (1982, p. 142) points out, competition is viewed in national policy "as serving the interests of the local consumers and as being the best means of influencing the business community in the industrial field toward beneficial manufacturing and market-oriented projects. The government also considers that competition is the most effective means for selecting the investment schemes which suit the market requirements, for encouraging low cost-production and for fixing fair prices for both consumer and producer".

However, many businesses are still reluctant to effect the radical changes in their management structures which a modern quality approach requires. For most of these businesses, other issues such as securing the required manpower and materials take precedence and are thus given priority over quality. In addition, there is little cooperation between the manufacturing sector and the government bodies in charge of quality.

The critical role of quality and the lack of compliance with even the quality standards set by the government are confirmed in the Kingdom's latest development plan which set as two of the main goals of the Saudi Arabian Standards Organisation (SASO) the task of:

- protecting consumers by ensuring that both locally produced and imported commodities meet appropriate quality standards,
- improving the penetration of foreign markets by Saudi products, through ensuring that they attain high quality standards and specifications.

The plan further points out, however, that, "although compliance of local products and imports with Saudi approved standards is obligatory, SASO is not responsible for their direct enforcement". (Plan V, p. 247)

NOTES

1. See Appendix E for a brief description of Saudi Arabia's geographical location, regional composition and population.

2. For socio-cultural reasons, industrial activity has traditionally been shunned by Saudi entrepreneurs in favour of trade and services. For more details on the trader mentality of Saudi businessmen, see Alaqi (1979), Al-Johany (1982) and Looney (1982).

3. Quality-related initiatives which have been wholly or partly sponsored by SASO include:

    a. The decision to develop a quality assurance system taken at a meeting held by the Saudi Arabian Organisation for Specifications and Standards (Health Inspection and Food control, 1979). The meeting focused on the importance of quality control in the industrial sector and food manufacturing in particular.
    b. The First Arab Standards Conference for the Food Industry (FASCFI, 1983) which examined the problems of food production in the Arab world and ways in which it could be improved.

Other quality-related studies to have been carried out addressed issues and made recommendations which are applicable to the whole of the manufacturing sector. These include the following:

a. A study by the Saudi Chamber of Commerce and Industry (1984) which found that shortcomings existed in the application of quality control in industrial establishments and highlighted the need for greater efforts to develop quality control procedures for the production units and for greater cooperation between the relevant government bodies and the organizations involved in the production sector.

b. A study by the Standardisation and Metrology Organisation of the GCC countries (The Standards Review, December 1986). The focus of the study was on the problems and difficulties encountered in the application of food specifications and standards in the Arabian Gulf countries.

4. As Hughes (1984, p. 9) notes, "the ability to adapt and to innovate is critical to industrial progress and, therefore, entrepreneurial, managerial and technical capacities are perhaps the most important, and most elusive, qualities in the maturing of an

industrial economy". For a similar observation with specific reference to Saudi Arabia, see for example, Crane (1978), Alaqi (1979), El-Mallakh (1982) and Looney (1982).

CHAPTER THREE

THEORETICAL BACKGROUND

3.1 INTRODUCTION

The aim of the present chapter is to examine the main issues involved in TQM and the tools and techniques necessary for achieving quality, particularly in relation to manufacturing. Pioneering work in the field of quality control will also be reviewed as it helps explain how quality evolved into an issue of strategic importance for the survival and long-term success of businesses of all kinds.

3.2 THE CONCEPT OF QUALITY

Before one can assess the quality of a product or service in the business environment, there has to be a clear understanding of what is meant by quality. However, examination of the literature on quality and TQM reveals that while there is general agreement on the importance of quality and on the broad bases on which it should be managed, there is no such consensus on what quality actually means. Among the reasons for the lack of a consensus definition for the term is the fact that it is a complex concept which combines such notions as taste, status symbol, usefulness, reliability, value for money, etc.

Subjective definitions of quality, although conveying some kind of information to particular customers, are not very useful to the general customers of the whole range of consumer goods. Moreover, such definitions give no indication as to the reliability of the product or the value for money obtained, or helpful to the management of the industries for the purposes of controlling the product standards, eliminating errors and defects and satisfying the requirements of the customer. This relative nature of quality and the need to devise practical means of measuring and thus controlling it was recognised early on in this century by W. A. Shewhart (1891-1967) when he stated that:

> dating at least from the time of Aristotle, there has been a tendency to conceive of quality as indicating the goodness of an object. The majority of advertisers appeal to the public upon the basis of the quality of product. In so doing, they implicitly assume that there is a measure of

> goodness which can be applied to all kinds of product, whether it be vacuum tubes, sewing machines, automobiles, Grape Nuts, books, cypress flooring, Indiana Limestone, or correspondence school courses. Such a concept is, however, too indefinite for practical purposes.
> (Bounds et al 1994, p. 37)

In addition to the fact that quality applies to a vast and disparate array of objects, actions and relationships, there are various angles from which it can be perceived, hence the various definitions which have been given to the term. These include the following:

- "the totality of features and characteristics that bear on its ability to satisfy stated or implied needs" (BS 4778, 1987)

A slightly more detailed definition of quality is given in Feigenbaum (1991, p. 7) as:

- the total composite product and service characteristics of marketing, engineering, manufacture and maintenance through which the product or service in use will meet the expectations by the customer.

Definitions given by other leading quality experts and summarised, among others, by Huxtable (1995, p. 10) are as follows:

- "Fitness for use or purpose" (Joseph Juran)
- "Conformance to requirements" (Philip Crosby)
- "A predictable degree of uniformity and dependability at low cost and suited to market" (W.Edwards Deming)
- "... the development, manufacture, administration and distribution of consistent low cost products and services that customers want and/or need" (Bill Conway)

For Garvin (1988), the concept of quality covers eight strategic dimensions which need to be considered in deciding which aspects of a product are most likely to enhance its competitiveness. These are as follows:

Performance i.e. a product's primary operating characteristics.

Features characteristics and features which supplement the basic functioning characteristics of the product or service.

Reliability which addresses the probability of a product not working properly or breaking down altogether within a specific period.

Conformance refers to the degree to which a product's design or operating characteristics conform to pre-established standards.

Durability is a measure of how much use a person gets from a product before it deteriorates or breaks down to such a point that replacement makes more sense than continual repair.

Serviceability refers to the promptness, courtesy, proficiency and ease of repair. Customers' evaluation of product and service quality is affected by the timeliness of service appointments, length of time before service is restored, the nature of dealings with service personnel, effectiveness of the final repair, etc.

Aesthetics refers to how a product looks, feels, tastes, sounds or smells - all subjective issues highly dependent on personal judgment and preference.

Perceived quality refers to individuals' subjective assessments of product or service quality. Such assessment may be based upon incomplete information but often it is perceptions that count with customers. In such circumstances, advertising, images and brand names (quality inferences) can be critical.

A crucial factor in deciding which aspects to emphasize is to ensure that the selected dimensions contribute to making the product meet the implied or stated requirements expected or stipulated by the customer.

It is evident from the definitions and essential aspects of quality reviewed above that whatever parameters are selected, these must first and foremost meet the requirements of the customer. However, the issue of customer requirements and the comprehensive view of the quality function are only now gaining wider attention, reflecting the growing realization among businesses of all kinds that quality is a crucial factor in achieving commercial survival, let alone success and long term growth.

3.3 THE CONCEPT OF TOTAL QUALITY MANAGEMENT

As with the definition of quality, a certain amount of confusion persists as to what TQM actually stands for. For example, a number of quality experts freely interchange the term with total quality control (TQC), as in Feigenbaum (1991) and Dale (1990).

Others reject the use of TQM altogether, as is the case with most Japanese quality experts and Ishikawa (1985) in particular, who, anxious to preserve the distinctive nature of their approach to quality, continue to refer to their quality management systems in terms of TQC or company-wide quality control[1]. TQC is also the term preferred by Hutchins (1992, p. 11) who views TQM as "a sub-element of Total

Quality". Other authors such as Garvin (1988, p. 24) often use the term Strategic Quality Management in view of its appeal "to gain the commitment of top managers, whose interests were strategic and competitive."

These conflicting views on which terms to use should not, however, detract from the fact that most modern approaches to quality management agree on a number of factors as being essential to achieving quality at the lowest possible cost and on the need to meet the requirements of the customer, whose satisfaction is the key to commercial survival and the long-term success of the business undertaking involved.

This fact becomes amply evident when we consider the following definitions which describe TQM as follows:

a. a management philosophy embracing all activities through which the needs and expectations of customer and the community, and the objectives of the organisations are satisfied in the most efficient and cost effective way by maximizing the potential of all employees in a continuing drive for improvement. (Dale 1994, p. 10)

b. a people-focused management system that aims at continual increase in customer satisfaction at continually lower cost which works horizontally across functions and departments, involving all employees top to bottom and extends backward and forward to include the supply chain and the customer chain. (Bounds et al. 1994, p. 10)

c. a corporate business management philosophy which recognizes that customer needs and business goals are inseparable. It is appropriate within both business and industry. (British Quality Association, 1989)

Although phrased differently, these definitions stress that TQM is:

1. A management philosophy

   In other words, it is not a programme which, once implemented, can be left to take care of itself. Rather, it is a "belief" system which needs to be inculcated and continually promoted and reinforced.

2. <u>An all-embracing customer-driven approach</u>

This implies that it cannot apply in one sphere of activity and ignored in another. On the contrary, it must be applied consistently and in such a way that it is reflected in every action within an organisation and in its outcome.

This also means that the emphasis on meeting customer requirements must be seen to apply within an organisation, as well as between the organisation and its customers. There are throughout departments and offices of an organisation people who receive the work of others. Managers receive reports and typing from their staff, budget holders receive financial information from the finance department and so on. The quality of this work is good if the information, service or product is accurate, timely and designed properly for its intended use. Thus, a quality chain (or web) exists within any organisation, and a great deal of time, money and motivation can be lost if there are quality failures in any individual unit.
For example, Juran (1988) regards the effect on quality of the various departments (production,

marketing, purchasing, research, etc.) as a "spiral of progress in quality", as illustrated in the following diagram:

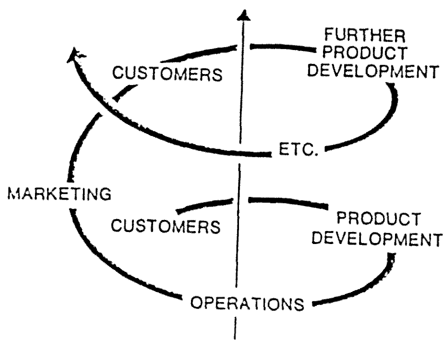

Figure 3.1: Spiral of progress in quality (Juran, 1988)

Each department has responsibility for its individual functions, but they also have company-wide functions such as finance, human relations and, of particular note, quality. This company-wide function occurs because the quality of a product is enhanced by the actions of each department in the spiral with a cumulative effect. They each ensure that their work is of the highest standard - deficiency free - and that it meets the needs of other sections. Moreover, as it is the customer who decides what constitutes quality, he should be the focus of all work and all efforts must be harnessed towards meeting his requirements.

If an organisation wishes to ensure it is meeting the customer requirements, then the starting point is to find out exactly what the requirements are. In other words, customer requirements have first to be understood and defined and then translated into standards against which all the products intended for that customer are measured. Thus, research must be carried out in order to establish how well the attributes and characteristics of the product match the needs of the customer and what steps need to be taken for this match to take place. For example, the marketing department must have an understanding of the ability of its organisation to meet the requirements of the customer, otherwise unattainable targets may be set and hence incur customer dissatisfaction. Equally important are the requirements between departments and individuals internally. If the organisation is to be efficient and effective, there needs to be a strong emphasis on information being communicated with respect to the requirements of each internal customer.

Again, to make sure that the requirements of the recipients of each aspect of work within the organisation are met, the requirements firstly have to be known, and secondly, they have to be managed as the attainment of quality will not happen by itself. In order to manage the information flow better, it is necessary for each person who supplies or receives work, products or services to be aware of the following:

- who their customers are,
- what their customers' needs are,
- how to keep up to date with their customers' needs,
- whether they are able to meet the customers' needs,

- how to monitor whether needs are being met on an ongoing basis,
- how to relate the above to their suppliers to ensure their own needs are being met.

3. A means to optimum use of human resources

One of the most significant lessons to have been learnt as a result of the Japanese success in the field of quality[2] is the importance of ensuring the motivation and goodwill of the workforce. To obtain the full cooperation of the workforce, however, it is necessary that their work and opinions are seen to be valued, that they are given the necessary training and tools to deliver what is expected of them and that the role models they are expected to emulate actually live up to their task.

Teamwork and shared objectives are the key to today's successful businesses, and this is a radical change which can take root only when appropriate changes in philosophy are actively and passionately held by the top management, and passed down through all levels of the company.

In traditional methods of management[3], managers are primarily concerned with planning, organising and directing a workforce whose role is limited to executing the decisions taken, with little involvement in the planning stages of their work or in devising solutions when things go wrong.

TQM requires a change in this basic philosophy so that managers, and all employees of a company, recognise the contributions they can make through motivation and and enthusiasm for achieving quality. Managers must show that they believe their employees can make important contributions to managing the business, creating an atmosphere which is conducive to allowing this to happen. The "them and us" attitude which is still prevalent in many organisations can only generate antagonism and produce a dictatorial or authoritarian approach to management, rather than a complimentary system which promotes relationships built on trust and cooperation.

Total quality management places great emphasis on the human element and the crucial role it plays in achieving quality as the pivot around which all other elements revolve.

These defining characteristics of TQM can be seen to constitute the most basic principles which should underpin any TQM strategy, regardless of the activity involved.

3.4 EVOLUTION OF THE TQM CONCEPT

3.4.1 Historical overview

It can be seen from the above discussion of the meaning of TQM that it is a complex concept which subsumes knowledge gained in various disciplines as to the meaning of quality and the practical aspects involved in its application. As Garvin (1988, p. 39) points out, "philosophy has focused on definitional issues, marketing, on the determinants of buying behaviour and customer satisfaction; and operations management, on engineering practices and manufacturing control".

Developments in the perception and management of quality are reflected in the various approaches adopted over the years, which are illustrated by Feigenbaum (1991) with the following diagram:

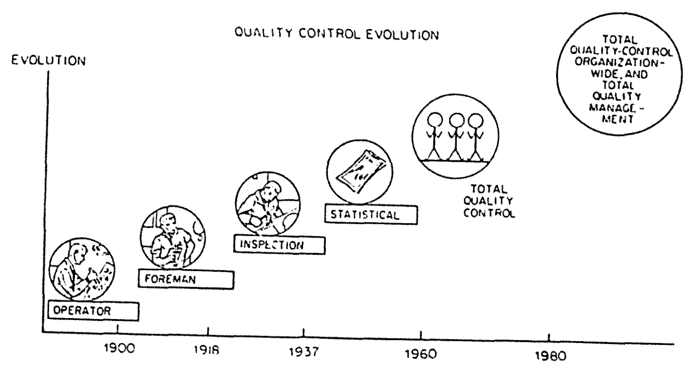

Figure 3.2: Quality Control evolution

The first step in the evolution of quality control is described by Feigenbaum as **operator quality control** where "one worker" or a very small number of workers was responsible for the whole production of the entire output. In this manner, each worker easily controlled the quality of his own work and hence the finished product.

The second stage, **foreman quality control**, came as a result of organising into larger production units or factories at the beginning of the twentieth century. Workers performing a similar task were grouped under the supervision of a foreman who was responsible for the quality of his group's output, which then contributed to the larger scale production of finished goods when all units were combined.

Inspection quality control developed during the first world war, reaching its peak during the 1920s and 1930s, when manufacturing systems became more complex and large numbers of workers were reporting to each foreman. To ensure a standard of quality in the production, it was necessary to engage full-time quality inspectors.

The next stage, **statistical quality control**, marks the beginning of quality control in the modern sense of the word and uses "scientific" tools and methods developed and refined over the years on the basis of pioneering work carried out by W. A. Shewhart during the 1920s and 1930s.

Total Quality Control, the fifth stage in the evolution of quality is defined by Feigenbaum (1961, p. 6) as follows:

> an effective system for integrating the quality-development, quality-maintenance and quality-improvement efforts of the various groups in an organisation so as to enable marketing, engineering, production and service at the most economic levels which allow for customer satisfaction.

Although this approach is shown in the diagram as having developed during the early 1960s, it was not until the late 1980s that it began to gain widespread acceptance in the West, when quality came to be seen as having played a major role in the success of Japanese industry to penetrate world markets and even dominate whole sectors of the world economy. As a result, quality acquired a strategic dimension in corporate thinking where it came to be viewed as a major determinant for business success.

This change in the perception of quality, and the consequent emphasis on prevention rather than detection, is seen in the literature as having occurred largely as a result of pioneering work carried out by such leading figures as Deming and Juran and the success of Japanese industry in not only implementing their ideas but in developing them further, demonstrating in particular the need for securing the total commitment of senior management and for providing adequate quality control training at all levels of the organisation[4].

Another major contribution to the field of quality is that made by Crosby, whose zero defect approach played a major role in the drive towards achieving quality "first time" and thus reducing the cost of quality[5].

3.4.2 Pioneering approaches to modern quality management

The specific approach advocated by each of Deming, Juran and Crosby is briefly reviewed here, in view of their impact on the evolution of the TQM concept, as illustrated by the comparative summary table given at the end of this section. A further consideration is the fact that almost all of the TQM systems being applied or advocated today are based on the ideas and solutions proposed by one or more of these so-called "quality gurus".

3.4.2.1 The Deming approach:

Although Deming's work[6] to promote quality started in the United States and dates back to the Second World, he did not receive attention in the West until his teachings have already been absorbed and successfully built on by the Japanese. His main contribution in this regard "was to help the Japanese cut through the academic theory, to present the ideas in a simple way which could be meaningful right down to production worker levels". (Hutchins 1991, p. 77)

Building on his initial work on statistical control and his experience of working practices and management structures in both the United States and Japan, Deming developed a quality approach which is encapsulated in the now famous fourteen points he recommends to management as a means of securing the long-term future of their companies, on the basis of quality and productivity. However, this goal can be achieved only once a number of barriers, referred to by Deming as the "deadly diseases", have been overcome. These include: lack of constancy, preoccupation with short-term profits, performance appraisal practices, mobility of management and their over-reliance on visible figures. Thus, companies must:

1. **Create constancy of purpose:** Be constant and purposeful in improving products and services. Allocate resources to provide for long-term needs rather than short-term profitability. Aim to be competitive, to stay in business and to provide jobs.
2. **Adopt the new philosophy**: Commonly accepted delays, mistakes, defective workmanship can no longer be tolerated, a transformation of Western management approach is needed to stop the downward spiral of decline in industry.
3. **Cease dependence on mass inspection**: as a way to achieve quality; build quality into the product in the first place. Demand statistical evidence of quality being built into manufacturing and purchasing functions.
4. **End the practice of awarding business on the basis of price tag alone**: Instead, require other meaningful measures of quality beyond price. Work to minimize total cost and not just initial cost. Move towards a single supplier for any one item on a long-term

relationship of loyalty and trust. Make sure purchasing managers realize they have a new job to do.

5. **Find problems**: It is management's job to improve the system continually, make better every process for planning, production and service to improve quality, increase productivity and decrease costs.
6. **Institute modern methods of on-the-job training**: Include management in the training to make better use of all employees. New skills are required to keep up with changes in material, methods, product design, machinery, equipment, techniques and service.
7. **Set up new ways of supervising production workers**: Front line supervisors should help people produce quality products, forgetting about the numbers game. Improvement of quality will automatically improve productivity. Management should initiate action in response to reports of inherited defects, maintenance needs, bad tools, confused operational definitions and other things that lead to bad quality.
8. **Drive out fear:** Fear robs people of their pride and of the chance to contribute to the company. Encourage top-down and bottom-up communications.

9. **Break down barriers between departments:** People in research, design, sales and production should work as a team to deal effectively with problems with products and service.
10. **Eliminate numerical goals, slogans, exhortations and production targets for the workforce:** Most quality problems have to do with processes and systems which are created by managers and are beyond the power of the employees. Such exhortations are simply a source of aggravation.
11. **Eliminate work standards that prescribe numerical quotas:** Instead, provide useful aids and supportive supervision. Use statistical methods for continuous improvement of quality and productivity.
12. **Remove barriers to pride of workmanship:** Listen and take action when workers report difficulties. Otherwise, they will soon lose interest in the job.
13. **Institute a vigourous programme of education and retraining:** Investment in people is vital for long-term planning.
14. **Take action to make the total transformation happen:** Create a structure in top management that will push every day on the above thirteen points.

3.4.2.2 The Juran approach:

Like Deming, Juran (1988) puts responsibility for quality firmly in the hands of management, arguing that 80-90% of the causes of poor quality is directly traceable to managerial actions. In his view, failure to meet specifications cannot be blamed on the workers unless and until:

a. They have the means of knowing what they are supposed to do.
b. They have the means of actually knowing what they are doing.
c. They have the means available to them of regulating their performance. (Dale and Oakland 1991, pp. 4-5)

Central to Juran's approach to quality management is the need to distinguish between control and break-through. For him, control means maintaining the status-quo and preventing adverse change. Break-through occurs when there is a change to a new and more desirable situation.

Quality is achieved through the "Juran trilogy", a sequence of three processes involving quality planning, quality control and quality improvement. The latter being achieved on an incremental basis, proceeding project by project towards the desired results. The contrast between what should happen under the processes recommended by Juran and the prevailing practice among companies has been summed up by Bank (1992, p. 73) as follows:

Table 3.1

End result of Juran's trilogy processes

TRILOGY PROCESSES	END RESULT
Quality planning: the process for preparing to meet quality goals	A process capable of meeting quality goals under operating conditions
Quality control: the process for meeting quality goals during operations	Conduct of operations in accordance with the quality plan
Quality improvement: the process for breaking through to unprecedented levels of performance	Conduct of operations at levels of quality distinctly superior to planning performance

Table 3.2

Juran's trilogy related to performance

Trilogy processes	Self-assessment by managers	Prevailing processes
Quality planning	Weak	Limited priority
Quality control	Very strong	Top priority by a wide margin
Quality improvement	Very weak	Very low priority

The ten steps Juran recommends for the implementation of a quality improvement programme consist of the following:

1. Create awareness of the need and opportunity for quality improvement.
2. Set goals for continuous improvement.
3. Build an organisation to achieve goals by establishing a quality council, identifying problems, selecting a project, appointing teams and choosing facilitators.
4. Give everyone training.
5. Carry out projects to solve problems.
6. Report progress.
7. Show recognition.
8. Communicate results.
9. Keep a record of successes.
10. Incorporate annual improvements into the company's regular systems and processes and thereby maintain momentum.

3.4.2.3 The Crosby approach:

Crosby gained popularity with the publication in 1979 of his book "Quality is free" in which he rejects the notion of acceptable levels of quality, asserting that the only measurement is the price of non-conformance. He maintains that the goal should be zero defects[7], arguing that doing "a job right the first time" can be achieved provided it is not assumed that error is inevitable. In his view: "Most human error is caused by lack of attention rather than lack of knowledge. Lack of attention is created when we assume that error is inevitable. If we consider this condition carefully, and pledge ourselves to make a constant and conscious effort to do our jobs right the first time, we will take a giant step towards eliminating the waste of rework, scrap and repair that increases costs and reduces individual opportunity. Success is a journey, not a destination." (Crosby 1979, p. 233)

Crosby recommends the use of what he calls a "quality management maturity grid" (see below) in order to measure the status of the company's quality improvement process. By considering the findings summarized in each block, it is possible to analyze the company's situation and then to set about improving the management accordingly.

QUALITY MANAGEMENT MATURITY GRID

Rater ______ Unit ______

Measurement categories	*Stage I: uncertainty*	*Stage II: awakening*	*Stage III: enlightenment*	*Stage IV: wisdom*	*Stage V: certainty*
Management understanding and attitude	No comprehension of quality as a management tool. Tend to blame quality department for quality problems.	Recognising that quality management may be of value but not willing to provide money or time to make it all happen.	While going through quality improvement programme learn more about quality management; becoming supportive and helpful.	Participating. Understand absolutes of quality management. Recognise their personal role in continuing emphasis.	Consider quality management an essential part of company system.
Quality organisation status	Quality is hidden in manufacturing or engineering departments. Inspection probably not part of organization. Emphasis on appraisal and sorting.	A stronger quality leader is appointed but main emphasis is still on appraisal and moving the product. Still part of manufacturing or other.	Quality department reports to top management, all appraisal is incorporated and manager has role in management of company.	Quality manager is an officer of company; effective status reporting and preventive action. Involved with consumer affairs and special assignments.	Quality manager on board of directors. Prevention is main concern. Quality is a thought leader.
Problem handling	Problems are fought as they occur; no resolution; inadequate definition; lots of yelling and accusations.	Teams are set up to attack major problems. Long-range solutions are not solicited.	Corrective action communication established. Problems are faced openly and resolved in an orderly way.	Problems are identified early in their development. All functions are open to suggestion and improvement.	Except in the most unusual cases, problems are prevented.
Cost of quality as % of sales	Reported: unknown. Actual: 20%	Reported: 3%. Actual: 18%.	Reported: 8%. Actual: 12%.	Reported: 6.5%. Actual: 8%.	Reported: 2.5%. Actual: 2.5%.
Quality improvement actions	No organised activities. No understanding of such activities.	Trying obvious 'motivational' short-range efforts.	Implementation of the 14-step programme with thorough understanding and establishment of each step.	Continuing the 14-step programme and starting Make Certain (a check that the programme is in place).	Quality improvement is a normal and continued activity.
Summation of company quality posture	'We don't know why we have problems with quality.'	'Is it absolutely necessary to always have problems with quality?'	'Through management commitment and quality improvement we are identifying and resolving our problems.'	Defect prevention is a routine part of our operation.'	'We know why we do not have problems with quality.'

Figure 3.3: Crosby's quality management maturity grid
Source: Dale and Oakland (1991)

His quality improvement strategy is also point-based and revolves around four basic principles which he calls "the absolutes" of quality:

1. Quality means conformance to requirements.
2. Quality is achieved by prevention. It is always cheaper to do the job right first time.
3. The quality performance standard is zero defects. In other words, acceptable quality levels or AQLs must not be tolerated.
4. Quality is measured by the price of non-conformance, not by indexes.

The fourteen steps recommended by Crosby for implementation of a quality improvement programme are as follows:

1. Make it clear that management is committed to quality
2. Form quality improvement teams with representatives from each department
3. Quality measurement: determine where current and potential quality problems lie.
4. Evaluate the cost of quality and explain its use as a management tool.

5. Raise the quality awareness and personal concern of all employees.
6. Take actions to correct problems identified through previous steps.
7. Establish an ad hoc committee for the zero defect programme.
8. Train supervisors to carry out their part of the quality improvement programme.
9. Hold a "zero defects day" to let all employees realize that there has been a change.
10. Encourage individuals to establish improvement goals for themselves and their group.
11. Encourage employees to communicate to management the obstacles they face in attaining their improvement goals.
12. Show recognition and appreciation to those who participate.
13. Establish quality councils to communicate on a regular basis.
14. Do it all over again to emphasize that the quality improvement programme never ends.

THE QUALITY GURUS COMPARED

	Crosby	Deming	Juran
Definition of quality	Conformance to requirements	A predictable degree of uniformity and dependability at low cost and suited to the market	Fitness for use
Degree of senior management responsibility	Responsible for quality	Responsible for 94% of quality problems	Less than 20% of quality problems are due to workers
Performance standard/ motivation	Zero defects	Quality has many 'scales'; use statistics to measure performance in all areas; critical of zero defects	Avoid campaigns to 'do perfect work'
General approach	Prevention, not inspection	Reduce variability by continuous improvements; cease mass inspection	General management approach to quality, especially 'human' elements
Structure	14 steps to quality improvement	14 points for management	10 steps to quality improvement
Statistical process control (SPC)	Rejects statistically acceptable levels of quality	Statistical methods of quality control must be used	Recommends SPC but warns that it can lead to 'tool-driven' approach
Improvement basis	A 'process', not a programme; improvement goals	Continuous to reduce variation; eliminate goals without methods	Project-by-project team approach; set goals
Teamwork	Quality improvement teams; quality councils	Employee participation in decision making; break down barriers between departments	Team and quality circle approach
Costs of quality	Cost of non conformance; quality is free	No optimum, continuous improvement	Quality is not free, there is an optimum
Purchasing and goods received	State requirements; supplier is extension of business; most faults due to purchasers themselves	Inspection too late; allows defects to enter system through AQLs; statistical evidence and control charts required	Problems are complex; carry out formal surveys
Vendor rating	Yes and buyers; quality audits useless	No, critical of most systems	Yes, but help supplier improve
Single sourcing of supply		Yes	No, can neglect to sharpen competitive edge

Figure 3.4:

Source: Dale, J. (1993)

3.5 ESSENTIAL COMPONENTS OF AN EFFICIENT TQM SYSTEM

From our above discussion of the development and meaning of TQM, it is evident that, for it to be achieved, it is necessary to ensure that all of its essential constituent elements are present, as summarized in the diagram below.

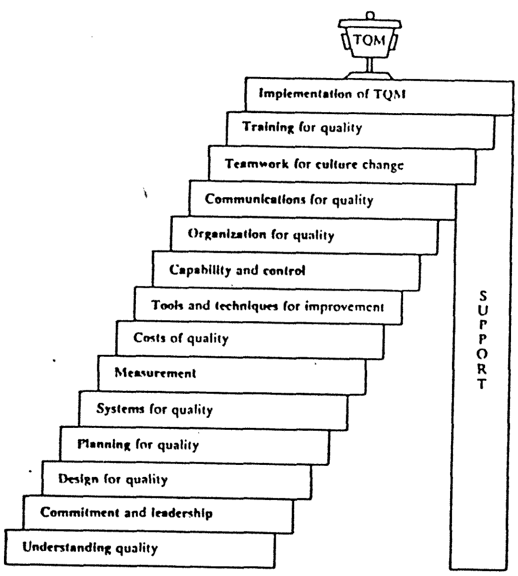

Figure 3.5: The Steps to TQM

Source: Oakland, J. (1993)

With reference to Saudi Arabia in particular, the most crucial aspects of these are, in our view, leadership, training and communication, each of which is discussed in more detail below.

3.5.1 Leadership

This means that in addition to issuing a clear statement of the organisation's quality objectives[8], senior management must ensure that overall responsibility for quality is placed at the executive level of the organisation or, as Oakland (1989, p. 289) points out, "quality must be treated like any other major managerial function, with a clear line of responsibility and command running up to an individual at the top of the organisation".

For quality-related initiatives to bear fruit, it is also necessary to ensure that managers at the operational level have the authority and the means to instigate such actions as may be required to achieve quality.

3.5.2 Training

The higher the level of competence of the individual worker, the greater the chances of achieving quality. For a successful quality management system, it is necessary to enlist the commitment of the workforce by encouraging enthusiasm for quality; they must believe in the importance and the potential benefits of the system. The problems faced by the management are more easily addressed if information is available on the workforce's knowledge and understanding of quality matters. Modern science is forever discovering new ways and means of production and controlling and monitoring the quality of output. As it is necessary to keep abreast of these developments, training has an important role to play in increasing knowledge and achieving quality-related goals. It is essential that the workforce should have the necessary skills.

However, enthusiasm and theoretical knowledge are not enough on their own. For an efficient training programme, a third element must be taken into account, namely performance skills. Training can raise the level of performance of the workforce provided that it is properly planned and correctly directed.

3.5.2.1 Aims of training

The aim of training is to develop individuals working on different tasks at every level within the organisation. Training raises morale and increases knowledge, skills and awareness of quality. The end result is the ability to produce products which satisfy the wishes of consumers at the lowest possible cost. However, training cannot be achieved over a short period. It is an ongoing process which will continue for so long as the organisation remains in operation. Therefore, when drawing up plans for training programmes, account must be taken of the knowledge, skills and motivation which the participants bring to the training process if the intended goals are to be achieved.

3.5.2.3 Types of training programmes

Training programmes will vary depending on the size and needs of individual organisations. Possible training programmes within the manufacturing sector may consist of the following:

1. Short intensive programmes directed at supervisors of different production centres within the factory in order to provide them with the latest information on modern methods relating to planning and quality control, focusing on the factors which affect the quality of production.

2. Short courses directed at senior and middle management to introduce the concept of TQM and the means by which to benefit from it as a tool for management planning, control and supervision, focusing on the economic and financial aspects of quality.

3. Quality related orientation courses held on a continuous basis for all new employees.

4. Simplified programmes directed at production line workers. Such courses aim to explain to the workforce the importance of controlling the quality of production and the effect of machinery and assembly processes on quality.

5. Detailed programmes directed at design sections and production technicians, as well as other departments and sections within the organisation. Such courses deal in detail with technological ways and means and statistical methods involved in TQM and quality control.

6. Special programmes designed to improve the competence of the workforce working in the field of production, maintenance, plant and everything concerned with quality. Such courses vary, depending on the nature of the product.

3.5.3 **Communication**

As we have already seen, quality is the responsibility of every individual in the organisation. This means that it is necessary to determine the role of each department or section and to systematise the work needed to ensure quality. Otherwise, the lines of responsibility would be blurred and the department responsible for the fault might not be called to account.

Thus, it is not only necessary to involve all of the departments, sections and staff of a plant or company at every administrative level, but also to define the tasks and duties assigned to them and to specify the lines of communication between them and their spheres of competence. In other words, a great deal of information and data has to be exchanged between various people within the factory in the form of reports, specifications, product information and information specially prepared for the management. For this reason, it is necessary to organise the means by which such information and data are obtained and to establish an efficient communications system between the administration and the workforce. This must apply in all directions of the management pyramid, i.e. the approach must include top-down, bottom-up and horizontal lines of communication, to ensure that information is received in the shortest time possible and at the lowest cost.

Our contention that all of the above need to be present necessarily means that the implementation of TQM cannot be carried out on a short-term basis.

Due to the complexity of the TQM concept and the fact that it is a radical change from traditional management and working practices, it is necessary to allow sufficient time for the individuals involved to understand the concept and to appreciate the various benefits a TQM system could bring to them and the company in which they work.

Time and patience are all the more necessary in societies generally characterised by their resistance to change, such as in Saudi Arabia where, due to a general rush to establish an industrial base, not enough attention is being paid to education and training.

For this reason, we feel that, while no single implementation model can be appropriate in all circumstances, the one proposed by Huxtable (1995) and reproduced overleaf is particularly relevant to Saudi Arabia, not least because of the top priority and emphasis given in his model to education and awareness.

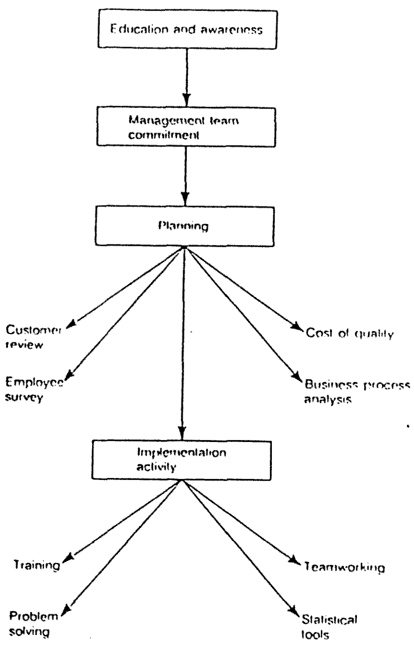

Figure 3.6 : A typical TQM implementation plan

Source : Huxtable, N. (1995)

3.6 TQM AND THE CONTROL OF PRODUCT QUALITY

Feigenbaum (1991, p. 737) makes the observation that "the acid test of the adequacy of a quality-control program comes during actual product manufacture". We would argue that, as far as manufacturing is concerned, the same observation applies to the quality system as a whole since it is product quality and the costs involved in achieving it which provide the most tangible evidence as to the efficiency or otherwise of the system.

The ISO definition of quality control states that it is "the operational techniques and activities that are used to fulfil requirements for quality." (ISO 8402, 1986) Unfortunately, however, this definition does not take into account the need for such techniques and activities to be part of an integrated system of quality management. It also does not address the issues of quality costs or customer requirements.

In the manufacturing sector, for example, the overwhelming tendency is for quality control to be used in its least effective mode, i.e. as a system for inspection and detection rather than one designed to prevent defects from occurring in the first place.'As Dale (1990, p. 7) points out, "an environment in which the emphasis is on making good the non-conformance rather than preventing it arising is not ideal for engendering team spirit, cooperation and a good working climate."

Moreover, this form of quality control is often the responsibility of "a quality department" with limited powers and influence within the organisation. Thus, instead of acting in concert with other departments in achieving quality and serving as the control centre for all quality related aspects of the organisation, the quality department is charged with a policing activity which often puts it in conflict with the production and other departments within the organisation. By contrast, in a prevention-based quality control system, the root causes of the problems encountered by the organisation are discovered and solved through team work involving all the departments and functions concerned.

The definition given in the Japanese Industrial Standards, on the other hand, is more consistent with modern approaches to quality in that it takes into account the crucial aspects of costs and customer requirements and reads as follows: "a system of methods for the cost-effective provision of goods or services whose quality is fit for the purchaser's requirements".

Commenting on the above definition, Ishikawa (1985, p. 44) takes the concept further and states that "to practice quality control is to develop, design, produce, and service a quality product which is most economical, most useful, and always satisfactory to the consumer."

A similar view is expressed by Feigenbaum (1991, p. 615) who states that "the basis for the effectiveness of a modern quality programme is the effectiveness of the specific quality-control applications that take place systematically and consistently in all marketing product plans, all production operations, all engineering designs, all equipments and processes, all employee relations, all production operations, all maintenance and service and all other relevant company activities".

Underlying modern approaches to quality is the total nature of the quality function. Therefore, product quality can be seen as being the sum total of the quality activities relating to the design, the materials and machinery, the processes and the human resources employed in manufacturing, maintaining and servicing the product. For this to come about in the most efficient manner, everybody in the company must be involved, not just a few engineers, statisticians or inspection workers.

3.6.1 PRODUCT QUALITY THROUGH THE APPLICATION OF QUALITY CONTROL JOBS

Feigenbaum (1991) divides the activities necessary for achieving product quality into the following "quality-control jobs":

1. **New-design control** which involves preproduction quality-control activities.
2. **Incoming-material control** which involves the activities carried on while vendor and other incoming parts and materials are purchased, received and examined.

3. **Production control** which involves quality-control activities carried on during active production and field service.
4. **Special process studies**[9] which involve the troubleshooting of quality problems.

The design stage can be seen as the most critical to the quality of a product, due to the fact that decisions concerning design can have a significant and long term impact on the organisation, particularly when errors continue to occur as a result of a design fault and the management decide that the fault is too expensive to correct. Feigenbaum (1991, p. 617) points out in this regard that "whenever a new product is planned and a new design begun, there will be potential risk for the company. Because this is so, there must be a thoroughly structured series of activities to minimize this risk and to assure the quality of the new design to satisfy the customer in the market place."

The importance of design control is easily appreciated when we consider that the quality, reliability and durability of a product are dimensions which cannot be incorporated into a product once it has already entered into the production phase. In other words, they must be present right from the design and planning stage. (Dale and Oakland, 1991)

Within the Saudi non-oil manufacturing sector, however, the design phase is rarely addressed as locally manufactured products are generally produced under license or in joint venture with foreign companies which usually take responsibility for the design specifications of the products involved.

Control of incoming materials, on the other hand, is extremely relevant to Saudi industry which, in common with other newly established manufacturing sectors, depend heavily on outside suppliers for all kinds of raw materials, parts, components, etc.

The same applies to the product control phase, the reason here being that, due to a lack of overall manufacturing maturity, local plants often suffer from most of the problems highlighted in Feigenbaum (1991) as making production control necessary, most important of which is the lack of quality awareness among a predominantly foreign and thus temporary workforce and the inadequate maintenance and general state of equipment and machinery.

To detect faults from the start, it is necessary to examine the products during the different stages of production. In this way, defective items are detected, the causes established and the corrective action determined.

Quality control represents the whole set of decisions and measures taken by the management to ensure that its products comply with the specifications laid down for them. One such decision concerns the place where quality control is to be carried out.

Quality control may occur at the point where the work takes place, after each successive stage, or it may be carried out at a particular location to which samples are taken (Al-Sharqawi, 1987). The choice will depend on the circumstances and the nature of the stages to be controlled, the testing and inspection procedures, the sampling procedures, the number of samples and the type of equipment used.

Whichever method is used, there are advantages and disadvantages, which are summarized by Ashmiwy (1982) as follows:

- The inspection operations are carried out quickly without interrupting production, as there is no need to waste time in taking work-in-progress to an inspection site and then bringing it back to the factory.
- The transport of samples between inspection site and factory is eliminated.
- The product in question may be too bulky to transport for inspection.
- On-site inspection is suitable when it is necessary to carry out inspections on a continuous basis throughout the different stages of manufacture or assembly.
- Faults can be detected quickly during manufacture and corrective action can be taken forthwith.

The disadvantages of on-site inspection include:

- The long waiting period for inspection to be carried out.

- The person carrying out the inspection may find it difficult or impossible to bring equipment - especially sensitive equipment - to the production site.

Separate specially equipped installations for inspection may be appropriate in the following cases:

- when the inspection operation requires the use of laboratory equipment and testing which would be difficult or uneconomical to provide in proximity to the production site
- when inspection needs to be carried out after completion of the manufacturing operation as this would help to determine the movement of finished products as they pass through specific inspection points
- when successive manufacturing operations are involved, such that on-site inspection would be a complex procedure
- when inspection is sample-based, the transport of the samples from the manufacturing site to the inspection

site generally has no negative effect and the cost involved is low.

The disadvantages include the increased costs of internal handling and transport. The possibility of delay in carrying out the inspection can also lead to an increase in the number of defective units.

3.6.2 THE TWIN FOUNDATIONS OF QUALITY: SPECIFICATIONS AND STANDARDS

3.6.2.1 Specifications

Dale and Oakland (1991, p. 21) define a specification as "a detailed statement of a set of requirements to be satisfied by a product, a material or a process, indicating procedure for checking compliance with these requirements." These can take the form of drawings indicating the measurements of the goods or written documents specifying colour, strength, solidity, chemical characteristics and other specifications which do not lend themselves to graphic representation. The requirements should be met entirely through the scope of the specification.

Oakland (1989) points out that, although standardisation does not guarantee that the best design is selected, if standards are used correctly, then the process of drawing up specifications should facilitate learning through innovation and a consequent adaptation of the standards.

While specifications are designed to ensure that the requirements of the customer are met, they nevertheless need drawing up in accordance with the production capabilities and processes available for meeting them.

The specification document should represent the main source of reference[10] for quality, whatever the product or service involved. It forms the basis upon which control is exercised and allows for independent checking and inspection at any stage of the production process. In confirmation of this, a specification is defined under ISO 8402 (1986) as "the document that prescribes the requirements which the product or service has to conform to". It must indicate:

1. The performance requirements of the product or service.

2. Parameters which describe the product or service adequately - dimensions, concentration, turn-round-time - and which are quantified in appropriate units of measurement.
3. The materials to be used by stipulating properties or by reference to other specifications.
4. The method of production or operations.
5. Inspection, testing and checking requirements.
6. Any references to other applicable specifications or documents. (Oakland 1989, p. 59)

The terminology of the specification should be clear and readily understood and not open to different interpretations. Moreover, specifications should contain at least three types of data: description or measurement of the quality characteristics, possible hazards and conditions of application and tests for verification. Other relevant data includes costs, tolerances, defects and failures. It is also necessary to ensure that a balance is struck so that the specifications do not contain too much detail or be too general, bearing in mind the technical level of the recipient of the document.

3.6.2.2 Standards

Whether the control function concerns new design, in-coming materials or the production process itself, it is necessary to establish the standards against which activities of all kinds are to be measured. For example, standards might indicate how well a product is to be made or how effectively a service is to be delivered. Standards may also affect specific activities or behaviours that are necessary to achieve organisational goals such as, for employees, coming to work on time, observing safety rules and respecting ethical guidelines when conducting organisational business. These standards are often incorporated into the goals as they are determined during the planning process.

A standard has been defined as a technical or management specification or other document. It is a precise policy statement which establishes the criteria necessary to ensure that a material, product or procedure is fit for the purpose it is intended for.

The establishment of standards relies upon the general approval and consensus of all interested parties. This process should make full use of the results of research and development, technological innovation and experience, based upon the requirements of the intended customer and aimed at the promotion of community-wide benefits. (Dale and Oakland, 1991)

Standardisation, i.e. the formulation, issuing and implementing of standards, is a process designed to improve efficiency by bringing consistency at the required level to the products and services of the organisation. Dale and Oakland (1991, p. 20) identify six main principles which are involved in effective standardisation:

1. Standards should be wanted. The production of standards relies upon voluntary agreements between the parties concerned for each of their stated purposes.
2. Standards should be used. Application of standards relies upon the voluntary relationships referred to in (1) above being extended to their uses. There is little point in establishing a standard if it is not going to be used. This usage should be envisaged and

borne in mind throughout all the stages of the standard's development.

3. Standards should be planned. The benefits (social and economic) should be compared with costs (preparation, publishing and maintenance). Standards should not hinder innovation or promote an excess of divergent and incompatible developments, both of which can prove costly.

4. Standards express what has been established or is about to be established. As standardisation requires agreement between parties, decisions as to when and how it is appropriate to standardise should take into account the pace of development in the industry concerned, the safety requirements, ecological issues, etc.

5. Standards should be reviewed at regular intervals and appropriate action taken. A standard which does not keep pace with changing needs and technology may become obsolete or even a hindrance.

6. Standards should not be duplicated. In order to be efficient, a standard should be formulated at a broad enough level to meet the needs of all interested

parties. Repeated efforts on identical subjects at different levels should be avoided.

For Ishikawa (1985, p. 62), the meaning of the term goes beyond the notion of national or company standards to include any method designed to achieve a particular goal. For him, "if a person designs a particular method, he must standardize it into the company's technology and property". He further points out that, as no standards are perfect - be they national, international or company-wide - it is necessary to ensure that they are regularly revised "to reflect the voices of consumers and their complaints as well as the requirements of the next process".

3.7 TOTAL QUALITY TOOLS AND TECHNIQUES

The first major breakthrough in the control of quality came with the use of statistical techniques for the control of variation. Other techniques to determine the extent of the variation and whether it is due to special or common causes have since been developed into what is generically known as Statistical Process Control (SPC). According to Oakland (1989, p. 246), "Statistical Process control methods, backed by management commitment and good organisation, provide objective means of controlling quality in any transformation process, whether used in the manufacture of artifacts, the provision of services, or the transfer of information". He further points out that SPC "is not only about plotting charts on the walls of a plant or office, it must become part of the company-wide adoption of total quality management and act as the focal point of never ending improvement".

Some of the tasks carried out by means of SPC and other statistical tools and problem solving techniques are listed in Dale (1990, p. 380) as follows:

- Collection, summarizing and presentation of data.
- Discovering and understanding problems.
- Finding and removing the cause of the problem.
- Assisting with the setting of priorities.
- Selecting problems for improvement.
- Identifying relationships.
- Structuring ideas.
- Performance measurement.
- Capability assessment.

- Planning.
- Implementing actions.
- Monitoring and maintaining control.

However, as Ishikawa (1985) notes, mastery of complex TQC techniques and aids to problem solving and decision making can only come about with the proper understanding and training in the use of the following seven basic tools:

1. Process flow charting. This gives an understanding of the inputs and flow of the process, by using symbols in a strict diagrammatical sequence.
2. Check sheets or tally charts. These are for recording direct observations and facts from the process in question. The duration, frequency of checks and degree of accuracy should be determined and the data recorded honestly.
3. Histograms. These are frequency graphs for values or groups of values. They are used to display the raw data obtained from check sheets in a meaningful way for comparative purposes.
4. Pareto analysis. This form of analysis works on the principle that if the symptoms or causes of defective

output are identified and recorded, it will be possible to determine what percentage can be attributed to any one cause. Based on the Pareto principle, a few of the causes can be shown to account for the majority of the problems. This can help prioritise the corrective action.

5. Cause and effect or fishbone diagrams. This is a problem solving tool by means of which problems are analysed and their root causes identified.
6. Scatter diagrams are used to plot correlations between two variables. Potential cause and effect relationships can then be analyzed on the basis of the extent of the correlations shown by means of the diagram.
7. Control charts. As we pointed out earlier, these charts are mainly used for the purpose of controlling various process parameters within statistically determined control limits. They can be likened to a system of traffic signals, the operation of which is based on evidence from the small sample taken at random during a process. A green light is given when a process should be allowed to run. The equivalent of an amber light appears when trouble is possibly

imminent. The red light shows that there is practically no doubt that the process has changed in some way and that it must be investigated and corrected. The most frequently used charts for variables are mean and range charts which are used together.

8. Graphs. These are the most common form of visual representation. Their main function is to present the general trends which can be extracted from numerical information, and to compare one trend with another. Graphs may include one, two or several curves, each representing a particular variable.

Other more sophisticated tools designed to assist in decision making, process improvement and problem solving are commonly referred to as "the new seven tools". These are listed in Oakland (1989, p. 255) as follows:

1. Affinity diagrams.
2. Interrelationship digraphs.
3. Tree diagram.
4. Matrix diagram or quality table.
4. Matrix or quality diagram.

5. Matrix data analysis.
6. Process decision programme chart (PDPC)
7. Arrow diagram

3.8 CONCLUSION

We have seen that the purpose of TQM is to ensure that all activities contribute positively to achieving the key objectives of the business through a systematic approach to quality and that the main challenge facing its efficient application is the extent to which senior management can demonstrate leadership and generate commitment and enthusiasm through adequate training and motivation of the workforce. This is because no amount of sophisticated technology, quality documentation and procedures can deliver quality unless due account is taken of the human skills which are brought to bear on their implementation. As Feigenbaum (1991, p. 737) points out, "without high plant morale and motivation, without a genuine desire throughout the company and its service sectors to produce and maintain products of high quality - including safety and reliability - without adequate communication of quality objectives throughout the plant, the more technical product control methods can have few lasting results."

At factory level, it is necessary to ensure that the following requirements are present:

1. The factory management must believe in the need for production quality control. Faults must be recorded and their causes examined. This can only be achieved if all the human and material resources necessary to carry out accurate controls are provided. This becomes apparent in areas where there is fierce competition between various companies producing particular goods and services and the consumer pays close attention to product quality before making a purchase. The same applies when the management is concerned about the damaging effects which may arise if the company products are found to be defective in any way. Similarly, this arises where the factory would become liable for compensation if harm comes to the consumer from its products. Moreover, the state may intervene in matters of quality control and compliance with

standards, forcing the factory to comply with specifications and to inspect all its output.

2. Workers must be trained so that they can exercise as much self-control as possible over their own work. This will not only help promote "quality mindedness" among the workforce but also raise their awareness as to the importance of adhering to the stipulated specifications and apply them accurately. As Juran points out, "failure to meet specifications cannot be blamed on the workers unless and until:

   - they have the means of knowing what they are supposed to do,
   - they have the means of actually knowing what they are doing,
   - they have the means available to them of regulating their performance. (Dale and Oakland 1991, p. 5)

However, such a situation can only come about if the factory management takes an interest in the workforce by providing the necessary training and applying a system of incentives and rewards in recognition of a job well done.

3. To implement the system, the necessary human and material resources must be provided. The inspection of materials, equipment, stages and products may require specific equipment and precision apparatus. If the equipment is unavailable or old, the results may be inaccurate. On the other hand, the equipment may be available but the results given are misleading because of lack of maintenance or because of failure to test and calibrate it.

4. Attention must be paid to procedural aspects such as record keeping, documentation and document routing, information flow, etc.

5. Solutions must be sought which address the root causes of non-conformance in products and processes. This means that senior management must be prepared to look to the long term and avoid the temptation to simply "mend" the situation at the least possible short term cost. All the efforts exerted to achieve quality will

be in vain if the results are not used to deal with the faults and problems underlying quality breakdowns.

NOTES

1. Although the Japanese first sought to emulate the West, they soon realized that Statistical quality control (SQC) could only be of benefit if it is used within an overall strategy, actively supported and promoted by top and middle management. This shift towards viewing quality as a management issue began with Juran's visit to Japan in 1954, which "marked a transition in Japan's quality control activities from dealing primarily with technology based in factories to an overall concern for the entire management.[...] The Juran visit created an atmosphere in which QC was to be regarded as a tool of management, thus creating an opening for the establishment of total quality control as we know it today." (Ishikawa 1985, p. 19)

   This is also the stage at which leadership in the field of quality began to shift almost imperceptibly from the United States to Japan which gradually perfected quality control into a company-wide approach requiring the participation of every department in the organisation. Thus, in addition to the quality assurance activities for products, quality control involved collection of quality information by the business department, checks on purchase data and acceptance of parts in the purchasing department, teaching and training of quality control in the personnel department and overall customer/supplier relationships such as increasing output, cost cutting, etc.

2. Many theories have been put forward as to why Japan managed to overtake the West in the field of quality. According to David Hutchins (1990, p. 49), Japan succeeded where the West had failed mainly because "the Japanese identified the Taylor concept with their failures, and associated it notably with low motivation, low job interest, absenteeism, and so forth".

Kaoru Ishikawa (1915-1989) cites a number of cultural, social and even religious reasons for Japan's achievements in this regard. However, the most convincing of his arguments is the one retained by Hutchins, namely the failure to address the drawbacks of Taylorism, which Ishikawa saw as no longer applicable when "workers are well educated and self-aware", castigating it for not recognizing the hidden abilities workers possess, ignoring humanity and treating workers like machines. "Under such conditions", he argued, "it is not possible to expect products with good quality and high reliability". (Ishikawa 1985, p. 25)

3. Taylorism continues to be seen as a major obstacle to TQM implementation in that, by separating the tasks of planning and checking from that of actually doing the work, it leaves the person doing the work with no sense of responsibility or incentive to improve the quality of his work.

4. For an acknowledgement of Deming and Juran's contribution to the development of quality in Japan, see Ishikawa (1985).

5. Although the issue of quality costs is beyond the scope of the present thesis, it is worth noting that it is of particular significance in TQM because, as

Dale and Oakland (1991, p. 41) point out, "quality costs display the importance of quality-related activities to management in meaningful terms and often help to galvanise people into action. They are also helpful in educating staff in the concepts and principles of TQM and in explaining why the organisation is setting out on the TQM journey".

Quality costs are commonly divided into the 3 categories of failure (internal and external), appraisal and prevention. Internal failure costs occur when products/services fail to reach the designated standards prior to customer purchase. They include scrap, rectification, re-inspection, downgrading to lower prices, waste and the resulting analysis of costs of these failures.

External failure costs result when products/services are not up to standard but are only detected after being transferred to the customer. These include repair and servicing, warranty claims, complaints, returns, legal liability and the loss of customer goodwill and reputation.

Appraisal costs are those incurred through evaluation of materials, processes, products and services whilst ensuring that specifications are adhered to. Particular procedures include verification of materials/appraisal against specifications, quality audits, the equipment and associated running costs of appraisal equipment and vendor ratings which assess all suppliers to the business.

Prevention costs are incurred through the design, implementation and maintenance of the quality system to eradicate future quality failures. These include determining the products/services requirements, quality planning, quality assurance, appraisal equipment (plus associated running costs), training, and general quality management activities. Failure costs are highest where quality levels acceptable to the customer are being poorly met. Where proper investment in prevention (and to a certain extent appraisal) occurs, failure costs will fall dramatically, making it possible to recover and exceed the initial investment in quality.

6. For more details on Deming's work and contribution to the field of quality management, see Walton 1989.

7. Prior to Crosby's popularization of the zero defect approach with his books, "Quality is Free" (1979) and "Quality without Tears" (1984), the prevailing assumption was and, in many instances, still is that, although it is possible to control and even eliminate all forms of variation, there comes a point when doing so becomes economically unacceptable, hence the necessity to set acceptable quality levels (AQLs).

   However, this notion of AQLs is increasingly being challenged for assuming that there is such a thing as "enough quality". As Crosby (1979) argues, to set acceptable levels of quality is to accept that mistakes are inevitable. For the zero-defect enthusiasts, the only course of action is to "do it right the first time". However, the zero defect approach has come under criticism for being "heavy on philosophy, motivation and awareness and lean on specific proposals and problem-solving techniques" (Bounds et al. 1994, p. 59).

Notwithstanding these criticisms, the zero defect approach has nevertheless served to focus attention on the fact that perfection is a goal worth striving for and that this can be achieved through continuous improvement.

8. For a discussion on the purpose and possible forms of quality policy statements, see Dale 1994 (p. 253-254).

9. This 4th "quality control job" needs to be carried out concurrently with the other 3 jobs and is, therefore, not developed under a separate section here. The two elements which are essential for carrying out special process studies, namely "coordination of company efforts and employment of the best technical methods" (Feigenbaum 1991, p. 807) are examined under sections 3.3 and 3.7 respectively.

10. Although the ISO 9000 series of standards and other national equivalents such as BS 5750 have not been specifically referred to here, their main provisions are implicitly reflected in the various quality-related issues examined in the present thesis.

We should point out, however, that although the installation and/or accreditation to the ISO 9000 series or equivalent is increasingly required of many manufacturing as well as service companies, it can only be regarded as just one step towards the implementation of TQM and should, therefore, not be taken as the end goal.

CHAPTER FOUR

RESEARCH RATIONALE AND METHODOLOGY

4.1 INTRODUCTION

The present chapter examines the main characteristics of the field survey carried out among Saudi manufacturing companies operating in and around the city of Jeddah, with the aim of obtaining empirical evidence on the difficulties facing TQM implementation in the Saudi context.

The chapter is divided into three main sections. The first section is devoted to a discussion of the hypotheses formulated for the purpose of designing the survey instrument and takes into account the information presented in chapter 2 relating to the features characterising Saudi Arabia's economic development in general and the knowledge gained from the literature on the principles underpinning the TQM concept (see below).

The second main section is devoted to a presentation of the survey instrument in terms of design, validation and structure of the questionnaire, together with the statistical techniques employed in the analysis and interpretation of the survey data.

The third and final section recalls the main features of the geographical context of the survey sample and the various categories of manufacturing activity covered by the survey.

In our discussion of the main principles underpinning the TQM concept, we have seen that achieving quality is no longer regarded simply as a matter of making products which conform to specifications but of ensuring that the requirements of the customer are met at the least possible cost through optimum management of the human and material resources deployed in the process of delivering quality.

In practical terms, this means that a minimum number of conditions need to be met at both the organisational and production levels, depending on the commitment of senior management to quality and on how high it is ranked in their order of priority. At the organisational level, this commitment needs to be translated into the following minimum actions:

1. a clear definition of the goals of the organisation with regard to quality, ensuring that they are clearly communicated and understood throughout the organisation,
2. the establishment of a management framework which

encourages cooperation between various departments, ensuring that well-defined lines of communication are established so as to allow for an efficient exchange of information between the various functions,

3. the promotion of team spirit and cooperation among all the individuals involved in the business through constructive criticism and volunteering of suggestions on the part of employees, regardless of their hierarchical status within the organisation,
4. the provision of the necessary training so as to obtain the commitment of the workforce to the goals of the organisation and also to ensure that each worker is adequately equipped to exercise control over the quality of his work,
5. the deployment of various research tools to ensure that the needs and requirements of customers (internal as well as external) are known and acted upon.
6. the establishment of clear procedures for ensuring strict adherence to the internal as well as external standards and specifications laid down for the organisation's work processes and products

At the production level, the quality control function must be so structured as to concentrate on defect prevention rather than on detection and should ensure that:

1. all the necessary quality control jobs (see chapter 3, section 3.6.1) are regularly and systematically carried out,
2. modern methods of quality management are used, particularly the statistical tools and techniques necessary for the control of various production processes,
3. defective products are detected before they leave the factory and that they are adequately segregated and disposed of.

Having established the minimum requirements necessary for the efficient management of quality, we now turn to the method adopted in assessing the extent to which they are present in the Saudi context.

4.2 RESEARCH HYPOTHESES

As we pointed out in chapter one, a major difficulty facing the Saudi researcher is the paucity of reliable data on large sectors of economic activity, including the manufacturing sector. Thus, as no comparative study on the issue of quality in Saudi manufacturing has come to our knowledge, the approach adopted is mainly exploratory in nature and takes, as a starting point, a number of hypotheses on the current situation of this sector. At the organisational level, our main hypothesis is that there is little awareness of TQM or the principles involved in its implementation. Consequently, we expect the sample to display all or some of the following features:

1. Lack of understanding of the TQM concept.
2. Lack of cooperation between the various departments and an inefficient system of communication and information exchange across the various functions within the organisations.
3. Little encouragement being given to employees wishing to express their opinions and offer suggestions and no explanation is offered to them as to the company's objectives or changes in its work policies, thus failing to promote a sense of belonging and team spirit among the workforce.
4. Not enough attention being given to training the workforce in improving the quality of their own work or in developing efficient methods for controlling the quality of production.
5. Inadequacy of the methods used to assess the needs and wants of customers.
6. Where product specifications and standards are set, these are likely to be insufficient or not correctly complied with.

At the production level, the main assumptions underlying the present research are as follows:

1. Quality control is mostly inspection based, with inadequate use being made of modern methods of quality management and statistical quality control tools.
2. The quality standard of locally produced goods is generally low and there is a high proportion of defective items reaching the market for lack of systematic defect prevention measures and inadequate control of incoming and in-process materials.
3. Efforts to promote quality on the part of the government are not followed up by concrete programmes to promote greater cooperation between the government bodies responsible for quality and the producers.

These hypotheses have been formulated by taking into account the fact that, as we saw in chapter 2, development of modern manufacturing in Saudi Arabia only began with the 1970-1975 development plan. Moreover, most of the efforts initiated by the government[1] were mostly concentrated on the petro-chemical industry as a way of exploiting the comparative advantage afforded by the Kingdom's natural resources.

Consequently, the policy of transfer of the necessary technological and management know-how actively pursued in this sector did not extend to other manufacturing, which was mostly left to the private sector.

Moreover, due to the gap which usually characterises the introduction by developing economies of new technology and know-how, Saudi manufacturers have as yet to gain full awareness of the strategic role of quality and the scope of its application beyond the traditional area of conformance to standard specifications.

This view is supported by observations made in the literature with regard to TQM adoption, which often depends on the degree of maturity reached by individual organisations and on the way they perceive themselves and the markets in which they operate. Crosby (1979), for example, argues that commitment to quality depends on the stage of maturity[2] reached by company management.

A similar observation is made by Dale, Broaden and Lascelles (Dale 1990) who have identified six different levels[3] of TQM adoption among European companies.

4.3 RESEARCH INSTRUMENT

The use of a self-completion questionnaire seemed the most appropriate instrument to test the above hypotheses because it represents a relatively inexpensive means of collecting information and usually provides a rapid turn-around time.

Moreover, the questionnaire has the advantage of increasing the generalisation of the data while, at the same time, giving the respondents more freedom to express their points of view.

4.3.1 Design and validation

The design of the questionnaire was based on the knowledge gained from the literature on TQM and its evolution, the features characterising Saudi Arabia's economic development as described in the literature on developing countries and Saudi Arabia in particular and on the Saudi official publications[4] available at the time the present research was undertaken.

In view of the relatively recent history of manufacturing in Saudi Arabia and to ensure relevance of the questions to the wide spectrum of industries covered by the survey, only the most salient features of TQM were retained for our investigation, with greater emphasis being placed on issues relating to quality control of production and the processes it involves. As we shall see in more detail below, most of the products manufactured locally are either import substitution products or products manufactured under licence which do not require any design capabilities on the part of the local manufacturers. The design stage of quality control is, therefore, not addressed in the questionnaire, focusing instead on finding out whether Saudi manufacturers practice any quality enhancing measures such as training, record keeping, use of statistical tools, etc.

With regard to the main processes involved in the quality control of production, the questions were designed to cover those aspects and stages which are judged to be applicable across the manufacturing industry, regardless of which product or manufacturing process is involved.

In formulating the first draft of the survey instrument, great care was taken not to alienate the respondents or discourage them from completing the questionnaire. In particular, as little specialist terminology as possible has been used and most of the questions were close-ended, in view of the advantages usually associated with this type of question, most notable of which is the fact that, as they require little active input other than a yes/no or a tick of the relevant answer, they ensure greater cooperation on the part of the respondents. Moreover, they are seen as particularly suitable to the nature of the present research since they allow for comparisons to be made between the various industries covered in the survey and make it possible to obtain a reasonably accurate measure of the extent to which quality control is applied across them.

The draft questionnaire was written in English and then translated into Arabic. The questions were then submitted to a number of lecturers at the Management Department of the Faculty of Business at King Abdul Aziz University in Jeddah, Saudi Arabia. In addition, one lecturer in the English Department and one in the Arabic Department of the same university were asked to check the English and Arabic versions to ensure that they were free of grammatical errors. The questionnaire was then given to a number of factory managers for completion, followed by face-to-face interviews with the researcher to discuss the questions and to hear the respondents' comments as to the clarity of the questions, their relevance, etc.

A final draft was then drawn up, incorporating the comments obtained from the piloting exercise. A covering letter in

Arabic and English was enclosed, explaining the aim of the study and assuring the respondents of the confidentiality of their replies. Arrangements were also made between the Faculty of Business at King Abdul Aziz University and the Ministry of Industry in Jeddah in order to facilitate the task of the researcher, making it possible to obtain information on the factories operating in the Jeddah area and introductory letters explaining the aim of the study (See Appendices A and B).

4.3.2 Survey questions

The questions retained for the survey fall into 3 categories. In addition to a section on the concept and implementation of TQM and one on the quality control of production, a third set of questions has been included with the aim of establishing the general profile of the factories surveyed in terms of the following:

- Categories of workers employed and percentage of Saudi nationals among the workforce.
- Distribution markets.
- Areas of competition with local and imported products.

As we pointed out earlier, one group of questions relates to the degree of understanding of the TQM concept[5] and the extent of its application among Saudi factories. However, to assess whether any of the TQM principles are actually put into practice, further details were sought through questions dealing with two major aspects of TQM, namely employee involvement and the notion of customer requirements. With regard to the first of these aspects, the questionnaire sought to elicit information on:

- The extent to which regular meetings are held between various departments within the organisations surveyed.
- The importance given to employee participation and team spirit.
- The extent to which company objectives are communicated to employees and whether changes to work policy and practices are explained to them.
- The extent to which employees are encouraged to voice their opinions and offer suggestions.

Issues involving the customer are assessed through questions on the following:

- Methods used to establish customer requirements.
- Availability of customer specifications.
- Difficulties encountered in establishing customer

requirements, complying with customer, national or international specifications.

The questions concerning quality control of production concentrate on the degree of conformity to specifications, and the control methods used prior to production, during manufacture and upon completion of the production process.

The extent to which Saudi manufacturers are aware of the importance of a preventive approach to quality is addressed through a group of complementary questions relating to the following:

- Availability and effectiveness of information and communication systems.
- Position of the quality function within the organisation.
- The provision of training in quality management, product quality control and the use of measurement and control tools.
- The use made of records and statistical methods.
- Relations between the manufacturing companies and government organisations with regard to quality.

4.3.3 Data analysis

Analysis of the data was carried out by grouping the returned questionnaires according to the 7 manufacturing categories listed in the table below. The MINITAB programme was used to facilitate statistical analysis and interpretation, applying the following statistical techniques: percentages, frequency distribution tables and non-parametric analysis using chi-squared tests. The chi-squared tests used the value of the chi-square approximating statistic (shown after the table) compared to the critical value given in X^2 distribution tables (see Appendix D) at the appropriate significance level and degrees of freedom. This indicates whether the attributes were possibly related or not related. Furthermore, the conditions for the chi-squared tests were met in nearly all the cases by combining appropriate rows and/or columns where necessary. The sample size in all the cases met the criteria of greater than 50.

4.4 GEOGRAPHICAL SCOPE AND SIZE OF THE SAMPLE

4.4.1 Geographical scope

The sample is geographically limited to the Jeddah Industrial area in view of the costs and difficulties involved in contacting personally all the Saudi industrial companies throughout the country. Another constraint was the limited time scale of the field study, which lasted from February to the end of April 1994.

Despite this limitation, the sample can be considered as truly representative of Saudi industry as a whole, not least because of the demographic, social and economic position of Jeddah and the western region as a whole in relation to other regions in the Kingdom. As the Saudi city with the longest tradition in manufacturing, Jeddah can be seen as the natural home of entrepreneurial talent and a major pool for management know-how among Saudi nationals. In addition, the city of Jeddah remains the commercial capital of the Kingdom and a yardstick by which vitality of the local economy is judged, despite the major developments which have taken place elsewhere in the Kingdom.

For example, commenting on the pressures of the Kingdom's rapid industrialisation on utilities such as electricity, the Financial Times states that: "by far the biggest demand has come from the Western region [which] consumes 40 per cent of power supplies but produces only some 25 per cent of aggregate power. The second largest consumer area is the central province which includes the capital, Riyadh. Then comes the eastern province, taking some 20 per cent of total power, but producing some 30 per cent of the country's total." (Financial Times Survey, December 22, 1993)

Other relevant features of the city are recalled below:

1. Jeddah has more than 2 million inhabitants, i.e. approximately 20% of the total population of Saudi Arabia.
2. Jeddah is the biggest industrial centre in Saudi Arabia and a large section of the population is involved in business activities.
3. The Industrial City in Jeddah is one of the largest of its kind in Saudi Arabia, not only in terms of surface area (which is divided into five industrial zones) but also in terms of the number of factories operating in the city and the diversity of products they manufacture. Thus, it groups all the industries found in the Kingdom of Saudi Arabia. (See table 4.1)
4. All the government authorities and departments concerned with the subject of the present research are represented in Jeddah. These include the Ministry of Industry and Electricity, the Chamber of Commerce, the Ministry of Health, the Ministry of Commerce, the Saudi Arabian Organization for Specifications and Standards and the quality control laboratories of

these last two authorities.

5. Jeddah boasts the highest concentration of shopping centres in the Kingdom of Saudi Arabia, with an ever increasing number of markets and shopping malls. Most of the major international companies represented in the Kingdom conduct their operations from the city. Moreover, Jeddah is a major, if not the biggest, port of entry and transit for the millions of Muslims who come to visit the holy sites of Mecca and Medina every year. Combined with the presence of a large expatriate community, this regular influx of pilgrims makes for a thriving trade in a wide range of local and imported goods.

As we pointed out in chapter 2, a distinction is often drawn in Saudi Arabia between hydro-carbon based industries and other manufacturing. In turn, other manufacturing is divided into a formal sector, consisting of privately owned enterprises and licensed by the Ministry of Industry and Electricity, and a much more informal sector, consisting mainly of small labour intensive firms engaged in small scale production and repair activities. These firms usually operate as workshops which are registered with the Ministry of Commerce and obtain their licenses from their local municipalities. They are eligible for fewer credit facilities and are less regulated than the formal manufacturing sector, the focus of the present survey. The main manufacturing activities carried on in the formal sector are as follows:

1. Foodstuffs and drinks
2. Chemical industries
3. Metal products
4. Construction materials and equipment
5. Textiles, ready-made clothing, leather
6. Wood and wood products
7. Paper and paper products, printing and publishing

4.4.2 The sample

For the purpose of the present survey, a sample of all these categories has been selected from the manufacturing firms licensed by the Ministry of Industry to operate in or around the city of Jeddah. These are shown in the table overleaf, grouped by sector of activity and location.

The total survey method was applied to all 408 manufacturing firms, excluding very small or recently established companies with less than five years in production and marketing. Similarly, the sample does not include any informal sector firms or those not registered with the Ministry of Industry and Commerce.

Of the 314 questionnaires which were returned, 32 were found to be unusable, leaving a total of 282 (Appendix C). Although the questionnaires were addressed to the company managers with overall responsibility for quality, completion was carried out by managers with various designations. These include production manager, manufacturing manager, director of operations, etc.

Table 4.1

Number and category of manufacturing companies established in and around the city of Jeddah

Category	A	B	C
Food and drinks	46	24	70
Chemicals	51	22	73
Metal products	79	51	130
Construction materials and equipment	36	32	68
Textiles, ready-made clothes and leather	8	6	14
Paper, printing and publishing	14	25	39
Wood industries	10	4	14
Total	244	164	408

A: Inside Jeddah industrial city

B: Outside Jeddah industrial city

C: Total

Sources:

1. Industrial City Department (1994), Directory of licensed factories operating in Jeddah city

2. Chamber of Commerce and Industry (1993), Directory of National Industries in Jeddah.

Table 4.2

Number of questionnaires distributed to factories in each category and number of copies returned, excluding completed questionnaires which were found not suitable for analysis

	INDUSTRIAL CATEGORY	No. of questionnaires distributed	No. of questionnaires returned
1	Food and Drinks	69	53
2	Chemicals	71	61
3	Metal products	129	76
4	Building materials	67	50
5	Clothes and textiles	12	6
6	Wood products	13	8
7	Paper, printing & publ.	37	28
	Total	398	282

The main reason given by managers for not returning the questionnaire was that they were too busy. A number of companies declined to answer the questions because the subject was too sensitive. Although a careful analysis of the non-response questionnaires was not carried out, it was observed that the questions which were avoided were directly related to and supported the statements in the hypotheses (see hypothesis statement no. 2, page 126). For example, the questions relating to defective items, namely questions 44 to 49 of the questionnaire were only partially answered or not at all.

The proportion of questionnaires returned gives a response rate of 70% which may be deemed adequate for analysis and reporting, especially when we consider that the response rate for postal surveys rarely exceeds 50%.

NOTES

1. As in many other developing countries, the Saudi government is the main promoter of those industries considered as essential for the country's economic development, hence its more active involvement in the hydro-carbon based industries.

2. According to Crosby's management maturity grid (see chapter 3, point 3.5.3), the first stage is one of **uncertainty**, characterised by ignorance on the part of management of the importance of quality as a positive management tool and by the total lack of awareness of the cost of quality. This is followed by the stage of **awakening** where management begins to recognise the benefits of a quality management system but is not yet ready to make the necessary investment in time and money to put such a system in place. **Enlightenment** occurs when the management shows genuine enthusiasm for quality and sets about organising for its implementation. This is followed by the stage of **wisdom** in which the required attitude, systems and sustained enthusiasm are in place and actively used to reach the final stage of **certainty**, which Crosby sums up as one in which very few significant problems actually occur.

3. The six different levels of TQM adoption identified by Dale, Broaden and Lascelles (Dale 1990) among European companies are: the **uncommitted**, i.e. organizations with no formal process of TQM implementation; The **drifters** and the **tool-pushers** represent the next two levels in TQM adoption. Organizations at these two levels have either adopted a "ready-made" TQM package but failed for lack of understanding of the TQM concept and what it really involves or, expecting immediate benefits from the adoption of TQM, they are forever pushing some tools aside and looking for new ones to bring about the desired results, without dealing with such fundamentals as commitment and consistency on the part of the decision makers; the **improvers** are the companies where TQM adoption is well under way but where future progress is at risk because the TQM ethos is not equally shared by everyone. Improvement in such companies usually remains vulnerable to short-term pressures and unexpected difficulties; the fifth and sixth levels of TQM adoption is reached by the **award winners** and **world class** companies which, as their name suggests, have an established reputation for quality. These are the kind of companies which continue to strive for improvement, knowing that it is a never-ending process and the only way of keeping in business in today's markets.

4. These publications include the: five-year development plans for the years 1970 to 1995; the annual reports of the Saudi Monetary Agency (SAMA), A Ministry of Planning Report on the Achievements of the Development Plans (1970-1991) and the 1993 Directory of National Industries operating in and around the city of Jeddah.

5. Translation of the term Total Quality Management into Arabic proved to be especially problematic as the Arabic word for management (*idara*) is also used to mean department. In interviews with the respondents, it became apparent that many took the term to mean "total quality department". To ensure that the respondents did not confuse between the two meanings of the Arabic term, the researcher had to explain and/or supervise completion of most of the questionnaires returned.

CHAPTER FIVE

DATA PRESENTATION AND ANALYSIS (I)

5.1 INTRODUCTION

As we pointed out in the introduction to the present thesis and again in the preceding chapter, the main aim of the field research was to shed light on the position of the Saudi manufacturing industry with regard to quality through an investigation of the quality activities currently carried on in the sector. To establish the conditions under which these activities are carried on, the survey begins by drawing a profile of the sample in terms of the composition of the workforce, the distribution markets of the products covered by the sample and the perceived quality of these products, together with the respondents' own assessment as to the areas of competition between their products and those of other local producers or imported products.

5.2 SAMPLE PROFILE

5.2.1 Number and category of employees

In common with other Gulf states, Saudi Arabia has had to rely heavily on migrant labour to further its development objectives. According to Sinclair and Birks (1982, p. 163), this characteristic of the Saudi labour market is most pronounced in the construction and manufacturing sectors.

They point out for example that "the lack of qualifications or skills suitable for many modern sector jobs has meant that nationals are often employed in unskilled jobs such as driving or guarding". The same source points out that, in general, skilled nationals tend to occupy key positions in government and industry but shun other industrial occupations, except in the oil sector.

This situation is borne out by the results of our research which show that Saudi nationals make up less than 35% of the total workforce, with 58.8% of this figure engaged in administrative tasks and 27.9% in technical positions.

Table 5.1

Number, category and nationality of employees working in the factories surveyed

Category	Admin.		Technic.		Unskilled		Total	
	No.	%	No.	%	No.	%	No.	%
Saudi	4867	20.4	2300	9.6	1101	4.7	8268	34.7
Non-Saudi	2568	10.8	5195	21.8	7793	32.7	15556	65.3
Total	7435	31.2	7495	31.5	8894	37.3	23824	100
Total Saudi workforce	4867	58.8	2300	27.9	1101	13.3	8268	100

[X^2 value = 19.6 with 2 df. Significant at the 1% level]

The implications of this situation are far reaching not only in terms of the cultural and social problems associated with the presence of a large expatriate community in the midst of a religiously and culturally close-knit society but also in terms of efficiency and productivity, particularly in the manufacturing sector.

As we saw in our review of the literature on quality, gaining the commitment of the workforce is crucial to the proper implementation of TQM. This is usually achieved through training, motivation and the promotion of team spirit. Hutchins (1990, p. 143) notes in this regard that "people are the most important asset of any organisation, even when it is highly automated. However dull and boring a person's job may be, and however alienated people may feel, they have a certain loyalty to their work and to their organisation".

It is our belief, however, that employee loyalty has to be nurtured and developed over a long time. A long-term and dedicated human resource strategy is also necessary in order to foster a sense of belonging and team spirit among employees and to obtain their full and genuine commitment.

The difficulty for Saudi companies and the economy as a whole is that the country is still heavily reliant on foreign labour, particularly at the extreme ends of the skills spectrum. The low-skilled category of migrant workers poses a particularly acute problem due to the fact that they are usually brought into the country on relatively short contracts (2 years on average) for wages that are far below those paid to Saudi nationals. In addition, the transient nature of the employer/employee relationship militates against there being any motivation on the part of the employers to provide training and include the employee as a stakeholder in the organisation. Equally, this situation does not provide the necessary incentive for the employee to exercise the kind of self control which workers in Japan, for example, are reported to exercise over the quality of their work.

The problem is compounded by the fact that, despite rapid population growth and massive investment on training and education on the part of the government, Saudi manpower remains woefully inadequate, not just in terms of quantity but also in terms of quality. This is supported by the X^2 value for this table, as it shows that there was a significant relationship between the nationality and the category of work performed.

Acknowledging this fact, the 1990-1995 development plan states that "excessive drop out rates and repetition which results in protracted study periods are a common feature of both the general and higher education systems. Students dropping out of the system before completing primary or intermediate schooling years translate into new labour market entrants who do not have even basic functional literacy." (Plan V, p. 56)

5.2.2 Distribution markets and the competition

Quality and value for money are seen as the key to success in increasing market share or gaining access to new markets. Success in gaining and maintaining access to foreign markets in particular is often in direct proportion to the quality standard and value for money which the product represents and its ability to overcome the fierce competition which usually characterises today's markets[1]. As Lascelles and Dale (1989) conclude from research carried out among British companies, competition and demanding customers are two of the main agents which usually trigger the introduction of quality improvement initiatives. Thus, we would expect that those companies which distribute their products in foreign as well as local markets would be more attentive to quality than the ones who supply the local markets only.

5.2.2.1 Distribution markets

Table 5.2 shows that 26.2% of the factories surveyed sell their products in local as well as foreign markets and that 10.3% of them export most of their products. However, product distribution is limited to local markets for the majority of the factories surveyed, i.e. 63.5%. This result is confirmed by the X^2 test, which shows that most of the industries covered by the survey distribute their products in the local market, save for the metal and foodstuffs industry which also distribute to foreign markets.

Table 5.2

Markets where products are distributed

INDUSTRY	DISTRIBUTION MARKETS						TOTAL	TOTAL
	LOCAL MARKETS		LOCAL & FOREIGN MARKETS		FOREIGN MARKETS			
	No.	%	No.	%	No.	%	No.	%
Food and drinks	29	55	15	28	9	17	53	100%
Chemicals	34	56	20	33	7	11	61	100%
Metal products	57	75	16	21	3	4	76	100%
Building materials	26	52	16	32	8	16	50	100%
Ready-made clothes & textiles	5	84	1	16	-	-	6	100%
Wood products	6	75	2	25	-	-	8	100%
Paper, printing & publishing	22	78	4	14	2	8	28	100%
TOTAL	179	63.5	74	26.2	29	10.3	282	100%

[X^2 value = 15.6 with 8 df. Significant at the 5% level, omitting rows 5 and 6 and column 2]

5.2.2.3 Areas of competition with other local products and imports

Competition between similar products is traditionally conducted on the basis of price, quantity, quality, brand name or any combination of the above. Nowadays, however, quality is regarded as playing an ever greater role in the choices made by customers, not least because of the fact that it subsumes the two crucial features of safety and reliability[2]. While this is most keenly felt in the industrialized countries which have seen their traditional markets being increasingly taken over by the newly industrialised countries of Asia, it is also applicable to other market economies where an increasingly discerning customer has a wide range of competing products to chose from. As a result, competition on the basis of price alone is no longer sufficient to boost demand for local products.

As can be seen from the two tables below, quality is seen to be the main basis for competition in relation to local products with 49.3% and to an even greater extent in relation to imported products with 63.2%. On the other hand, competition on quantity seems to be more significant in relation to local products. This is rated at 28.5% compared to 5.8% in relation to imports. The same applies to competition on price, which is rated at 14.2% for local products and 7.6% for imports. The use of a brand name as a competitive weapon is associated mostly with foreign products, in this case 23.4% compared to 7.9% for local products.

It is perhaps not surprising to find that competition from foreign products is based mainly on quality and the use of a brand name. In the mind of the consumer, these two aspects are often closely linked, the brand name serving as a flag for the quality of the product concerned. Here, quantity is of little material significance as foreign products rarely use this as a basis for competition in the Saudi markets.

Table 5.3 (a)

Basis for competition with other local products

Basis for competition	Frequency	Percentage
Quality	142	49.3%
Quantity	82	28.5%
Price	41	14.2%
Brand name	23	7.9%
TOTAL	288	100%

Table 5.3 (b)

Basis for competition with imported products

Basis for competition	Frequency	Percentage
Quality	184	63.2%
Quantity	17	5.8%
Price	22	7.6%
Brand name	68	23.4%
TOTAL	291	100%

5.3 TQM UNDERSTANDING AND IMPLEMENTATION

The success or failure of any undertaking depends to a large extent on the way in which it is managed. While most managers profess total commitment to quality, not many of them have a clear understanding of how such commitment can be translated into concrete action, i.e. the production of goods and services which conform to requirements at the least possible cost.

We saw in chapter 3 that total quality management is an all-embracing concept which must be systematically applied to all the activities within an organization. Thus, the role of managers is to create the environment necessary for this concept to be understood by everyone and to provide the ways and means necessary for its implementation.

As leaders, managers must create a culture and an environment in which concern for quality is not limited to the quality control department or unit. On the contrary, everyone must be made aware of what is meant by quality and encouraged to feel that they form an integral part of the quality chain. However, the lead given by managers can only be taken seriously if they themselves act in such a way as to gain the respect and trust of their subordinates. In the words of Crosby, "teaching people, leading people, showing people, providing tools - everything loses meaning if employers, customers and suppliers feel that management is not walking like they talk". (Bank 1992, p. 48),

As to the practical aspects of quality management, managers must ensure that a system of checks and controls is in place so that the materials, tools, processes and skills employed in each activity and at every stage do not result in a costly or even irreparable break in the quality chain.

5.3.1 Understanding of the TQM concept

In common with many other developing countries, the teething problems encountered in Saudi Arabia with regard to establishing and operating a modern economy are often compounded by the scarcity of the necessary managerial and technical talent. The gap in know-how between Saudi managers and managers in industrial countries has also been observed by Al-Hajjar and Presley (1992) who found that Saudi manufacturing as well as the retail and wholesale sectors are characterized by a general lack of management sophistication and ignorance of modern techniques in management and marketing[3].

Table 5.4

Familiarity with the TQM concept

INDUSTRIAL CATEGORY	LITTLE KNOWLEDGE		FULL KNOWLEDGE		NO KNOWLEDGE		TOTAL	
	NO.	%	NO.	%	NO.	%	NO.	%
Food & drinks	32	60	14	26	7	14	53	100
Chemicals	36	59	22	36	3	5	61	100
Metal products	41	54	31	40	4	6	76	100
Building materials	26	52	19	38	5	10	50	100
Clothes & textiles	4	67	1	16	1	16	6	100
Wood products	5	62	2	25	1	13	8	100
Paper, printing & publi.	20	71	6	22	2	7	28	100
Total	164	58.2	95	33.6	23	8.2	282	100

[X^2 value = 6.5 with 6 df. Not significant at the 5% level, combining columns (1,3)]

The figures obtained from the survey show that only 33.6% of the sample are familiar with the TQM concept[4] and 58.2% have very little knowledge of what it involves. The remaining 23 factories replied either that they have no knowledge of the TQM concept or that they are not very clear about it (see note 5, chapter 4). Looking at the X^2 value for this table, we find that there is no relationship between the type of industrial category and the degree of familiarity with TQM, further confirming our observation that the majority of the sample has imperfect or no knowledge of the concept.

As with the direct questions on product quality, some respondents may have found it difficult to admit to being ignorant of the TQM concept altogether. For this reason, instead of limiting the possible responses to a simple yes or no, a third alternative is offered as "a way out" although, in practical terms, having little knowledge of TQM amounts to the same thing as having no knowledge of it. This is because, as we pointed out earlier, full understanding is necessary for its successful implementation. As with any other management system, this success depends not only on understanding its method, process and structure but even more on an appreciation of its rationale.

5.3.2 The extent to which the TQM concept is applied

Knowledge of the TQM concept and its principles is of no benefit unless it is systematically applied in such a way that the quality of production and management of the organization is continually improving.

The great majority of the factories surveyed, i.e. 59.2% of the sample give no importance to the application of TQM. This compares with just 25.8% who indicated that they implemented the concept.

Table 5.5

Application of TQM concept

INDUSTRIAL CATEGORY	YES		NO		PLANS FOR IMPLEMENT.		TOTAL	
	NO.	%	NO.	%	NO.	%	NO.	%
Food & drinks	11	20.7	33	62.3	9	16.9	53	100
Chemicals	19	31.1	37	60.6	5	8.2	61	100
Metal products	26	34.2	40	52.6	10	13.2	76	100
Building materials	12	24	30	60	8	16	50	100
Clothes & textiles	-	-	1	16.6	5	83.3	6	100
Wood products	1	12.5	5	62.5	2	25	8	100
Paper, printing & publi.	4	14.3	21	75	3	10.7	28	100
Total	73	25.8	167	59.2	42	14.9	282	100

When we compare the figures in this table with those in table 5.4, we find that out of the 95 managers who indicated that they understood the concept fully, only 73 said that they actually put it into practice. The factories which plan to introduce TQM make up 14.9%, leaving 167 factories out of a total of 282 with no intention of doing so.

5.3.3 Reasons for the failure to apply the TQM concept

The failure to put the TQM concept into practice has far-reaching consequences on both the performance of staff and the quality of production. In addition, if no feedback system is in place to assess and meet their requirements and wishes, customers will soon switch to other competing products. In turn, this often leads to the factory having to close down for lack of demand. Alternatively, additional capital might have to be brought in so as to make up for the high proportion of defective products which inevitably follows when a quality system is not implemented.

Research carried out by Dale and Duncalf (Dale 1990) among British companies found that, in addition to lack of management commitment and vision, other barriers to TQM implementation include poor appreciation of its concepts and principles, reluctance on the part of middle ranking management and older employees to switch to a different way of doing things and lack of time and resources.

As can be seen from the following table, 32.4% of the sample pointed to the lack of understanding of the concept as the main reason for their failure to implement TQM. This was followed by the lack of the necessary expertise at 23.8% and the lack of the necessary skills among the workforce at 16.7%. The high cost of applying the TQM concept applied to 13.5% while the size of the company was cited as the main problem by 7.6% of the sample. Finally, 5.9% of the respondents said that they were not convinced by the usefulness of TQM.

Table 5.6

Reasons given for failure to implement TQM

REASON	FREQUENCY	PERCENTAGE
High cost of implementation	25	13.5
Lack of necessary expertise	44	23.8
Lack of skilled workforce	31	16.7
The TQM concept is not clear	60	32.4
The size of the company	14	7.6
Not convinced by TQM	11	5.9
TOTAL	185	100

5.3.4 Meetings within the organisation

One of the TQM definitions given in chapter 3 of the present thesis states that it is a system which works horizontally across functions and departments, involving all employees top to bottom and extends backward and forward to include the supply chain and the customer chain. This form of management, which takes into account both vertical and horizontal structures and functions within an organisation, is often contrasted with purely hierarchical forms of management in which responsibilities are allocated solely along vertical lines. According to Bounds et al. (1994, p. 313), deficiencies of this system are "rooted in management's failure to think of the organisation in terms of cross-functional systems".

Solutions which have been suggested for ensuring better coordination and cooperation between the various functions and levels within the organisation include the notion of internal customers, the establishment of task forces, brainstorming, project teams, quality circles, etc.

However, whatever kind of management system is in place, it is necessary that regular meetings are held between and across departments, if only to encourage joint participation in the goals of the organisation. These are especially useful in relatively large corporations where it is all too easy to create a de-humanized environment dominated by an all-powerful management structure which is invisible and inaccessible to the individuals lower down the hierarchy.

Table 5.7

Regular meetings

ARE REGULAR MEETINGS HELD?	NUMBER OF RESPONSES	PERCENTAGE
YES	63	22.3
NO	219	77.7
TOTAL	282	100

The table shows that 77.7% of the sample attach little importance to holding regular meetings involving all the departments, sections and workforce. The reasons given by the sample as to why this is so are discussed below.

5.3.5 Reasons for lack of participation in regular meetings

Table 5.8

Reasons given for not holding regular meetings

REASON	FREQUENCY	PERCENTAGE
Decisions and orders are issued by the senior management	142	61.7
Reluctance of departments and sections to take part	20	8.7
Not necessary, departments and sections are aware of their responsibilities and obligations	68	29.6
TOTAL	230	100

As highlighted in table 5.8, the main reason is that the decisions and orders are defined by the senior management and adhered to by all the departments and sections (61.7%). The next most frequent reason given in the questionnaire (29.6%) is that there is no need for regular meetings and involvement of personnel from all levels of the hierarchy because each department and each section is aware of its responsibilities and obligations. The unwillingness of the departments and sections to take part is put at a mere 8.7%.

5.3.6 Employee participation and team spirit

A crucial factor in total quality management is collective management and effort whereby all those working in the organisation are seen as participants in achieving the aims of the company. This provides a concrete means of generating a sense of responsibility in everyone and of encouraging them to excel in their work and, more generally, to cooperate and coordinate with their colleagues.

The issues considered in this part of the analysis relate to the attention given to fostering team spirit among the workers; whether the aims of the company are understood by its employees; the extent to which employees are encouraged to voice their opinions, to offer their suggestions and participate in problem solving activities; and whether changes in work policy and practices are explained to the workers.

5.3.6.1 Attention given to fostering team spirit among the workers

As table 5.9 indicates, 70% of the managers questioned strongly believe in the importance of team spirit and 22% rate this variable as reasonably important.

The managers who expressed reservations on the importance of team spirit account for 8% of the sample. They are the same managers who replied that they were not convinced of the usefulness of applying the TQM system.

Table 5.9

Belief in the importance of team spirit

Importance of team spirit	Number	Percentage
Very important	197	70
fairly important	62	22
not very important	23	8
not convinced	-	-
Total	282	100

5.3.6.2 Awareness of the aims of the company on the part of employees

Employees must be given a clear understanding of the aims of the company they work for if they are to respond fully to the demands made on them and to take an effective part in the collective effort. This also helps in achieving better cooperation and coordination between them and in making them feel an integral part of the group. Over half of the sample indicated that their employees were aware of the aims of their company to a reasonable degree but only 24% thought that their employees had a very good understanding of the company's aims. About the same proportion (22%) estimated that their company's aims were understood to a certain extent.

Table 5.10

Degree of awareness of company aims by its employees

Degree of awareness	Number	Percentage
To a great extent	68	24
reasonably aware	147	52
to a limited extent	62	22
not sure	5	2
Total	282	100

These findings, taken together with the figures given in table 5.9, lead us to conclude that although companies are aware of the importance of such factors as team work and shared aims, very few of them take positive action to see that they are put into practice.

5.3.6.3 Encouragement of employees to voice their opinions and offer suggestions.

Encouragement of employees to voice their opinions and to offer their suggestions motivates them to improve their performance, encourages innovation and the sense of responsibility. In turn, this leads to better performance by everyone and to improved quality in all aspects of the organisation's activity.

Table 5.11

Encouragement given to employees to voice their opinions and offer suggestions

Encouragement given	Number	Percentage
Always	143	51
Most of the time	101	35
Sometimes	32	12
Rarely	6	2
No encouragement	-	-
TOTAL	282	100

Table 5.11 shows that 51% of managers always encourage their employees to voice their opinions in the interest of the work while 35% of the respondents encourage them most of the time, 12% some times and 2% rarely do so. On average, therefore, only 50% of the managers encourage their employees to voice their opinions.

5.3.6.4 Explanation of changes to work policy and practices

Changes occur in the work policy or practices of industrial companies due to changing market conditions, consumer tastes, competitors, government policies, etc. For this reason, any changes to the work policy or practices to suit the new circumstances must be explained to the employees. This is essential in order to promote in them a sense of belonging and to make them value their role in the success of the organisation.

Table 5.12

Explanation of changes to employees

Changes explained to employees	Number of responses	Percentage
YES	102	36.2
NO	180	63.8
TOTAL	282	100

Table 5.12 shows that only 36.2% of the respondents in the factories surveyed explained such changes to their employees. However, the majority of them (63.8%) said that they did not do so, thereby failing to observe an important principle of TQM which requires the involvement of the employees and the development of team spirit among them.

5.3.7 Customer requirements

The customer is always right. The customer is king. These, and other expressions like them, are simply ways of saying that the aim behind all work and all efforts to make improvements must be to serve the customer better. The notion that the customer is the lifeblood of the business is embodied in TQM, a system designed essentially as a means to meet the main requirements of the customer. In other words, the product or service must conform to specifications, be reliable, provide value for money and be delivered to the customer when he wants it.

Dale (1990, p. 81) notes in this regard that, in Japan, companies go to considerable length to collect information on the wants and needs of customers, to obtain their opinions, better understand their expectations and assess their satisfaction with products and services." A similar emphasis is given to consumer expectations by Feigenbaum

(1991, p. 30) who points out that "an essential function of producers is to understand the character of consumer expectations, to respond rapidly and effectively to them and, as often as possible, to anticipate and act upon them before the consumer even verbalized them".

Common techniques used to discover the needs and wants of consumers include personal interviews, market testing, after-sales feedback, etc. A more structured technique known as Quality Function Deployment (QFD) and developed in Japan is also increasingly being used to translate customer requirements into specific product and service characteristics. According to Bound et al. (1994, p. 276), more and more US companies are using QFD, including such major corporations as Ford Motor Company, Procter & Gamble, General Motors, etc.

The great majority of the factories surveyed (87.9%) have conditions and specifications required by the customer. That this applies across most of the industrial categories in the sample is confirmed by the X^2 value, which indicates that there are no significant differences between the various categories. The only exception (12.1% of the sample) consists of producers of such goods as sugar, salt, spices, plastic products and some mineral and wood products.

Table 5.13

Compliance with conditions and requirements laid down by the customer

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	NO.	%	NO.	%	NO.	%
Food & drinks	46	86.8	7	13.2	53	100
Chemicals	55	90.2	6	9.8	61	100
Metal products	68	89.5	8	10.5	76	100
Building materials	43	86	7	14	50	100
Clothes & textiles	6	100	-	-	6	100
Wood products	7	87.5	1	12.5	8	100
Paper, printing & publishing	23	82.1	5	17.8	28	100
Total	248	87.9	34	12.1	282	100

[X^2 value = 1.5 with 5 df. Not significant at the 5% level. Rows omitted: 5]

5.3.7.1 Method of establishing customer requirements

The means used by the sample to establish customer requirements are listed in the table below.

Table 5.14

Means of determining customer requirements

METHOD	FREQUENCY	PERCENTAGE
Market research	48	18.7
Feedback from sales representatives	133	51.7
Collaboration between the departments of marketing, production, sales, etc.	15	5.8
Past experience	61	23.7
TOTAL	257	100

Sales representatives provide the main source of information on what customers want (51.7%). Others rely on past experience in the industry (23.7%), market research (18.7%) and, lastly, cooperation between the departments of marketing, production, sales and other departments (5.8%). This is a very low figure when we consider that it is one of the most efficient and principled means of developing a coherent policy towards the customer.

NOTES

1. Feigenbaum (1991, pp. 55-56) points out in this regard that, "for a long time, deeply ingrained stereotypes have strongly influenced business policy thinking on trade - for example, technically innovative products, or very cheap products, or otherwise completely unavailable products represent the key to export success in the international consumer marketplace."

   He goes on to explain that, in fact, the products which have achieved success in the export market "have been neither highly technically innovative nor extremely cheap - indeed, with recognisable quality, they have sold at higher prices and they have moved into already well stocked markets with similar goods."

   Another stereotype used to be that, for consumers in developing countries, the main criterion to bear in mind is price since they do not have the kind of purchasing power available to their western counterparts and do not, therefore, have the freedom of choice to opt for more expensive and hence "better quality" products. However, except in circumstances of dire penury, the prevailing trend in the developing as well as the developed countries is a greater consciousness on the part of the consumers of the importance of quality and value for money. As Feigenbaum (1991, p. 30) points out, "former have-not consumers not only want merchandise they never had before, they want good merchandise for their money - not junk or shoddy - they are rapidly developing the discrimination to select the good from the shoddy and to be proud of the difference". However, despite all the evidence to the contrary, it is often very hard to dispel stereotypes, particularly in an economy where conducting independent market and consumer surveys is still very much a rare occurrence. Manufacturers who limit their production to the local markets and for whose products demand trends remain stable or on the increase may well develop a sense of complacency with regard to quality and assume that all is going well for them, particularly if their perceptions of the competition and the consumers are not informed by the appropriate research and market analysis.

2. See Feigenbaum 1991, pp. 590-592.

3. See note 2, chapter 2.

4. See note 5, chapter 4.

CHAPTER SIX

DATA PRESENTATION AND ANALYSIS (II)

6.1 INTRODUCTION

This part of the analysis examines the type of activities carried on by the sample in the context of product quality control, beginning with the control of incoming materials through to the control of the finished product.

We noted earlier in chapter 3 that a great deal of emphasis is increasingly being placed on product planning and design. However, due to the limited nature of the design capabilities of Saudi manufacturing (see chapters 2 and 4), control of product design has not been addressed in the survey, concentrating instead on the incoming and production quality control and the key components involved in ensuring the quality of production.

6.2 CONFORMANCE TO STANDARDS AND SPECIFICATIONS

As was pointed out in chapter 3, standards and specifications provide the main reference criteria against which goods and products are measured in terms of properties, dimensions, quality, function, mode of operation, etc. It follows from this that one of the functions of quality control should be to ensure that materials, processes and products conform to the relevant standards and specifications.

Certain basic standards, such as units and methods of measurement, chemical and other symbols are internationally recognised and applied as a matter of routine. Other standards and specifications may be specific to a company, a professional grouping, a country or an economic and/or regional grouping such as the European Union (EU) or the Gulf Cooperation Council (GCC).

In this connection, data was sought on the degree of adequacy of the available specifications, adherence to standard specifications on the part of the factories surveyed, source of the specifications to which the factories are required to conform, foreign organizations as a source for specifications, the difficulties posed by the application of standard specifications and the reasons for such difficulties.

6.2.1 Adequacy of the available specifications

If products are to be accepted by the consumers and if they are to compete successfully on the market, well-defined standards and specifications must be set to ensure that the desired quality is achieved. Conformity with standards and specifications is important at every stage of the production process. In addition, standards must be adhered to in matters relating to the health, security and safety of the workers involved.

Table 6.1

Adequacy of the specifications available

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	No.	%	No.	%	No.	%
Food & drinks	29	54.7	24	45.3	53	100
Chemicals	33	54.1	28	45.9	61	100
Metal products	41	53.9	35	46.1	76	100
Building materials	27	54	23	46	50	100
Clothes & textiles	4	66.7	2	33.3	6	100
Wood products	5	62.5	3	37.5	8	100
Paper, printing & publishing	15	35.6	13	36.4	28	100
Total	154	54.6	128	45.4	282	100

[X^2 value = 0.57 with 5 df. Not significant at the 5% level. Rows combined: 5 and 6]

As can be seen from table 6.1, a significant number of the factories surveyed do not have well-defined standards and specifications against which major aspects of production can be measured. The data obtained suggests this to be the case across all the industrial categories included in the sample, as confirmed by the X^2 value which indicates that there are no significant differences between the various industrial categories in this regard.

The respondents who have indicated this to be the case account for 46.1% in the metal industry, 46% in the construction materials industry, 45.9% in the chemical industry, 45.3% in the foodstuffs industry, 37.5% in the wood products industry and 33.3% in the textile industry.

6.2.2 Compliance with standard specifications

As we have mentioned earlier, the Saudi Arabian Organisation for Specifications and Standards is the authority responsible for laying down the standard specifications which must be met in locally manufactured products.

Table 6.2

Compliance with standard specifications

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	No.	%	No.	%	No.	%
Food & drinks	17	85.6	12	41.4	29	100
Chemicals	20	60.6	13	39.4	33	100
Metal products	24	85.5	17	41.5	41	100
Building materials	16	59.3	11	40.7	27	100
Clothes & textiles	3	75	1	25	4	100
Wood products	4	80	1	20	5	100
Paper, printing & publishing	9	60	6	40	15	100
Total	93	60.4	61	39.6	154	100

[X^2 value = 0.507 with 4 df. Not significant at the 5% level. Rows combined: 5,6 and 7]

Table 6.2 shows that while standard specifications are complied with in 60% of the factories surveyed, a significant minority (39.6%) reported that they do not apply such standards. Moreover, the X^2 value indicates that there is no association between the industrial category and compliance with standard specifications.

6.2.3 Source of the specifications observed by the sample

In addition to international norms and those set by the Saudi Arabian Organisation for Specifications and Standards, product manufacturers often have to conform to specifications, whether laid down by their customers, dictated by the industry concerned or stemming from the need to remain competitive in relation to other similar products.

As can be seen from table 6.3, 40.5% of the specifications observed by the factories included in the sample are issued by the Saudi Arabian Organisation for Specifications and Standards and 21.2% are obtained from foreign sources.
With regard to the specifications laid down by the company itself, 15.8% are formulated by factory engineers, 11.4% by a specialised unit of the production department, 6.9% by the marketing department and 4.1% by the research section of the marketing department.

Table 6.3

Source of specifications

INDUSTRIAL CATEGORY	A		B		C		D		E		F		TOTAL	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Food & drinks	22	38.6	12	21.1	10	17.5	6	10.5	4	7	3	5.3	57	100
Chemicals	24	35.3	15	22.1	11	16.2	8	11.7	6	8.8	4	5.8	68	100
Metal products	35	43.7	16	20	13	16.3	10	12.5	4	5	2	2.5	80	100
Building materials	25	45.5	10	18.2	7	12.7	6	10.9	4	7.3	3	5.4	55	100
Clothes & textiles	4	36.4	3	27.2	2	18.2	1	9.1	1	9.1	-	-	11	100
Wood products	5	38.5	3	23.1	2	15.4	2	15.4	1	7.6	-	-	13	100
Paper, print. & publish.	13	40.6	8	25	5	15.6	3	9.4	2	6.3	1	3.1	32	100
Total	128	40.5	67	21.2	50	15.8	36	11.4	22	6.9	13	4.1	316	100

[X^2 value = 3.2 with 15 df. Not significant at the 5% level. Combining rows 5 and 6 and columns D,E and F]

A. The Saudi Arabian Organization for Specifications and Standards

B. Foreign institutions

C. Factory engineers

D. Specialised unit in the production department

E. Marketing department

F. Research section of the marketing department

The X^2 value further indicates that there is no relationship between industrial category and source of the specifications. The prevailing trend seems to be that the same company may use one or more sources, depending on its own particular needs and the products it manufactures.

6.2.4 Compliance with specifications laid down by foreign organisations

The justification for treating this aspect separately lies in the fact that a number of products manufactured in the Kingdom of Saudi Arabia are produced under licence or in joint venture partnerships with foreign companies, particularly from Western Europe and the United States. Compliance with specifications laid down by such foreign companies can have a major impact on the quality of locally produced goods, particularly in view of the expertise and the long quality tradition enjoyed by the suppliers of such specifications. The factories in the sample which produce goods in accordance with specifications laid down by foreign companies indicated that, as the goods they produce bear the trade-name of the foreign producer, they are contractually obliged to conform to the specifications laid down for such goods by the foreign partner.

Table 6.4

Compliance with specifications supplied from abroad

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	No.	%	No.	%	No.	%
Food & drinks	12	100	-	-	14	100
Chemicals	15	100	-	-	15	100
Metal products	16	100	-	-	18	100
Building materials	10	100	-	-	12	100
Clothes & textiles	3	100	-	-	1	100
Wood products	3	100	-	-	1	100
Paper, printing & publishing	8	100	-	-	6	100
Total	67	100	-	-	67	100

Our sample reflects the fact that foreign participation can be seen across almost all industrial activities. The multinationals and foreign companies active in the Kingdom include:

- the Danish Company for dairy products,
- Pepsi Cola Int.,
- McDonald & Bertson,
- Procter & Gamble,
- Dow Chemicals,
- George Gloss of Germany (aluminium products)
- Garnkust of Sweden (electrical equip. and appliances)
- Kelvinator Falcon (refrigerators and air-conditioning installations)
- Epoxhady Lenton (steel)
- Universal Equipment (office furniture)

6.2.5 Difficulties encountered in conforming to specifications

The majority of the factories surveyed indicated that they had no difficulty in implementing specifications laid down for their products, regardless of the source of the specifications. However, just under a quarter of the sample pointed to difficulties in conforming to specifications with the lack of suitable measuring instruments and equipment being the most frequently cited reason as the main problem.

Table 6.5
Problems encountered in conforming
to specifications

Response	Number	Percentage
YES	68	24.1
NO	214	75.9
TOTAL	282	100

As table 6.6 shows, lack of adequate equipment represents 26.3% of all the difficulties encountered in this regard, followed by the lack of skilled labour (21.1%), working conditions where extremes of temperature make it impossible to achieve the desired quality (17.1%), the low quality of the raw materials and semi-finished products used in manufacture (14.5%), the extreme precision of the specifications (11.8%) and the fact that the machinery available is not suitable for the technologies applied (9.2%).

Table 6.6
Reasons given for the difficulty of conforming to specifications

Reason	Frequency	Percent.
Lack of the necessary measuring equipment	20	26.3
Lack of skilled labour	16	21.1
Working conditions (extremes of temp.)	13	17.1
Low quality of raw/ semi-finished materials	11	14.5
The extreme precision of the specifications	9	11.8
The machinery available is unsuitable for the technology applied	7	9.2
TOTAL	76	100

6.3 QUALITY CONTROL OF INCOMING MATERIALS

All incoming materials need to be tested or otherwise verified to ensure that they conform to the relevant specifications. The extent and scope of control over such materials will depend on whether purchasing is carried out on the basis of price alone, with the purchasing contract being awarded to the lowest bidder or on the basis of carefully developed relationships of cooperation and trust with one or more suppliers. Ideally, incoming materials should be purchased on the basis of the latter so that the quality of the supplies can be systematically monitored over a sufficient period of time. In this way, problems encountered due to faults in the supplies can be solved jointly with the suppliers and, over the long term, obviate the need for extensive testing and checking on the part of the purchasing company.

We saw in chapter 3 that one of Deming's fourteen points is that companies should end the practice of awarding business on price tag alone as "price has no meaning without a measure of the quality being purchased". (Walton 1989, p. 62) Other major quality experts who hold the same view include Taylor (1989, p. 302) who points out that "it is far better to develop one good quality supplier and keep that source of supply, rather than call for bids each time and place orders on the basis of price alone. What good does the purchase of unsatisfactory products at a lower price do a company that is trying to improve or maintain its quality?".

Another key factor in the quality of incoming materials is the extent of the purchasing department's attention to quality and of its cooperation with the quality and production departments of the organisation. For Feigenbaum (1991, p. 684), the role of the purchasing department is crucial to incoming quality control because "it is

Purchasing's responsibility to establish and maintain direct relations with vendors." For the purchasing department to discharge this role fully, it needs " to work as part of the plant quality-control team so that materials which are of the proper quality and which reflect the right cost so far as quality is concerned are ordered"[1].

In Saudi Arabia, companies and plants of all kinds continue to rely on imports for a great deal of their supplies, not only in terms of machinery and equipment but also in terms of raw materials, component parts and sub-assemblies.

Although such materials are usually supplied with documents attesting to their conformance to specifications, it is often necessary to submit them to quality control tests, if only to ensure that quality has not been compromised during shipment, storage, handling, etc. In any case, a certificate of compliance alone should not constitute objective evidence of conformance, although it may be accepted when the quality of supplies is corroborated in other ways. (Taylor, 1989)

6.3.1 Source of raw and other incoming materials

The table below shows the variety of sources used by the factories surveyed for the purchase of their raw materials.

The majority of the sample (54%) obtain the materials they need from local as well as foreign markets.

Table 6.7

Raw material purchasing

INDUSTRIAL CATEGORY	Local markets		Local & Foreign markets		Foreign markets		TOTAL	
	NO.	%	NO.	%	NO.	%	NO.	%
Food & drinks	14	26	31	58	8	16	53	100
Chemicals	6	10	26	42	29	48	61	100
Metal products	12	16	40	53	24	31	76	100
Building materials	20	40	26	52	4	8	50	100
Clothes & textiles	2	33	4	67	-	-	6	100
Wood products	-	-	5	62	3	38	8	100
Paper, printing & publi.	7	25	21	75	-	-	28	100
Total	61	21	153	54	68	24	282	100

[X^2 value = 17.2 with 4 df. Significant at the 5% level. Combining rows 5,6 & 7 and columns 2 & 3]

The factories which obtain their materials solely from abroad make up 24% and only 21% of all the factories surveyed rely exclusively on the local markets for their purchases.

The X^2 value indicates that a relationship exists between the type of industrial category and the markets where primary materials are purchased. Thus, industries such as wood, clothing, paper and printing rely more on the local markets than on imports. On the other hand, a significant number of chemical and metal industries rely on imports for certain of their incoming supplies.

6.3.2 Testing for quality on delivery

Table 6.8

Quality control of incoming materials

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	NO.	%	NO.	%	NO.	%
Food & drinks	40	75.4	13	24.5	53	100
Chemicals	49	80.3	12	19.6	61	100
Metal products	58	76.3	15	23.6	76	100
Building materials	41	82	9	18	50	100
Clothes & textiles	4	66.6	2	33.3	6	100
Wood products	5	62.5	3	37.5	8	100
Paper, printing & publishing	20	71.4	8	28.5	28	100
Total	217	77	65	23	282	100

[X^2 value = 2.9 with 6 df. Not significant at the 5% level. Combined rows: 5 and 6]

Table 6.8 shows that the majority of the factories surveyed (77%) carry out tests on incoming materials. This is supported by the X^2 test which indicates control of incoming materials to be independent of industrial category.

Having said this, it is interesting to note that the highest proportion of the factories which carry out such tests are those active in the construction (82%) and chemical (80.3%) industries, followed by the factories involved in the production of metal products (76.3%), foodstuffs (75.4%), printing and publishing (71.4%), textiles and clothing (66.6%) and, finally, wood products (62.5%).

Sixty five respondents from the various categories surveyed said that they did not test incoming materials. From interviews carried out with the respondents concerned, it became apparent that certain materials were not tested because they were supplied already packaged and ready for use, having been tested by the suppliers. Other respondents relied on the inspections carried out by the Saudi Organization for Specifications and Standards.

In our view, however, it is a mistake to take documentary evidence at face value, not least because of the chain reaction which a fault in incoming materials usually triggers in the remainder of the production process. All the materials purchased must be subjected to tests at the premises of the buyer. It is not sufficient to rely on the tests carried out by the supplier, particularly with regard to foodstuffs, chemicals and construction materials. Testing is necessary not only to confirm the results of the tests carried out prior to purchase but also to ensure that the quality and characteristics of the materials involved have not been adversely affected during shipment, transport and storage.

6.3.3 The methods used to test incoming materials

Just as failure to carry out tests is a mistake, excessive testing can also result in unnecessary costs. Feigenbaum (1991), among others, believes that neither "blind trust" in the suppliers or inspection of incoming materials "to death" make for good quality management. In his view, "the high price of the latter extreme is prohibitive, while the former extreme can increase the safety/liability risk beyond reasonable bounds". (Feigenbaum 1991, p. 677)

Table 6.9 indicates that most of the factories which carry out their own testing of the materials purchased for their production processes use random samples for testing purposes.

Random sampling is used by 82.8% of the factories which carry out their tests on purchased materials. The factories reported to rely 100% on this method are those involved in the manufacture of chemical products, textiles and garments and wood products. The printing and publishing industry uses this method 91.3% of the time, followed by the metals and construction materials industries with 76.6% and 76.1% each and the foodstuffs industry with 68.9%.

Table 6.9

Methods used for quality control of

purchased materials

INDUSTRIAL CATEGORY	Random tests		Full tests		TOTAL	
	NO.	%	NO.	%	NO.	%
Food & drinks	31	68.9	14	31.1	45	100
Chemicals	55	100	-	-	55	100
Metal products	49	76.6	15	23.4	64	100
Building materials	35	76.1	11	23.9	46	100
Clothes & textiles	5	100	-	-	5	100
Wood products	6	100	-	-	6	100
Paper, printing & publishing	21	91.3	2	8.7	23	100
Total	202	82.8	42	17.2	244	100

[X^2 value = 4.2 with 3 df. Not significant at the 5% level. Omitted rows: 2,5 and 6

The remaining 17.2% indicated that they tested all their purchases fully. The percentage figures for the industrial categories surveyed are as follows: 31.1% in the foodstuffs industry, 23.9% in the metal industry, 23.4% for construction materials industries and 8.7% for paper and publishing.

6.3.4 Place where incoming materials are tested and checked for quality

As a rule, it is best if primary materials are tested on the work site to ensure that they are free of defects before entering into the production process. However, it is not always possible to carry out the necessary tests on the production site because of the need for specialised testing or laboratory equipment. Thus, the output of certain stages of the production processes may be tested in specific locations.

Table 6.10

Place where testing is carried out

INDUSTRIAL CATEGORY	Vendor's premises		Purchaser's premises		Other		TOTAL	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Food & drinks	21	36.8	32	56.2	4	7	57	100
Chemicals	20	31.7	40	63.5	3	4.8	63	100
Metal products	16	21.6	53	71.6	5	6.8	74	100
Building materials	12	21.8	39	70.9	4	7.2	55	100
Clothes & textiles	2	13.3	12	80	1	6.7	15	100
Wood products	5	26.3	14	73.7	-	-	19	100
Paper, printing & publi.	3	9.4	29	90.6	-	-	32	100
Total	79	25.2	219	69.5	17	5.3	315	100

[X^2 value = 13.8 with 8 df. Not significant at the 5% level. Combined rows: 5,6 and 7.

Table 6.10 shows 69.5% of the respondents indicating that they have their materials tested and examined on the vendor's premises and 25.2% on the premises of the purchaser.

With the exception of wood, paper and publishing products, 17 respondents prefer to have the tests carried out in quality control laboratories within the Kingdom of Saudi Arabia. The frequency of the responses indicates that, regardless of activity, the factories which test the materials purchased use either of the two sites depending on the type and nature of the materials involved and the location of the vendor. This observation is confirmed by the X^2 test which does not show any significant relationship between industrial category and the location chosen for the tests.

6.3.5 Responsibility for testing and examination of the purchased materials

The accuracy and reliability of test results depends to a large extent on the skills of the staff responsible for carrying out the tests. In addition to specialised testing equipment and instruments, the persons responsible for this type of work must be fully conversant with all the technical and laboratory aspects of the testing process and have a total understanding of the testing instruments and equipment at their disposal.

The figures shown in table 6.11 indicate that in 238 of the factories surveyed, i.e. 65.7% of the sample, most of the testing operations are carried out by technical committees representing the purchaser.

According to the X^2 test, responsibility for testing and examination of purchased materials depends on the industrial category concerned, particularly with regard to the use of quality control laboratories and specialised testing offices.

Table 6.11

Responsibility for checking the quality of purchased materials

INDUSTRIAL CATEGORY	Quality control labs. in KSA		Purchaser's technical committees		Specialised testing office		Specialist store supervisor		TOTAL	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Food & drinks	12	18.5	38	58.5	11	16.9	4	6.1	65	100
Chemicals	27	37.5	43	59.7	2	2.8	-	-	72	100
Metal products	22	27.2	47	58	3	3.7	9	11.1	81	100
Building materials	13	22	44	74.6	-	-	2	3.4	59	100
Clothes & textiles	-	-	19	86.4	-	-	3	13.6	22	100
Wood products	1	4.2	21	87.5	-	-	2	8.3	24	100
Paper, printing & publishing	-	-	26	66.7	-	-	13	33.3	39	100
Total	75	20.7	238	65.7	16	4.4	33	9.2	362	100

[X^2 value = 8.5 with 3 df. Significant at the 5% level, combining columns (1,3) and (2,4) and omitting rows 5,6 and 7]

Of the 20.7% of the sample which assigned this task to quality control laboratories in the Kingdom of Saudi Arabia, 37.5% relate to chemical products, 27.2% to metal products, 22% to construction materials, 18.5% to foodstuffs and 4.2% to wood products. With the exception of the chemical industry, testing is carried out by the supervisor of the store concerned in 9.2% of cases, followed by a specialised testing firm for 16.9% in the foodstuffs industry, 2.8% in the chemical industry and 3.7% in the metal industry.

6.3.6 The means used to carry out incoming quality control

The means used to control quality varies according to the nature of the material concerned and the use for which it is intended. For example, simple visual inspection may be carried out in certain industries where it is possible to detect certain colours or foreign bodies visually. At other times, the testing operation may require the use of chemicals, laboratory equipment and precision instruments. Where measuring equipment is used, it is necessary to ensure that the equipment used is adequately calibrated and that it is appropriate for the task involved. This fact is confirmed by the X^2 results for table 6.12 below, which point to the presence of a significant relationship between the means used for testing and the industrial category involved.

Thus, 31.9% of the tests are carried out using simple, hand-held instruments and 28.4% using specialised equipment. Laboratory testing is used by 31 of the factories active in the production of foodstuffs, 39 in the chemical industry, 28 in construction materials and 2 in wood products. Visual inspection is used in 10.1% of all the factories surveyed. The senses such as smell, taste and touch are used in 17 companies involved in the production of foodstuffs, chemical and metal products, textiles and garments as well as in printing and publishing.

Table 6.12

Instruments and equipment used for testing incoming materials

Categ.	Lab tests		Spec. equip.		Manual tools		Visual insp.		Other		TOTAL	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Food & drinks	31	45.6	16	23.6	8	11.7	10	14.7	3	4.4	68	100
Chemicals	39	51.4	20	26.3	12	15.8	3	3.9	2	6.2	76	100
Metal products	-	-	42	47.2	34	38.2	9	10.1	4	4.5	89	100
Building materials	28	45.2	7	11.3	21	33.8	6	9.7	-	-	62	100
Clothes & textiles	-	-	12	42.9	8	28.6	5	17.8	3	10.7	28	100
Wood products	2	6.7	4	13.3	20	66.7	4	13.3	-	-	30	100
Paper, etc.	-	-	11	26.2	23	54.7	3	7.2	5	11.9	42	100
Total	100	25.3	112	28.4	126	31.9	40	10.1	17	4.3	395	100

[X^2 value = 58.1 with 8 df. Highly significant at the 1% level, combining columns (1,2) and (4,5) and rows 5,6 and 7]

6.3.7 Control of non-conforming materials

As management of non-conforming items forms an integral part of a sound quality control system, there must be clear guidelines on how such items should be identified, segregated from good items and disposed of. The approach adopted with regard to non-conforming quantities of materials varies according to the activity concerned. In some cases, the whole of the quantity purchased is rejected. In others, only the non-conforming items are rejected[2].

Table 6.13
Disposal of non-conforming
incoming materials

INDUSTRIAL CATEGORY	The whole quantity is rejected		Non-conforming quantity is rejected		Materials accepted at reduced price		Total	
	Fr.	%	Fr.	%	Fr..	%	Fr.	%
Food & drinks	20	35.1	32	56.1	5	8.8	57	100
Chemicals	24	34.8	36	52.2	9	13	69	100
Metal products	37	45.2	45	54.8	-	-	82	100
Building materials	32	57.1	24	42.9	-	-	56	100
Clothes & textiles	3	25	7	58.3	2	16.7	12	100
Wood products	4	23.5	13	76.5	-	-	17	100
Paper, printing & publi.	9	26.5	22	64.7	3	8.8	34	100
Total	129	39.5	179	54.7	19	5.8	327	100

[X^2 value = 14.7 with 5 df. Significant at the 5% level, combining rows 5 & 6 and columns 2 & 3]

The figures shown in table 6.13 indicate that the same factory may adopt a number of policies. This may be due, among other things, to the tolerance limits allowed, the differences in the nature of the materials involved or the nature of the industrial activity itself.

Looking at the X^2 value, we find that disposal of non-conforming materials depends on the industry concerned, with rejection of all of the quantity supplied being most systematically adopted in the foodstuffs and drinks industry, particularly with regard to dairy products; bread and bakery products; meat production, etc.

This approach is also adopted for products used in the chemical and metal industries such as tyres, plastic products, chemical detergents and perfumes; electrical equipment, air-conditioning and heating systems, gold and jewellery and for construction materials and equipment such as building materials, cement, bricks, pre-assembled and pre-fabricated accommodation units.

The policy of accepting non-conforming materials at a reduced price is adopted in a few industries. Such materials are accepted in 16.7% of the cases in the clothes and textile industry, 13% in the chemical industry and 8.8% in the foodstuffs and printing & publishing industries.

6.3.8 Non-conformity of incoming materials and its effects on product quality

The use of materials which do not conform to the required quality specifications affect the products in varying degrees.

The X^2 test on the figures shown in the table below indicates that there is a relationship between the type of industry and the effects of defective materials on the quality of products.

Thus, while over half of the respondents across all the industrial categories indicated that the use of defective materials results in the total loss of the production output, 29.2% reported that products are affected to a considerable extent, 11.8% described the effect on product quality as being negligible and 4.5% indicated that this had no effect whatsoever.

Looking at the data obtained for each industry, we find that such cases represent 14.5% of wood products, 9.4% of construction materials, 6.9% of foodstuffs and 3.8% of chemical products.

Table 6.14

Reported effects of non-conforming materials on product quality

INDUSTRIAL CATEGORY	Loss of the whole production		Major effect on products		Products affected slightly		No effect on products		TOTAL	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Food & drinks	31	53.5	15	25.8	8	13.8	4	6.9	58	100
Chemicals	38	57.6	22	33.3	6	9.1	-	-	66	100
Metal products	46	57.5	24	30	7	8.7	3	3.8	80	100
Building materials	23	43.4	16	30.3	9	16.9	5	9.4	53	100
Clothes & textiles	5	50	3	30	2	20	-	-	10	100
Wood products	6	42.8	3	21.4	3	21.4	2	14.5	14	100
Paper, printing, etc.	21	67.7	8	25.8	2	6.5	-	-	31	100
Total	170	54.5	91	29.2	37	11.8	14	4.5	312	100

[X^2 value = 13.2 with 5 df. Significant at the 5% level, combining rows 5 & 6 and columns (1 &2) and (3 & 4)

6.4 QUALITY CONTROL OF PRODUCTION

For Feigenbaum (1991, p. 67), "product control involves the control of products at the source of production and through field service so that departures from the quality specifications can be corrected before defective or non-conforming products are manufactured and the proper service can be maintained in the field to assure full provision of the intended customer quality." Within this overall function, there is a need to ensure that the in-process materials and procedures are properly controlled so that appropriate preventive action can be taken before proceeding to the final stage of the product manufacture[3].

6.4.1 Quality control during the production process

The scope and extent of in-process control will depend on a whole host of factors, including such considerations as how much is known about the process involved, the extent to which a sample or lot is representative of the lot or batch as a whole and what will be the effect on the finished product or service of defects in its component parts.

For Oakland (1993, p. 114), in-process monitoring should ideally concentrate on the "actual process parameters [which] should be monitored to ensure feedforward control of the process. The work instructions should also indicate the frequency of any in-process inspections or checks, and the action to be taken in the event of process parameters being found to be incorrect or 'out of control'".

As can be seen from table 6.15 below, the majority of the factories surveyed (86.9%) carry out quality control tests during the production process compared to 13.1% of the total sample which do not.

Table 6.15

In-progress quality control

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	NO.	%	NO.	%	NO.	%
Food & drinks	48	90.6	5	9.4	53	100
Chemicals	54	88.5	7	11.5	61	100
Metal products	64	84.2	12	15.8	76	100
Building materials	46	92	4	8	50	100
Clothes & textiles	5	83.3	1	16.7	6	100
Wood products	6	75	2	25	8	100
Paper, printing & publishing	22	78.6	6	21.4	28	100
Total	245	86.9	37	13.1	282	100

[X^2 value = 4.9 with 5 df. Not significant at the 5% level. Combined rows: 5 and 6]

6.4.2 Method of controlling quality during production

Table 6.16

Testing method

INDUSTRIAL CATEGORY	Random tests		Full tests		TOTAL	
	Fr.	%	Fr.	%	Fr.	%
Food & drinks	36	64.3	20	35.7	56	100
Chemicals	42	65.6	22	34.4	64	100
Metal products	53	67.1	26	32.9	79	100
Building materials	36	67.9	17	32.1	53	100
Clothes & textiles	7	77.8	2	22.2	9	100
Wood products	8	72.7	3	27.3	11	100
Paper, printing & publishing	29	93.5	2	6.5	31	100
Total	211	69.6	92	30.4	303	100

[X^2 value = 10.2 with 5 df. Not significant at the 5% level. Combined rows: 5 and 6]

As can be seen from table 6.16, items in the course of production are taken at random and subjected to examination and testing in 69.6% of the cases. On the other hand, the figure for full testing stands at just 30.4%.

6.4.3 Stages at which quality control is carried out during production

The production process may consist of many and various stages depending on the type of activity involved. This is reflected in the results of the survey, with each factory applying either method in accordance with its activities and its approach to quality control.

Table 6.17

Stages at which in-progress quality control is carried out

INDUSTRIAL CATEGORY	Main stages only		At every stage		TOTAL	
	Fr.	%	Fr.	%	Fr.	%
Food & drinks	18	36	32	64	50	100
Chemicals	26	46.4	30	53.6	56	100
Metal products	38	56.7	29	43.3	67	100
Building materials	20	41.7	28	58.3	48	100
Clothes & textiles	2	28.6	5	71.4	7	100
Wood products	1	11.1	8	88.9	9	100
Paper, printing & publishing	3	12.5	21	87.5	24	100
Total	107	40.9	154	59.1	261	100

[X^2 value = 19.1 with 4 df. Significant at the 5% level. Combined rows: 5,6 and 7]

The X^2 result confirms that the factories which control quality during the production process carry out the necessary tests and inspections either after every stage in the production process or only after the main stages, depending on the industrial activity carried on.

The systematic approach appears to be the prevailing trend across all the industrial categories surveyed with 59.1%, followed by selective testing after the main production stages with 40.9%. As we pointed out earlier, a combination of the two approaches is the norm in all the factories.

Although special test and measuring equipment is shown in table 6.18 to be the most commonly used method for controlling quality during production, the X^2 value for this table indicates that the method of controlling quality during production is highly dependent on the industrial category concerned. In particular, we find that only the metal industry uses such equipment more than 50% of the time, followed by the construction materials industry with 46.9% and the textiles and garments industry with 44.4%. The chemical industry and the foodstuffs industry use this method in 35% and 34.5% of the cases respectively.

Table 6.18

Means used during production

for control of quality

INDUSTRIAL CATEGORY	Lab. tests and analyses		Special measuring instruments		Visual inspection		Total	
	Fr.	%	Fr.	%	Fr..	%	Fr.	%
Food & drinks	22	40	19	34.5	14	25.5	55	100
Chemicals	27	45	21	35	12	20	60	100
Metal products	12	14.8	44	54.3	25	30.8	81	100
Building materials	10	20.4	23	46.9	16	32.7	49	100
Clothes & textiles	-	-	4	44.4	5	55.6	9	100
Wood products	-	-	2	18.2	9	81.8	11	100
Paper, printing & publi.	-	-	6	22.2	21	77.8	27	100
Total	71	24.4	119	40.7	102	34.9	292	100

[X^2 value = 41.4 with 5 df. Highly significant at the 1% level. Combined rows: 5 and 6 and columns 1 and 2]

On the other hand, relatively less reliance is placed on specialised equipment by the paper and publishing industry with 22.2% and the wood products industry with 18.2%. These last two industries rely more on the naked eye for testing quality in the course of production. The figures given for this method are: 81.8% in the wood products industry, 77.8% in the paper and publishing industry, 55.6% in the textiles and garments industry, 30.8% and 25% for construction materials and foodstuffs respectively and 20% in the chemical industry.

The percentages obtained on the use of laboratory tests and analyses are: 45% for the chemical industry, 40% for the foodstuffs industry, 20.4% for construction materials and 14.8% for metal products.

6.4.5 Adequacy of the instruments and equipment used for quality control

The reliability and accuracy of data, particularly when it is obtained by means of measuring instruments and equipment, is wholly dependent on the extent to which such instruments and equipment are properly calibrated and maintained.

The importance given to the accuracy and reliability of quality control equipment is reflected in the fact that most quality manuals give particular attention to this aspect of quality control. A typical provision in this regard can be found in the quality system recommended by Taylor (1989). For example, his system requires companies either to establish their own programme or to purchase the services of a facility for "measuring equipment procurement, calibration, and use that will ensure that the accuracy of characteristics produced are within the limits specified in design specifications and user information". (Taylor 1989, p. 159)

Table 6.19

Adequacy of the available quality control instruments and equipment

INDUSTRIAL CATEGORY	Inadequate		Adequate		TOTAL	
	NO.	%	NO.	%	NO.	%
Food & drinks	44	83.1	9	16.9	53	100
Chemicals	41	67.2	20	32.8	61	100
Metal products	48	63.2	28	32.8	76	100
Building materials	32	64	18	36	50	100
Clothes & textiles	5	83.3	1	16.7	6	100
Wood products	6	75	2	25	8	100
Paper, printing & publishing	21	75	7	25	28	100
Total	197	69.9	85	30.1	282	100

[X^2 value = 7.8 with 5 df. Not significant at the 5% level. Combined rows: 5 and 6]

The figures obtained from the survey and shown in the table above confirm this to be the case, with only 30.1% of the respondents expressing satisfaction with the level of adequacy of their testing instruments and equipment. This leaves 69.9% of the total sample having to rely on SASO laboratories for carrying out quality tests on products in the course of manufacture. The X^2 test further confirms that this problem is independent of industrial category. The reason for this is probably due to the fact that in Saudi Arabia, again due to a general lack of industrial maturity and technological know-how, little provision is made in this regard, with most companies continuing to rely on government agencies for routine measurements and tests.

6.5 QUALITY CONTROL OF FINISHED PRODUCTS

Quality control during the final stage of production is necessary, if only to make absolutely sure that the finished product not only conforms to specifications but is also fit for its intended use.

Moreover, as Ishikawa (1985, p. 79) points out, "as long as there are defects, all items must in principle be inspected". This is all the more applicable where neither a total quality control system nor a properly trained workforce is in place. Yet, a significant minority (24.1%) of the sample does not ensure that a final inspection is carried out.

Table 6.20

Quality control of finished products

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	NO.	%	NO.	%	NO.	%
Food & drinks	39	73.5	14	26.4	53	100
Chemicals	48	78.6	13	21.3	61	100
Metal products	56	73.6	20	26.3	76	100
Building materials	38	76	12	24	50	100
Clothes & textiles	6	100	-	-	6	100
Wood products	7	87.5	1	12.5	8	100
Paper, printing & publishing	20	71.4	8	28.5	28	100
Total	214	75.8	68	24.1	282	100

[X^2 value = 2.9 with 6 df. Not significant at the 5% level. Combined rows: 5, 6 and 7]

The reasons given by the 24.1% of the sample which does not carry out controls during this stage of production include the following:

- they do not require such controls to be carried out,
- the controls carried out in the two previous stages are judged to be sufficient,
- the materials used in the production have already been tested by the supplier.

6.5.1 Methods used to test finished products

The factories surveyed do not limit themselves to a single method in carrying out quality control tests of their finished products.

Table 6.21

Methods used for the control of finished products

INDUSTRIAL CATEGORY	Random tests		Full tests		TOTAL	
	Fr.	%	Fr.	%	Fr.	%
Food & drinks	47	85.5	8	14.5	55	100
Chemicals	58	93.5	4	6.5	62	100
Metal products	72	92.3	6	7.7	78	100
Building materials	45	86.5	7	13.5	52	100
Clothes & textiles	6	75	2	25	8	100
Wood products	7	70	3	30	10	100
Paper, printing & publishing	26	86.7	42	13.3	30	100
Total	261	88.5	34	11.5	295	100

[X^2 value = 8.13 with 5 df. Not significant at the 5% level. Combined rows: 5 and 6]

As with pre-production and in-progress quality control, testing is carried out either systematically or selectively depending on the nature and intended use of the products involved.

The X^2 result confirms that there is no association between industrial category and the testing method selected. The most common method is to carry out the tests and quality control checks on random samples of the total output. This method is used in 88.5% of cases, compared to just 11.5% for 100 per cent testing. However, it should be pointed out that, unless sampling inspection is carried out on the basis of statistically valid methods, it is safer to carry out 100 per cent inspection, particularly where non-conformance of the products involved can have far reaching consequences on the health and/or safety of the end users, as is the case in the production of foodstuffs and chemical products. In the quality system recommended by Taylor (1985), for example, 100 percent inspection is specifically stipulated for the control of a product's safety and liability characteristics. His system further requires that, in any case, "no completed items of product shall be shipped by the company without at least an audit of quality characteristics having been carried out on the items." (Taylor 1989, p. 161)

6.5.2 Tools and equipment used for quality control of finished products

The choice of the quality control tools and equipment is usually determined by the nature of the finished product to be tested. The X^2 test result for this table indicates that no significant relationship exists between industrial category and the method used for quality control of finished products. Thus, in all the industrial categories surveyed, 48.9% of the quality control tests are carried out using manual tools. The five senses are the next most frequently used means (33.2%), followed by electronic equipment (17.9%).

Table 6.22

Equipment used for finished product quality control

INDUSTRIAL CATEGORY	Lab. tests and analyses		Special measuring instruments		Visual inspection		Total	
	Fr.	%	Fr.	%	Fr..	%	Fr.	%
Food & drinks	16	31.4	23	45.1	12	23.5	51	100
Chemicals	19	33.3	27	47.4	11	19.3	57	100
Metal products	25	30.9	42	51.8	14	17.3	81	100
Building materials	18	36	23	46	9	18	50	100
Clothes & textiles	2	25	5	62.5	1	12.5	8	100
Wood products	3	33.3	4	44.5	2	22.2	9	100
Paper, printing & publi.	11	39.3	15	53.6	2	7.1	28	100
Total	94	33.2	139	48.9	51	17.9	284	100

[X^2 value = 2.6 with 4 df. Not significant at the 5% level. Combined rows 5,6 and 7 and columns 1 and 2]

However, the use of manual tools and the five senses are no longer sufficient to ensure that products conform to the required specifications, particularly in an age where more sophisticated tools are available for this task.

6.5.3 Control of defective or nonconforming products

Disposal of defective items varies from one industry to another depending on the seriousness of the defect, the nature of the products concerned and the general policy adopted by the company concerned.

So far in the present thesis, no distinction has been made between "non-conforming" and "defective" items or products. Although the two terms are not exactly synonymous, no distinction is drawn between them here[4] because, as we pointed out in chapter 4, the questionnaire was deliberately kept as simple as possible so as not to alienate the respondents.

6.5.3.1 Acceptance of defective items

The general impression given by the sample is that factories allow defective items of one or other of their products to be passed on to the customer, depending on the circumstances of production.

Table 6.23

Acceptance of defective items

INDUSTRIAL CATEGORY	YES		NO		SOMETIMES		Total	
	Fr.	%	Fr.	%	Fr..	%	Fr.	%
Food & drinks	44	81.5	6	11.1	4	7.4	54	100
Chemicals	49	79	5	8.1	8	12.9	62	100
Metal products	58	75.3	9	11.7	10	13	77	100
Building materials	39	76.5	5	9.8	7	13.7	51	100
Clothes & textiles	4	50	3	37.5	1	12.5	8	100
Wood products	6	66.7	2	22.2	1	11.1	9	100
Paper, printing & publi.	18	64.3	7	25	3	10.7	28	100
Total	218	75.4	37	12.9	34	11.7	289	100

[X^2 value = 5.9 with 5 df. Not significant at the 5% level. Combined columns: 2 and 3 and rows: 5 and 6]

The X^2 test on the figures set out in table 6.23 confirms that defective items are accepted in all the industries surveyed, depending on the limits permitted and the commitment of each organisation to quality.

6.5.3.2 Defect rates

Table 6.24 indicates that in most factories, the proportion of defective items in relation to total production lies between 5% and 8%, followed by proportions of between 9% and 12%, 0% and 4%, 13% and 16% and, finally, 17% and 20%.

Table 6.24

Percentage of defective items

INDUSTRIAL CATEGORY	0% - 4%		5% - 8%		9% - 12%		13% - 16%		17% - 20%		TOTAL	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Food & drinks	13	22.4	26	44.8	17	29.3	2	3.5	-	-	58	100
Chemicals	12	17.9	31	46.3	19	28.4	4	5.9	1	1.5	67	100
Metal products	10	12.5	42	52.5	17	21.2	9	11.3	2	2.5	80	100
Building materials	11	19.6	29	51.8	13	23.2	3	5.4	-	-	56	100
Clothes & textiles	2	14.3	8	57.2	3	21.4	1	7.1	-	-	14	100
Wood products	2	11.1	10	55.6	4	22.2	2	11.1	-	-	18	100
Paper, print. etc	4	11.7	21	61.7	5	14.8	3	8.8	1	2.9	34	100
Total	54	16.5	167	51.2	78	23.8	24	7.3	4	1.2	327	100

6.5.3.3 Causes of defective production

Defective products result from faults occurring for any number of reasons. As we pointed out earlier, they may be due to defective raw materials, faulty equipment, inaccurate measurements and tests, etc. As can be seen from the X^2 test results for this table, there does not seem to be any association between industrial category and the causes of production defects. The main problem encountered in all the industrial categories surveyed is the lack of the necessary skills.

As the table overleaf indicates, the lack of adequately trained staff is reported to be the main cause for defective production. Of the 282 industrial companies surveyed, 107 factories, i.e. 31.1% of the sample, pointed to the lack of skilled labour as the main problem. In this connection, we should recall our earlier observations on employee involvement and participation and the implications of the temporary nature of a predominantly migrant workforce.

The second most common problem relates to the use of obsolete machinery (22.4%). The low quality of the materials used in the production process is blamed in 16.8% of the cases, followed by shortcomings in supervision and monitoring (11.1%). Only 4.1% of the respondents felt that there was excessive precision in testing.

Table 6.25

Causes of production defects

Industrial category	Lack of skilled labour		Outdated machinery		Low qual. of materials used		Lack of supervision/ monitoring		Excessive precision in testing		Lack of necess. measuring/test equipment.		TOTAL	
	Pr.	%	Pr.	%	Pr.	%	Pr.	%	Pr.	%	Pr .	%	Pr.	%
Food and drinks	19	31.2	12	19.7	11	18	8	13.1	4	6.5	7	11.5	61	100
Chemicals	21	30	15	21.5	12	17.1	11	15.7	3	4.3	8	11.4	70	100
Metal products	23	28	19	23.2	14	17.2	12	14.6	4	4.8	10	12.2	82	100
Building materials	18	31.1	13	22.4	10	17.2	9	15.5	2	3.4	6	10.4	58	100
Clothes & textiles	7	41.2	4	23.5	3	17.6	2	11.7	-	-	1	5.9	17	100
Wood products	8	38.1	5	23.8	2	9.5	3	14.3	1	4.7	2	9.5	21	100
Paper, print., publishing	11	31.4	9	25.7	6	17.2	5	14.2	-	-	4	11.4	35	100
TOTAL	107	31.1	77	22.4	58	16.8	50	14.5	14	4.1	38	11.1	344	100

[X^2 value = 0.6 with 6 df. Not significant at the 5% level. Rows (5,6) and columns (1,4) and 2,3) combined. Columns 5 and 6 omitted]

6.5.3.5 Disposal of defective products

Table 6.26

Disposal of defective products

INDUSTRIAL CATEGORY	Discarded totally		Returned to product. line		Sold at reduced price		Used in other products		TOTAL	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Food & drinks	33	60	17	31	1	1.8	4	7.2	55	100
Chemicals	23	37.1	30	48.4	3	4.8	6	9.7	72	100
Metal products	15	19.2	45	57.7	5	6.4	13	16.7	78	100
Building materials	25	48.1	12	23.1	4	7.7	11	21.1	52	100
Clothes & textiles	3	33.3	4	44.4	-	-	2	22.2	9	100
Wood products	3	27.3	5	45.5	2	18.2	1	9.1	11	100
Paper, printing & publishing	14	46.6	9	30	1	3.3	6	20	30	100
Total	116	39.1	122	41.1	16	5.3	43	14.5	297	100

[X^2 value = 28.5 with 10 df. Highly significant at the 1% level. Combined rows : 5 and 6 and columns 2 and 4]

As can be seen from table 6.26, the most common course of action across the factories surveyed is for the defective product to be returned to the production line for reworking. This represents 41.1% of all the actions taken in relation to defective production. The product is discarded in 39.1% of the cases, particularly in the foodstuffs industry where 60% of the factories surveyed indicated this to be their policy. In 14.5% of the cases, the defective items are re-processed and incorporated in a different type of product.

The policy of selling the defective product at a lower price after the fault has been made good represents no more than 5.3% of the total number of ways in which defective products are disposed of.

When we look at the X^2 result, we find that a significant relationship exists between the type of industry and the method in which defective production is disposed of. As would be expected, defective products are most frequently discarded in the food industry, whereas in the metal and chemical industries, the main trend is for the defective item to be reworked or incorporated into a different product.

6.5.3.6 Problems encountered by the various industries due to the presence of defective items

The low quality of certain raw materials purchased locally leads to problems in final production which, in turn, create difficulties for the factories concerned.

Table 6.27 shows that 85.5% of the factories surveyed face problems due to the release onto the market of defective product items, as against just 14.5% which do not face such problems.

Table 6.27

Factories which face problems

as a result of production defects

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	No.	%	No.	%	No.	%
Food & drinks	48	90.6	5	9.4	53	100
Chemicals	52	85.3	9	14.7	61	100
Metal products	65	85.5	11	14.5	76	100
Building materials	43	86	7	14	50	100
Clothes & textiles	4	66.7	2	33.3	6	100
Wood products	5	62.5	3	37.5	8	100
Paper, printing & publishing	24	85.7	4	14.3	28	100
Total	241	85.5	41	14.5	282	100

[X^2 value = 6.18 with 5 df. Not significant at the 5% level. Combined rows : 5 and 6]

Defective products which slip through the net and onto the market cause many problems in the relations of the factories concerned with government as well as non-government organisations.

Table 6.28 shows that the consequences of allowing defective products to reach the market are most damaging to the factory's relations with the consumer. This is the most frequently cited negative effect (40.9%) as the consumer often opts for competing products which are imported from abroad and, more generally, loses all confidence in the products manufactured locally.

Relations with distributors are reported to be the second most serious problem (28.1%). Here, the problem seems to be that distributors insist on prices being lowered, arguing that they have difficulties in selling locally manufactured products due to the defects they contain.

Table 6.28

Problems encountered as a result of product defects

INDUSTRIAL CATEGORY	A		B		C		D		TOTAL	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Food & drinks	23	40.4	16	28.1	10	17.5	8	14	57	100
Chemicals	27	42.2	15	23.4	13	20.3	9	14.1	64	100
Metal products	29	36.7	22	27.8	17	21.5	11	13.9	79	100
Building materials	21	38.9	18	33.3	9	16.7	6	11.1	54	100
Clothes & textiles	7	46.7	5	33.3	2	13.3	1	6.7	15	100
Wood products	8	42.1	6	31.6	4	21.1	1	5.2	19	100
Paper, printing & publishing	16	50	8	25	5	15.6	3	9.4	32	100
Total	131	40.9	90	28.1	60	18.7	39	12.2	320	100

[X^2 value = 2.9 with 10 df. Not significant at the 5% level. Rows (5,6) combined]

A. Consumers turning to imports / loss of confidence

B. Problems with distributors. Difficulties in marketing products, prices forced down, etc.

C. Problems with various government authorities; repeated warnings, notices, etc.

D. Problems with other companies; breach of contract; loss of competitiveness, etc.

Problems with government organisations are ranked as the third most serious consequence of defective manufacture with 18.7% of the sample reporting difficulties. This usually takes the form of repeated notices and warnings issued by various authorities such as the Ministry of Industry and Commerce, the Saudi Arabian Organisation for Standards and Specifications and, particularly in the case of foodstuffs, the Ministry of Health.

The least frequently cited problem concerns the effect of defective products on relations with the contracting partners of the factories concerned. Difficulties of this nature arise, for example, when the defective products are manufactured under licence from a foreign company. This can be taken as a breach of contract due to the prejudice such products may cause to the tradename of the foreign partner and the loss of market share in favour of competing products.

NOTES

1. For example, Taylor (1989, p. 153) recommends that delivery of incoming materials should be accepted on the basis of one or a combination of the following:

    a. Full qualification and approval of the supplier's quality system.
    b. Evidence of quality of supplies provided with each delivery by the supplier.
    c. Inspection by the company at the source.
    d. Inspection of supplies upon their receipt by the company.

2. These and other alternatives are listed in Feigenbaum (1991, p. 706) as follows:

    1. reject the entire lot, and return it to the vendor.
    2. 100 per cent sort the lot, and return the non-conforming units to the vendor. The vendor bears the cost of the sorting inspection.
    3. 100 per cent sort the lot at the vendor's expense, and repair the nonconformances right at the purchaser's plant. The vendor pays the cost of these repairs.

4. Accept the entire lot, based upon a special disposition which temporarily relaxes specification requirements.
5. Alternatives 2 or 3, except that the purchaser plant bears part or all of the extra inspection and repair costs.

3. To illustrate the advantages of product control during manufacture, Feigenbaum (1991, p. 740) gives the example of two products. "Product A, whose quality is poor during manufacture, faces the strong likelihood of high manufacture losses, high inspection and test costs and high complaint expense in the field. Product B, whose quality is high during the manufacture will represent a better situation. The likelihood is that this article will experience a good loss, cost and complaint record."

4. According to the ISO definitions (ISO 8402-1985), "non-conformity is the non-fulfilment of specified requirements. This covers the departure or absence of one or more quality characteristics from specified requirements. It also covers the departure or absence of an element of a quality system". Defect, on the other hand, is "the non-fulfilment of intended usage requirements". (Taylor 1989, p. 26)

Other distinctions which have been drawn in relation to product quality relate to the degree of seriousness of the non-conformance or defect and their effect on one or other quality related characteristic.

For example, Taylor (1989, p. 244) recommends that a distinction should be made between major and minor non-conformances. According to him, "major non-conforming material is that which has one or more non-conformances that will render the material incapable of meeting requirements for one or more of the following:

1. Performance, effective use, or operation.
2. Reliability or durability.
3. Interchangeability.
4. Weight, volume or appearance (when a factor).
5. Health or safety.

Minor non-conforming material is that which has one or more nonconformances that do not affect (1) to (5) above but which is a non-conformance to the requirements in the contract, specification, drawing or other approved product description."

Other distinctions which have been made in relation to non-conformity and defects concern the quality characteristics of products or processes, whereby the non-conformance is classified as critical, major, minor or incidental. These are described in Feigenbaum (1991, p. 253) in relation to product quality characteristics as follows:

- A critical characteristic is one which threatens loss of life or property or makes the product non-functional if it was outside prescribed limits.
- A major characteristic is one which makes the product fail to accomplish its intended function if outside prescribed limits.
- A minor characteristic is one which makes the product fall short of its intended function if outside prescribed limits.
- An incidental characteristic is one where any variation from the tolerance that may occasionally occur will have no average long-term nonconformity or defect consequences.

The importance of distinguishing between various levels of non-conformity or quality characteristics is that it helps in making decisions on whether to carry out 100 percent or sample inspection, what corrective action should be taken and how to dispose of the non-conforming or defective production items.

Thus, depending on the relative importance of the defect or non-conformity, a product may be scrapped, reworked, repaired, sold for a reduced price or, in the case of incoming materials, returned to the supplier.

CHAPTER SEVEN

DATA PRESENTATION AND ANALYSIS (III)

7.1 INTRODUCTION

This final section of the analysis examines the extent to which some of the basic components of an efficient quality system are provided for, if at all, among the sample. As was discussed in some detail in chapter 3, an efficient quality management system rests on there being:

- clear and well-defined lines of communication between the quality department and other departments in the organisation;
- efficient information and documentation systems to allow for proper monitoring and follow-up of quality control activities;
- training provision in the use of statistical and other quality control tools and in other skills which would enable the workforce to exercise as much self control as possible.

There is also the need to ensure that the equipment and instrumentation used to measure quality is regularly calibrated and adequately maintained.

In this connection, a further consideration of particular relevance to a developing economy such as that of Saudi Arabia relates to the role of the government in promoting quality and the extent of cooperation between the relevant government agencies and the country's producing sector.

7.2 INFORMATION AND COMMUNICATION SYSTEMS

Businesses of all kinds and industrial companies in particular need to process large volumes of data and information on all the constituent parts of their activities. The information may relate to the primary materials, equipment and machinery, employees, product specifications, the competition, importers, the internal structure of the organisation, customer requirements and satisfaction, etc.

The establishment of a reliable and efficient information system is no longer a luxury, nor is it beyond the means of even the smallest of businesses. Any acquisition costs involved in the creation of such a system are far outweighed by the benefits which may be gained from a technology offering a wide choice of equipment, ranging from mainframe computers and dedicated intelligent systems to "user-friendly" microcomputers and software. Moreover, the technology has reached such a stage of development that collecting, recording and analysing data and information can all be carried out in a fraction of the man-hours these tasks would otherwise take.

The type of information which is of relevance to the quality control team may relate to the constituent part or process stage of a particular product and the number of associated faults, defects or rejects. Other information may relate to customer complaints, the frequency and nature of them, etc.

Thus, the minimum requirement is the availability of an information system by means of which data can be collected and analysed so that major quality problems and causes can be identified and corrective action planned and implemented.

The survey sought to find out whether such a system is available to the factories surveyed and, if not, the reasons for its absence.

7.2.1 Availability of information systems

From the responses obtained through the survey, it would appear that the importance of an information system is not always appreciated. Even where the system is available, no mechanism is put in place to assess its efficiency.

Table 7.1

Availability of information systems

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	NO.	%	NO.	%	NO.	%
Food & drinks	11	20.7	42	79.3	53	100
Chemicals	15	24.6	46	75.4	61	100
Metal products	17	22.4	59	77.6	76	100
Building materials	13	26	37	74	50	100
Clothes & textiles	1	16.7	5	83.3	6	100
Wood products	2	25	6	75	8	100
Paper, printing & publi.	5	17.8	23	82.2	28	100
Total	64	22.7	218	77.3	282	100

[X^2 value = 0.9 with 5 df. Not significant at the 5% level. Rows combined: 5 and 6]

As can be seen from table 7.1, 22.7% of the sample indicated that they had such a system. However, the overwhelming majority, i.e. 77.3% of the sample do not have an information system, regardless of the industrial category concerned. The X^2 result also indicates this to be the case, confirming the absence of any significant relationship between industrial category and this particular attribute.

7.2.2 Reasons for the absence of an information system

Information systems are a key resource in the management of quality as it is the basis on which a company establishes whether the wishes or requirements of its customer are met and assesses the development/movement of the activities, departments and employees within the organisation. It is also seen as the nerve centre which links the departments and the sections together and as a management tool in planning for the production of quality goods which comply with the stipulated specifications.

Table 7.2

Reasons given for lack of information systems

REASONS GIVEN	Frequency	Percentage
Insufficient documentation for the necessary information	89	40.8
The existing records are unsystematic	58	26.6
Information on quality is not reliable	43	19.7
The cost would be too high	28	12.8
TOTAL	218	100

The reason most frequently cited by the managers who do not have an information system is the fact that the existing documentation is insufficient to supply the required information. This represents 40.8% of the replies, followed by the unsystematic nature of the existing records (26.6%), the fact that the information available is not reliable (19.7%) and cost (12.8%).

7.2.3 Information system input and output

A great deal of information provided from within as well as from outside the organisation usually needs to be processed, analysed and acted upon. External information, for example, relates to data on the customer and the extent to which he feels that the product offered to him is in conformity with his requirements and specifications. Other data relates to the markets for procurement of such items as raw materials, equipment and machinery, etc.; the job market and the skills and expertise necessary for the activities of the company; the product markets, i.e. information on the state of the market, the competition, alternative goods, prices and distribution channels; support structures and services such as government bodies, banks, insurance companies, transport, communication, energy sources and all the facilities necessary for industry.

From an internal point of view, the information system relays information from every work site concerning: operation schedules; the products and their conformity to the specifications; the type of defects and faults found in the products; the means of rectifying them; the problems facing the work and affecting the level of quality; safety and security in the work place; complaints, suggestions and other issues relating to the work environment in general; and all other factors directly or indirectly affecting quality.

The data on these various aspects forms the input for the quality management information system. Appropriate methods for processing and analysis of information are then developed and the resulting output is used to assist in the implementing the total quality system.

The replies obtained through the questionnaire suggest that the factories which do have an information system use it mainly as a tool to store and retrieve basic information such as the chemical composition or the constituent elements of the product permitted in the particular industry and the date of production and expiry, particularly in the food industries and for certain chemical products. It is also used to store findings of sample tests for review and development of the product, information on the primary materials used in the production, etc.

This confirms our earlier observation that the full potential of information systems is not clearly understood by the subjects of the research.

7.3 COMMUNICATION SYSTEMS

Efficient communication channels and media must be established both vertically, from senior management down to the shop floor and from the lowest levels in the organisation's hierarchy upwards, and horizontally across departments, sections, units, etc. Only then can the quality message be transmitted to and understood by everyone in the organisation and the main elements of a quality system be implemented, including the promotion of teamwork, participation and motivation of the workforce.

The questions addressed in this regard sought to elicit information on the availability of communication systems within the factories surveyed, the efficiency of the systems used and the preferred methods of communication.

7.3.1 Availability of communication systems

Oakland (1989, p. 365) observes that communication is "possibly the most neglected part of many organizations' operations, yet failure to communicate effectively creates unnecessary problems, resulting in confusion, loss of interest and eventually in declining quality through apparent lack of guidance and stimulus."

This is borne out by the figures shown in the table below which indicate that poor communication or lack of it remains the norm in many of the factories surveyed. The figures in table 7.3 show that 74.5% of the respondents indicated that their organisation did not have any communication system in place while only 25.5% replied that they had such a system.

Table 7.3

Availability of communication systems

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	NO.	%	NO.	%	NO.	%
Food & drinks	12	22.6	41	77.4	53	100
Chemicals	16	26.2	45	73.7	61	100
Metal products	19	25	57	75	76	100
Building materials	14	28	36	72	50	100
Clothes & textiles	2	33.3	4	66.6	6	100
Wood products	3	37.5	5	62.5	8	100
Paper, printing & publishing	6	21.4	22	78.6	28	100
Total	72	25.5	210	74.5	282	100

[X^2 value = 1.4 with 5 df. Not significant at the 5% level. Rows combined: 5 and 6]

These results mirror closely the results obtained in relation to the question on information systems (see table 7.1). This is to be expected given the fact that the two systems complement each other.

7.3.2 Efficiency of communication systems

The efficiency of communication systems varies from one organisation to the other, depending on the circumstances of the work within each organisation and the support given by the management to quality.

Table 7.4

Degree of efficiency of the system

Degree of efficiency	Frequency	Percentage
highly efficient	24	33.3
Average	37	51.4
Poor	11	15.3
Total	72	100

Out of all the respondents who indicated that a communication system was in place in their organisation, 51.4% rated the efficiency of their systems as being average.

The system was judged to be highly efficient by 33.3% of them while 15.3% considered the efficiency of their communication systems to be poor. This applies mainly to industrial companies involved in the production of relatively simple goods such as ice, salt, tyres, plastic bags and cardboard products.

7.3.3 Methods of communication

Communication may be verbal, written, visual, by example or any combination of these methods. To achieve effective communication, the advantages and limitations of each method must be considered in the light of the nature and purpose of the message which is to be communicated and the individuals concerned[1].

Table 7.5

Methods of communication

Method	Frequency	Percentage
Written communication	6	7.4
Verbal communication	6	7.4
A combination of both	69	85.2
Total	81	100

Table 7.5 shows that the most widely used method for communication is a combination of the written and oral modes (85.2%). Equal preference is indicated for one or the other of the two methods (7.4% each). In general, therefore, a combination of the two methods is perceived to be the most efficient means of communication.

7.4 RECORDS AND OTHER QUALITY RELATED DOCUMENTS

The availability of systematic records and sound documentation of quality information are essential elements for the efficient implementation of quality management[2]. Among other things, records help to keep track of information exchanged between the various departments and sections, to store data on the various stages of production and to identify the originators of particular decisions, particularly when things do not proceed according to plan.

In addition, records serve to monitor progress in industrial production through the logging of such information as the percentage of non-conformance, the types of faults detected, the work done to prevent recurrence of such faults, the rectification measures taken and the related costs, customer feedback, movement of sales, etc.

7.4.1 Availability of records

Table 7.6 indicates that records are either incomplete or not kept at all in a sizeable number of the factories surveyed, i.e. 37.6% of the total sample. It appears that the 62.4% which do keep records are the factories which are affiliated to foreign companies and/or those equipped with the latest measuring instruments and tools.

Table 7.6

Record keeping

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	No.	%	No.	%	No.	%
Food & drinks	35	66.1	18	33.9	53	100
Chemicals	37	60.6	24	39.3	61	100
Metal products	43	56.6	33	43.4	76	100
Building materials	31	62	19	38	50	100
Clothes & textiles	4	66.7	2	33.3	6	100
Wood products	6	75	2	25	8	100
Paper, printing & publishing	20	71.4	8	28.6	28	100
Total	176	62.4	106	37.6	282	100

[X^2 value = 2.9 with 5 df. Not significant at the 5% level. Rows combined: 5 and 6]

7.4.2 Reasons for not keeping records

Table 7.7

Reasons why records are not kept

INDUSTRIAL CATEGORY	Not needed		Cost too high		Inaccuracy of data		Data not sufficient		TOTAL	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Food & drinks	8	36.4	6	27.3	5	22.7	3	13.6	22	100
Chemicals	11	40.7	8	29.2	6	22.2	2	7.4	27	100
Metal products	14	36.8	10	26.3	8	21.1	6	15.8	38	100
Building materials	11	52.4	5	23.8	4	19.1	1	4.7	21	100
Clothes & textiles	4	57.1	2	28.6	-	-	1	14.3	7	100
Wood products	5	71.4	2	28.6	-	-	-	-	7	100
Paper, printing & publishing	8	61.5	3	23.1	1	7.7	1	7.7	13	100
Total	61	45.2	36	26.6	24	17.8	14	10.4	135	100

[X^2 value = 7.8 with 8 df. Not significant at the 5% level. Combined rows: 5, 6 and 7 and columns: 3 and 4]

The factories concerned attributed their failure to keep records and to update them to a number of reasons. Foremost among the explanations given is that such records are not needed and that the firms rely on the efforts of individuals for the quality control of their products. It is perhaps not surprising to find that the 45.2% who gave this explanation are also the ones who do not feel it necessary to invest in inspection and testing equipment.

The second most commonly cited reason (26.6%) is the high costs involved, followed by the inaccurate nature of the information and data available (17.8%).

Finally, 10.4% of the respondents pointed to the insufficient nature of the information available to them as the main reason.

7.5 LEADERSHIP AND THE MANAGEMENT OF QUALITY

The first practical step in the implementation of an efficient quality system is for the senior management to formulate a clear policy towards quality and see that it is communicated to everyone in the organisation concerned.

However, for such policy to be of any practical significance, it is necessary to ensure that the quality management function is adequately placed to exercise the feedback and feedforward tasks which an integrated system requires and that it has the necessary authority over quality matters.

As already pointed out on various occasions in the present thesis, achieving quality of production and/or service is the concern of every employee in the organisation. Companies which recognise this to be the case will usually place responsibility for the quality of work with those who actually do the work. Consequently, the tasks assigned to the quality department of such companies would mainly consist in providing the ways and means necessary for people to be able to control the quality of their own work.

However, as this kind of structure requires a genuine and deliberate commitment to quality, it is as yet unlikely to be applicable to most of the companies in our sample. For this reason, the survey simply sought to establish the level of authority enjoyed by the quality control unit/department and the kind of tasks it is called upon to perform.

The figures indicate that the industrial companies in the sample do not have a uniform administrative structure with regard to quality control as each company adopts the administrative structure which is most appropriate for its own specific circumstances. In 37.9% of the cases surveyed, the quality control unit is under the responsibility of the factory manager, 23.1% under the responsibility of the general manager and 15.2% under the responsibility of the production manager who, in turn, is answerable to the factory manager. In 13.8% of the cases surveyed, the general manager has responsibility for the quality control department which also includes quality control laboratories and quality assurance.

Table 7.8

Position of the quality control unit

Position	Number	Percent.
Factory manager - quality control manager - quality control laboratories	107	37.9
General manager - quality control department - quality control laboratories - quality assurance laboratories	65	23.1
General manager - production manager - quality control department - quality laboratories	43	15.2
Factory manager -production manager - quality control laboratories	39	13.8
Other	28	9.9
Total	282	100

In the remaining 28 factories, i.e. 9.9% of the sample, the quality control unit occupies various levels in the administrative hierarchy. These can be broken down as follows:

- Directly under the general manager 42.8%
- Factory manager 35.7%
- Production manager 21.5%

7.5.1 Tasks performed by the quality control unit

Despite the many tasks involved in quality control, the resources allocated to this function vary from the establishment of a specifically dedicated unit to the appointment of a single employee.

The figures set out in table 7.9 indicate that the tasks most frequently performed by the quality control unit/department are:

- sampling of materials prior to commencement and during the various stages of production (15.2%)
- carrying out tests and measurements (15.1%)
- detecting faults and defects (15.7%)
- recommending corrective actions (15.1%).

Table 7.9

Quality control tasks

TASK	Frequency	Percentage
Taking samples	66	15.2
Carrying out tests and measurements	65	15.1
Detecting faults and defects and determining their cause	68	15.7
Suggesting corrective actions	65	15.1
Drawing up specifications for raw materials	57	13.2
Keeping records and statistical data	44	10.2
Drawing up product specifications	34	7.8
Writing reports	33	7.6
TOTAL	432	100

The more or less equal weighting given to these tasks reflects the close link which exists between them as various aspects of the quality control process as a whole. The importance of drawing up specifications for raw materials is given a 13.2% weighting. Drawing up product specifications and writing reports are rated at 7.8% and 7.6% respectively.

The 10.2% weighting given to the task of keeping records and statistical data masks the fact that, as the figures in table 7.6 show, many of the factories surveyed do not keep systematic records of their operations.

7.6 TRAINING

Any improvement in the skills mastered by the workers results in an increase in the quality of the products manufactured and vice-versa. In other words, there is a direct correlation between the level of quality achieved and the level of performance of a trained worker. However, different groups of employees will need different training programmes and methods. For example, managers need to be trained in communication and listening skills. Various categories of workers may need training to develop new and more efficient ways of carrying out their tasks and cutting down or eliminating waste, etc. The opportunity to develop and consolidate quality control skills and to learn of new developments in this field must also be provided, especially to first-line supervisors and inspectors. Thus, training programmes must be drawn up to cater for the needs of staff at every hierarchical level within the organisation, including those with responsibility for purchasing, quality control at the various stages of production, warehousing, etc.

7.6.1 Training provision

As can be seen from table 7.10, more than half the sample, namely 61.3% of the factories surveyed do not have any training provision in the field of quality.

Table 7.10

Training provision

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	No.	%	No.	%	No.	%
Food & drinks	21	39.6	32	60.4	53	100
Chemicals	23	37.7	38	62.3	61	100
Metal products	31	40.8	45	59.2	76	100
Building materials	18	36	32	64	50	100
Clothes & textiles	2	33.3	4	66.7	6	100
Wood products	3	37.5	5	62.5	8	100
Paper, printing & publishing	11	39.3	17	60.7	28	100
Total	109	38.7	173	61.3	282	100

[X^2 value = 0.4 with 5 df. Not significant at the 5% level. Rows combined: 5 and 6]

7.6.2 Place where training is held

Training takes place in the work place itself, at institutions within the country or abroad. The option selected by individual organisations depends not only on cost but on several factors including the general policy with regard to training, the level and duration of the training required, the availability of qualified training staff and, no less important, the costs involved.

Table 7.11

Training location

INDUSTRIAL CATEGORY	In-house		Saudi and foreign Instit.		Saudi instit. only		Foreign institutions		TOTAL	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Food & drinks	13	56.5	5	21.7	3	13.1	2	8.7	23	100
Chemicals	14	56	6	24	3	12	2	8	25	100
Metal products	18	52.9	8	23.5	5	14.7	3	8.8	34	100
Building materials	12	60	5	25	2	10	1	5	20	100
Clothes & textiles	3	60	1	20	1	20	-	-	5	100
Wood products	4	57.1	2	28.6	1	14.3	-	-	7	100
Paper, printing & publishing	7	53.8	3	23.1	2	15.4	1	7.7	13	100
Total	71	55.9	30	23.6	17	13.4	9	7.1	127	100

[X^2 value = 0.3 with 5 df. Not significant at the 5% level. Rows combined: 5 and 6]

Table 7.11 shows the distribution of the responses obtained in relation to the location where training is held by the factories which provide quality control training for their staff (see table 7.10).

In all the industrial categories surveyed, a large proportion of training courses (55.9%) takes place within the factory itself. Provision of training at institutions within the Kingdom and abroad is the second most frequent option (23.6%), followed by the provision of training at institutions within the Kingdom only (13.4%). The proportion of training provided by foreign institutions stands at just 7.1%. According to the X^2 test, the choice of training location is independent of industrial category. On the other hand, this may be due to the costs involved in providing specialised training and the additional expenses of sending trainees abroad or recruiting expatriate instructors. In this connection, it should be pointed out that a number of respondents responsible for quality indicated that they preferred the training courses offered outside the Kingdom, as this option gave them the opportunity to learn about new developments in the field of quality control and to familiarize themselves with the often more advanced equipment and methods used in the countries where such training is held.

7.6.3 Number of training programmes offered annually

The number of training courses held annually often gives an indication as to the importance attached to training by the organization concerned. Analysis of the data obtained through the questionnaire reveals that the majority of the factories who do provide training (61.5%) limit the number of courses to the bare minimum of between 1 and 3 per annum. A slightly more generous annual provision of 4 to 6 training programmes is made by 30.3% of them, while only 9% of all the factories concerned offered more than 6 training programmes.

Table 7.12

Number of training programmes offered annually

Number of programmes	Number	Percentage
Between 1 and 3 programmes	67	61.5
Between 4 and 6 programmes	33	30.3
More than 6 programmes	9	8.2
TOTAL	109	100

7.6.4 Reasons for the failure to provide training

Quality control and industrial activity in general are the subject of continuous developments and changes affecting not only the technology and equipment used but also the methods, procedures and working practices adopted for a particular activity. Thus, continuous training is necessary at all times, regardless of the skills already mastered by the employees concerned and of whether they are recruited nationally or from abroad. The figures in table 7.13 below confirm the general tendency for management to avoid providing training for lack of time.

Lack of training provision due to lack of time represents 39.1% of all the reasons given, followed at 27.1% by the lack of suitably qualified staff. The high cost of training is ranked as the third most important reason (17.7%), followed by the fact that there is no need for training with 10.4%.

Table 7.13

Reasons given for the absence of training provision

INDUSTRIAL CATEGORY	A		B		C		D		E		TOTAL	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Food & drinks	12	34.3	9	25.7	7	20	5	14.3	2	5.7	35	100
Chemicals	15	37.5	10	25	8	20	4	10	3	7.5	40	100
Metal products	20	40.8	13	26.5	7	14.3	5	10.2	4	8.2	49	100
Building materials	13	39.4	11	33.3	6	18.2	2	6.1	1	3	33	100
Clothes & textiles	3	42.8	2	28.6	1	14.3	1	14.3	-	-	7	100
Wood products	4	44.4	2	22.2	2	22.2	1	11.1	-	-	9	100
Paper, print. etc	8	42.1	5	26.3	3	15.8	2	10.5	1	5.3	19	100
Total	75	39.1	52	27.1	34	17.7	20	10.4	11	5.7	194	100

[X^2 value = 2.0 with 5 df. Not significant at the 5% level. Combining rows 5 and 6 and columns C, D and E]

A. There is insufficient time for training
B. Lack of suitably qualified training staff
C. High cost of training
D. The need for quality training does not arise
E. Other

Eleven respondents explained that they did not provide quality control training programmes because they recruited only trained staff or because training is gained through experience on the job, i.e. there is no need to provide any training, so long as the staff recruited are suitably qualified to carry out quality control tasks.

7.6.4 Quality training instructors

The usefulness and efficiency of any training depends on a number of factors, not least of which is the competence and commitment of the training instructors themselves and their ability to impart some of their expertise, knowledge and experience to the trainees.

Table 7.14 shows that 26.5% of the factories which provide training rely on their own senior staff to carry out the task of training and 20.5% of them assign this task to the training department within the factory. Specialist training staff are engaged specifically for this purpose by 18.9%, while 15.2% make use of the services provided by vocational training centres. Again, only a small proportion (5.3%) send their staff for training outside the Kingdom.

The remaining 13.6% indicated that they called on the services of the following:

- the Chamber of Commerce and Industry
- quality control engineers
- production engineers
- representatives of international companies.
- The services offered by universities, educational institutes and specialist firms

Table 7.14

Quality training instructors

Training given by:	Frequency	Percentage
Senior staff	35	26.5
Training department within the factory	27	20.5
Specialist training staff	25	18.9
Vocational training centres	20	15.2
Specialised training institutions abroad	7	5.3
Other	18	13.6
TOTAL	132	100

7.7 INSTRUMENTS AND EQUIPMENT USED IN MEASURING PRODUCT QUALITY

The instruments and equipment used to measure product quality play a crucial role in establishing whether the specifications of the manufactured products conform with those laid down for them. This is in addition to their role in detecting defects and determining the seriousness of the faults arising during manufacture. Testing and control instruments and equipment have become so advanced as to make the use of manual tools and, in some cases, even human intervention superfluous to the task of testing and inspecting the products.

The questions asked in this regard were designed to elicit information on the reasons for any shortcomings in testing and calibration of measuring equipment, the place where testing and calibration are carried out, the age of the equipment used, the extent to which it is replaced and upgraded and, finally, the reasons for the lack of attention to equipment replacement and upgrading.

7.7.1 Testing and calibration of measuring equipment

Regular and systematic testing and calibration of quality control equipment must be carried out in order to ensure the accuracy and reliability of the results and to assess the efficiency of the equipment used. However, the attitude towards this crucial aspect among the factories surveyed seems to be that, so long as the equipment works, there is no need for it to be checked or tested. Confirmation of the prevailing nature of this attitude came during a field visit carried out by the researcher. When asked why one such piece of equipment was left idle, one manager said that it was put into operation only when visitors were expected at the factory!

Table 7.15

Testing and calibration of equipment

Is quality control equip. tested and calibrated?	Number	Percentage
Yes	61	21.6
No	221	78.4
TOTAL	282	100

As can be seen from table 7.15, the overwhelming majority of the respondents, i.e. 78.4% of the total sample, replied in the negative to the question put to them in this regard.

7.7.2 Place where equipment is tested and calibrated

A reasonable assumption to make in this regard is for simple equipment to be tested within the factory itself and for more complex instruments to be sent for testing and calibration in specialised centres within the Kingdom or abroad, depending on the level of sophistication and technology involved.

Table 7.16

Place where testing and calibration are carried out

Location	Number	Percentage
In the factory	31	49.2
Outside the factory	25	39.7
Abroad	7	11.1
TOTAL	63	100

Table 7.16 shows that 49.2% of all testing and calibrating of instruments takes place within the factory itself, as against 39.7% of cases where equipment is sent for testing and calibrating in the specialised maintenance workshops run by the suppliers.

The proportion of test and calibration operations carried out abroad amounts to just 11.1%. This generally involves sending the equipment to the service centres of the supplier or foreign partner with the aim of obtaining certificates of conformity and/or quality marks.

7.7.3 **Useful life of the measuring equipment used**

The anticipated useful life of measuring equipment depends, among other things, on its function and on the rate at which it is used. However, a significant proportion of the factories surveyed does not set any specific periods beyond which particular pieces of equipment are considered obsolete and no longer suitable for use. Thus, while 66.7% of the sample define the useful life of the equipment used to measure quality, 33.3% indicated that they did not.

Table 7.17

Useful life of measuring equipment

Is a time limit set for the usefulness of measuring equipment?	Number	Percentage
Yes	188	66.7
No	94	33.3
TOTAL	282	100

The justification given is that this is irrelevant in their case as they only use simple ordinary instruments and that, in any case, they rely mostly on the experience and skills of their employees for the measurement of quality.

7.7.4 Extent of equipment replacement and upgrading

Investment in upgrading and replacing obsolescent equipment in general and quality control instruments in particular is essential if industrial companies are to maintain the quality standards of their products and to hold and even improve their market share.

It is interesting to note that the degree of attention given to this aspect mirrors exactly that accorded to the testing and calibrating of quality measuring equipment (compare the table below with table 7.15).

Table 7.18

Equipment upgrading and replacement

Is equipment upgraded and replaced?	Number	Percentage
Yes	61	21.6
No	221	78.4
TOTAL	282	100

The survey also revealed that the factories which use technologically advanced equipment are also the ones which are most concerned to ensure that it is continually maintained and upgraded.

7.7.5 Reasons why equipment is not replaced or upgraded

In asking the respondents to give reasons for the lack of attention to the replacement and upgrading of quality measuring equipment, the expectation was that they would point to the high cost of technologically advanced instruments and the lack of skilled labour as the main reasons. Table 7.19 confirms this to be the case for the majority of the respondents who answered this question. Thus, while none of the respondents felt it unnecessary to upgrade and replace equipment, 10.8% of them did not do so because of the high costs involved and 89.2% pointed to the lack of skilled labour as the main problem.

Table 7.19

Reasons for failure to upgrade and replace equipment

Reason	Frequency	Percentage
Lack of skilled labour	197	89.2
Not necessary	-	-
Cost of equipment too high	24	10.8
TOTAL	221	100

7.8 USE OF STATISTICAL METHODS

As we saw in chapter 3 of the present thesis, the use of statistical tools and techniques is an integral part of TQM implementation. Even in less advanced quality systems, simple statistical tools can prove invaluable in obtaining empirical evidence for determining the seriousness of particular problems of non-conformance, for identifying areas of weakness at management as well as at factory floor level and for measuring the success or otherwise of any corrective action or improvement initiative.

As can be seen from table 7.20, the overwhelming majority of the factories surveyed, i.e. 82.3% of the total sample, indicated that they did not use any statistical methods for quality control of production.

Table 7.20

Use of statistical methods

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	No.	%	No.	%	No.	%
Food & drinks	8	15.1	45	84.9	53	100
Chemicals	11	18.1	50	81.9	61	100
Metal products	17	22.4	59	77.6	76	100
Building materials	7	14	43	86	50	100
Clothes & textiles	1	16.2	5	83.3	6	100
Wood products	1	12.5	7	87.5	8	100
Paper, printing & publishing	5	17.8	23	82.1	28	100
Total	50	17.7	232	82.3	282	100

[X^2 value = 1.9 with 5 df. Not significant at the 5% level. Rows combined: 5 and 6]

As the X^2 test result indicates, the absence of statistical techniques for the control of quality applies to all the industrial categories surveyed and betrays a general lack of understanding on the part of Saudi manufacturers as to the important role statistical methods can play in improving quality. This general lack of management sophistication is further evidenced by the figures set out in the tables given below.

7.8.1 Reasons for not using statistical methods

As summarized in the table below, 31.6% of the factories which do not make use of statistical methods cited the complex nature of such methods and 25.8% of them pointed to the effort and costs involved as the main reasons for not doing so.

The lack of trained technical staff is the third most frequently cited reason (22.6%). The remaining 19.9% indicated that there were other reasons for this but did not specify what they were.

Table 7.21

Reasons given for not using statistical methods

Reason	Frequency	Percentage
Complexity of statistical methods	81	31.6
Effort and costs	66	25.8
Lack of trained technical staff	58	22.6
Other	51	19.9
TOTAL	256	100

7.8.2 Statistical methods used

A wide range of statistical methods is used in various industrial sectors[3] for a whole host of quality related purposes, including the selection of samples during the production process, analysis and interpretation of test and sales results, translation of data into percentages and indices for interpretation in the light of weighted averages, etc.

As table 7.22 indicates, the two most widely used statistical methods in the factories surveyed are sampling and statistical tables with 48.6% and 36.1% respectively. Statistical measurements, cause and effect diagrams and quality control charts are less commonly used (4.2% each). Very few respondents (2.7%) indicated that they made use of the frequency distribution method.

Table 7.22

Statistical methods used

Methods	Frequency	Percentage
Sampling	35	48.6
Statistical tables	26	36.1
Statistical measurements	3	4.2
Frequency distribution	2	2.7
Cause and effect diagrams	3	4.2
Control charts	3	4.2
TOTAL	72	100

7.9 RELATIONS BETWEEN THE INDUSTRIAL SECTOR AND GOVERNMENT BODIES RESPONSIBLE FOR QUALITY

Concern for the protection of the consumer has led the government of Saudi Arabia to establish a number of institutions entrusted with the task of ensuring compliance with the rules and regulations laid down for products on sale in the Saudi markets, particularly those concerning the health and safety of consumers. The main government authorities responsible for implementation of legislation on quality and standard specifications are the Saudi Arabian Organisation for Specifications and Standards and the quality control laboratories of the Ministry of Commerce.

The information sought through the questionnaire in this regard relates to the extent to which Saudi companies collaborate with government bodies to improve the quality of the goods produced, the type of assistance received, SASO quality marks or conformity certificates granted and the reasons for the failure of factories to obtain such marks or certificates.

7.9.1 Collaboration with government bodies

The X^2 test indicates that collaboration between government bodies and industrial companies is not specific to particular industrial categories. However, while it is a common feature of the whole sample, it consists mainly in the provision of laboratory services on the part of the two authorities referred to above.

Table 7.23

Cooperation with government bodies

INDUSTRIAL CATEGORY	YES		NO		TOTAL	
	No.	%	No.	%	No.	%
Food & drinks	46	86.8	7	13.2	53	100
Chemicals	52	85.2	9	14.7	61	100
Metal products	63	82.9	13	17.1	76	100
Building materials	44	88	6	12	50	100
Clothes & textiles	5	83.3	1	16.7	6	100
Wood products	6	75	2	25	8	100
Paper, printing & publishing	24	85.7	4	14.3	28	100
Total	240	85.1	42	14.9	282	100

[X^2 value = 1.2 with 5 df. Not significant at the 5% level. Rows combined: 5 and 6]

In the case of industrial organisations which have modern and well-equipped laboratories in-house, the role of the government authorities is limited to the certification of test results and to the issue of certificates of conformity and quality marks.

A relatively small number of the factories surveyed, 14.9% of the total sample, indicated that they did not use the services provided by the government authorities. Most of these are engaged in relatively simple industrial activities or rely on primitive methods of production. A further possible explanation for this is contained in the figures obtained in relation to quality marks and certificates of conformity (see section 7.9.3).

7.9.2 Assistance granted by government bodies

Assistance on the part of the government to industrial companies falls within the Kingdom's overall policy of encouraging national companies to produce quality goods and of ensuring that imports conform to Saudi and other internationally recognised standards and specifications.

Table 7.24

Type of assistance provided by government bodies

Reason	Frequency	Percentage
- Provision of standards for the goods	130	50.8
- Services of quality control and assurance laboratories	72	28.1
- Preparation of training and quality awareness programmes	23	8.9
- Provision of quality control experts	18	7.1
- Other	13	5.1
TOTAL	256	100

Table 7.24 shows that the greatest part of the assistance received from the government (50.8%) consists in the provision of standard specifications for the goods produced. The provision of quality control and assurance services is ranked second at 28.1%, followed by the preparation of quality training and awareness programmes at 8.9%. and the provision of quality control and management experts (7.1%).

The other forms of assistance cited by the respondents are calibration of measuring instruments, control of security and safety equipment, provision of publications, books and journals on quality and environmental health, etc. Assistance with safety and health matters is also given by town councils, civil defence and the Ministry of Health.

7.9.3 Quality marks and certificates of conformity

The picture which has gradually been emerging throughout this analysis is that many of the factories surveyed have a long way to go before they achieve the desired quality in their products.

Table 7.25

Certificates of conformity and quality marks

INDUSTRIAL CATEGORY	Quality marks		Conformity certificates		Neither		TOTAL	
	NO.	%	NO.	%	NO.	%	NO.	%
Food & drinks	9	16.9	18	33.9	26	49.2	53	100
Chemicals	5	8.2	21	34.4	35	57.4	61	100
Metal products	4	5.3	26	34.2	46	60.5	76	100
Building materials	-	-	14	28	36	72	50	100
Clothes & textiles	-	-	-	-	6	100	6	100
Wood products	-	-	2	25	6	75	8	100
Paper, printing & publi.	-	-	7	25	21	75	28	100
Total	18	6.4	88	31.2	176	62.4	282	100

[X^2 value = 11.4 with 5 df. Significant at the 5% level, combing rows 5, 6 and 7 and columns 1 and 2]

Table 7.25 above shows that 62.4% of the total sample do not have any quality marks or certificates of conformity for their products. Of the remaining factories in the sample, 18 have been granted quality marks and 88 have obtained certificates of conformity.

Application of the X^2 test shows that a significant relationship exists between industrial category and the award of quality marks or certificates of conformity.

Thus, more quality marks and certificates of conformity are to be found in the food industry than in any other industrial category. This can be explained by the fact that much of the efforts of the government to improve the quality of locally produced goods concentrated on this industry above all others, because of its implications for the health of the public. On the other hand, no quality marks and very few certificates are granted to the clothing and textiles industry, wood production and printing and publishing. As we shall see in the section below, these industries see little incentive for obtaining such accreditation since most of their production is distributed locally.

7.9.4 Reasons for not obtaining quality marks or conformity certificates

From the responses obtained through the questionnaire, a great discrepancy appears to exist between the standards and specifications laid down by SASO and the ability of local industries to meet them.

Table 7.26

Reasons given for the absence of quality marks or certificates of conformity

Reason	Frequency	Percentage
Demanding nature of specifications	145	76.4
Not possible to comply with SASO specifications	19	10
Not necessary	17	8.9
Other	9	4.7
TOTAL	190	100

Indeed, 76.4% of the respondents concerned felt that the specifications laid down by SASO were too demanding and 10% felt that it was impossible to comply with the organization's requirements. The remaining 8.9% who said that this was not necessary were referring to the certificates of conformity which are compulsory only in relation to goods produced for export. However, it must be pointed out that most factories seek to obtain such certificates as evidence that their products conform to standard specifications.

Other reasons given for the lack of quality marks or conformity certificates include the high level of the fees payable for such marks or certificates and the high cost of the investment necessary to meet the requirements laid down by SASO.

NOTES

1. For example, verbal communication in a face-to-face situation can have greater impact as it is possible to use everyday language which is easily understood and to judge whether the message is understood from the reaction it triggers on the part of listeners.

   Written communication, on the other hand, is an efficient means of communicating the message simultaneously to large numbers of individuals by letter, notices, circulars, etc. It is also the best means of ensuring that the same message is communicated to everyone and of confirming messages already communicated verbally.

2. The provision and maintenance of quality records is one of the principal clauses of the ISO 9001 series of standards. For a detailed study of the type of records and documents which must be systematically controlled, see, for example, Dale (1994) and Taylor (1989).

3. Although a much more extensive range of statistical tools is used in modern quality management (see chapter 3, section 3.7), only those deemed to be most essential are included here.

CHAPTER EIGHT

RESEARCH FINDINGS

8.1 INTRODUCTION

The main aim of the present research was to assess the extent to which the Saudi manufacturing sector can meet the challenges set for it in the Kingdom's development strategy, namely those of improving the quality of local products so as to increase their market share at home and abroad and thus positively contribute to the growth of the national economy.

The assessment was carried out by means of a field survey of 282 factories operating in Jeddah, the capital of the Western Province and the Kingdom's leading commercial centre. The data obtained from the survey and presented in chapters 5, 6 and 7 provided us with evidence on the following three main aspects:

- A general profile of the sample in terms of manpower, perception of product quality and the competition.
- The extent of understanding and implementation of Total Quality Management.
- Product quality and whether it is achieved through detection or prevention.

In this chapter, we present the main findings of the research and, where relevant, compare them with the hypotheses posited in chapter 4 as to the current situation of the sample.

The chapter is divided into three main sections. In the first section, we present the survey findings on the general profile of the sample in terms of workforce, distribution markets and the competition.

The second section discusses the main findings concerning TQM understanding and implementation. Those aspects which are judged to be most significant for the future of this sector are also summarised in table form. A further sub-section is devoted to a recapitulation of those areas where application of the X^2 test has shown a significant relationship between a particular attribute and one or more of the industrial categories included in the survey.

The chapter concludes with a number of suggestions as to the main quality-related issues requiring further research so that a more comprehensive picture can be drawn as to the state and future prospects of Saudi manufacturing.

8.2 GENERAL FINDINGS ABOUT THE SAMPLE

8.2.1 Human resources

Saudi nationals employed in the sample factories make up no more than 34.7% of the total workforce. When we look in detail at the type of positions held by these nationals, we find that they make up 20.4% and 9.6% of all the administrative and technical staff respectively. Concentration of Saudi nationals in administrative positions is confirmed by the X^2 result, which revealed a significant relationship between type of position and nationality.

A detailed study of Saudi Arabia's human resource development (Looney, 1991) indicates that this is a problem which is not unique to this particular sample. According to the author of the study, the continued over-reliance of the Saudi economy on foreign labour is due to the unemployment of productive nationals and to the underdevelopment of the Kingdom's human resources.

In Looney's view, the large number of cheaply and easily available expatriate labour is slowing down the transfer of nationals from traditional to modern sectors of the economy. In addition, this widespread use of migrant labour, combined with the relatively high level of wealth, has led to a proliferation of "luxury employment" for Saudis, which amounts to their withdrawal from the productive workforce.

Other problems highlighted by this and other studies on the Kingdom include the general preference of Saudi nationals for white collar jobs. The resulting skills mismatch translates into an over-supply of highly educated young nationals and not enough mechanics and artisans. According to Crane (1978), this problem arises mainly because of a tradition where, for centuries, the purpose of education was to produce intellectual and religious thinkers and leaders rather than to train the young for the practical world of work.

The implications of this situation for the Saudi industry are of critical importance for the promotion of quality, not least because it is extremely difficult to obtain the necessary commitment and dedication from a workforce which does not feel it has a stake worth defending within the organisation itself or in the wider society in which such an organisation operates.

8.2.2 Market conditions of the sample

Most of the sample factories distribute their products in the local market with only a small minority of them enjoying any export sales. As these factories are not exposed to the rigours of the export markets, they are unlikely to exceed the bare minimum level of quality in their products.

Because of increasing or stable turnover, a great many respondents may be tempted to believe that enough is being done to contain the effects of imported higher quality goods on their own share of the market. However, experience in other parts of the world has shown that there comes a time when the price differential does not significantly affect the choices which customers make.

8.3 TQM UNDERSTANDING AND IMPLEMENTATION

It will be recalled that, in order to arrive at a fair assessment of the current quality situation of Saudi manufacturing companies, the questionnaire sought to obtain data on a number of quality-related features of the sample at both the organisational and production levels. At the organisational level, we postulated that the sample would display the following characteristics:

1. Lack of understanding of the TQM concept.
2. Lack of cooperation between the various departments and an inefficient system of communication and information exchange across the various functions within the organisations.
3. Little encouragement is given to employees wishing to express their opinions and offer suggestions and no explanation is offered to them as to the company's objectives or changes in its work policies, thus failing to promote a sense of belonging and team spirit among the workforce.
4. Not enough attention is given to training the workforce in improving the quality of their own work or in developing efficient methods for controlling the quality of production.
5. The methods used to assess the needs and wants of customers are inadequate.
6. Where product specifications and standards are set, these are usually insufficient or not correctly complied with.

We further postulated that, at the production level, it is unlikely that Saudi manufacturing companies will have moved on to a preventive approach to quality control, particularly in view of the recent history of Saudi Arabia's industrialisation process and the consequent lack of management know-how and maturity. Hence our initial hypotheses that:

1. Quality control would be mostly inspection based, with inadequate use being made of modern methods of quality management and, in particular, statistical quality control tools and techniques.

2. The quality standards of locally produced goods is generally low and there is a high percentage of defective products reaching the market for lack of sound and systematic defect prevention procedures and inadequate quality control of incoming materials and in-process work.

3. Efforts to promote quality on the part of the government are not followed up by concrete programmes to foster quality through, for example, greater cooperation between the government bodies responsible for quality and the producers.

The main findings of the survey data are summarised in table form and discussed in more detail below.

Table 8.1

Main findings on key aspects of TQM

	PERCENTAGE RESPONSE	
1. TQM understanding[1]	Yes	33.6
	A little	58.2
	No	8.2
2. TQM implementation	Yes	25.8
	No	59.2
	Planned	14.9
3. Inter-departmental meetings	Yes	22.3
	NO	77.7
4. Availability of information - communication systems[2]	Yes	23
	No	77
5. Record keeping	Yes	62.4
	No	37.6
6. Explanation of policy changes to employees	Yes	36.2
	No	63.8
7. Training provision	Yes	38.7
	No	61.3
1. Production quality control	Incoming materials	77
	During manufacture	86.9
	Finished product	75.8
2. Use of statistical methods	Yes	17.7
	No	82.3
3. **Defect rates**	**0% to 4%**	**16.5**
	4% & over	**83.5**
4. Quality marks and/or conformity certificates	Yes	37.6
	No	62.4

1. See chapter 4, note 5.

2. Average figures

8.3.1 Organisational aspects

8.3.1.1 About 70% of the sample has little or no knowledge of TQM and just over a quarter of the sample claim to be implementing it. However, looking at the survey data on essential components of quality management, it is difficult to see how this could be the case.

For example, the figures obtained on the use of statistical methods provides clear evidence to the contrary. As the data suggests, the use of such basic quality management techniques as control charts or cause and effect diagrams is rated at a mere 4.2% of all the tools used to control product quality.

8.3.1.2 Further evidence which contradicts this claim is provided by most of the data on the sample's information and communication systems, which can best be described as woefully inadequate.

Thus, even the relatively small proportion of the sample (22.7%) which said that they had an information system in place failed to make use of this essential resource, its use being limited to the storage and retrieval of the minimum amount of basic information which no manufacturing plant can do without.

When we look at the data on record keeping, we find the majority of the sample stating that they kept records. However, the nature of the questions on this aspect makes it difficult to draw any categorical conclusions from the figures obtained in this regard. While this may be a sign of well-ordered and smooth procedures for monitoring and follow-up of various aspects of production activity, it could equally be indicative of a bureaucratic structure in which too much paper is being pushed around. Again, the evidence of the data obtained in relation to information systems would suggest the latter to be the case. For example, of the 218 respondents who indicated that they did not have an information system, 40.8% of them pointed to the inadequate nature of their documentation and 26.6% to the fact that their records were not systematic.

8.3.1.3 The majority of the sample (70%) strongly believes in the importance of team spirit and employee involvement. However, few practical steps are taken to foster a sense of belonging and to encourage greater involvement on the part of the workforce. For example, only 24% of the sample indicated that their employees were fully aware of their organisation's objectives. Similarly, changes to company policy are made known to the workforce by just 36.2% of the sample.

Much more significant in this respect is the data obtained in relation to the holding of regular meetings within the organisation. Here, 77.7% of the respondents indicated that such meetings were not held because:

a. decisions and orders are issued by senior management (61.7%),

b. they are not necessary (29.6%).

8.3.1.4 Further evidence of the lack of any meaningful steps to promote employee involvement and team spirit is provided by the data on training. As the figures given in table 7.10, chapter 7 indicate, approximately 60% of the respondents said that they did not provide any training for their workforce. The reasons given for the lack of training provision also tend to suggest a short-term approach to doing business which often translates into senior management's unwillingness to invest either time or money in this important aspect of quality management.

As was shown in table 7.13, the need for training either does not arise or is left to "take care of itself" through experience on the job by a significant minority of the sample (16% approxim.).

8.3.1.5 The majority of the sample indicated that they met the requirements of their customers. However, when we look at the data on the means used to establish these requirements, we find that there is an over-reliance on feedback from sales representatives (51.7%) and, to a lesser extent, on past experience.

Market research and cross functional cooperation come a poor third and fourth with 18.7% and 5.8% respectively. This tends to suggest that customer requirements are mainly established in reaction to customer complaints passed on via the sales representatives. Confirmation that this is indeed the case can be seen in the fact that the greatest problems faced by the sample due to the sale of defective products are reported to affect relations with customers.

However, a reactive approach is no longer sufficient to establish customer requirements, as it is often necessary to anticipate and meet the needs and wants of customers before they actually express them. In total quality management, customer requirements are established and his satisfaction is sought through intelligence gathering, using sophisticated tools and techniques for the measurement of customer attitudes, tastes, trends, etc. and through the cooperative efforts of various departments and the departments of marketing, R&D, production in particular. In other words, activities to establish customer requirements and to translate them into product specifications are carried out on a proactive basis, in the same way as those concerned with the control of product quality.

8.3.1.6 One of the constant themes in quality management literature is the need to establish clear standards and specifications for every aspect of work. In addition to setting out the various minimum criteria which must be met in a product or service, they should also serve as a common frame of reference for everyone concerned, including all those responsible for the delivery of the product or service to the customer. Unless a company can demonstrate that it is working to sound and well-documented standards and specifications, it is unlikely to inspire confidence on the part of potential customers, be they the general consumer, potential trading partners or even the company's own employees. Given the wide range of industries covered by the survey, it is only to be expected that the standards and specifications used should come from a variety of sources, prominent among them being the Saudi Organisation for Standards and Specifications. However, according to the data on the adequacy of the standard specifications available to the sample, 45% of the respondents felt these to be inadequate or ill-defined and just under a quarter had difficulty complying with them.

Those who reported this to be the case gave as the main reason for their difficulty in applying standards the fact that they lacked the necessary resources, i.e. adequate equipment and a suitably trained and technically skilled workforce.

A significant minority (40%) of the 154 respondents who said that they had established standards indicated that they did not always comply with national standards. However, until further research is undertaken to investigate this particular aspect, we could only speculate as to the reasons why this is so. Thus, while it could be that the standards which are used are those of the ISO or other foreign sources whose standards are recognised in the Kingdom, the reason could equally be that the national standards currently available are too restrictive or ambitious for the capabilities of the sample. A comment made by Ishikawa (1985) with reference to developing countries may very well apply here. For him, no matter how many national standards are established or how sound they appear on paper, they are bound to remain meaningless until capabilities are developed for meeting them.

8.3.2 Production-related aspects

The findings of the survey with regard to production quality control tend to mirror the shortcomings observed in relation to the organisational aspects of the sample, particularly when we consider the following:

8.3.2.1 The majority of the sample indicated that they controlled the quality of incoming materials and work-in-progress (77% and 86.9% respectively). Yet, when we look at the figures for the final output, we find 51.2% of the respondents admitting to defect rates of between 5 and 8 percent. A further 23.8% put the number of defective products at between 9 and 12 percent of total production.

Random sampling seems to be the preferred method for all of the sample's quality control activities. Out of the 217 respondents who indicated that they controlled the quality of purchased and other incoming materials, 82.8% did so using acceptance sampling. The same method is applied by 69.6% of the 245 respondents who said that they controlled quality during manufacture.

While this practice is still the norm among Saudi factories, it has long been abandoned by most successful companies, whose target defect rates are or approaching the zero mark. As Ishikawa (1985, p. 78) rightly points out, this methods "is unsatisfactory for companies that seek high quality, such as those seeking defect rates of 0.01% or those seeking ppm (parts per million) control". A similar observation can be found in Bounds et al (1994), namely that while the sampling method was a tolerable and even useful approach to quality in an era when companies could afford defects, the competitive nature of today's economic environment means that it is no longer adequate as it does not allow for continuous improvements to be made through the study and reduction of variation.

8.3.2.2 The sample's reported defect rates for final production speak volumes as to the quality situation of locally produced goods. Although zero defect production was not expected, it was reasonable to assume that, given that the majority of the sample carried out pre-production and in-process controls, the defect rate of final products would be contained within 0% and 4%.

In fact, only 16.5% were able to keep their defect rates within this range.

This is particularly alarming when we consider that, even when acceptable quality levels (AQLs) used to be the norm among Western companies, defect rates would probably have been contained within one or two percentage points at most. For example, commenting on the era of AQLs in the manufacturing industry of western nations, Taylor (1985, p. 23) notes that "whereas one percent of incoming supplies, for example, was an acceptable quality level and 0.5 percent of faulty outgoing products was acceptable in many commercial operations, manufacturing companies are now expecting and receiving 0.01 percent fault levels of incoming supplies and many are approaching zero functional failure in final products".

As we noted in our review of the historical development of quality control, inspection has long been shown to be an inefficient means of controlling quality, particularly when it is mostly carried out using primitive tools and techniques or when it is totally based on the human senses. Moreover, even when defects are indeed detected through inspection, the costs of the exercise are often damaging not only in terms of the corporate balance sheet but also in terms of the reputation of the company/country concerned. Once more, to quote from Ishikawa (1985, p. 79), "when defects are found, the only action the manufacturer can take is that of making adjustments, reworking the product or consigning it to scrap. In addition, products that have been adjusted or reworked are more likely to break down, which is just the opposite of quality assurance". Yet, when we look at the data on the disposal of defective products, we find that the overwhelming practice (approx. 41%) among the sample is for the defective product to be returned to the production line for reworking, followed at 39% by the product being scrapped altogether.

It was beyond the scope of the present research to investigate the costs incurred by the sample as a result of quality failures. However, on the evidence of the present research, these must primarily fall in the category of failure costs, with little, if any, being expended on prevention.

8.3.2.3 Provision of standard specifications for locally produced goods is ranked by the sample as representing 50.8% of the assistance provided by the government bodies responsible for quality, followed by the provision of quality control services at 28.1%. On the other hand, services such as the promotion of quality through awareness programmes and the provision of training facilities and expertise in the field of quality come much lower down in the ratings given by the respondents.

This lack of active involvement on the part of the authorities in the promotion of quality, combined with antiquated quality control practices and the stated problems relating to manpower and equipment mean that well over half of the sample have been granted neither quality marks nor certificates of conformity for their products.

8.3.3 Results of the X^2 test

Application of the X^2 test to the survey data confirmed that the above observations apply to the majority of the sample. When we look at the X^2 results in detail, we find that they confirm a trend observed in many sectors of the Saudi economy, namely the overwhelming concentration of Saudi nationals in administrative positions (see table 5.1).

As we pointed out under section 8.2.1, this characteristic of the Saudi labour market has far-reaching consequences for the future prospects of the Kingdom's manufacturing as well as other sectors of the economy.

With regard to the other problems examined in the survey, the X^2 test confirmed that they are shared by most of the sample, regardless of industrial category. The few significant differences which were shown to obtain between the various industrial categories included in the sample relate to the following:

- Distribution markets: The chemical and construction industries appear to have greater access to the export markets than the other industrial categories included in the sample. (Table 5.2)

- Raw material purchasing: The two categories which rely most on imports for their incoming supplies are the chemical and metal industries. (Table 6.7)

- Responsibility for quality control of purchased materials: The foodstuffs, chemical and metal product industries make use of external agencies as well as their own internal technical committees. (Table 6.11)

- Equipment used for the control of incoming materials: A highly significant relationship was shown by the test to exist between the type of industry and the equipment used for the control of incoming materials. The foodstuffs, chemical and construction industries mostly rely on laboratory testing. These industries also use special equipment but do so to a lesser extent than the metal industry. (Table 6.12)

- Disposal of non-conforming incoming materials: The tendency to discard the entire lot of non-conforming incoming materials is most common in the metal and construction industries. (Table 6.13)

- Effects of non-conforming raw materials on production: The most affected are the foodstuffs, chemical and metal industries where the majority indicated that this resulted in the loss of the whole production run. (Table 6.14)

- In-progress quality control stages: As with the control of incoming materials, the metal industry uses special equipment to a greater extent than other industries. (Table 6.17)

- Means used for quality control during manufacture: The metal and construction industries appear to use special test and measuring equipment more frequently than any of the other industrial categories, followed by the foodstuffs and chemical industries. (Table 6.18)

- Disposal of defective products: As would be expected, defective products are most frequently discarded in the food industry. In the metal and chemical industries, on the other hand, the main trend is for the defective items to be reworked or incorporated into another product. (Table 6.26)

- Quality marks and/or certificates of conformity: The industries where more than 30% have been granted quality marks and/or certificates of conformity are active in the production of food, chemicals and metal products. Although none of the construction firms surveyed have been awarded quality marks, 28% have obtained certificates of conformity. (Table 7.25)

The pattern which emerges from the foregoing is that the Saudi industries where relatively more attention is paid to quality are those active in the production of foodstuffs, building materials, chemicals and metal products. As we noted earlier in the present thesis, attention to quality in the foodstuffs industry is much more closely monitored due to the implications this has on the health of the general consumer.

For its part, the construction industry in Saudi Arabia is relatively more mature than the others, not least because of the massive construction programmes launched in the mid-1970s for the building of the country's physical infrastructure, as well as housing. This industry has also benefited from foreign expertise and know-how through the government's policy of Saudization, introduced in the Kingdom's third development plan. The same applies to the metal and chemical industries, which are more actively encouraged by the government because of their potential for exports[1].

8.4 CONCLUSION

The nature and scope of the present research meant that only the symptoms of the quality failures of Saudi manufacturing have been highlighted. A great deal of field research remains to be undertaken to establish the exact nature and degree of seriousness of the defects found in locally manufactured products and the root causes of various quality failures. The visible problems of poor quality have been likened to the tip of an iceberg, with most of the real and unsolved problems being hidden under the water line. This phenomenon is succinctly illustrated by the following diagram.

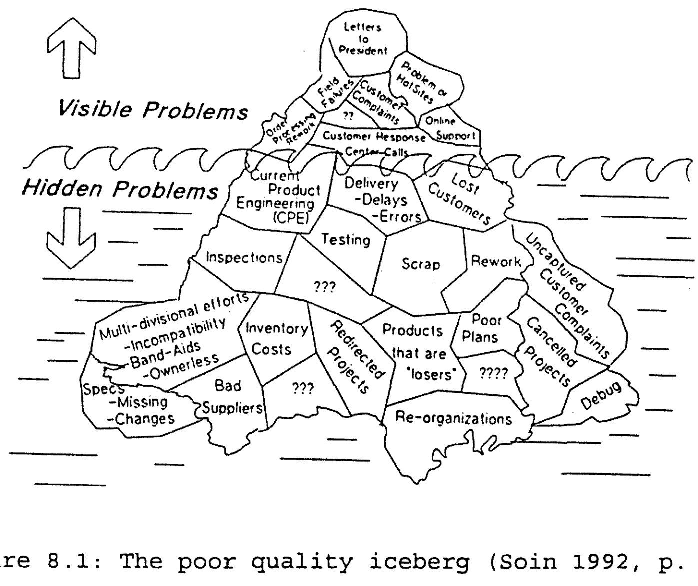

Figure 8.1: The poor quality iceberg (Soin 1992, p. 94)

In addition to the need to investigate these hidden problems, examples of other studies which have as yet to be undertaken include:

1. Comparative studies of the business performance of various companies of the same sector and the correlation between this and the approach of the same companies to quality.

2. A case by case study of various companies to investigate the costs of quality. This would not only provide empirical evidence as to the nature of these costs but would also give a clear indication as to their implications for the country's economy.

3. Attitude surveys of Saudi captains of industry could be undertaken to gauge the extent of their commitment to and awareness of the importance of quality.

While this is far from being an exhaustive list of all the quality-related topics which need investigating, they nevertheless seem to us to constitute the minimum needed if we are to gain a comprehensive view of the quality situation of Saudi manufacturing.

NOTES

1. They are also directly linked downstream to the hydro-carbon industries which are at the core of the Kingdom's diversification strategy. As a result, a relatively high degree of technology transfer has taken place in these industries, as many of them were originally established by the government in joint venture with foreign companies and subsequently privatised (see El-Mallakh, 1982).

CHAPTER 9

CONCLUSION AND POLICY IMPLICATIONS

9.1 INTRODUCTION

We began the present thesis by advancing the argument that the adoption of TQM can help a developing country like Saudi Arabia to achieve its aim of establishing a more broadly based economy, particularly through the development of an efficient and quality-driven manufacturing base.

In chapter 2, we reviewed the development of modern manufacturing in Saudi Arabia, pointing out the emphasis in national policy on the role of the private sector in the development of this industry and the stimulus it is expected to provide for future economic growth through, among other things, greater attention to efficiency and quality of production.

The basic principles underlying the TQM concept and the various issues involved in modern management of quality were discussed in chapter 3, together with the procedures, tools and techniques used in its implementation.

In chapter 4, we discussed the design and validation of the survey instrument and presented the main features of the sample. The main factors affecting the adoption of TQM in Saudi manufacturing which were examined through the survey questionnaire are summarized in the table below, which also gives the reference number of the tabulated data relating to each of these factors.

Table 9.1

Summary of the main TQM aspects examined through the survey questionnaire

Management level		Production level	
MAIN ASPECT	Ref.	MAIN ASPECT	Ref.
TQM understanding and implementation at organisational level	5.4, 5.5, 5.6	Application of TQM principles in the quality control of production	6.8, 6.11, 6.15, 6.20
Availability of information and communication systems and quality-related records	7.1, 7.3, 7.5, 7.6	Use of statistical methods, diagnosis and disposal of non-conforming materials and products	6.13, 6.17, 6.23, 6.25, 6.26, 6.28, 7.20, 7.22
Training provision	7.10, 7.12, 7.13	Use of special equipment and laboratories, calibration and upgrading of quality control tools and equipment	6.12, 6.18, 6.19, 6.22, 7.15, 7.18
Cooperation with government bodies and foreign companies and institutions	6.4, 7.23, 7.24	Application and adequacy of standards	6.1, 6.2, 6.3

Analysis of the data, as presented in chapters 5, 6 and 7, showed that many of the key aspects summarized above are lacking in the sample and that many difficulties need to be overcome by the companies surveyed and the private sector in general if they are to provide the expected stimulus for the future growth of the Saudi economy.

In our view, the most critical of the survey findings presented in chapter 8 relate to the under-development of the sample's human resources and to the lack of capital investment and quality mindedness on the part of the Saudi producers. All three aspects which must be addressed if the Saudi non-oil manufacturing sector is to fulfil adequately its role in the development and future growth of the Kingdom's economy.

With regard to human resources, we found that a major characteristic of the sample's workforce is that it predominantly consists of non-nationals, especially at the technical and manual skill levels.

A large influx of foreign labour was a necessary solution to the Kingdom's rapid development needs, particularly during the 1970s and 1980s when most of the country's infrastructure was under construction. For those past two decades, the dearth of nationals to occupy white as well as blue collar positions could be explained by the fact that, with the introduction of mass education, most were still being educated at institutions of all kinds, both at home and abroad. The massive investment on the part of the government in education and the establishment of vocational and other training institutions naturally concentrated on satisfying the manpower needs of priority sectors such as national security, the civil service, education, health and the petro-chemical industry.

However, if the non-oil manufacturing sector is indeed to become a major player in the country's economy, determined efforts must be made to extend the Saudization process to the private sector which could emulate the practice followed in other vital sectors of the economy through, for example, greater cooperation with foreign firms and institutions and the establishment of its own training facilities.

The second most frequently cited problem relates to the inadequacy of the equipment and tools available to the sample. The inability or unwillingness to invest in appropriate equipment and materials and the failure to ensure that existing equipment is adequately maintained can be due to a hole host of reasons. It may be that the necessary capital is not available to the non-oil manufacturing sector, the package of incentives offered by the government at the start of operations having been exhausted. A situation which cannot have been helped by the downturn in oil prices experienced over the past few years. Another reason is, of course, closely related to the scarcity of the necessary human resources to operate and maintain whatever equipment is provided.

9.2 POLICY IMPLICATIONS

In policy terms, this situation requires long-term solutions which can only be provided through the concerted efforts of the government and the Saudi producers who must realize that the quality of their products can only improve if the necessary structures and systems are in place and that any investment in establishing them will be more than justified by the long term and beneficial effects they could have on the profitability of their undertakings. More particularly, senior managers and chief executives of Saudi companies must ensure that:

a. A function is created within their organisation with the task of designing and implementing a total quality strategy. Such a function must be given the necessary authority and powers to ensure that it can discharge its task fully and efficiently, in accordance with the overall aims of the organisation.

b. Training in quality is provided, particularly to first line supervisors and foremen who are in the best position to influence positively workers lower down the hierarchy. Training must also be provided in the use of statistical tools and techniques so that progress can be monitored and decisions taken on the basis of the reality on the ground, rather than at the whim of any one manager or official.

c. Procuring from abroad, if necessary, the necessary skills and expertise to implement TQM until such time as qualified nationals become available to assume this task.

d. Ensuring that proper records and documents are kept and maintained for each activity and/or product and establishing adequate information and communication systems for the efficient management of such records and documents.

To this end, producers must be prepared to invest in the necessary information technology hardware and software and in training the workforce in using them efficiently.

e. Ensuring that a consistent and a comprehensive quality control system is drawn up, covering every aspect of work and including specific and well defined procedures for the control of incoming supplies, manufacturing processes, machinery, quality documents, etc.

Further and qualitatively different government effort is also needed because, as we have seen in chapter 2, it is only over the past two decades that the country can, in any meaningful sense, be said to have had a modern manufacturing sector. In other words, it is a sector which is still lacking in management know-how, particularly since many of the firms established in the private sector are managed by the owners themselves, who are often ignorant of modern methods of management and/or reluctant to hand over the running of their business to better qualified third parties. For this reason, it is necessary for the government to take the leading role in promoting quality.

Thus, in addition to the already substantial help offered by various government authorities and financial institutions, other government initiatives are needed so that, over the long term:

1. The wage differential between Saudi nationals and expatriates could be reduced through a system of "on the job training" grants and a system of incentives to encourage Saudi manufacturers to take on Saudi nationals and train them in the skills most urgently needed by the sector.

2. Financial assistance focused on the transfer of quality-related technology and know-how from the Kingdom's main trading partners.

3. The establishment of the necessary regulatory and structural frameworks to extend the Saudization policy to the private sector as this would encourage the non-oil manufacturing industry to emulate the successful experience of the petro-chemical sector with regard to training.

Over the short term, other measures which may be taken include:

4. Close cooperation between the Business management departments of the Kingdom's universities and the chambers of commerce with a view to promoting the concept of total quality management and its potential benefits to the manufacturing sector. Similar cooperation can also be sought in the organisation of Kingdom-wide conferences and seminars on TQM for the benefit of the companies operating in the Kingdom.

5. A clear distinction must be made between the areas of competence of the Consumer Protection Department of the Ministry of Commerce on the one hand and, on the

other, the Saudi Arabian Organisation for Specifications and Standards. In addition, SASO must ensure that the standard specifications laid down for each product are available to the Ministry so that the latter can monitor whether these are complied with during the production process itself, rather than waiting to take samples of the products once they are already on the shelves.

6. A quality control and assurance agency of SASO must be established in the industrial city of Jeddah to monitor the quality control activities of the various factories and to provide them with assistance in the form of studies and consultancy services.

7. A package of incentives must be designed to encourage industrial companies to obtain quality marks and certificates of conformity and thereby improve their competitive position in relation to imported products. To this end, companies should be encouraged to take part in trade exhibitions organised at national as well as international level. Prizes could also be introduced and certificates awarded to companies which achieve excellence in one or more of their products.

9.3 CONCLUSION

The nature of the problems highlighted by the empirical research presented in the present thesis means that a great deal of time and effort will be needed before Saudi manufacturing can successfully meet the challenges currently facing it. Solutions to these problems need to be devised on a long term basis through the concerted efforts of everyone concerned for the future prospects of Saudi manufacturing, including the producers themselves, the government and the various bodies and institutions closely connected with the Kingdom's industrial sector.

APPENDIX A

INTRODUCTORY LETTER, COVERING LETTER
AND
SURVEY QUESTIONNAIRE

ENGLISH VERSION

UNIVERSITY OF LEICESTER

UNIVERSITY ROAD · LEICESTER LE1 7RH · ENGLAND

MANAGEMENT CENTRE

DIRECTOR
Professor P M JACKSON
Direct line
0116 252 3957

PROGRAMMES MANAGER
Patricia Greatorex
Direct line
0116 252 3991

Enquiries:
Full Time Programmes
0116 252 3952
Distance Learning Programmes
0116 252 5630
FACSIMILE
0116 252 3949

3rd February, 1994

TO WHOM IT MAY CONCERN

This is to confirm that Mr Hani Abdel Rahman Alamri is under my personal supervision and he is registered as a full - time postgraduate research student at the Leicester University Management Centre, carrying out research leading to the Degree of Doctor of Philosophy (Ph.D.). The subject of his research is : "Total Quality Management in Saudi Manufacturing, Prospects and Difficulties".

Mr Hani Al - Amri needs to collect information for his research, and the main aim of the project is simply academic and any data or information provided will remain confidential and will be used only for the purposes of the research.

I would be grateful for your kind collaboration and support to him. Thank you in anticipation.

Yours sincerely

Dr C. A. Bourlakis

Lecturer in Management Economics

THE QUEEN'S ANNIVERSARY PRIZES 1994

Dear Sir,

I am presently studying for a PhD degree in the field of production management at the University of Leicester in the United Kingdom. The subject of my research is:

Total Quality Management in Saudi Manufacturing
Prospects and Difficulties

This is a field which has not been accorded sufficient importance by researchers in the Kingdom of Saudi Arabia.

The main aim of my project is not simply academic but, more importantly, it is intended to shed light on the concept of Total Quality Management and Quality Control and the degree to which they are accepted and the difficulties which they face in industry in the Kingdom of Saudi Arabia.

Any information you provide will remain strictly confidential and will be used only for the purposes of my research. The information will be collated and classified without reference to the name of the respondent.

Your cooperation in completing the attached questionnaire will be greatly appreciated and I should like to take this opportunity to thank you in advance for your support.

Yours faithfully,

Hani Abdulrahman Al-Amri
PhD Student
Management Centre
Leicester University
Leicester, UK

QUESTIONNAIRE

ON

TOTAL QUALITY MANAGEMENT IN SAUDI MANUFACTURING
PROSPECTS AND DIFFICULTIES

Submitted by:

Hani Abdulrahman Al-Amri

Studying for a PhD degree in the field of
Production Management

University of Leicester
United Kingdom

Name of company	:	......
Year established	:	......
Type of business	:	......
Capital	:	......
Main products	:	......
Annual turnover (approx)	:	......
Head office	:	......
Address	:	......
Telephone number	:	......
Branches (where applicable)	:	......
1. Number of employees	:	......
Administrative	:	Saudi ( ) Non-Saudi ( )
Technical	:	Saudi ( ) Non-Saudi ( )
Unskilled	:	Saudi ( ) Non-Saudi ( )
2. Markets for products	:	
Domestic	:	( )
Foreign	:	( )
Domestic and foreign	:	( )

3(A). The most important factors affecting the competitiveness of your products as compared with similar local products are as follows:

(please list them a, b, c, etc in descending order):

a. quality ( )

b. price ( )

c. quantity ( )

d. trademark ( )

e. other (please specify) ....

....

3(B). The most important factors affecting the competitiveness of your products as compared with similar imported products are as follows:

(please list them a, b, c, etc in descending order):

a. quality ( )

b. price ( )

c. quantity ( )

d. trademark ( )

e. other (please specify) ....

....

4. Which of the alternatives below best describes your knowledge of the concept of total quality management?

a. full knowledge ( )

b. little knowledge ( )

c. no knowledge ( )

5. Would you describe your company as:

a. implementing TQM ( )

b. not implementing TQM ( )

c. planning to implement TQM ( )

6. If your company is not implementing TQM, is it because:

a. high cost of implementation ( )

b. lack of necessary expertise ( )

c. lack of skilled workforce ( )

d. the TQM concept is not clear ( )

e. the size of the company ( )

f. the management is not convinced by TQM ( )

7. Does your company organise regular meetings involving all departments, sections and employees?

   a. Yes ( )

   b. No ( )

8. If the answer to the question is "no", is the reason they do not take part:

   a. decisions/instructions issued by senior management ( )

   b. reluctance of the departments/sections to take part ( )

   c. not necessary, as each department or section is aware of its own responsibilities and obligations ( )

   d. don't know ( )

   e. other (please specify) ....

   ....

9. In your opinion, what importance does the company attach to team spirit?

   a. very important ( )

   b. fairly important ( )

   c. not very important ( )

   d. not convinced ( )

10. To what extent are the employees in your company aware of its aims?

   a. to a great extent ( )

   b. to a reasonable extent ( )

   c. to a limited extent ( )

   d. not sure ( )

11. Would you say that, in your company, management encourages its employees to take decisions on quality matters and to be involved in them?

    a. always ( )

    b. most of the time ( )

    c. sometimes ( )

    d. rarely ( )

    e. other (please specify) ....

    ....

12. Are explanations given to employees when there are changes to work policies or practices?

    a. Yes ( )

    b. No ( )

13. Does the company have to meet any conditions or specifications for production laid dow by customers?

    a. Yes ( )

    b. No ( )

14. If the answer to the question is "yes", how does the company establish what the customer wants and requires?

    a. market research ( )

    b. feedback from sales representatives ( )

    c. cooperation between marketing, production, sales and other departments ( )

    d. past experience ( )

    e. other (please specify) ....

    ....

15. If the answer to the question is "no", please indicate the reasons.

....
....
....

16. Are there adequate production specifications available in the company?

a. Yes ( )

b. No ( )

17. If the answer to question 16 was "yes", are the products manufactured by the factory in compliance with any of these specifications?

a. Yes ( )

b. No ( )

18. Who is responsible for setting the specifications to which the products must conform?

a. the marketing department ( )

b. the research section of the marketing department ( )

c. a specialised unit of the production department ( )

d. factory engineers ( )

e. foreign bodies ( )

f. the Saudi Arabian Organisation for Specifications and Standards ( )

g. other (please specify) ....

....

19. If the answer to question 16 was "no", what does the company rely on as a basis for manufacturing products with given specifications?

....
....
....

20. Do any foreign bodies or institutions provide the factory with specifications for the products which you manufacture?

a. Yes ( )

b. No ( )

21. If the answer to question 20 was "yes", please give the names of the bodies concerned:

....
....
....
....

22. Does the application of standard specifications pose difficulties in carrying out the work?

a. Yes ( )

b. Nc ( )

23. If the answer to question 22 was "yes", what, in your opinion, are the reasons for the difficulty in applying the specifications?

a. the extreme precision of the specifications ( )

b. lack of the necessary tools and measuring equipment ( )

c. lack of skilled labour ( )

d. the machinery available is not of the technological level required ( )

e. the low quality of the raw materials and semi-finished materials ( )

f. working conditions (heat - cold) make it impossible to achieve the desired quality ( )

g. other reasons (please specify) ....

....

....

24. From what sources does the company purchase the raw materials used in production?

a. the local market ( )

b. local and foreign markets ( )

c. foreign markets ( )

d. other (please specify) ....

....

....

25. Are incoming raw materials tested for quality at delivery?

a. Yes ( )

b. No ( )

26. If the answer to question 25 was "yes", what methods are used to test the raw materials?

a. random sampling ( )

b. full test ( )

c. other (please specify) ....

....

....

27. Where are the materials purchased tested and examined for quality?

a. on the purchaser's premises ( )

b. on the vendor's premises ( )

c. elsewhere (please specify) ....

....

....

28. Who is responsible for testing and examination of the materials purchased?

a. a technical committee representing the purchaser ( )

b. the factory's specialised testing office ( )

c. the supervisor of the store concerned ( )

d. a quality control laboratory in the Kingdom ( )

e. other (please specify) ....

....

....

29. How is the quality testing and examination carried out?

a. laboratory tests ( )

b. special equipment ( )

c. manual instruments and tools ( )

d. visual inspection ( )

e. other (please specify) ....

....

....

30. If the materials purchased do not comply with the required quality specifications:

a. the whole quantity purchased is rejected and returned to the vendor ( )

b. the items which do not comply with the specifications are rejected ( )

c. the quantity which does not comply with the specifications is accepted but the purchase price is reduced ( )

d. other (please specify) ....

....

....

31. If materials which do not comply with the specifications are used, does this:

    a. cause loss of the whole production ( )

    b. cause major effect on production ( )

    c. affect the quality of the product only slightly ( )

    d. not affect the product at all ( )

    e. other (please specify) ....

    ....

    ....

32. Is quality control carried out at the factory during the production process?

    a. Yes ( )

    b. No ( )

33. If the answer to question 32 was "yes", how is the product examined and tested during the production process?

    a. full testing ( )

    b. random sampling ( )

    c. other (please specify) ....

    ....

    ....

34. At what stages is quality control carried out during the production process?

    a. after every stage of production ( )

    b. after each major stage of production only ( )

    c. other (please specify) ....

    ....

    ....

35. How is quality control carried out during production?

a. by carrying out laboratory tests and analyses ( )

b. by using specialised test and measurement equipment ( )

c. by visual inspection ( )

d. other (please specify) ....

....

....

36. Are the materials and equipment used for quality control of products during manufacture:

a. adequate ( )

b. inadequate ( )

c. other (please specify) ....

....

....

37. Is there quality control of finished products in your factory?

a. Yes ( )

b. No ( )

38. If the answer to question 37 was "yes", does the quality control take the form of:

a. full testing ( )

b. random sampling ( )

c. other (please specify) ....

....

....

39. What tools and equipment are used for quality control of the finished product?

a. laboratory tests and analyses ( )

b. specialised test and measurement equipment ( )

c. by visual inspection ( )

d. other (please specify) ....

....

40. Are defective items accepted in your company?

a. Yes ( )

b. No ( )

c. Sometimes ( )

41. What percentage of the total production in your factory is defective?

a. between 0% and 4% ( )

b. between 5% and 8% ( )

c. between 9% and 12% ( )

d. between 13% and 16% ( )

e. between 17% and 20% ( )

42. What are the causes of production defects?

a. lack of skilled labour ( )

b. lack of the necessary measuring and test equipment ( )

c. outdated machinery ( )

d. excessive precision in testing ( )

e. low quality of material used ( )

f. lack of supervision and monitoring ( )

g. other (please specify) ....

....

43. How do you deal with defective products?

a. return to the production line ( )

b. discard totally ( )

c. use in other products ( )

d. sell for a lower price after the fault has been made good ( )

e. other (please specify) ....

....

44. Has the company ever encountered problems due to defective items failing to comply with specifications?

a. Yes ( )

b. No ( )

45. With whom has the company encountered problems due to defective products?

a. with consumers ( )

b. with distributors ( )

c. with other companies ( )

d. with government bodies ( )

e. others (please specify) ....

....

46. Does your company have a department or section or information system or records for keeping information on production quality?

a. Yes ( )

b. No ( )

47. If the answer to question 46 was "yes", what kind of information is kept in the system? (please specify)

....

....

48. If the answer to question 46 was "no", why not?

a. the existing documentation is insufficient to supply the information ( )

b. the existing records are unsystematic ( )

c. the information on quality is not reliable ( )

d. the cost would be too high ( )

e. other reasons (please specify) ....

....

49. Is there in your company availability of communication systems?

a. Yes ( )

b. No ( )

50. If the answer to question 49 is "yes", in your opinion, is the system of communication and coordination between the various departments, sections and staff of your company:

a. highly efficient ( )

b. average ( )

c. poor ( )

51. In communications and coordination between departments and sections, the company relies on the following means:

a. written communications ( )

b. verbal communication ( )

c. both written and verbal communication ( )

52. Does the factory keep records of quality documents and other quality related information?

a. Yes ( )

b. No ( )

53. If the answer to question 52 was "no", what are the reasons for this?

a. high cost ( )

b. the information and data is not accurate ( )

c. not needed ( )

d. information and data not sufficient ( )

e. other (please specify) ....

....

....

....

....

54. What is the hierarchical position of the quality control unit?

a. factory manager - quality control department - quality control laboratories ( )

b. general manager - quality control department - quality control laboratories - quality assurance laboratories ( )

c. general manager - production manager - quality control department - quality laboratories ( )

d. factory manager - production manager - quality laboratories ( )

e. other (please specify) ....

....

....

....

....

55. What are the tasks carried out by the department or person responsible for quality control?

a. taking samples ( )

b. drawing up product specifications ( )

c. drawing up specifications for raw materials ( )

d. writing reports ( )

e. carrying out tests and measuring ( )

f. keeping records and statistics ( )

g. detecting faults and defects and determining their cause ( )

h. other (please specify) ....

....

....

56. Does your company provide training for its employees?

a. Yes ( )

b. No ( )

57. If the answer to question 56 was "yes", are the training courses held:

a. at the factory ( )

b. Saudi and foreign institutions ( )

c. Saudi institutions only ( )

d. at foreign institutions ( )

58. How many training courses have been held during the course of the year:

a. between 1 and 3 programmes ( )

b. between 4 and 6 programmes ( )

c. more than 6 programmes ( )

59. If the answer to question 56 was "no", what is the reason for having no training programmes?

a. high cost of training ( )

b. lack of qualified training staff ( )

c. no need for training ( )

d. insufficient time for training ( )

e. other (please specify) ....

....

60. To train its employees, does the company use:

a. senior staff ( )

b. factory training department ( )

c. specialist training staff engaged for that purpose ( )

d. vocational training centres ( )

e. specialised training institutes abroad ( )

f. other (please specify) ....

....

61. Is there a specific arrangement for testing and calibrating the factory measuring equipment from time to time?

a. Yes ( )

b. No ( )

62. If the answer to question 61 was "yes", where does the testing and calibration of the measuring equipment take place?

a. in the factory ( )

b. outside the factory ( )

c. outside the Kingdom ( )

d. elsewhere (please specify) ....

....

63. Is there some specific period, after which the measuring equipment is considered to be obsolescent and no longer suitable for use?

a. Yes ( )

b. No ( )

64. If the answer to question 63 was "yes", does the company replace and upgrade its measuring equipment?

a. Yes ( )

b. No ( )

65. If the answer to question 63 was "no", why not?

a. lack of skilled labour ( )

b. cost of equipment too high ( )

c. not necessary ( )

d. other (please specify) ....

....

66. Are statistical methods used for quality control or production?

a. Yes ( )

b. No ( )

67. If the answer to question 66 was "no", why are statistical methods not used?

a. the complexity of statistical methods ( )

b. lack of trained technical staff ( )

c. effort and costs ( )

d. other (please specify) ....

....

68. If the answer to question 66 was "yes", what statistical methods are used?

a. sampling ( )

b. statistical tables ( )

c. statistical measurements ( )

d. frequency distributions ( )

e. cause and effect diagrams ( )

f. control charts ( )

69. Does the company collaborate with government bodies to improve the quality of the goods produced?

a. Yes ( )

b. No ( )

70. If the answer to question 69 was "yes", what type of assistance is received?

a. provision of standards for the goods ( )

b. provision of quality control experts ( )

c. services of quality control and quality assurance laboratories ( )

d. preparation of training and awareness programmes ( )

e. other (please specify) ....

....

....

71. Has the factory been granted a quality mark or certificate of conformity by the Saudi Arabian Organisation for Standards (SASO)?

a. quality mark ( )

b. certificate of conformity ( )

c. neither ( )

72. If the answer to question 71 was "no", is this because:

a. the specifications laid down by SASO were too demanding ( )

b. it is impossible to comply with the specifications laid down by the SASO ( )

c. it is not necessary ( )

d. other (please specify) ....

....

....

73. What suggestions would you make to raise the level of quality within the factory?

....

....

....

....

....

....

....

Thank you for completing the questionnaire.

The Researcher

APPENDIX B

INTRODUCTORY LETTER, COVERING LETTERS
AND
SURVEY QUESTIONNAIRE

ARABIC VERSION

بسم الله الرحمن الرحيم

KINGDOM OF SAUDI ARABIA
Ministry of Higher Education
KING ABDULAZIZ UNIVERSITY
FACULTY OF ECONOMICS & ADMINISTRATION

المملكة العربية السعودية
وزارة التعليم العالي
جامعة الملك عبد العزيز
كلية الاقتصاد والادارة

Ref ____________ الرقم ____________
Date ____________ التاريخ ____________
Encl. ____________ المرفقات ____________

الى من يهمه الامر

تفيد كلية الاقتصاد والادارة بجامعة الملك عبد العزيز بجدة بأن المبتعث السيد/ هاني عبد الرحمن العمري هو احد مبتعثي الكلية ببريطانيا لتحضير درجة الدكتوراه في مجال ادارة الاعمال بجامعة ليستر ويقوم حاليا برحلة علمية لجمع المعلومات اللازمة لاستكمال متطلبات درجة الدكتوراة في مجال ادارة الانتاج حول موضوع (وظيفة ادارة الجودة في القطاع الصناعي ـ دراسة تحليلية بالتطبيق على المملكة العربية السعودية) .

نرجو التكرم بمساعدة سيادته في الحصول على المعلومات اللازمة لاستكمال بحثه العلمي . علما بأن هذه المعلومات لن تستخدم الا لاغراض البحث العلمي .

شاكرين لكم كريم تعاونكم .
وتقبلوا وافر تحياتي ،،

عميد كلية الاقتصاد والادارة

د. بكر بن عمر العمري
٢٥/٨/١١/١٤١١ هـ

بسم الله الرحمن الرحيم

المملكة العربية السعودية
وزارة الصناعة والكهرباء
المدينة الصناعية بجدة

الرقم : ١٤٦٤/ص ل
التاريخ : ٢٨/٨/١٤١٤هـ
المرفقات : .

الموضوع :

حضرة المكرم مدير مصنع / المحترم

السلام عليكم ورحمة الله وبركاته وبعد :-

تلقينا خطاب عميد كليه الاقتصاد والاداره رقم ١٢٠٤/ك وتاريخ ١٤١٤/٨/٢٥هـ بشأن رغبه الطالب /هانى عبدالرحمن العمرى وهو من طلاب الدراسات العليا بالقيام باعداد بحث عن وظيفه اداره الجوده فى القطاع الصناعى وهذا يتطلب مراجعته للجهات الرائده ذات العلاقه لموضوع بحثه .

نأمل مساعدة الطالب المذكور تحقيقاً للاهداف المرجوه لهذا الجهد العلمى ..

شاكرين تعاونكم .. ولكم خالص التحيات ..

مدير المدينة الصناعية بجدة بالنيابة

محمد نجيب عبدالله الخطيب

ع/م

بسم الله الرحمن الرحيم

السيد المدير المحترم

السلام عليكم ورحمة الله وبركاته

أقوم حالياً بإجراء دراسة لنيل درجة الدكتوراه في مجال إدارة الإنتاج من جامعة ليستر بالمملكة المتحدة حول موضوع :

" إدارة الجودة الكليه في القطاع الصناعي السعودي "
توقعات وصعوبات

ويبدو أن هذا المجال لم يحظ بالكثير من البحث والإهتمام من قبل الباحثين في المملكة العربية السعودية ، كما أن الهدف الأساسي لهذا البحث ليس خدمة الغرض الأكاديمي فحسب بل أهم من ذلك هو إلقاء الضوء على مفهوم إدارة الجودة الكاملة ومراقبة الجودة ومدى الأخذ بها والصعوبات التي تواجهها في الصناعة بالمملكة العربية السعودية ، وستكون المعلومات المقدمة من لديكم سرية ولن تستخدم إلا في أغراض هذا البحث وسيتم تجميعها وتصنيفها دون الإشارة إلى أسماء المجيبين .

أتقدم لسعادتكم بخالص الشكر لتفضلكم بالإجابة على الأسئلة المرفقة كما أن معاونتكم في الإجابة على هذه الأسئلة وتكملة الإستبيان مدلول منكم في دعم هذا البحث .

الباحث

هاني عبد الرحمن العمري
طالب لدراسة الدكتوراه
جامعة ليستر
مركز الإدارة
ليستر – المملكة المتحدة

المملكة العربية السعودية
وزارة التعليم العالي
جامعة الملك عبد العزيز
كلية الإقتصاد والإدارة
قسم إدارة أعمال

إستبيان بشأن
إدارة الجودة الكلية في القطاع الصناعي السعودي
توقعات وصعوبات

إعداد :
هاني عبد الرحمن العمري

دراسة لنيل درجة الدكتوراة في مجال إدارة الإنتاج
جامعة ليستر ، المملكة المتحدة

أسم الشركة :

سنة الإنشاء :

نشاط الشركة :

رأس مال الشركة :

أهم المنتجات :

العائد السنوي (تقريبي) :

مركز الشركة الرئيسي :

العنوان :

تليفون :

فروع الشركة (إن وجدت) :

١- حجم القوى العاملة :

إداريين
- سعوديين ( )
- غير سعوديين ( )

عماله فنية
- سعوديين ( )
- غير سعوديين ( )

عماله عاديه
- سعوديين ( )
- غير سعوديين ( )

٢- <u>أسواق توزيع المنتجات</u>

أسواق داخلية ( )

أسواق داخلية وخارجية ( )

أسواق خارجية ( )

٣ (أ) أسس المنافسة بين منتجاتكم والسلع المحلية المشابهة رتبها حسب أهميتها بحيث يعطي أهمية رقم (أ) والذي يليه في الأهمية رقم (ب) وهكذا :

أ- الجودة	( )
ب- السعر	( )
ج- الكمية	( )
د- العلامة التجارية	( )

هـ-أخرى(أذكرها)..

....

....

....

٣(ب) أسس المنافسة بين منتجاتكم والسلع المستوردة المشابهة ، رتبها حسب أهميتها بحيث يعطي الأكثر رقم (أ) والذي يليه في الأهمية رقم (ب) وهكذا .

أ- الجودة	( )
ب- السعر	( )
ج- الكمية	( )
د- العلامة التجارية	( )

هـ-أخرى(أذكرها)..

....

....

....

٤- هل يوجد في منشأتكم إلمام أو معرفة أو تطبيق نظام إدارة الجودة الكلية في الإدارة أو الإنتاج ؟

أ- معرفة تامة	( )
ب- معرفة ضئيلة	( )
ج- لا نعرف	( )

٥- أذا كان هناك معرفة تامة أو ضئيلة عن إدارة الجودة الكلية بالشركة هل يتم :

أ- تطبيق إدارة الجودة الكاملة ( )

ب- لا نطبق إدارة الجودة الكلية ( )

ج- نخطط لتطبيقها في المستقبل ( )

٦- أذا كانت الشركة لا تطبق أدارة الجودة الكلية ، ما هى الأسباب من وجهة نظرك ؟

أ- أرتفاع تكلفة التطبيق ( )

ب- عدم توافر المتخصصين في هذا المجال ( )

ج- النقص في المهارات لدى العاملين ( )

د- مفهوم إدارة الجودة الكلية غير واضح ( )

هـ - حجم الشركة ( )

د- عدم إقتناع الإدارة بجدوى التطبيق ( )

٧- هل توجد إجتماعات دورية يشارك فيها جميع الإدارات والأقسام والعاملين ؟

أ- نعم ( )

ب- لا ( )

٨- إذا كانت الإجابة (بلا) هل يعود السبب إلى عدم المشاركة إلى :

أ- القرارات والأوامر تحدد من الإدارة العليا ( )

ب- عدم رغبة الإدارات والأقسام ( )

ج- لا تحتاج لذلك حيث يعرف على إدارة وقسم مسئولياته وإجاباته ( )

د- لا أعلم ( )

هـ-أخرى(أذكرها)..

....

....

....

٩- ما مدى إيمان الشركة بأهمية نظام العمل بروح الفريق الواحد من وجهة نظرك ؟

أ- أهتمام كبير ( )
ب- أهتمام متوسط ( )
ج- أهتمام ضعيف ( )
د- لا يوجد إقتناع بالأهمية ( )

١٠- من وجهة نظرك إلى أى مدى يدرك العاملين أهداف الشركة ؟

أ- إلى حد كبير ( )
ب- بدرجة معقولة ( )
ج- إلى حد ما ( )
د- غير متأكد ( )

١١- عند حدوث أى تغييرات على سياسة العمل وإجراءاته ، هل تشرح للعاملين بالشركة ؟

أ- نعم ( )
ب- لا ( )

١٢- هل يمكن القول ، أن الإدارة تشجع العاملين على إبداء آرائهم ومقترحاتهم لتحسين مستوى العمل بالشركة ؟

أ- دائماً ( )
ب- غالباً ( )
ج- أحياناً ( )
د- نادراً ( )
هـ- أخرى(أذكرها) ....

....

....

....

١٣- هل يوجد إشتراطات أو مواصفات معينة في أنتاج الشركة يطلبها العملاء ؟

أ- نعم ( )

ب- لا ( )

١٤- إذا كانت الإجابة (بنعم) كيف تتعرف الشركة على رغبات ومطالب العملاء ؟

أ- بحوث تسويق ( )

ب- مندوبي المبيعات ( )

ج- التعاون بين التسويق والإنتاج والمبيعات وإدارات أخرى ( )

د- من خلال الخبرة والتجارب السابقة ( )

هـ-أخرى(أذكرها) ....

....

....

١٥- إذا كانت الإجابة بـ (لا) فما هي الأسباب ؟

....

....

....

....

١٦- هل تتوافر لدى الشركة مواصفات أنتاجية كافية ؟

أ- نعم ( )

ب- لا ( )

١٧- أذا كانت الأجابة (بنعم) هل يتم تطبيق المواصفات فعلياً ؟

أ- نعم ( )

ب- لا ( )

١٨- ما هى المصادر التي تمد مصنعها بالمواصفات المطلوب توافرها في منتجاتها ؟

أ- جهاز التسويق ( )

ب- جهاز بحوث التسويق ( )

ج- جهاز مختص في إدارة الأنتاج ( )

د- فنيون داخل المصنع ( )

هـ- هيئات أجنبية ( )

و- البيئة العربية السعودية للمواصفات والمقاييس ( )

ز- مصادر أخرى (أذكرها) ....

....

....

١٩- إذا كانت الإجابة بـ (لا) فما هو الأساس الذي تعتمد عليه الشركة في صنع المنتجات بمواصفات معينة ؟

....

....

....

....

٢٠- هل هناك مؤسسات أو هيئات أجنبية تمد المصنع بمواصفات المنتجات التي تنتجها مصانعكم ؟

أ- نعم ( )

ب- لا ( )

٢١- إذا كانت الإجابة بـ (نعم) أذكر أسماء هذه الهيئات ؟

....

....

....

....

٢٢- عند تطبيق المواصفات هل تواجه صعوبات عند التنفيذ ؟

أ- نعم ( )

ب- لا ( )

٢٣- إذا كانت الإجابة بـ (نعم) فما هي الأسباب في رأيك التي تدعو إلى صعوبة تطبيق هذه المواصفات ؟

أ- الدقة المتناهية للمواصفات الموضوعة ( )

ب- عدم توافر أجهزة القياس والأدوات اللازمة ( )

ج- عدم توافر الأيدي العاملة المدربة ( )

د- عدم توافر آلات في المستوى التكنولوجي المطلوب ( )

هـ- إنخفاض جودة المواد الأولية والمواد النصف مصنعة ( )

و- ظروف العمل (الحرارة – البرودة) تمنع تحقيق الجودة ( )

ز- أسباب أخرى (أذكرها) ....

....

....

....

٢٤- ما هي مصادر شراء المواد الأولية للإنتاج ؟

أ- السوق المحلي ( )

ب- أسواق محلية وخارجية . ( )

ج- أسواق خارجية ( )

د- أخرى (أذكرها)..

....

....

....

٢٥- عند إستلام المواد الأولية الواردة هل يتم فحصها للتأكد من جودتها ؟

أ- نعم ( )

ب- لا ( )

٢٦- إذا كانت الإجابة بـ (نعم) ما هو الأسلوب المستخدم في فحص المواد الأولية ؟

أ- عينة عشوائية ( )

ب- فحص شامل ( )

ج-أخرى(أذكرها) ....

....

....

....

٢٧- أين تتم عملية فحص وإختبار جودة المواد المشتراه ؟

أ- في مقر البائع ( )

ب- في مقر المشتري ( )

ج- فيمكان آخر (أذكره) ....

....

....

....

٢٨- من الذي يتولى عملية فحص وإختبار جودة المواد المشتراه ؟

أ- لجنة فنية تمثل المشتري ( )

ب- مكتب فحص متخصص للمصنع ( )

ج- أمين المستودع المتخصص ( )

د- مختبرات الجودة النوعية بالملكة ( )

هـ- جهة أخرى (أذكرها) ....

....

....

....

٢٩- كيف تجري عملية الفحص وإختبار جودة المواد المشتراة والداخلة في الإنتاج ؟

أ- بواسطة الإختبار معملي ( )

ب- بواسطة أجهزة فحص متخصصة ( )

ج- بواسطة أدوات يدوية بسيطة ( )

د- بواسطة العين المجردة ( )

هـ-أخرى(أذكرها)..

....

....

....

٣٠- في حالة عدم مطابقة المواد المشتراه لمواصفات الجودة المطلوبة يتم :-

أ- رفض الكمية المشتراه بالكامل وردها للبائع ( )

ب- رفض الوحدات غير المطابقة للمواصفات ( )

ج- قبول الكمية غير المطابقة للمواصفات مع خفض سعر شرائها ( )

د-أخرى(أذكرها) ....

....

....

....

٣١- هل يؤدي إستخدام مواد غير مطابقة للمواصفات إلى :-

أ- تلف المنتجات تماماً ( )

ب- تأثر المنتجات بدرجة كبيرة ( )

ج- تأثر بسيط على مستوى جودة المنتجات ( )

د- عدم تأثر المنتجات ( )

هـ-أخرى(أذكرها) ....

....

....

....

٣٢- هل يتم في المصنع مراقبة جودة المنتجات أثناء عملية الصنع ؟

أ- نعم

ب- لا

٣٣- إذا كانت الإجابة بـ (نعم) ما هو الأسلوب المتبع في فحص وإختبار المنتج أثناء عمليات الصنع ؟

أ- فحص شامل ( )

ب- عينة عشوائية ( )

ج-أخرى(أذكرها)..

....

....

....

٣٤- في أي مرحلة تتم عملية مراقبة الجودة أثناء عملية الإنتاج ؟

أ- بعد كل مرحلة من مراحل الإنتاج ( )

ب- بعد كل مرحلة إنتاج رئيسية ( )

ج-أخرى(أذكرها)..

....

....

....

٣٥- كيف تتم عملية مراقبة الجودة أثناء الإنتاج ؟

أ- إجراء إختبارات وتحاليل معملية ( )

ب- إستخدام أجهزة قياس وضبط متخصصة ( )

ج- استخدام العين المجردة ( )

د-أخرى(أذكرها)..

....

....

....

٣٦- هل الأجهزة والمعدات لمراقبة جودة المنتجات تحت الصنع تعتبر :-

أ- الكافيه ( )

ب- غير كافيه ( )

ج-أخرى(أذكرها)..

....

....

....

٣٧- هل يتم في مصنعكم مراقبة جودة المنتجات النهائية ؟

أ- نعم ( )

ب- لا ( )

٣٨- إذا كانت الإجابة بـ (نعم) فهل تتم الإختبارات على :-

أ- فحص شامل ( )

ب- عينة عشوائية ( )

ج-أخرى(أذكرها)..

....

....

....

٣٩- ما هي الأدوات والأجهزة المستخدمة في مراقبة جودة المنتج النهائي ؟

أ- إجراء إختبارات وتحاليل معملية ( )

ب- إستخدام أجهزة قياس وضبط متخصصة ( )

ج- إستخدام العين المجردة ( )

د-أخرى(أذكرها)..

....

....

....

٤٠- هل تعتبر الوحدات المعيبة من الأنتاج مقبولة في هذه الصناعة ؟

أ- نعم ( )

ب- لا ( )

ج- أحياناً ( )

٤١- ما هي نسب المنتجات المعيبة إلى حجم الإنتاج في مصنعكم ؟

أ- صفر إلى (٤٪) ( )

ب- (٥٪) إلى (٨٪) ( )

ج- (٩٪) إلى (١٢٪) ( )

د- (١٣٪) إلى (١٦٪) ( )

هـ- (١٧٪) إلى (٢٠٪) ( )

٤٢- ما أسباب الإنتاج المعيب ؟

أ- عدم توفر العمالة المدربة ( )

ب- عدم توافر الأجهزة اللازمة للقياس ( )

ج- الآلات غير حديثة ( )

د- المبالغة في دقة الإختبار ( )

هـ- إنخفاض جودة المواد المستخدمة ( )

و- قصور الإشراف والمتابعة ( )

ز-أخرى(أذكرها)..

....

....

....

٤٣- كيف يتم التصرف في الوحدات المعيبة من الإنتاج ؟

أ- تعاد إلى خط الإنتاج ( )

ب- تستبعد تماماً ( )

ج- تستبعد تماماً ( )

د- تباع بعد تصحيحها بسعر منخفض ( )

هـ-أخرى(أذكرها)..

....

....

....

٤٤- هل تعرضت الشركة إلى مشكلات بسبب الوحدات المعيبة للمنتجات غير المطابقة للمواصفات؟

أ- نعم ( )

ب- لا ( )

٤٥- ما هي المشكلات التي يتعرض لها المصنع بسبب المنتجات المعيبة ؟

أ- مع المستهلك ( )

ب- مع الموزعين ( )

ج- مع الشركات ( )

د- مع هيئات حكومية ( )

هـ-مع آخرين(أذكرهم)..

....

....

....

٤٦- هل يوجد لدى الشركة إدارة أو قسم أو نظام معلومات أو سجلات خاصة لحفظ معلومات جودة الإنتاج ؟

أ- نعم ( )

ب- لا ( )

٤٧- إذا كانت الإجابة بـ (نعم) فما هي نوعية المعلومات التي يقدمها هذا النظام ؟
(أذكرها)...
....
....
....

٤٨- إذا كانت الإجابة بـ (لا) فما الصعوبات التي تعوق وجود ذلك ؟
أ- المستندات الحالية غير كافية لتقديم المعلومات اللازمة ( )
ب- السجلات الحالية غير منظمة ( )
ج- عدم دقة البيانات والمعلومات الخاصة بالجودة ( )
د- إرتفاع التكاليف ( )
هـ-أخرى(أذكرها)...
....
....
....

٤٩- هل يتوافر داخل الشركة نظام للإتصالات ؟
أ- نعم ( )
ب- لا ( )

٥٠- أذا كانت الأجابة بـ (نعم) ، فمن وجهة نظرك كيف تصف نظام الإتصال بالشركة ؟
أ- قوى ( )
ب- متوسط ( )
ج-ضعيف ( )

٥١- هل تعتمد الشركة في الإتصال والتنسيق بين الإدارات والأقسام على الوسائل :

أ- الكتابية ( )

ب- الشفهيه ( )

ج- الكتابية والشفهيه ( )

٥٢- هل تحتفظ الشركة بسجلات عن جودة الأنتاج وكل ما يتعلق بها من معلومات ؟

أ- نعم ( )

ب- لا ( )

٥٣- إذا كانت الإجابة بـ (لا) فما هي الأسباب ؟

أ- إرتفاع التكاليف ( )

ب- عدم دقة البيانات والمعلومات المتاحة ( )

ج- عدم الحاجة إليها ( )

د- المعلومات المتاحة غير كافية ( )

هـ-أخرى(أذكرها)..

....

....

....

٥٤- ما هو التسلسل الإداري لوحدة مراقبة الجودة ؟

أ- مدير مصنع .... إدارة مراقبة الجودة ....

مختبرات الجودة . ( )

ب- مدير عام .... إدارة مراقبة الجودة ....

مختبرات ضبط الجودة .... مختبرات تأكيد الجودة . ( )

ج- مدير عام .... مدير إنتاج .... إدارة مراقبة الجودة

مختبرات الجودة ( )

د- مدير مصنع ....مدير إنتاج ....

مختبرات جودة ( )

هـ- أخرى (أذكرها)

٥٥- ما هي المهام التي يقوم بها الجهاز أو المسئول عن مراقبة الجودة ؟

أ- أخذ عينات ( )

ب- وضع مواصفات المنتجات ( )

ج- وضع مواصفات المواد الأولية ( )

د- كتابة التقارير ( )

هـ -إجراء الفحص والمعايرة ( )

و- الإحتفاظ بالسجلات والإحصاءات ( )

ز- إكتشاف الأخطاء والعيوب وتحديد أسبابها ( )

ح-أخرى(أذكرها)..

....

....

....

٥٦- هل تعقد الشركة برامج لتدريب العاملين ؟

أ- نعم ( )

ب- لا ( )

٥٧- إذا كانت الإجابة بـ (نعم) فهل تتم برامج التدريب :-

أ- داخل المصنع ( )

ب- هيئات من داخل المملكة وخارجها ( )

ج- هيئات من داخل المملكة ( )

د- هيئات خارجية ( )

٥٨- ما عدد البرامج التدريبية التي يتم عقدها خلال سنة ؟

أ- من (١) إلى (٣) برامج ( )

ب- من (٤) إلى (٦) برامج ( )

ج- أكثر من (٦) برامج ( )

٥٩- إذا كانت (لا) توجد برامج تدريبية ، فما أسباب عدم توافرها ؟

أ- إرتفاع تكاليف التدريب ( )

ب- عدم توافر مدربين أكفاء ( )

ج- عدم الحاجة إلى التدريب ( )

د- عدم وجود الوقت الكافي للتدريب ( )

هـ-أذكرها (أذكرها) ....

....

....

....

٦٠- توفر الشركة مدربين لتدريب عمال مراقبة جودة الإنتاج من خلال :

أ- قدامى العاملين ( )

ب- جهاز التدريب بالمصنع ( )

ج- إستخدام مدربين متخصصين بالشركة ( )

د- مراكز التدريب المهني ( )

هـ- معاهد تدريب متخصصة خارجية ( )

و-أخرى(أذكرها) ....

....

....

....

٦١- هل يوجد نظام معين لإختبار ومعايرة أجهزة القياس الموجودة في المصنع بين الحين والآخر ؟

أ- نعم ( )

ب- لا ( )

٦٢- إذا كانت الإجابة بـ (نعم) أين تجري هذه الإختبارات والمعايرة لأجهزة القياس ؟

أ- داخل المصنع ( )

ب- خارج المصنع ( )

ج- خارج المملكة ( )

د-أخرى(أذكرها) ....

....

....

٦٣- هل هناك مدة معينة تعتبر بعدها أجهزة القياس تالفة ولا تستعمل ؟

أ- نعم ( )

ب- لا ( )

٦٤- إذا كانت الإجابة بـ (نعم) فهل يهتم المصنع بتجديد وسائل القياس وتطويرها ؟

أ- نعم ( )

ب- لا ( )

٦٥- إذا كانت الإجابة بـ (لا) فهل يرجع السبب إلى :-

أ- عدم وجود عاملين مدربين ( )

ب- إرتفاع التكاليف ( )

ج- عدم الحاجة إلى ذلك ( )

د-أخرى(أذكرها) ....

....

....

....

٦٦- هل يتم إستخدام الأساليب الإحصائية لضبط جودة الإنتاج

أ- نعم ( )

ب- لا ( )

٦٧- إذا كانت الإجابة بـ (نعم) فهل تستخدم الأساليب الإحصائية ؟

أ- العينات ( )

ب- جداول إحصائية ( )

ج- المقاييس الإحصائية ( )

د- التوزيعات التكرارية ( )

هـ- تحليل السبب والأثر ( )

و-أخرى(أذكرها)..

....

....

....

٦٨- إذا كانت الإجابة بـ (لا) ما هي أسباب عدم إستخدام الأساليب الإحصائية ؟

أ- تعقد الأساليب الإحصائية ( )

ب- عدم توافر فنيين مدربين ( )

ج- الجهد والتكاليف ( )

د-أخرى(أذكرها)..

....

....

....

٦٩- هل يتم التعاون مع الجهات الحكومية لتحسين جودة السلعة المنتجة ؟

أ- نعم ( )

ب- لا ( )

٧٠- إذا كانت الإجابة بـ (نعم) ما نوع المساعدات ؟

أ- تقديم مواصفات قياسية المعدة للسلعة ( )

ب- توفير الخبراء المتخصصين في مراقبة الجودة ( )

ج- خدمات مختبرات فحص وضبط الجودة ( )

د- إعداد برامج التدريب والتوعية ( )

هـ-أخرى(أذكرها)..

....

....

....

٧١- هل لدى المصنع علامة جودة أو شهادة مطابقة التي تمنح من قبل الهيئة العربية السعودية للمواصفات والمقاييس ؟

أ- نعم ( )

ب- لا ( )

٧٢- إذا كانت الإجابة بـ (لا) هل ترجع الأسباب إلى :-

أ- إرتفاع المواصفات التي تضعها الهيئة ( )

ب- عدم إمكانية الإلتزام بمواصفات الهيئة ( )

ج- عدم الحاجة لها ( )

د-أخرى(أذكرها)..

....

....

....

٧٣- ما هي مقترحاتك لرفع مستوى الجودة داخل المصنع ؟

....

....

....

....

....

....

....

....

....

....

....

....

شكراً لتعاونكم وأجابتكم للإستبيان ،

الباحث

APPENDIX C

LIST OF FACTORIES INCLUDED IN THE SAMPLE

FOODSTUFFS AND DRINKS

1. Saudi Meat Factory
2. Halawani processed meat plant
3. Meat Processing Plant - Saudi Danish Co.
4. Modern Dairies Factory
5. Saudi Dairy Product Factory
6. Danish Dairy Products Co. Ltd.
7. Halawani Dairy and Ice cream Plant
8. Jeddah Dairy Plant
9. Al-Marai Co. Ltd.
10. Al-Ghamdi Industrial Co.
11. Halawani Processed Cheese Plant
12. Saudi Ice cream Factory "Kwality"
13 Saudi Nuts and Foodstuffs Packing Factory
14. Bin Zager Corp. Ltd.
15. Saudi Fruit Juice and Beverages Industry
16. Hop Saudi Factory
17. Bafarat Industrial Group
18. Savola Vegetable Oil Co.
19. Bohara Food Processing Plant
20. Tasalee Food Processing
21. Bader Automatic Bakeries
22. Salama Electronic Bakery
23. National Food Manufacturing Co., "Macaroni Factory"
24. Saudi Modern Foods Factory
25. Bakabas Factory for Ice cream Biscuits
26. Badrah Saudi Factory
27. Hana Biscuit Factory
28. Saudi National Biscuits and Confectionery Co.
29. Saudi Bakeries
30. Al-Jalsi Pastries Factory
31. Saudi Pastries Factory
32. Bafarat Sugar Factory
33. Abu Jadayil for Sugar Processing
34. Saudi Lebanese Factories Ltd.
35. Al-Khuzundar Confectionary Factories
36. Saudi Refreshment and Ind. Co.
37. Al-Mutawakel Sugar Cone Factory
38. Saudi Chewing Gum Production Factory
39. United Industries Co., Chewing Gum Factory
40. Halawani Sesame Factory
41. Alsunbulah Food & Fine Pastries Manufacturing Co.
42. Sweet Orient Factory
43. Jeddah Ice Factory
44. Kaki Ice Factory
45. Saudi Yeast Co.
46. Saudi Salt Refinery Works

47. Saudi Tea Tip Factories Co. Ltd.
48. Snack Food Company
49. Saudi Industrial Projects Co., "Pepsi Cola"
50. Delta Water Bottling Co.
51. Medina Water Bottling Plant
52. Seven-Up Bottling Plant
53. Al-Amoudi Soft Drinks Manufacturing Co.

CHEMICAL PRODUCTS

1. Abdullah Hashim Industrial Gases and Equipment Co.
2. Saudi Industrial Gases Co. Ltd.
3. Alkem Chemical Industrial Co.
4. Salama Chemicals Factory "Parco"
5. Red Sea Paint Factory
6. United Industrial Co. Ltd.
7. Al-Sharq Paints Factory
8. Jeddah Paints Factory
9. Sherwin Williams A. Ltd.
10. Saudi Chemical Industrial Co.
11. Pharmaceutical Solution Industries Ltd.
12. Medical Nitrous Oxide Plant
13. Bin Zager Lever Ltd.
14. Attaj Soap Factory
15. Abu Dawood for Industry, "Clorox Factory"
16. Saudi Perfumes and Cosmetics Industry
17. Perfumes of Arabia Ltd.
18. Modern Industries Co.
19. Mushir Alam Perfume Industry
20. Batterjee Factory for Cosmetics and Baby Care
21. Bin Zager Match Factory
22. Fosam Company Ltd.
23. Arab Building Material Chemicals Factory
24. Arab Plastic Materials Factory
25. Saudi Match Book Factory
26. Petromin Jeddah Oil Refinery Co.
27. Petromin Lubricating Oil Refining Co.
28. Saudi Markets and Shell Co. Ltd.
29. Al-Sharq Asphalt Factory
30. Arabian Water Proofing Industries Co.
31. Arab Asphalted Paper Factory
32. Gandora Plastic Co.
33. Badreig Melamine Factory
34. Jeddah Plastic Factory
35. Badreig Plastic Factory for Toys and House Utensils
36. National Cup and Container Co.
37. Woven Mats Factory
38. Saudi Industries for Plastic Windows Ltd.

39. Advertising and Publicity Products Manufacturing Co.
40. National Polystyrene Cases Plant
41. Modern Luggage Industries
42. Jeddah Foam Laminates Factory
43. Saudi Lightweight Industries
44. Insulation Factory Ltd.
45. Arabian Chemical Co. (Polystyrene) Ltd.
46. Saudi Polystyrene Plant
47. Medni and Arab Roofing Contractors (MERCO)
48. Arab Gulf Factories Co. for Plastic Industries
49. National Factory for Plastic Pipes and Fittings (FIBRO)
50. Saudi Industries for Pipes Co. Ltd.
51. Wali Plastic and Decor Ind. Co. Ltd.
52. Al-Tayar Plastic and Rubber Industries Factory
53. Al-Mourky Engineering Tools Factory
54. Red Sea Plastic Factory Co.
55. Al-Hemaid Plastic Factory
56. Al-Saigh Plastic Factory
57. Arifco Plastic Factory
58. Bin Rafah Factory for Plastic Hoses
59. Al-Shark Factories P.V.C Pipes
60. Saudi Video Cassettes Factory
61. Sout Al-Jazirah Cassette Tapes Factory

<u>METAL PRODUCTS</u>

1. Steel Rolling Co. (SABIC)
2. Saudi Factory for Steel Sheets Ltd.
3. Aluminium Products Co. (ALUPCO)
4. Saudi Factory for Aluminium Foil Containers
5. Red Sea Aluminium Factory for Households
6. Al-Taj Metal Industries
7. Yamama Iron Industries
8. Universal Shelves Industrial Co. Ltd.
9. Saudi Arabian Est. for Metal Furniture
10. National Factory for Chrome and Metal
11. Al-Sorayal Steel Bed Factory
12. Arabian Spring Mattresses Factory (Sleep High)
13. Saudi Spring Mattresses Factory
14. Al-Taiseer Aluminium Kitchens Factory
15. A.A. Al-Brahim & Partners Factory for Aluminium Kitchens
16. Al-Zamil Heavy Industries Ltd.
17. Al-Zahrani Co. Ltd. (Prefab. Houses and Villas)
18. Hidada Company Ltd.
19. Saudi Building Systems
20. Saudi Steel Manufacturing Co.

21. Steel Constructions Co. (STEELCO)
22. National Industries Factory for Iron
23. Al-Howaish G. Smith Co. Ltd.
24. Arabian Co. for Iron Products
25. Al-Jazeera Steel Products Factory
26. Al-Etaiby Lighting Poles and Metal Works Factory
27. Arabian Steel Sheet Factory
28. Binladin Factory for Metal Industries
29. Saudi Cover Factory Co.
30. Azzam Metal Industries Factory
31. Saudi Metal Decoration Co.
32. Saudi Factory for Pies Moulds Manufacturing
33. Alenma Factory for Metal Ceilings
34. Metal Slices Decoration Factory
35. Aluminium Industrial Co. (Metal)
36. Aluminum Manufacturing Co. Ltd. (ALUMACO)
37. Saudi German Aluminium Products Co. Ltd.
38. Badreig Factory for Aluminium, Iron Smithing
39. Jeddah Aluminium Manufacturing Co.
40. Al-Khair Industry for Barbed Wire Fencing
41. B.R.C. Al-Fadhal Saudi Co.
42. Al-Qahtani Nails Galvanized Wire
43. Al-Zafer Factory for Cold Processing of Steel and Metals
44. Jeddah Beverage Can Making Co. Ltd.
45. Saudi Can Co. Ltd.
46. Fine Tool Saudi Arabia
47. Al-Homrany, Jeddah Barrels Factory
48. Al-Jaffali Air Conditioning and Accessories Factory
49. Saudi Factory for Gas Cookers
50. Salem Factory for Metal Casting
51. Specialized Industries Co.
52. Saudi Tractor Manufact. Co. Ltd.
53. Saudi Computer Industries
54. Saudi Factory for Electrical Appliances Ltd.
55. Saudi Refrigerators Manufacturing Co. Ltd.
56. Gulf Saudi Pump Factory
57. Fire Extinguisher Factory
58. Al-Naser Factory for Grills, Ovens and Heaters
59. Foudah Factory for Bakery Equipment
60. Saudi Cable Company Inc.
61. Saudi American Co. for Lighting Fixtures
62. Metal Work Co.
63. Green Line Radiators Factory
64. Saudi Exhaust Systems Co.
65. Al-Mutalk Filter Co.
66. National Automobile Ind. Co.
67. Saudi Swiss Co. for Electric Meters
68. Al-Shahrani Factory for Truck Tanks
69. Jamjoom Metal Industries Co.

70. Jeddah Cable Factory
71. Al-Huwaish Cooling Factory
72. Saudi Seicli Co.
73. Jeddah Wire Factory
74. Chrome and Metal Articles Factory
75. Tankers, Hangers and Steel Works Factory
76. Bawareth Metal Products Factory

<u>CONSTRUCTION MATERIALS</u>

1. Saudi Red Bricks Co.
2. Al-Khayat Red Bricks Factories
3. Al-Hamrani Co. for Industry
4. Saudi Sand and Lime Brick Co.
5. Biladi Factory for Polishing and Grinding
6. Binladin Brick and Cement Pipe Factory
7. Al-Sharq Concrete Factory
8. Al-Mansour Construction Materials Factory
9. A.R. Namlah Factory for Tiles and Curbstone
10. Jamjoom Tiles Factory
11. Beladi Factory for Terrazzo, Marble and Granite
12. Saudi Tiles Factory
13. Saudi Building Materials Co.
14. Al-Aziziya Rock and Tile Factory
15. Saudi Arabia Concrete Products (SACOP) Ltd.
16. Saif Noman Said & Partners Co.
17. Arabian Industrial Construction Ltd.
18. Industrialized Building Saudi Factories (IBSF)
19. Al-Amaen Prefab. Buildings and Design Factory
20. Saudi Transport Beton
21. Ready Mix Saudi Ltd.
22. JAC Production / Jeddah Factory
23. Alma Concrete Co. Ltd.
24. Saudi Marble Co.
25. Al-Ghamdi Marble Co. Ltd.
26. Binladin Saudi Marble Co.
27. Arab Marble and Aluminium Factory
28. Saudi Gypsum Decoration Factory
29. Jeddah Industrial Material Co. (JIMCO)
30. National Quarries Co.
31. Red Sea Mining Co. Ltd.
32. Badr Fibre Glass Factory
33. Masadir Fibre Glass Products
34. Al-Zamil Glass Factory
35. Jeddah Fibre Glass Factory
36. Saudi Arabian Glass Co. Ltd.
37. Dabbagh Ceramic Gift Factory
38. Al-Sabah Est. for Glass Manufacture
39. Mangour Fibre Glass Factory

40. Saudi Fibre Glass Factory
41. Arafat Red Brick Factory
42. Al-Ghazi Block Factory
43. Dabbagh Block and Concrete Products Factory
44. Technical Tiles Factory
45. Industrial and Commercial Relations Company
46. Jardi and Kaki Plant
47. Fayez Trading and Contracting Co. Ltd.
48. A.S. Bugshan & Bros Precast Factory
49. Red Sea Housing Services Co. - Prefab. residential Units Factory
50. Talha Building Industries

<u>CLOTHES AND TEXTILES</u>

1. Saudi Textile Factory
2. Behles National Carpet Factory
3. Ready-made Wear Factory
4. Saudi Finished Clothes Factory
5. Al-Nahda Est. Factory for Tricot Weaving
6. Al-Sarea Carpet Factory

<u>WOOD PRODUCTS</u>

1. Binladin Factory for Woodwork
2. Arab Wood Industry Co. Ltd.
3. Saudi Wooden Furniture Factory
4. Arabian Arts for Carpentry and Decoration
5. Al-Shimaimry for Kitchens Production
6. Bin Hamad Factory for Kitchens and Cabinets
7. Al-Abouseoud Furniture Factory
8. Al-Redwan Woodwork and decoration

<u>PAPER AND PAPER PRODUCTS, PRINTING AND PUBLISHING</u>

1. Injaz Saudi International Paper Co. Ltd.
2. National Paper Factory
3. Paper Bags Factory
4. Banawi Packaging
5. Nasr Packing and Printing Co.
6. Saudi Carton Co. Ltd.
7. Tawfik Printers
8. Mubarco Printers Co.
9. Saudi Paper Cups and Containers Co.
10. Eagle Industrial Co. for Envelopes and Wax Pen Products

11. Najeeb Stationery Factory
12. Saudi Industrial Paper Co.
13. Trust Printing Press Co.
14. Baghanem for Industry Clean Paper Co. Ltd.
15. Al-Hemeid Paper Products Factory
16. Modern Products Co. (Pampers, Loves Diapers)
17. Al-Madina Printing and Publishing Co.
18. Sarawat Printing Press
19. Sahar Printing Press
20. Dar Okaz Printing and Publishing
21. Modern Printing Press
22. Jeddah Graphic Centre
23. Dar Al-Asfahani Printing
24. Dar Al-Ilm Printing Co.
25. The Saudi Company for Paper Processing
26. Hygienic Paper Co. Ltd.
27. National Printing Press
28. Al-Aoun Factory for Commercial Labels

APPENDIX D

X^2 DISTRIBUTION TABLE

The χ^2 distribution

df	$\chi^2_{0.05}$	$\chi^2_{0.025}$	$\chi^2_{0.01}$	$\chi^2_{0.005}$	df
1	3.841	5.024	6.635	7.879	1
2	5.991	7.378	9.210	10.597	2
3	7.815	9.348	11.345	12.838	3
4	9.488	11.143	13.277	14.860	4
5	11.070	12.832	15.086	16.750	5
6	12.592	14.449	16.812	18.548	6
7	14.067	16.013	18.475	20.278	7
8	15.507	17.535	20.090	21.955	8
9	16.919	19.023	21.666	23.589	9
10	18.307	20.483	23.209	25.188	10
11	19.675	21.920	24.725	26.757	11
12	21.026	23.337	26.217	28.300	12
13	22.362	24.736	27.688	29.819	13
14	23.685	26.119	29.141	31.319	14
15	24.996	27.488	30.578	32.801	15
16	26.296	28.845	32.000	34.267	16
17	27.587	30.191	33.409	35.718	17
18	28.869	31.526	34.805	37.156	18
19	30.144	32.852	36.191	38.582	19
20	31.410	34.170	37.566	39.997	20
21	32.671	35.479	38.932	41.401	21
22	33.924	36.781	40.289	42.796	22
23	35.172	38.076	41.638	44.181	23
24	36.415	39.364	42.980	45.558	24
25	37.652	40.646	44.314	46.928	25
26	38.885	41.923	45.642	48.290	26
27	40.113	43.194	46.963	49.645	27
28	41.337	44.461	48.278	50.993	28
29	42.557	45.722	49.588	52.336	29
30	43.773	46.979	50.892	53.672	30

Source: Statistics for Business, Whitehead, P. and Whitehead, G. (1992)

APPENDIX E

THE KINGDOM OF SAUDI ARABIA

THE KINGDOM OF SAUDI ARABIA

1. GEOGRAPHICAL LOCATION

The Kingdom of Saudi Arabia occupies nearly nine tenths of the Arabian peninsula, covering an area of some 2 240 000 square kilometres and extending from the Arabian Gulf in the east to the Red Sea and the Gulf of Aqaba in the west and from the borders with Iraq, Jordan and Kuwait in the north to the borders of Yemen and Oman in the south. As the above map shows, the Kingdom is situated at the crossroads of Europe, Africa and mainland Asia and, lying close to the Suez canal, it has frontiers on both the Red Sea and the Arabian Gulf. Thus, it is strategically placed in terms of international trade, quite apart from its religious significance as the seat of the Holy cities of Mecca and Medina and its economic importance as the holder of a quarter of the world's proven oil reserves.

The implications of this privileged position are clearly recognised in national policy. For example, commenting on the need to strengthen and expand international linkages, the Kingdom's fifth development plan highlighted the significance of international trade in respect of which it stated the following:

"As the world's leading oil exporter and a major importer of goods from all over the world, the Kingdom has always been closely linked to the international economy. In addition, Saudi Arabia has deep and close ties with other Arab countries and the Islamic world in general. These international linkages deepened over the fourth plan period, as Saudi petrochemicals and refined products emerged as two major areas for international joint-venture enterprises with the Kingdom. In addition, other economic sectors succeeded in opening up new international export markets and increasing international cooperation, particularly with GCC countries. Thus, the Kingdom's international trading relations have expanded to become a significant element influencing the national economy and Saudi society. As a result, a major theme of the Fifth plan is to establish appropriate institutional arrangements to ensure national economic competitiveness, thereby enhancing the Kingdom's contribution to global economic cooperation and its wider trading links with the world economy". (Plan V, P. 50-51)

2. REGIONAL COMPOSITION

Saudi Arabia is traditionally divided into the four regions of Najd, Hijaz, Asir and Al-Ahsa. These regions also form the main economic growth centres of the Kingdom. For administrative purposes, they are referred to as provinces, with the fifth province being made up of the region bordering Jordan and Iraq on the northernmost part of the Kingdom.

Najd or the Central Province lies at the centre of the Arabian Peninsula. Its main population centre, Riyadh, is also the capital of the Kingdom. Al-Ahsa or the Eastern Province is to the east of Najd, along the Arabian Gulf coast and contains most of the country's known oil reserves. In addition to the main population centres of Dammam, Dahran and Al-Khobar, the region is also the site of the Jubail Industrial City, one of the two newly built industrial complexes devoted to hydro-carbon based and energy intensive primary industries in the Kingdom. The other twin industrial city of Yanbu is situated in the Hijaz or Western Province along the Red Sea. It is in this province that the holy cities of Mecca and Medina and the summer resort of Taif are located, in addition to Jeddah, the regional capital and the Kingdom's leading commercial centre. (Al-Farsy, 1986)

The Asir or Southern Province extends down from the south of Hijaz to the borders with Yemen and includes the major towns of Abha, Jizan and Najran. Being the only part of Saudi Arabia to receive regular rainfall, activity in this region is focused mainly on agriculture and, more recently, on tourism as it is being developed into one of the Kingdom's summer resort areas. (Al-Farsy 1986, p. 29)

3. POPULATION

In common with other developing countries, Saudi Arabia's demography is characterized by a high birth rate and by the youthfulness of its population, 49% of which are estimated to be aged 15 years and under. The latest estimates (1992) put the total population at 16 929 294, Saudis and non-Saudis included. According to a United Nations estimate, the Saudi population is expected to reach 19 million by the year 2 000 and 30.6 million by the year 2020.

REFERENCES

Adam, E.E. and Ebert, J. (1982), Production and Operations Management, Prentice Hall, N.J.

Aguayo, R. (1991) Dr Deming, the Man who Taught the Japanese about Quality, Mercury Books, London.

Ahmed, N.U., Tunc, E.A. and Montagno, R.V. (1991), A Comparative Study of US Manufacturing Firms at Various Stages of Just-in-Time Implementation, International Journal of Production Research., Vol. 29, No. 4, pp. 787-802.

Al-Farsy, F.A. (1982), Saudi Arabian Industrial Development: Aspirations and Realities, in *Saudi Arabia: Energy, Development Planning and Industrialization*, ed. El-Mallakh et. al., D.C. Heath and Co., US, pp. 21-27.

Al-Farsy, F. (1986), Saudi Arabia: A Case Study in Development, 4th revised edition, Kegan Paul, London.

Al-Hajjar, B. and Presley, J.R. (1992), Constraints on Development: Small Businesses in Saudi Arabia, Middle Eastern Studies, Vol. 28, No. 2, April 1992, pp. 333-351.

Al-Hamlawi, M.R. and Sharara, H. (1983), Product Management, Al-Tigara wa Al-Ta'aun Library, Cairo.

Al-Said, A.H. (1982), The Transition from a Tribal Society to a Nation-State, in *Saudi Arabia: Energy, Development Planning and Industrialization*, ed. El-Mallakh et. al., D.C. Heath and Co., US, pp. 99-110.

Al-Salim, S. (1407 AH), Standards in the Kingdom of Saudi Arabia, The Saudi Arabian Standards Organisation Magazine, Issue no. 6, Second year, Riyadh.

Al-Sallum, Y.I. (1406 AH), The Kingdom of Saudi Arabia's Development Strategy: An Analysis, Sharikat Al-Tiba'a Al-Arabiya Al-Saudiya, Riyadh.

Al-Shar', H.A. (1983), Economic Progress in the Kingdom of Saudi Arabia and the Future of Development, Dar Al-Ulum, Riyadh.

Al-Sharif, (1990), Geography of the Kingdom of Saudi Arabia, Marikh Publishing House, Riyadh.

Al-Sharqawi, A. (1987), Product Activity Management in Industrial Projects, Dar Al-Nahda Publications, Beirut.

Alaqi, M.A. (1979), Business Management in the Saudi Environment: Theory and Practice, Dar Al-Shurouq, Jeddah.

Aperatec Executive Briefing (1994), Total Quality Management, 2nd edition, Chapman and Hall, London.

Arab Organisation for Standards (1983), Quality Control Guide to Industry, Amman.

Arab Organisation for Standards (1983), Guide to Standards Application in Factories, Amman.

Arabian Gulf States Standards Organisation, (1989), Technical Inspection Training Systems for the Quality Control of Mechanical Production, Jeddah.

Ashmiwy, S. (1992), Industrial Management, Shams Library, Cairo.

Atkinson, P.E. (1990), Creating Culture Change: the Key to Successful Total Quality Management, IFS, Bedford.

Badawi, M.N. (1989), Industrial Development Planning in the Kingdom of Saudi Arabia, Mesbah Library, Jeddah.

Badri, M.A. (1992), A Conceptual Framework for Quality Control in the United Arab Emirates, Industrial Cooperation Journal, No. 47, pp. 3-25.

Bank, J. (1992), The Essence of Total Quality Management, Prentice Hall, Hemel Hempstead, UK.

Bounds, G., Yorks, L., Adams, M. and Ranney, G. (1994), Beyond Total Quality Management towards the Emerging Paradigm, McCraw-Hill, New York.

Buffa, E.S. (1983), Modern Production, Operations Management, J.Willey and Sons, New York.

Caplen, R. (1972), A Practical Approach to Quality Control, 2nd edition, Business Books, London.

Caroselli, M. (1991), Total Quality Transformations, Human resource development Press Inc. USA.

Collard, R. (1989), Total Quality - Success through People, Institute of Personnel Management, London.

Crane, R.D. (1978), Planning the Future of Saudi Arabia: A Model for Achieving National Priorities, Praeger Special Studies Series, Praeger Publishers, New York.

Crosby, P.B. (1979), Quality is Free, McCraw-Hill, New York.

Crosby, P.B. (1984), Quality without Tears, McGraw-Hill, New York.

Dale, B.G. (ed.), (1990), Managing Quality, Prentice Hall International, Hemel Hempstead, UK.

Dale, B.G. and Oakland, J.S. (1991), Quality Improvement through Standards, Stanley Thornes, Cheltenham, UK.

Deming W.E. (1986), Out of the Crisis, MIT, Centre of Advanced Engineering Study, Massachusetts, USA.

Donthu, N. (1991), Quality Control in Services Industry, Journal of Professional Services Marketing, Vol. 7(1), pp. 31-55.

Duhig Berry Ltd. (1993), Quality Management, Prince Practitioners Series, NCC Blackwell, Oxford.

Duncan, J., Thorpe, B. and Sumner, P. (1990), Quality Assurance in Construction, Gower Publishing, US.

Ebrahimpour, M. (1985), An examination of Quality Management in Japan: Implications for Management in the United States, Journal of Operations Management, Vol. 5, No. 4, pp. 419-431.

El-Mallakh, R. (1982), Saudi Arabia: Rush to Development, The Johns Hopkins University Press, Baltimore.

Fahmi, M. (1979), Product Management and Plant Control, Dar Al-Ma'arif, Cairo.

Feigenbaum, A.V. (1991), Total Quality Control (3rd edition, revised), McCraw-Hill, New York.

Fox, R. (1991), Making Quality Happen - Six Steps to Total Quality Management, McCraw-Hill, Australia.

Garvin, D.A. (1988), Managing Quality: The Strategic and Competitive Edge, Free Press, New York.

Grant, M.R., Shani, R. and Krishnam, R. (1994), Total Quality Management's Challenge to Management Theory and Practice, Sloan Management review, Winter 1994, Mass. Institute of Technology, pp. 25-35.

Hakes, C. (1991), Total Quality Management - The Key to Business Improvement, Pera International Executive Briefing, Chapman & Hall, London.

Hand, M. and Plowman, B. (1992), Quality Management Handbook, Professional Handbook Series, Butterworth-Heinemann, Oxford.

Harvard Business Review Paperback No. 900 89, Unconditional Quality, Harvard Business School Press, Boston.

Hassan, A. and Obeid, A.M. (1974), Industrial Control and Product Management, Dar Al-Nahda Al-Arabiya li Al-Tiba'a wa Al-Nashr, Beirut.

Hiam, A. (1992), Closing the Quality Gap - Lessons from America's Leading Companies, Prentice-Hall, Englewood Cliffs, N.J.

Hughes, H. (1984), Industrialization and Development: A Stocktaking, in *Industrialization and development: A third World Perspective*, ed. by Ghosh, P.K, Greenwood Press, US, (pp. 5-21)

Hutchins, D. (1990), In Pursuit of Quality, Pitman, London.

Hutchins, D. (1992), Achieve Total Quality, Director Books, Cambridge.

Huxtable, N. (1995), Small Business Total Quality, Chapman and Hall, London.

Industrial City Department (1994), Directory of Licensed Factories Operating in Jeddah City, Saudi Arabia.

Ishikawa, K. (1982), Guide to Quality Control, 2nd edition, Asian Productivity Organisation, Tokyo.

Ishikawa, K. (1985), What is Total Quality Control? The Japanese Way, (D.J. Lu translation), Prentice-Hall, Englewood Cliffs, N.J.

Ishikawa, K. (1990), Introduction to Quality Control, Chapman and Hall, London.

Jablonski, J.R. (1991), Implementing Total Quality Management: An Overview, Pfeiffer and Company, San Diego (USA).

Johany, A.D. (1982), The Saudi Economy: Yesterday's Performance and Tomorrow's Prospects, in *Saudi Arabia: Energy, Development Planning and Industrialization*, ed. El-Mallakh et. al., D.C. Heath and Co., US, pp. 1-15.

Juran, J.M. (1988), Juran on Planning for Quality, Free Press, Collier Macmillan, London.

Juran J.M. (ed.) 1988, Juran Quality Control Handbook, 4th edition, McGraw-Hill, New York.

Juran, J.M. (1989), Juran on Leadership for Quality, The Free Press, Collier Macmillan, New York.

Katzan, H. (1989), Quality Circle Management: The Human Side of Quality, Tab Books, PA (USA).

Lochner, R.H. and Matar, J.E. (1990), Designiq for Quality, Chapman and Hall, London.

Lock, D. (ed.), 1990, The Gower Handbook of Quality Management, Gower Publishing Co., Aldershot, UK.

Lockyer, K. (1983), Production Management, 4th edition, Pitman Books, London.

Looney, R.E. (1982), Saudi Arabia's Development Potential: Application of an Islamic Growth Model, Lexington books, Mass.

Looney, R. E (1989), Structural and Economic Change in the Arab Gulf after 1973, Middle Eastern Studies, Vol. 26, No. 4, pp. 514-546.

Looney, R.E. (1991), Patterns of Human Resource Development in Saudi Arabia, Middle Eastern Studies, Vol. 27, pp. 668-678.

Looney, R.E. (1992), Employment Creation in an Oil-Based Economy: Kuwait, Middle Eastern Studies, Vol. 28, No. 3, July 1992, pp. 565-576.

McNealy, R. (1993), Making Quality Happen, Chapman and Hall, London.

Ministry of Industry and Electricity (1975-1993), Industrial Statistical Publication, Riyadh.

Ministry of Commerce, Kingdom of Saudi Arabia, Quality Control Laboratories in Jeddah, Annual Report - 1987.

Ministry of Industry, Kingdom of Saudi Arabia, Licensed Plants and Industrial Licenses Issued up to 29.9.1988.

Ministry of Planning, Kingdom of Saudi Arabia, First Development Plan (1970-1975).

Ministry of Planning, Kingdom of Saudi Arabia, Second Development Plan (1975-1980).

Ministry of Planning, Kingdom of Saudi Arabia, Third Development Plan (1980-1985).

Ministry of Planning, Kingdom of Saudi Arabia, Fourth Development Plan (1985-1990).

Ministry of Planning, Kingdom of Saudi Arabia, Fifth Development Plan (1990-1995).

Ministry of Planning, Kingdom of Saudi Arabia, (1992) Achievements of the Development Plans: 1970-1991.

Moir, P. W. (1988), Profit by Quality - The Essentials of Industrial Survival, Ellis Harwood, Chichester.

Newall, D. and Dale, B.G. (1991), The Introduction and Development of a Quality Improvement Process: A study, International Journal of Production Research., Vol. 29, No. 9, pp. 1747-1760.

Oakland, J.S. (1989), Total Quality Management: The Route to Improving Performance, Butterworth-Heinemann, Oxford.

Obeid, A. and Shoheib, M. (1981), Production Management, Roseal Yousef Publications, Cairo.

Parry, W.G. (1985), The Control of Quality, McMillan, New York.

Peters, T.J. (1982), In Search of Excellence, Harper and Row, New York.

Picconi, M., Romano, A. and Olson, C. (1993), Business Statistics: Elements and Applications, Harper Collins, New York.

Pike, J. and Barnes, R. (1994), TQM in Action: A Practical Approach to Continuous Performance Improvement, Chapman and Hall, London.

Price, F. (1990), Right First Time: Using Quality Control for Profit, Gower Press, Aldershot.

Qoraitam, A. (1981), Industrial Production Management, Port Said Publications Ltd., Alexandria.

Qoraitam, A. et al., (1982), Production Difficulties in Saudi Industries - Part I: Marketing Management Difficulties, Research and Development Centre, Faculty of Economics and Management, King AbdulAziz University, Jeddah.

Qoraitam, A. et al., (1984), Production Difficulties in Saudi Industries - Part II: Financial, Research and Development Difficulties, Research and Development Centre, Faculty of Economics and Management, King Abdul Aziz University, Jeddah.

Ragheb, H.M. (1985), Introduction to Product Management, Dar Al-Nashr, Cairo.

Richards, A. and Waterbury, S. (1990), A Political Economy of the Middle East: State, Class and Economic Development, Boulder, Oxford.

Roth, W.F. (1992), A Systems Approach to Quality Improvement, Praeger Publishers, New York.

Rothery, B. (1993), ISO 900, Gower Press, Aldershot.

Ryan, B. and Joiner B.L. (1994), The Minitab Handbook, 3rd edition, Chapman and Hall, London.

Saudi Consulting House (1986), A guide to Industrial Investment in the Kingdom of Saudi Arabia, 7th edition, Riyadh.

Shank, J.K. and Govindarajan, V. (1994), Measuring the Cost of Quality, Sloan Management Review, MIT, pp. 6-17.

Sinclair, C.A. and Birks, J.S. (1982), Manpower in Saudi Arabia: 1980-1985, in *Saudi Arabia: Energy, Development Planning and Industrialization*, ed. El-Mallakh et. al., D.C. Heath and Co., US, pp. 161-177.

Soin, S.S. (1992), Total Quality Control Essentials - Key Elements, Methodologies and Managing for Success. McCraw-Hill, New York.

Soleiman, H.M. (1979), Product Management, Dar Al-Jami'ah Al-Masriyah, Cairo.

Spenley, P. (1992), World Class Performance through Total Quality, Chapman and Hall, London.

Stevens, J. (1982), The Interaction between Oil Policy and Industrial Policy in Saudi Arabia, in *Saudi Arabia: Energy, Development Planning and Industrialization*, ed. El-Mallakh et. al., D.C. Heath and Co., US, pp. 27-43.

Straugh, H. (1984), Handbook of Quality Control, 2nd edition, McCraw-Hill, New York.

Taylor, J.R., (1989), Quality Control Systems, McCraw-Hill, New York.

Tenner, A.R. and De Toro, I.J. (1992), Total Quality Management -Three Steps to Continuous Improvement, Addison-Wesley, Reading, Mass.

The Chamber of Commerce and Industry (1992), Factory Management, The Research Centre, Jeddah.

The Chamber of Commerce and Industry (1993), Directory of National Industries in Jeddah, Saudi Arabia.

The Financial Times, Financial Times Survey: Saudi Arabia, 22.12.1993.

The Saudi Arabian Monetary Agency, Kingdom of Saudi Arabia, Annual Report - 1990.

The Saudi Arabian Standards Organisation (1979), Health Inspection and Foodstuff Quality Control, Riyadh.

The Saudi Arabian Standards Organisation (1991), Quality Marks, Certificates of Conformity and Accreditation of Services Regulations, Parts 1 and 2: Quality Marks and Certificates of Conformity, Riyadh, Saudi Arabia.

The Saudi Arabian Standards Organisation (1992), Quality Marks, Certificates of Conformity and Accreditation of Services Regulations, Part 3: Accreditation of Laboratories, Riyadh, Saudi Arabia.

The Saudi Arabian Standards Organisation, Annual Reports 1989-1992.

The Chamber of Commerce and Industry (1992), Statistics Guide to the City of Jeddah, Jeddah.

The Saudi Arabian Organisation for Standards (1979), Health Inspection and Foodstuff Quality Control, Riyadh.

The Chamber of Commerce and Industry (1992), The Importance of Quality Control, Riyadh.

Walkin, L. (1992), Putting Quality into Practice, Stanley Thornes, Cheltenham.

Walton, M. (1989), The Deming Management Method: The Complete Guide to Quality Management, Mercury Books, London.

Whitehead, P. and Whitehead, G. (1992), Statistics for Business: An Introduction, Pitman Publishing, UK.

Wille, E. (1992), Quality: Achieving Excellence, Century Business, London.

Young, A.N. (1983), Saudi Arabia: the Making of a Financial Giant, Studies in Near Eastern Civilization Series, No. 8, New York University Press.