A QUALITY FUNCTION DEPLOYMENT APPROACH FOR IMPROVING QUALITY OF YARN: A CASE OF BEXIMCO SYNTHETICS LIMITED.

BY

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A Thesis submitted to the Department of Industrial and Production Engineering, Bangladesh University of Engineering and Technology in Partial Fulfillment of the requirements for the Degree of **Master of Engineering in Industrial & Production Engineering.**

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CERTIFICATE OF APPROVAL

The thesis titled " A QUALITY FUNCTION DEPLOYMENT APPROACH FOR IMPROVING QUALITY OF YARN: A CASE OF BEXIMCO SYNTHETICS LIMITED " submitted by Muhammad Ahasan Habib, Student No.: 1005080181F, Session: October 2005, has been accepted as satisfactory in Partial Fulfillment of the requirements for the degree of **Master of Engineering in Industrial & Production Engineering** on July 28,2009.

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CANDIDATES'S DEDICATION

It is here by declared that this thesis or ahy part of it has not been submitted elsewhere for the award of any degree or diploma.

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MUHAMMAD AHASAN HABIB

This dissertation is dedicated to my parents and my wife.

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NOMENCLATURE

Acronyms

BSL	Beximco Synthetics Limited
BTMC	Bangladesh Textile Mills Corpoation
KSFL	Kader Synthetics Fibers Limited
MSFL	Modern Synthetics Fibers Limited
BSFL	Bangle Synthetics Fibers Limited
QFD	Quality Function Deployment
TQM	Total Quality Management
VOC	Voice of the Customer
GDP	Gross Domestic Products
POY	Pre-Oriented Yarn
DTY	Draw-Texturised Yarn
IPDC	Development Company of Bangladesh Limited
MW	Megawatt
HP	Horse power
RPM	Revelation per Minute
FDY	Full Draw Yarn

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ABSTRACT

Quality Function Deployment (QFD) is a structured approach to defining customer needs or requirements and translating them into specific plans to produce product to meet those needs. The voice of customer is the term to describe these stated and understand the needs or requirements. The voice of customer is captured in a verity of way: direct interview or discussion, survey focus group customer specification, observation data, field report, collect data from customer by electrical media etc. this understanding of the customer needs is then summarized in a product planning matrix or "house of quality". These matrices are used to translate higher level "what's" or needs into lower levels "how's" product requirements or technical characteristics to satisfy these needs. While the quality function deployment matrices are a good communication tool to each step in the process, the matrices are the means and not the end. The real value is in the process of communicating and decision making with QFD. QFD is oriented towards involving a team of people representing the various functional departments that have involvement in product development: Marketing, Design, Quality Assurance, Manufacturing, Test Engineering. Finance, Product Support, etc.

In the textile sector level of production and quality maintain is a very important factor in this competitive market. In order to improve its quality the companies needs to be aware of the expectation of its customer and how to satisfy them. The QFD methods are applied in order to correlate the expectation of the customer and the internal quality indicators of this process. In this thesis the key process of the continuous supply our product polyester yarn to the market and to take a leading position for textile sector in this competition market, identifying internal quality indicator associated with the expectation of the final customer. The objective of this work is to provide the companies that supply polyester yarn to different customer by different ways and all products are using the textile sector. Then we are collecting the information from different type of customer for improve the quality. This should also determine on which process, customers expectation while continuously improving quality. The expectation of the customer have to be gathered, analyzed and dealt with. We had chosen as a starting point the segmentation made by this

company. The results lead to improvement in the basic process. Quality must be designed into the product, not inspected into it. Quality can be defines as meeting customers needs and providing superior value. This focus on satisfying the customer's needs place emphasis on technique such as Quality function deployment to help understand those needs and plan a product to provides a superior value.

CHAPTER-ONE

INTRODUCTION

1.1 Introduction

The manufacture of synthetic fibers represents a huge industry, both in the United States and worldwide. We sometimes forget how much of these fibers we consume, especially since the appeal of "natural" fibers of cotton and wool has grown in recent years. Despite questions of aesthetics and taste, there should continue to be a significant demand for synthetic fibers, in large part because these fibers can be tailor-made to provide specific properties that natural fibers cannot provide.

The term synthetic describes any manufactured fiber made from chemical synthesis. Synthetic materials vary in their properties. Many are engineered to imitate and replace natural materials. The benefit of engineered fibers is that special qualities can be added and undesirable traits eliminated. Synthetic fibers can provide specific characteristics such as high absorbency or the ability to hold pleats. The most common synthetic fibers in 20th century collections are nylon, polyester, acrylic, and polyurethane.

The word "fiber" originally referred only to naturally occurring materials (cotton, wool, etc.), it is now used extensively for synthetics product. The latter usages includes both cellulosic and polyfiber.

These synthetics, form there humble beginning in 1990, have grown to a total world production of more then 12140 million kgs even in 1974. the list of synthetics fibers, which in 1990 included only nitrocellulose, today has many product, the more important ones being polyamide or nylon, fibers made from polyacrylonitrile (orlon, dynel, acrilan),spandex fibers (lycra, glospan), glass (fiberglas, vitron), and cellulosic fibers (viscose and acetate rayon).

Three of the more important general properties of fibers are length, crimp, denier. Concerning length, there are essentially two types of fibers. Continuous – filament and staple. Continuous filaments are individual's fibers whose length is almost infinite. Silk, rayon. nylon, and most others true synthetics are manufacture are in this manure. Cotton and wool are examples of natural fibers in the staple form.

Textile products have a very important role in society. Those are used for many purposes in the home, commerce, industry. The raw materials include various types of chemical of organic and inorganic nature used for sizing, dyeing, printing, and finishing of textile products. There are textile mills of integrated nature which include practically all the process from spinning weaving to dyeing – finishing.

The use of polyester filament as well as spun yarns is growing rapidly throughout Bangladesh by a rising import trend. Most of the texturised polyester filament yarn in150 denier. The demand for synthetics yarn in the country is increasing has been mentioned earlier and there are only a few industries producing synthetics fibers / yarn, of the kind the present project is going to produce. Still Bangladesh imports various textile materials including synthetics yarn which costs a substantial amount of foreign currency for the country. In this regards, the BEXIMCO project under consideration, to produce synthetics yarn is another very positive steps towards fulfilling local requirements of these product from local sources.

Beximco synthetics limited (BSL) is a Synthetics fibers / yarn producing industrial unit at Kabirpur, Saver Thana, in the district of Dhaka. It is a modern and medium to large plant by Bangladesh standards. The plant was appraised and approved by Industrials promotion Development Company of Bangladesh Limited (IPDC) as early as in 1990.

1.2 Project Description

Beximco Synthetic Limited (BSL) is an under construction synthetic fiber/yarn producing industrial unit at Kabirpur, Savar Thana, in the district of Dhaka. It is a modern and

medium to large plant by Bangladesh standards. This is a private project with local finance, having an annual attainable capacity (at 100%) of about 16100 tons of pre-oriented yarn (POY) and 7700 tons of Draw Texturised Yarn (DTY) per year, on three shifts of 8 hours operating per day and 350 working days per year. The project originally envisaged production of pre-oriented yarn (POY) from polyester (PET) chips and finally conversion of entire quantity of POY to Drawn Texturised Yarn (DTY). The capacity of the project based on 3 shifts, operation of 8 hours each and 350 working days was estimated at 5,000 tons of 150 denier DTY or 2,700 tons of 75 denier DTY or any mix of 75 and 150 deniers in every year.

The proposed plants site occupies about 6.16 acres of land in a rural setting. Accessibility to the plant site by road is good and easy. The cost of land along with land development, construction of approach road, internal road and drainage has been estimated at about TK.5.12 million.

The product from the industry will be synthetic draw texturised yarn. The major item of raw material is only polyester chips which will be imported from abroad, particularly from Korea or Taiwan. The technology concerned is pretty well known in the country. The project will require both imported and local machineries and equipments.

In a normal year of operation the project will contribute Tk. 370.149 million to the country's Gross Domestic Products (GDP). The average contribution to GDP during the ten years operation has been computed at Tk. 344.736 million per year.

1.3 Process of Synthetic Fiber Manufacture

The rapidly growing and versatile non-cellulose fibers are classified chemically and by the method of spinning. The manufacture of all true synthetic fibers first begins with the preparation of a polymer consisting of extremely long, chainlike molecules. The polymer is spun in one of three ways resulting in most cases in a week, practically unless fiber until it is stretched further to orient the molecules and set up crystalline lattices. Although

the range of any one polymer is always limited by controlling the degree of orientation, crystallinity and average chain length, a single polymer can be used to make a number of fibers with different mechanical properties; i.e., some can be weak and stretch, other strong and strife. The two elements important in determining the range of the polymer's mechanical properties are the attractive force between the molecules and the flexibility and length of the molecular chains.

The three spinning procedure are melt, dry and wet. Melt spinning developed for nylon and also used for polyester, polyvinyl, polypropylene and others, involves pumping molten polymer through spinneret jets. In dry spinning, as for acetate, the polymer is dissolved in a suitable organic solvent. The solution is forced through spinnerets and dry filaments result upon the evaporation of the solvent in warm air.

1.4 Production of POY from Polyester Chips

Polyester chips will be transferred to a crystallizer / dryer to reduce moisture before it is feed to the extruder also serve as a pump to force the molten polymer through a filter as it leaves the extruder and then forces the polymer through a manifold system to distribute the polymer to each spinning position of the POY spinning machine.

Each spinning position has a polymer pump which will control the follow of polymer through pack assembly it is again filtered and distributed to the spinerette. The spinerette has holes corresponding to the number of filaments whish will be produced. As the yarn leaves each spinerette it will pass through quench chamber where it is cooled by a controlled flow of cool air. The bundle of filaments which make up each yarn will then be passed over to a system where a small amount of finish oil is added to the yarn to control static current and lubricant the yarn to prevent abrasion as it passes over yarn guides in the subsequent process.

The yarn then passes through a commingling unit where a jet air will intertwine the filaments of the yarn bundles and improve the cohesion between filaments. The yarn is then collected on bobbins which operate partially oriented yarn – POY. The POY is the feeder yarn for subsequent draw texturising.

The POY yarn packages are collected on a buggy and checked for quality and then transferred to the texturising area.

1.5 Production of DTY from POY

Draw texturising units are equipped with creels to hold the POY. POY will be unwound from the POY package by restraining godet rolls for the simultaneous drawing and texturising operation. The yarn fast passes through the primary heater unit to facilitate drawing and texturising as it passes through a false twisting mechanism. The amount of drawing and texturising is determined by the speed of a second godet.

The yarn will then passes through a second heater to set the yarn. Here the yarn speed is controlled by another godet roll. The texturised yarn is then passed through an intermingling or commingling device to improve the integrity and running properties of the yarn when used to produce fabric. It is then wound into a bobbin. After packaging the texturised yarn is removed (doffed) and transferred to a yarn buggy for transfer to an area to checks it quality before being packed into cartons for shipment or delivery.

QFD was originally developed in Japan by Yoji Akao in 1966 when the author combined his work in quality assurance and quality control points with function deployment used in Value Engineering. Mr. Akao described QFD as a "method to transform user demands into design quality, to deploy the functions forming quality, and to deploy methods for achieving the design quality into subsystems and component parts, and ultimately to specific elements of the manufacturing process."

QFD helps transform customer needs the voice of customer (VOC) into engineering characteristics (and appropriate test methods) for a product or service, prioritizing each product or service characteristic while simultaneously setting development targets for product or service[1].

Management experts developed the tools and technique for QFD and organized them in to a comprehensive system to assure quality and customer satisfaction in new products and service [2].

Quality Function Deployment (QFD) is a systematic approach to design based on a close awareness of customer desires, coupled with the integration of corporate functional groups. The QFD process is an orderly sequence of activities for evaluating customer requirements and developing a product [3]. Basically it is designed to improve customer satisfaction with the quality of products and services. QFD is a systematic process for motivating a business to focus on its customers. As it is a structured approach to define the customer needs or requirements and translate them in to specific plans to produce products to meet those needs [4]. It can translate customer requirements in to engineering specification. It is a link between customer needs and service provider. QFD facilitates translation of a prioritized set of subjective customer requirements in to a set of system level requirements during system conceptual design [5-6].

Customer satisfaction is key determining factor for the probability, growth and perpetuity of any business organization. Every organization must have a system to capture the "Voice of the Customer" and build their product and process to meet the customer specification. QFD is very important because it incorporates the Voice of Customer in the design phase [7-8]. The Voice of Customer is the process of understanding what the customer wants, understanding how customer becomes interested, chooses and is satisfied intelligently linking the needs of the customer with design, development, engineering, manufacturing and service function. The Voice of the Customer is then summarized in a product planning matrix called "House of Quality". These matrices are used to translate higher level "Whats" or needs in to lower level "Hows" product requirements or technical characteristics to satisfy these need [9-12]. In literature, a

variety of authors have proposed some applications of QFD to develop their customer services in competitive market in various cases, such as food, building construction, library, educational organization, power sectors, various control plants, maintenance plants, computer services and in many industrial sectors [13-15]. So far, no study has been reported in literature to apply QFD on Synthetic fibers process in textile sector. The aim of this proposal is to study QFD for improving the Synthetics fibers yarn quality of Beximco Synthetics limited, which is one of the leading filament yarn group of companies in Bangladesh. This group has important role for improving the economical structure in Bangladesh in any sector. Specially, Beximco textile sector is providing a good support for improving the economical structure in Bangladesh by earning a lot of foreign exchange in the national exchequer.

1.6 Objective with specific aims and possible outcomes

The specific objectives of the present research work are as follows:

(a) To define the specifications for the polyester Yarn to the highest level for the customer requirements and specification.

(b) To ensure consistency between customer requirements and product's measurable characteristics such as dimensions and features of polyester Yarn.

(c) To ensure the continuity of supply of products to the customer end in easiest way.

(d) To reduce the time to perform quality features throughout product development.

The outcome of the research works are as follows:

(a) To improve the quality of the final polyester yarn and overall benefits with respect to the House of Quality.

(b) For the fulfillment of customer expectation the internal quality indicators are obtained in order of importance.

(c) Strategy to stay ahead for achieving the goal according to customer satisfaction.

1.7 Limitation of the Thesis

This thesis has some definite limitation, which must be mentioned for the sake of reader's understandability and achieving transparency. The limitation of the thesis has been outline in the following:

Beximco Synthetics is a fully privet organization and it is running there own concept. Absence of similar organization make difficult to understand the comparison in Textile sector. So this is the most important limitation is that the thesis suffers the lack of prior study on this sector particularly.

Beximco Synthetics is the continuous process plant so capital is one of the vital roles for this plant. Some times market demand has low and that time we have faced some problem. Ultimately we have seen a big effect on this continuous process plant.

Finally, the thesis suffers the limitation of intellectual, idea as all parties related in this thesis had there own limitation in contributing to there best

CHAPTER-TWO

ORGANIZATION IN SYNTHETICS PLANT AND BSL

2.1 Others Synthetics in Textile Sector and BSL

The major synthesis involve in textile sector are BSL, KSFL, Bangle Synthetic Fiber Limited, Modern Polymers Limited. Balaka Synthetics Fibers Limited, Pylon Synthetics Limited. However the synthetics yarn production and utilization programming are being strengthen by involving in private sector. All these synthetics yarn manufacturer are convert 78 percent of the textile sector. Totally two types of yarn producing in our country, one is DTY(draw texturizing yarn) and another is FDY (full draw yarn) .

2.1.1 Bangladesh Textile Mills Corporation (BTMC)

These synthetics from their humble beginning in 1900 have grown to a total world production of more than 12140 millions kgs even in 1974. The list of synthetics fibers, at present there are 17 public sector textile processing units operating in the country all these units are under the management of BTMC and they centre to the needs of BTMC weaving mills only.

2.1.2 Kader Synthetics Fibers Limited (KSFL)

KSFL start their production mainly in 1986 join venture the Bangladesh and Denmark in BSCIC industrial area Konabari, Gazipur. From the very beginning they have imported in very high speed and fully automatic DTY machine from Japan. Their plant capacity was 40 ton per day from 14 machines.

After 5 years, when they have found there experiment result from the market survey the demand of synthetics yarn are gradually increasing then the management took the decision for extension the existing project as per demand of market. In 1994 they bought an old synthetic plant from South Korea, origin of that machines were Germany are very modern and robotics controlled. They purchased 37 no of machines with all auxiliary

accessories. And hence, their production has increased from 40 T to 120 T per day. Their initial investment was very high. So per unit production cost of yarn was also high. Now the raw materials cost of this polyester yarn is upward and unit cost of production also going high. In the competitive market cost is a big factor from the customer side. So some big project already which project invested very large capital, it is very difficult to stay in this competition for them. In 1990-92 another 3 units of synthetics fibers plant has established in our country in different place. This synthetics plant has 1450 employees of which 185 were supervisory level (holding position sub assistant or higher post)

2.1.3 Beximco Synthetics Fibers Limited (BSL)

The demand for synthetic yarn in the country is increases as has been growing earlier and there are only few industries producing fiber / yarn of the kind BSL project has built to produce yarn. Still Bangladesh imports various textile materials including synthetics yarn which costs a substantial amount of foreign currency for the country. In this regards BSL project has established to produce synthetics yarn is another very positive steps towards fulfilling local requirements of this produce for local sources.

In 1992 BSL starts their production with 10 m/c and capacity was 15 ton/day. They exported all m/c was brand new but price and install at cost was lower the KSFL. All m/c are manually control In this area man power is available, so labor cost is very low. Consider different factor management has taken the permission for BTMC to establish a new project for synthetics plant. Per unit kg of production cost low and with in short time BSL has occupied a strong position in the local market very easily. Their production rate is lower than other synthetics plant. Still now this project is going on the business with goodwill and with very good reputation. After six years again they have survey the local market and they saw that the demand is growing rapidly only due to the low cost and also production quality is very good.

BSL ensure to the customer about their optimum quality. All synthetics fibers are continuous process plant and power interruption is not allowable in continuous plant. Now a days going on the gas crisis overall area in Bangladesh especially at noon time. Minimum 10 to 12 hours we are away from the production only due to the low gas pressure. We have total 5 unit's generator and our factory demand is 3 MWh. Some times we have stopped our generator due to gas pressure. For this problem we have converted our generator from high pressure to low pressure only for the continuous supply yarn to market and fulfill the customer requirements.

BSL has 760 employees of which 140 nos are in supervisory level (holding post of sub assistant engineer or higher level). In 1992 BSL customer demand was 12 ton/day due to their quality and customer relation also continuous market supply and in 1996 the customer demand reaches to 20 ton/day on the basis of this forecast they have imported more six m/c and now their target production is 22 ton/day.

2.1.4 List of Machinery and Equipments (Imported) for BSL

1. One high speed partially oriented yarn (POY-1) spinning system consisting of the following:
    - Quench air unit and ducting
    - Chip feed hopper
    - Extruder mounted chip dryer with air desiccators
    - One 150 mm Barmag extruder
    - Melt piping with in line filter
    - Two spin pack and one spin pump pre-heaters
    - Forty-eight gear type metering pumps
    - One Barmag spin beam with ninety six spin packs
    - Ninety six spin pumps
    - Ninety six spin packs with 25% spares
    - Quench air cabinets, distributor and ducting to serve ninety six positions
    - One electrical dowtherm boiler

- One forty eight position take up stand with a complete set of yarn cutters and spin finish guides and pumps
- Forty eight IWKA take up winders suitable for double cop, model EPP 320
- Complete set of electrical wiring, motors and starters for the above spinning system
- Complete set of new inverter drives for IWKA winders and metering pumps
- Forth yarn transport trolleys
- Drawings, technical documents and maintenance manuals.

2. Sixteen Himson draw texturizing machines by Barmag 196 texturizing positions per machine, each with double heaters and friction twist units. Each machine complete with individual motor drive, heater controls and yarn creel.
3. One high speed partially oriented yarn (POY-I &II) spinning system consisting of the following :
    - Quench air unit and ducting
    - Chip feed hopper
    - Extruder mounted chip dryer with air desiccators
    - One 150mm Barmag extruder
    - Melt piping with in line filter
    - Two spin pack and one spin pump pre-heaters
    - Forty eight gear type metering pumps
    - One Barmag spin beam with ninety six spin packs
    - Ninety six spin pumps
    - Ninety six spin packs with 25% spares
    - Ninety six spinneret's with 25% spares
    - Quench air cabinets, distributor and ducting to serve ninety-six positions
    - Four electrical dowtherm boiler
    - One forty eight position take up stand with a complete set of yarn cutters and spin finish guides and pumps

- Forty-eight IWKA take up winders suitable for double cop, model EPP 320
- Complete set of electrical wiring, motors and starters for the above spinning system
- Complete set of new inverter drives for IWKA winders and metering pumps
- Forth yarn transport trolleys
- Drawings, technical documents and maintenance manuals.

4. Polymer chip handling system
5. Spin pump, Ground plates, Flush plates, etc.
6. Finish system, Tank and mixer (Local S.S piping Required)
7. Water de-mineralized and spare cartridge (150/200 fiber glass or S.S Tank required.)
8. Vacuum unit for dowtherm (Local Piping)
9. Spare take up winder (2 No.)
10. Bobbin carts (40 Nos.)
11. Other Ancillary
12. Maintenance equipments and tools
13. Laboratory equipment
14. Spare parts
15. List of operating supplies
    A. Different spinnerets spray HT tube, klaber lacate, isoflex etc.
    B. Dowtherm chem. typ-A(12 barrel)
    C. TEG (chemical) (3 barrel)
    D. Lubricants (1 lot)
16. Service equipments
    A. Air-conditioning unit 768 ton capacity, consisting of 5 AHU and 3 chiller, distribution fans, washers and pumps (1 set)
    B. Generator (gas) 920 kw (4 Nos)
    C. Air screw compressors, (2 Nos)
    D. Steam boiler (2,200 kg/hr, 275 PSI)

E. Sub-station consisting of L.T. panel and PFI plant

17. Finish makeup system
18. Pack makeup system
19. Continuous polymer filter system

    Gasket 1/8" * 48" *48" A1 sheet

    Special parts

    Filter candle

20. Tag system

    Tag

    High temp pump (300°C)

    11/2 HP (5 to 6 bar)

    Dynesco inst. Part

    Temp control part

21. Air & Finish system

    Air & finish valve

    Air entanglement part

    Air & finish fitting

    Hot air blower bearing

    Finish analyzer Enka Technique

    Pre dryer parts

22. Extruder heater

    Good year match maker 14/set

    Extruder drive SCR part

    Southcon inverter part

    Panel inst. (used)

    D.C motor 125 HP/1750 RPM 500

    VaRM/300V FLD

    Techo generator

    Extruder drive motor

23. Dowtherm system

    Dow gasket and valves

Kylo insulation

Fuller cleaning equipment With 3 set sp.

Brushes one set consisting of 1

Polishing and 1 washing brushes

220-50 CS

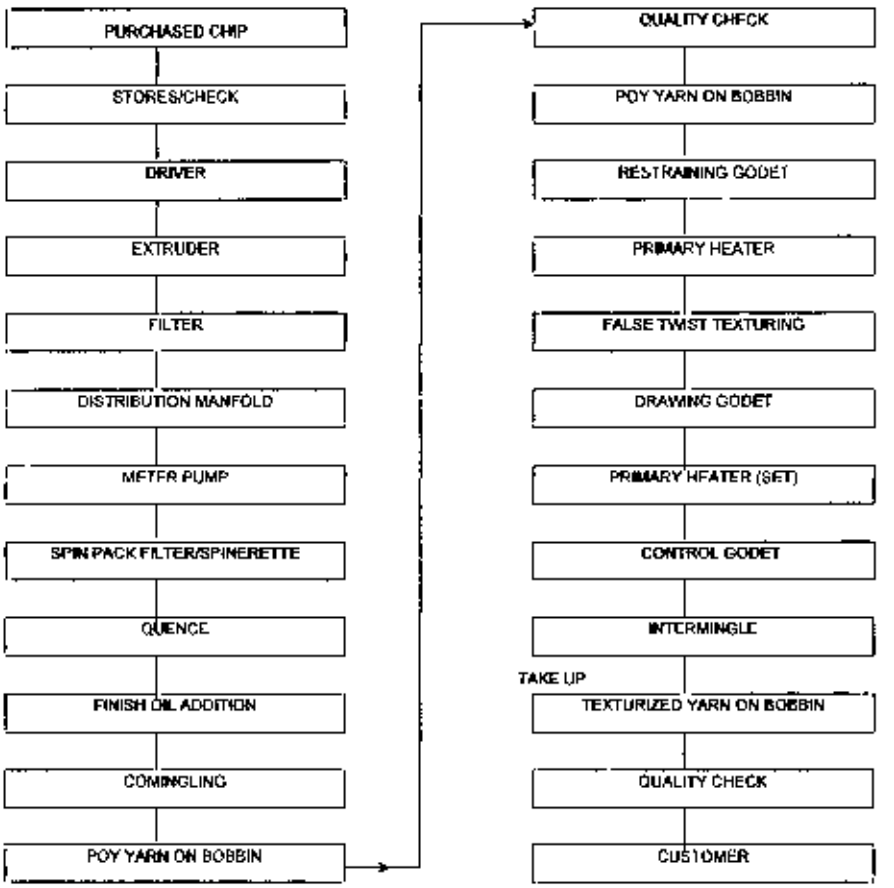


Figure 2.1: Simplified process flow diagram

2.1.5 Modern Synthetics fibers limited (MSFL)

In 1993 has established another two synthetics plant under BTMC in Bangladesh. Modern synthetics fibers are one of them. Since 1993 they have started production in commercial purpose, capacity was 15 T/day. It is situated near the Chitagong sea port.

After 3 years, according to the market survey report and the demand of customer again taken re-permit from the BTMC for extension the plant capacity up to 25 T/day. Most of them machine are Indian origin and due to location of this plant near the sea port there initial investment smaller then other Synthetics plant. So there production cost also little less then other plant. Specially Modern Synthetics fibers also producing full draw yarn (FDY) which is new concept for our country but our Textile sector are very familiar with this product. From the beginning we have imported lot of FDY from India and Pakistan. Now we are producing FDY and savings lot of foreign currency. Although this FDY is not completed fulfill our local customer requirements. . This synthetics plant has 568 employees of which 87 were supervisory level (holding position sub assistant or higher post).

2.1.6 Bangle Synthetics fibers limited (BSFL)

This synthetics plant also established at the same time with Modern Synthetics plant. But it way from the Modern Synthetics fibers limited also its capacity less then Modern Synthetics fibers plant. Form the beginning they have produced 8 T/day, now they are producing 11 T/day. They have imported all there DTY machine from Tawin and South Korea, and all those machine are brand new hence there initial investment was very high.

Table 2.1: At a glance production status for our local Synthetics plant

sl no	Name of the Plant	Type of Yarn producing		Capacity of the Plant for		Capacity of POY production	Market Demand fulfill(%)
				DTY	FDY		
1	Kader Synthetics Fibers Limited	DTY	FDY	120 T/day	20 T/day	300 T/ day	
2	Beximco Synthetics Fibers Limited	DTY		22 T/day		46 T/day	
3	Bangle synthetics Fibers Limited	DTY		11 T/day		22 T/day	
4	Modern synthetics fibers limited	DTY	FDY	25 T/day	9 T/day	70 T/ day	

Table2.2: Monthly Production and Sale forecast

Monthly production forecast

Product Name	Opening Stock(MT)	Production (MT)	CONV (MT)	Sales (MT)	Closing Stock (MT)
POY 120/128D	-	651	633.81	-	17.19
POY 85D	-	-		-	-
DTY 75D (Non Int)	139.74	157.92		225.00	72.66
DTY 75D (Int)	143.2	464.8		500.00	108
DTY 40D(Non Int)	-	-		-	-
DTY 50D (Non Int)	11.28	-		11.28	0

Monthly sale forecast

Product Name	Quantity (MT)	Average Rate (TK/LB)		Value (Taka)
POY (115D)	-	-	/Kg	-
POY (230D)	-	-	/Kg	-
DTY 75 D (Non Int)	225.00	56.00	/Lb	27,777,960 00
DTY 75 D (Int)	500 00	58 00	/Lb	63,933,400.00
DTY 150 D (Non Int)	-	-	/Lb	-
DTY 50 D (Non Int)	11.28	62 00	/Lb	1,541,809.06

2.2 The Company Profile: BSL

2.2.1. Back ground

Bangladesh is a small developing country of 1, 44,000 square kilometer with a huge population of around 140 million and a high annual population growth of about 2 percent. Textile product has a very important role in society. Those are used for many purposes in the home, commerce, industry etc.

The Beximco Synthetics Limited will add to the synthetics fibers and subsequently textile production of the country (ensure production of DTY and POY) for the domestic market, give gainful employment to a substantial number of personal 400, save foreign exchange, participated in the overall development of the national economy.

The plant is expected to go into regular production October 1993. the construction of the main factory building i.e texturizing area and the POY area covering 4004.2 sq.m. Complete except for some finishing work. The substructure and substantial amount of superstructure of the service bay covering 929.4 sq.m, where the compressor, boiler, substantial air conditioning plant, generator, chiller, Quality control room located completed. Beside on the pump housing 25 sq.m, Mechanical workshop 72 sq.m has completed. Construction of the general administration and account section 125 sq.m, warehouse 900 sq.m, prayer room 35 sq.m, over head water tank, septic tank. boundary wall, and gate also completed.

Table 2.3:DTY machine wise monthly average production

Machine #	No. of spindle	Product	Capacity per machine	Working days	Total production
1	192	75D Int	1 29T	28	36.12T/day
2	192	75D NI	1 29T	28	36.12T/day
3	216	75D Int	1.45T	28	40.60T/day
4	216	75D Int	1 45T	28	40.60T/day
5	216	75D NI	1.45T	28	40.60T/day
6	216	75D NI	1.45T	28	40 60T/day
7	216	75D NI	1.45T	28	40.60T/day
8	216	75D Int	1.45T	28	40.60T/day
9	192	75D Int	1.29T	28	36.12T/day
10	192	75D Int	1.29T	28	36.12T/day
11	192	75D Int	1.29T	28	36.12T/day
12	192	75D Int	1.29T	28	36 12T/day
13	192	75D Int	1.29T	28	36.12T/day
14	192	75D Int	1.29T	28	36.12T/day
15	240	75D Int	1 61T	28	45 08T/day
16	240	75D Int	1 61T	28	45.08T/day

Figure 2.2: Plant Locations in Bangladesh Map

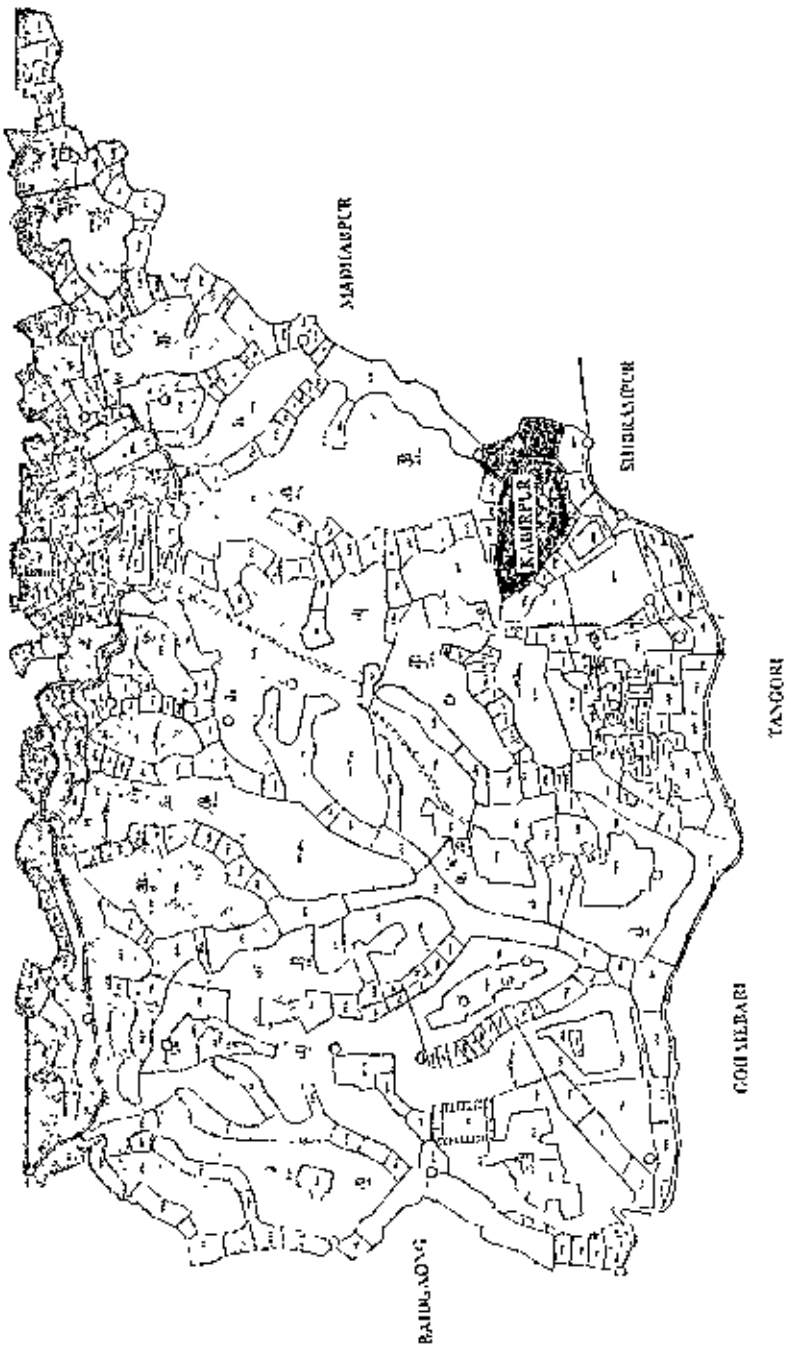


Figure 2.3: Plant Location in Kaborpur Area Map.

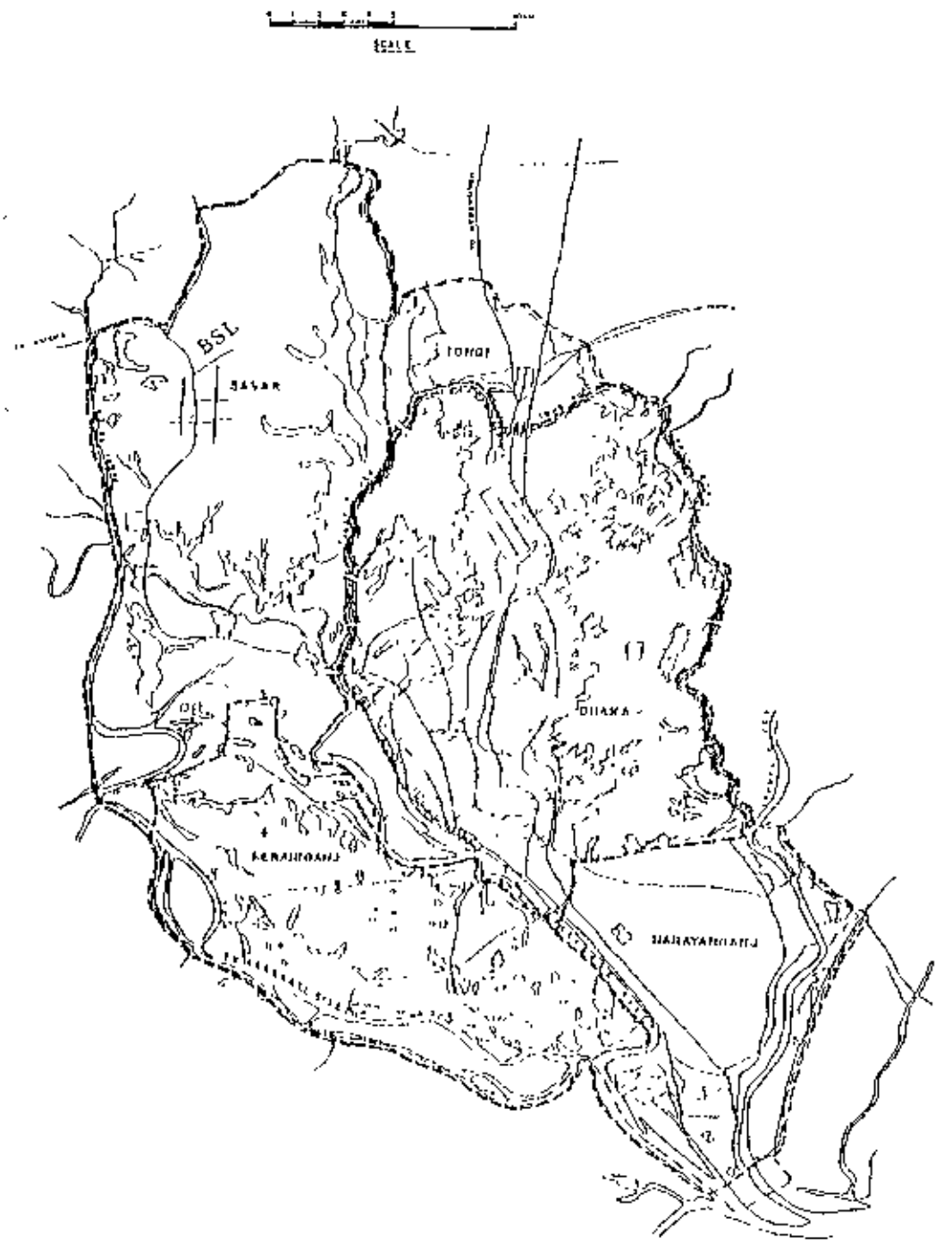


Figure 2.4: Plant Location in Greater Dhaka Map.

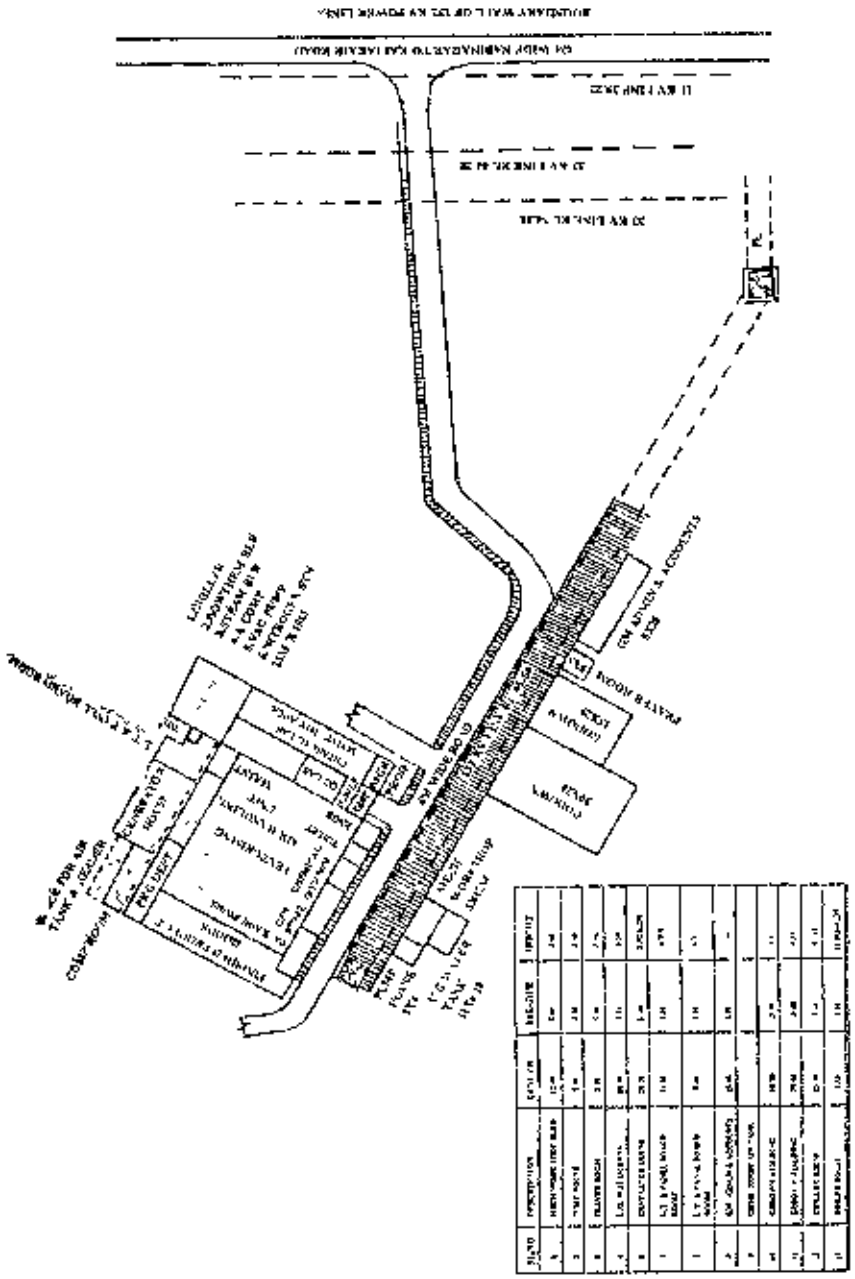


Figure 2.5: Plant Layout

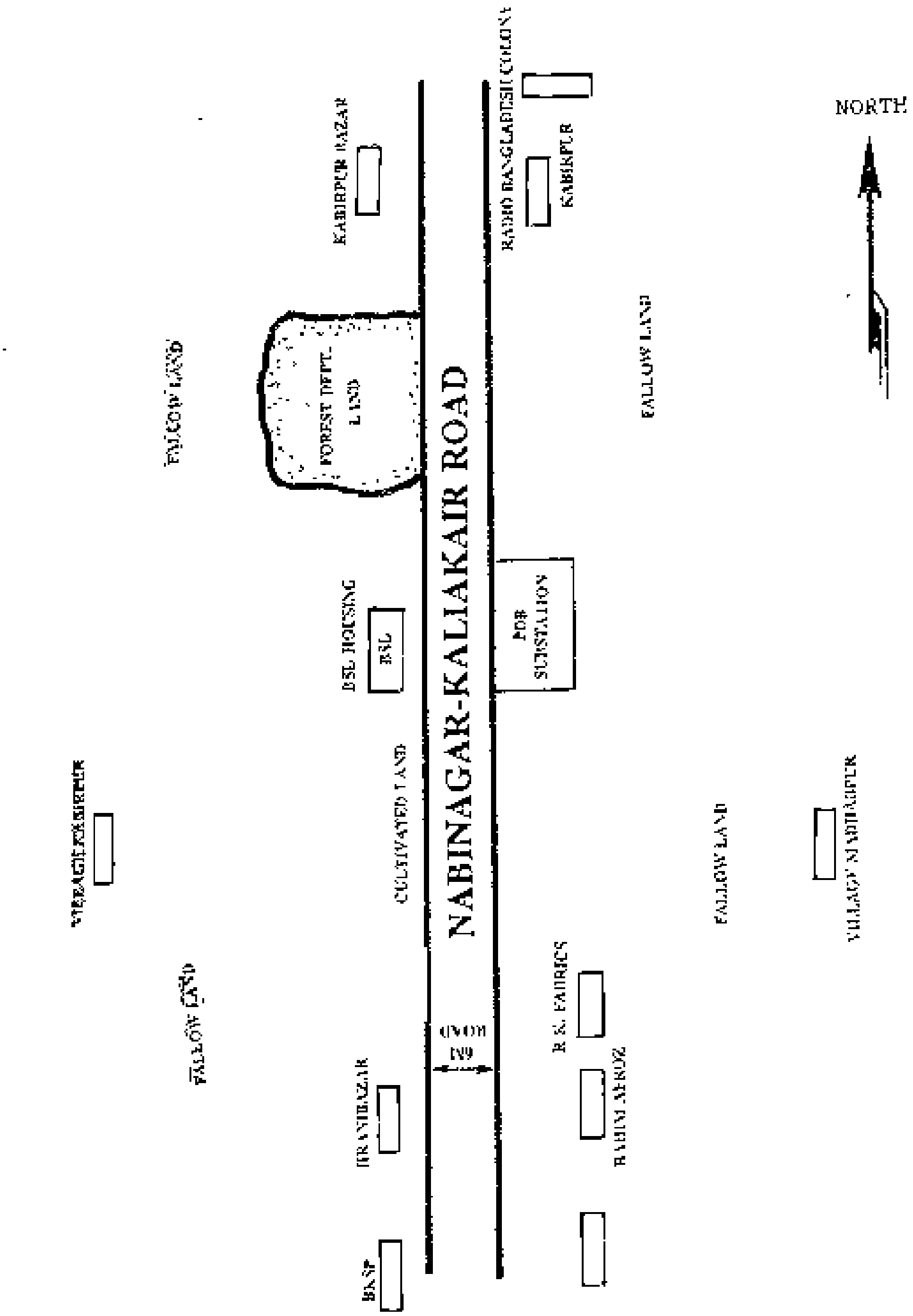


Figure 2.6: Environmental Study Area

Table 2.4: Annual DTY Production Report-2008

Beximco Synthetics Limited

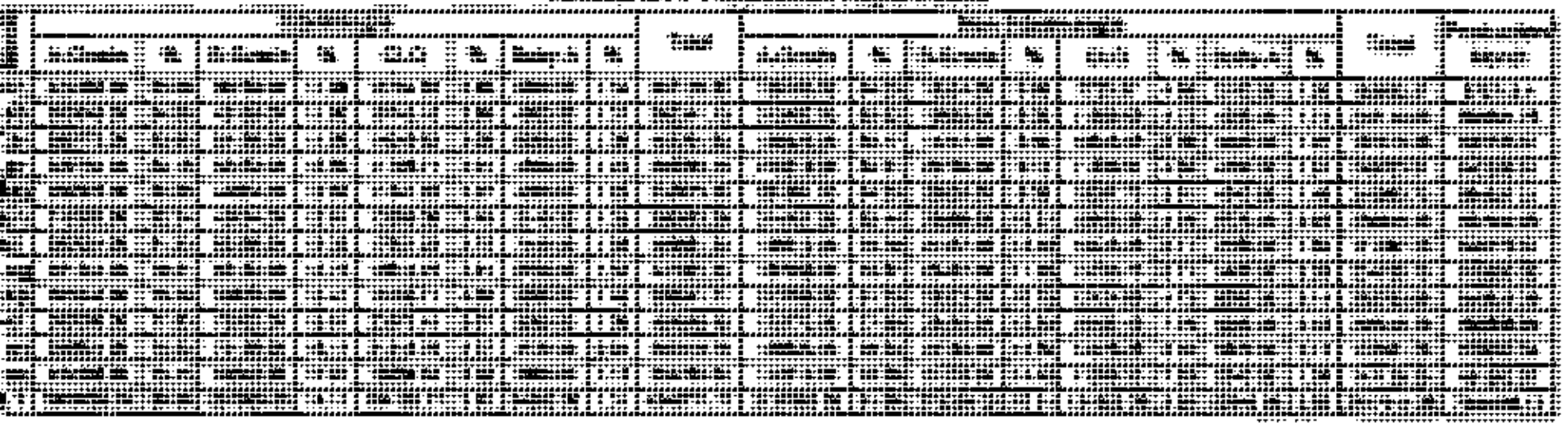


Table 2.5: Annual DTY Production Report-2007

Beximco Synthetics Limited
Annual DTY Production Report-2007

Month	Intermingle								Total	Non Intermengle								Total	Production/ Month
	A-Grade	%	B-Grade	%	CLQ	%	Baby-A	%		A-Grade	%	B-Grade	%	CLQ	%	Baby-A	%		
an	132496.00	84.62	15232.00	9.73	7030.06	4.49	1820.00	1.16	156578.06	169128.00	86.36	17199.00	8.78	7758.9	3.96	1760.00	0.90	195845.90	352423.96
eb	263368.00	86.33	27916.00	9.15	9934.37	3.26	3860.00	1.27	305078.37	298215.00	87.44	26217.00	7.69	11947.67	3.50	4660.00	1.37	341039.67	646118.04
ar	264460.00	85.83	29986.00	9.73	10464.12	3.4	3220.00	1.05	308132.12	350271.00	87.47	33804.00	8.44	11829.24	2.95	4560.00	1.14	400464.24	708596.36
pr	399196.00	87.97	35924.00	7.92	14208.66	3.13	4440.00	0.98	453768.66	186921.00	85.18	17577.00	8.01	12476.90	5.69	2460.00	1.12	219434.90	673203.56
ay	134092.00	87.28	12096.00	7.87	5970.79	3.89	1480.00	0.96	153638.36	200637.00	87.45	19089.00	8.32	7153.40	3.12	2560.00	1.12	229439.40	383077.76
un	245084.00	87.26	23352.00	8.31	9590.36	3.41	2840.00	1.01	280866.79	152415.00	85.88	17118.00	9.65	6927.75	3.90	1000.00	0.56	177460.75	458327.54
ul	343784.00	85.99	36848.00	9.22	15179.51	3.80	4000.00	1.00	399811.51	196749.00	84.94	23679.00	10.22	9233.32	3.99	1960.00	0.85	231621.32	631432.83
ug	393400.00	83.96	52566.00	11.22	17377.65	3.71	5240.00	1.12	468573.65	127305.00	80.78	15984.00	10.14	12829.25	8.14	1480.00	0.94	157598.25	626171.90
ep	407344.00	82.95	62606.00	12.75	16195.00	3.30	4920.00	1.00	491067.00	143748.00	81.53	19008.00	10.78	11619.31	6.59	1940.00	1.10	176315.31	667382.31
ct	314720.00	82.70	47376.00	12.45	12881.24	3.38	5580.00	1.47	380557.24	250317.00	85.20	29970.00	10.20	10226.81	3.48	3280.00	1.12	293793.81	674351.05
ov	168280.00	82.48	24024.00	11.77	9340.08	4.58	2420.00	1.19	204064.08	241110.00	84.66	28053.00	9.85	12707.23	4.46	2920.00	1.03	284790.23	488854.31
ec	425964.00	84.01	56898.00	11.22	17947.82	3.54	6260.00	1.23	507067.82	156600.00	83.71	18441.00	9.86	9066.67	4.85	2960.00	1.58	187067.67	694135.49
.T	3492188.00	84.98	424816.00	10.34	146119.66	3.56	46080.00	1.12	4109203.66	2473416.00	85.44	266139.00	9.19	123776.45	4.28	31540.00	1.09	2894871.45	7004075.11

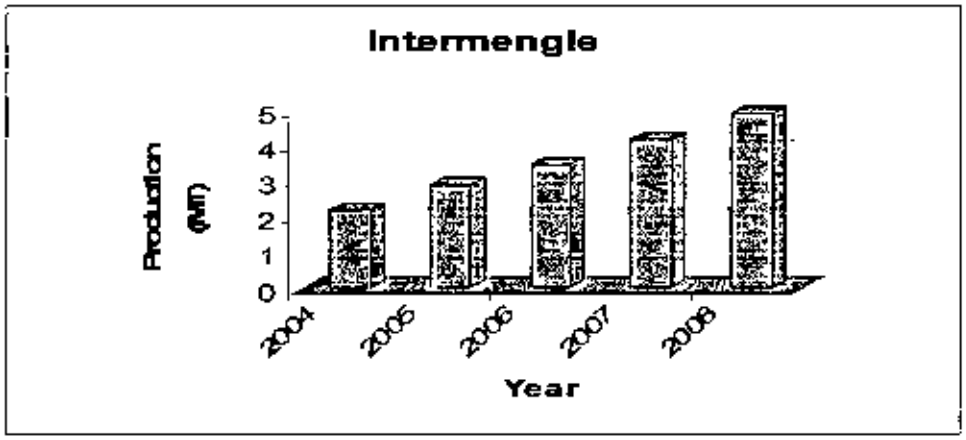


Figure 2.7: Year wise production rate for Intermingle Yarn

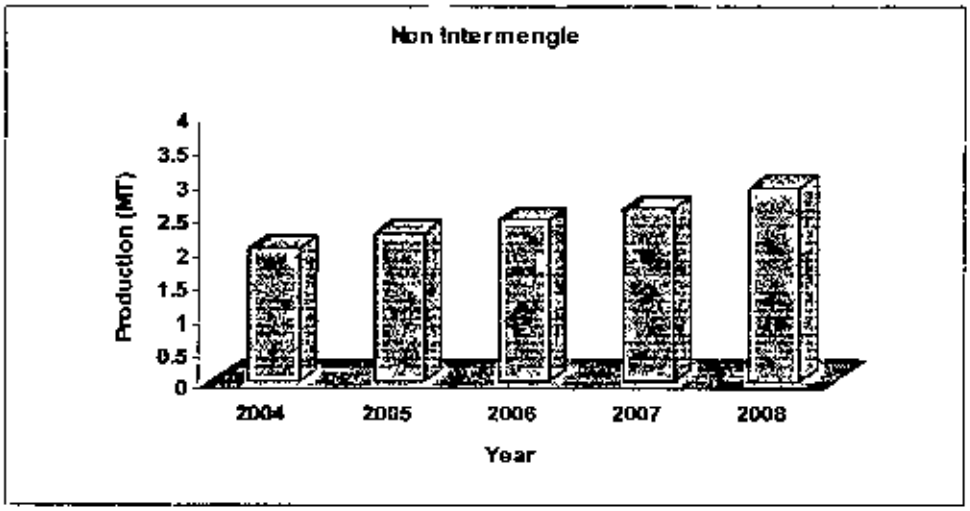


Figure 2.8: Year wise production rate for Non Intermingle yarn

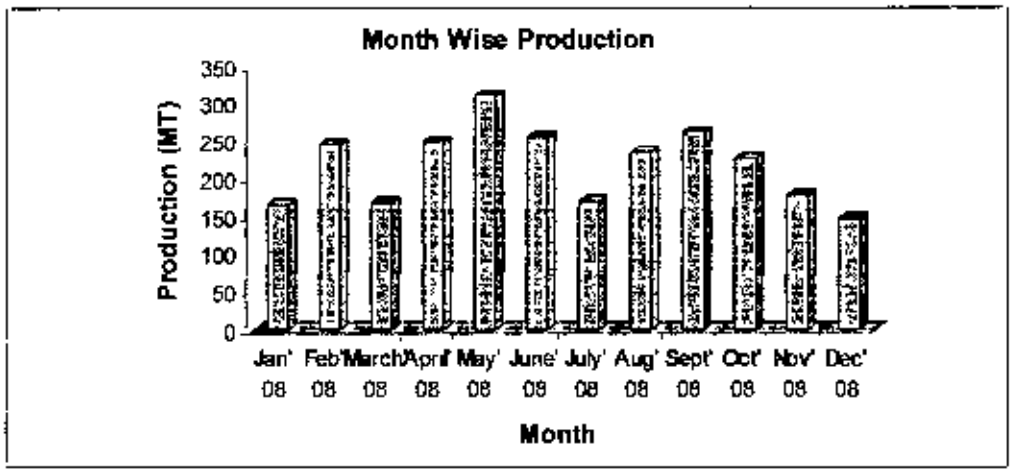


Figure 2.9: Monthly production rate for the year of 2008 Non Intermingle yarn

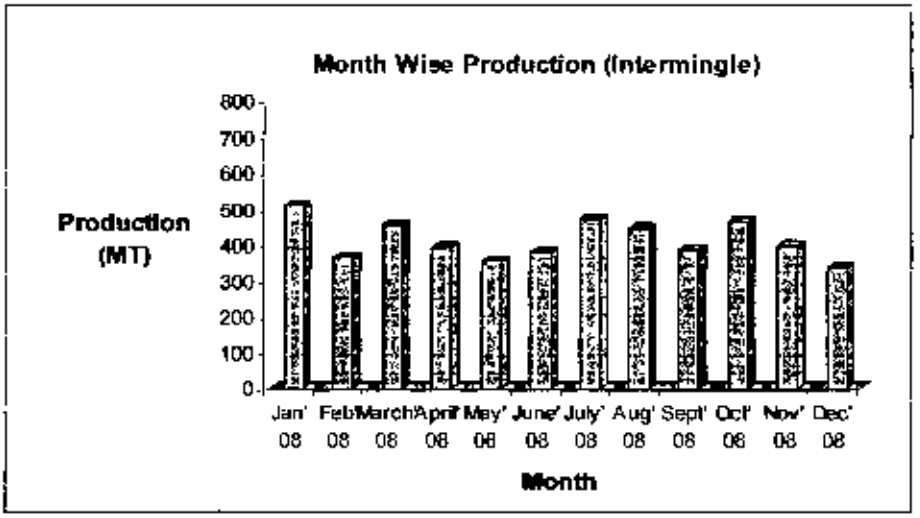


Figure 2.10: Monthly production rate for the year of 2008 Intermingle yarn.

2.2.2 Vision, Mission & Corporate Philosophy

Vision:

To be a role model yarn continuous market supply in the region using most dependable technology and being a development partner in the competitive market of the textile sector. Also always try to provide a quality full yarn to the customer as per there demand.

Mission:

Service to the optimum satisfaction of consumer through reliable and uninterruptible yarn supply and provide value for money. Provide congenial working environment for employees. Also save the foreign currency and earn the exchequers.

Corporate Philosophy:

Service excellence with integrity and corporate social responsibility Provide to market with in short time according to customer needs.

Major Function

I. Provide reliable and uninterruptible yarn supply to market.
II. Proper cost/ price for yarn.
III. Collected customer wants/ demands from market.
IV. To ensure optimum quality for yarn according to customer demand.

2.2.3 BSL's Objective

To be sustainable and consistent organization in textile sector Beximco is working to achieve the following objective:

- Better customer service
- Provide reliable and uninterruptible yarn supply to market.
- Reduce the yarn fault and increases revenue earning to become a profitable business entity.
- Self sufficient in every avenue.
- Better working environment for worker.

2.2.4 Organogram

Managing Director is the operational chief of the organization. A senior General Manager is full time working as a Technical and production side. One General Manager is full time working as an Administrator and finance & marketing side. One deputy manager is always cooperating to the Sr. General Manager for technical side. Total number of employee is 760 among them 140 are officers level.

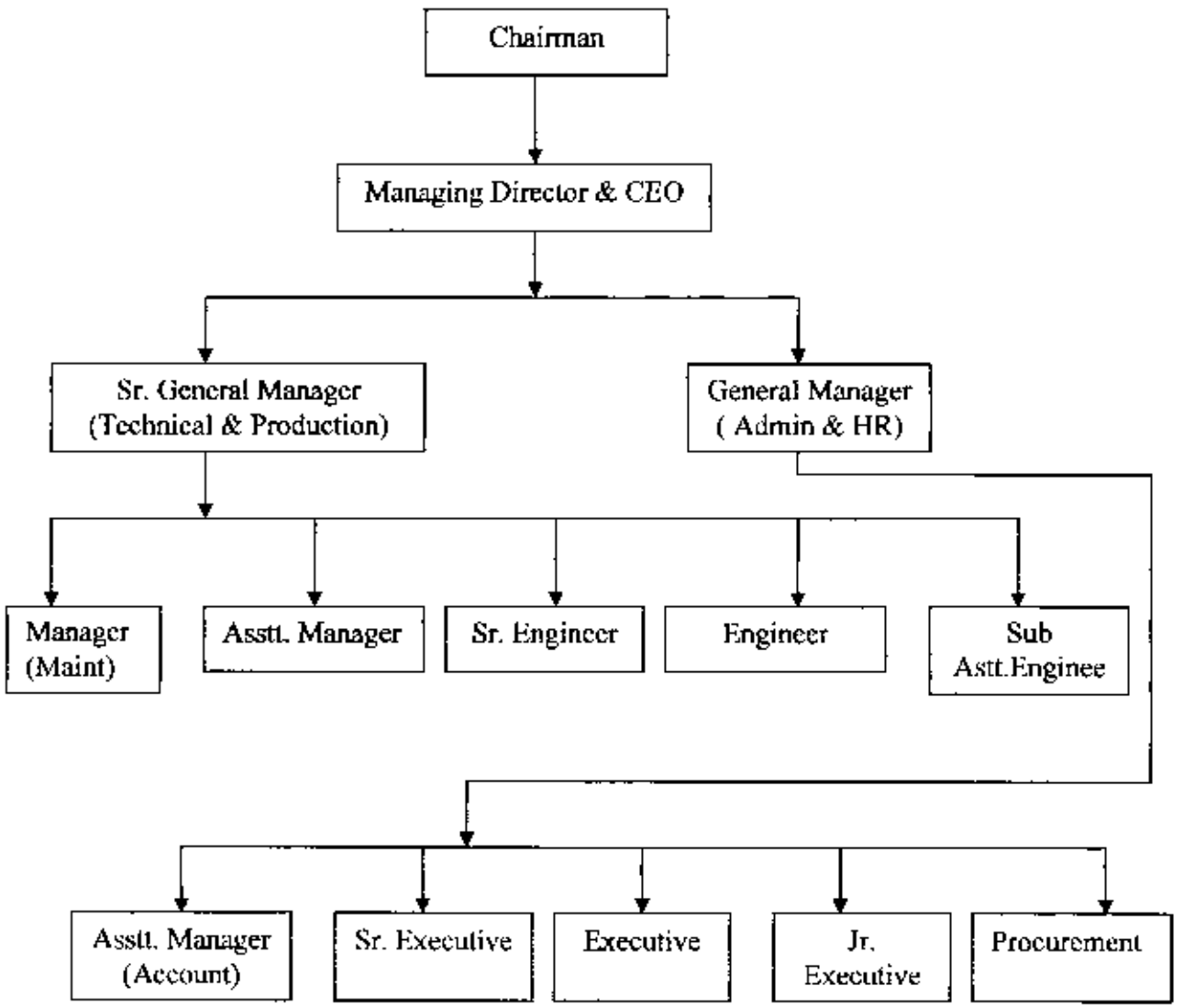


Figure 2.11: Organogram for Beximco Synthetics Limited

2.2.5 Consumer Mix

Number of consumer of Beximco Synthetics Limited was 8 in 2004. Among them maximum portion of them are large / wholesaler customer. After 4 years total number of customer for Beximco Synthetics Limited is 22. With in these 4 years retailer/ small type of customer have increased.

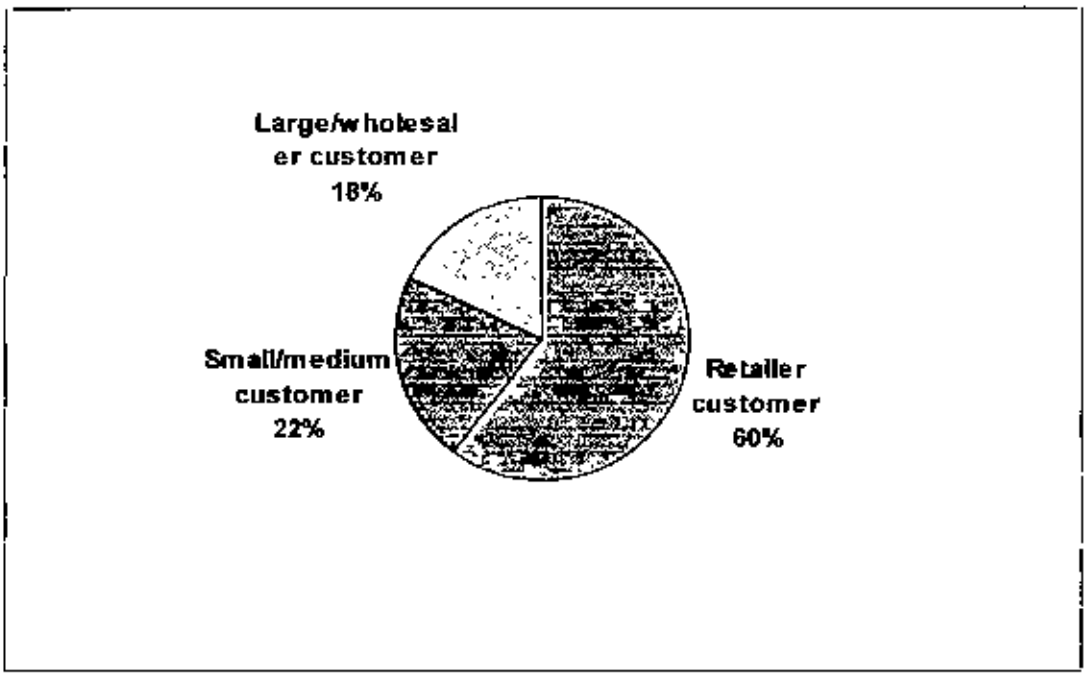


Figure 2.12: Consumer mix of Beximco Synthetics Limited in 2008.

CHAPTER-THREE

LITERATURE REVIEW

3.1 Introduction

Dr. Mizano, professor emeritus of the Tokyo Institute of Technology is credited with initiating the quality function deployment (QFD) system. The first application of QFD was at Mitsubishi heavy Industries Ltd. in the Kobe shipyard, Japan in 1972. After four years of the study development, and training. QFD was successfully implemented in the production of mini-vans by Toyota.

Quality function development (QFD) is a planning tool used to fulfill customer expectations. It is a disciplined approach to product design, engineering and production and provides in depth evaluation of a product. An organization that correctly implements QFD can improve engineering knowledge, productivity and quality and reduce costs, product development time and engineering changes.

Quality function deployment focuses on customer expectation or requirements, in often referred to as the voice of the customer. It is employed to translate customer expectations, in terms of specific requirements, into direction and actions, in terms of engineering characteristics, that can be deployed through

Production planning
Part development
Process planning
Product planning
Service

Quality function deployment is a team-based management tool in which customer expectation are used to drive the product development process. Conflicting characteristics

or requirements are identifies early in the QFD process and can be resolved before production.

Organizations today use market research to decide what to produce to satisfy customer requirements. Some customer requirements adversely affect others and customers often cannot explain their expectation. Confusion and misinterpretation are also a problem while a product moves from marketing to design to engineering to manufacturing. This activity is where the voice of customer becomes lost and the voice of organization adversely enters the product design. Instead of working on what the customer expects, work is concentrated on fixing what the customer dies nit want initially. By implementing QFD, an organization is guaranteed to implement the voice of the customer in the final product.

Quality function deployment helps identify technology and job function to carry out operations. This tool provides a historic reference to enhance future technology and prevent design errors [16]. QFD is primarily a set of graphically oriented planning matrices that are used as the basis for decisions affecting any phase of the product development cycle. Result of QFD are measured based on the number of design and engineering changes, time to market, cost, quality. It is considered by many experts to be a perfect blueprint for quality by design.

Quality function deployment enables the design phase to concentrate on the customer requirements, there by spending less time on redesign and modification.

The saved time has been estimated at one-third to one-half of the time taken for redesign and modification using traditional means. This savings means reduced development cost and also additional income because the product enters the market sooner.

3.2 Quality Function Deployment (QFD)

Quality function deployment (QFD) is a basic TQM tool that systematically develops customer needs and expectations. The tool provides a graphically methodology for unearthing customer stated and unstated needs and expectations for making decisions in case[9] where these needs and expectations conflict, and for driving these customer based needs requirements and expectations into the product development. QFD is driven by what the customer wants, and for these reasons, the technique is often described as "developing the voice of customer".

A technique to deploy customer requirements into design characteristics and deploy them into subsystem, components, materials and production processes (Hoyle: 1994). The initials QFD stands for 'Quality Function Deployment'. These initials will be used when referring to this technique.

In the new economic era [17] where the customer have greater possibility to choose then in the past, the companies have found themselves obliged to adapt and acquire a from of customer oriented management. Of all the technique and philosophies that have been developed, QTA is one of the most complete that enables the realization of this culture change.

The methodology of QFD allows the deployment of the expectation of the customer [18], or rather, the characteristic expected of this service, through all the function of the company; it is possible therefore, to translate the expectation (what the customer wants) with the appropriate means, into specification of service and internal action (how we should it), 'The QFD is a management tool, where the customers expectations are used to manage the design of the processes' [19-20].

The QFD is not only used in the development of new services, it is also used for the improvement of an existing service, such as that given by the distributing and retailing

companies of Textile sector for Beximco synthetics fibers- the objective of the present article.

The QFD has different applications for each business or company [21-22] which means it, has to be adapted to the characteristics of the business. In this case we are talking about the design of a physical product, such as a pen for example, but rather that the distributing and retailing companies, as well as yarn, give the different types and grade of polyester t then collecting payment, customer demand about he yarn quality by either telephonic or personally from market. So we are dealing with a complex service to which the methodology of QFD has been adapted.

The QFD approach on experienced factory is proposed in [23].He has focused reuse of products, processes and experience originating from the life style which is a feasible solution to the problem of developing higher quality system at a lower cost. This article present an infrastructure, called experienced factory, aimed at capitalization and reuse of life cycle experience and products. The experience factory is a logical and physical organization and its activities are independent from the ones of the development organization. Here an appropriate analysis has been done to find out faults, errors and failures associated with various phases. Then they have used for prediction, project monitoring, evaluation and provide specific focuses for improvement of the factory.

The application of QFD to design a course in total quality management at the University Of Michigan College Of Engineering is proposed in [24]. Here this technique is used to increase the student to teacher ratio in the course, grown from one section to three and continuously sends student teams in to various departments in the university and local businesses to improve their quality programs. This paper shows the step by step application of QFD that focuses both on external evaluators of the University and internal evaluators of the University.

3.3 Benefits of QFD

Organizations using QFD have reported a reduced product development time. Quality function deployment was originally implemented to reduce start-up cost. For example, U.S car manufacturers of the late 1980s and early 1990s needed an average of five years to put a product on the market from drawing board to showroom, whereas Honda put a new product on the market in two and a half years and Toyota did it in three years. Both organization credit this reduced time to the use of QFD. Product quality and consequently, customer satisfaction improve with QFD due to numerous factors depicted in figure 3.1. QFD offers a wide variety of benefits including the flowing:

- It takes the customer as a straight point.
- It cuts down on cycle time since it encourages designing right first time by closely sticking to customers true requirements.
- It is a tool for never ending improvement. If offers the ability to prioritizes customers own preference and following a ranking procedure, suppliers may not necessarily have to focus on customers top priorities if this are strong enough on other aspect which they may be weak at.
- It is a team building process. QFD forms teams by encouraging input not just from marketing, development, manufacturing and distribution. It combines efforts which link in the emotional needs of customers to those which have to convert them into physical outputs which are produced and delivered to the satisfaction of the end customer.
- QFD helps create a strong database of customer understanding and internal effectiveness and external competitiveness.
- QFD provides firms with the opportunity to reduce costs and waste by using experiential learning and constantly working on reducing cycle time for product to market.
- QFD is a tool of innovation since it currently encourages people to rate their capabilities against those of competitors and others. It assesses the ability of the process to deliver the customer right first time and every time.

Customer Driven

Quality function deployment looks past the usual customer response and attempts to define the requirements in a set of basic needs, which are compared to all competitive information. All competitors are evaluating equally from customer and technical perspectives. This information can then be prioritizes using a pareto diagram. Management can then place resources where they will be the most beneficial in improving quality. Also, QFD takes the experience and information that are available within an organization and puts them together as a structured format that is easy to assimilate. This is important when an organization employee leaves a particular project and a new employee is hired.

Reduces Implementation Time

Fewer engineering changes are needed when using QFD and when used properly, all conflicting design requirements can be identified and addressed prior to production. This results in a reduction in retooling, operator training and changes in traditional quality control measure. By using QFD, critical items are identified and can be monitored from product inception to production. Toyota reports that the quality of their product has improved by one-third since the implementation of QFD.

Promotes Teamwork

Quality function deployment forces a horizontal deployment of communication channels. Inputs are required from all facets of an organization from marketing to production to sales thus ensuring that the voice of customer is being heard and that each department knows what the other is doing. This activity avoids misinterpretation opinion, and miscues. In other words, the left hand always knows what the right hand doing. Efficiency and productivity always increase with enhanced teamwork.

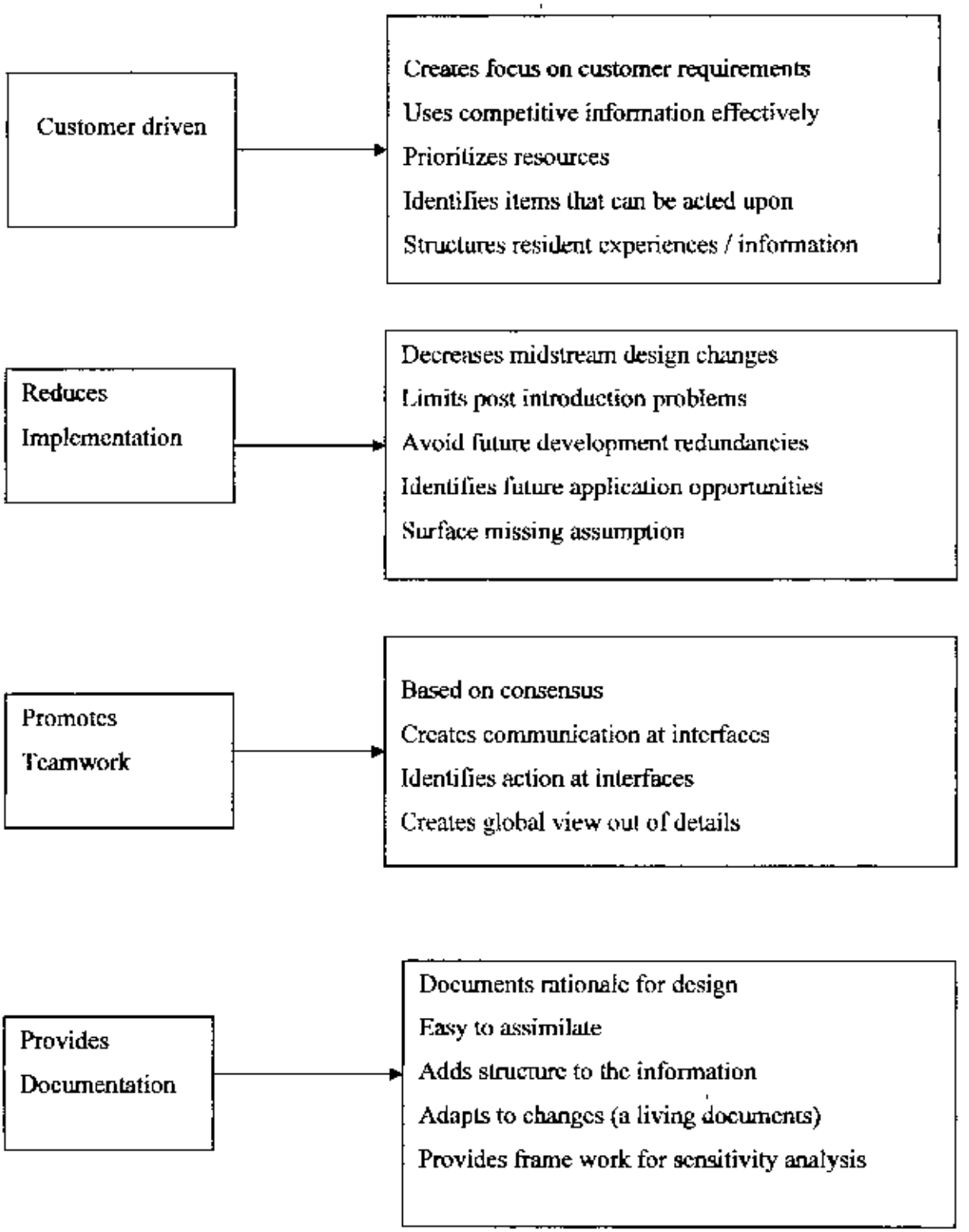


Figure 3.1: Benefit of QFD

Provides Documents

A database for future design or process improvements is created. Data that are historically scattered within operation, frequently lost and often referenced out of context are now saved in an orderly manner to serve future needs. This database also serves as a training tool for new engineers. Quality function deployment is also very flexible when new information is introduced or things have to be changed on the QFD matrix.

3.4 QFD Process

The QFD matrix (house of quality) is the basis for all future matrices needed for the QFD method. Although each house of quality chart now contains a large amount of information, it is still necessary to refine the technical description further until an action able level of details is achieved. Often, more then one matrix will be need depending on the complexity of the project. The project is accomplished by creating a new chart in which the HOW's (technical description) of the previous chart become the WHAT's (customer requirements) of the new chart, as shown in figure 3.2. This process continues until each objective is refined to an actionable level. The HOW MUCH (prioritized technical description) values are usually carried along to the next chart to facilitate communication. This action ensures that the target values are not lost during the QFD process. If the target values are changed, then the product is not meeting the customer requirements and not listening to the voice of voice of the customer, which defeats the purpose of QFD.

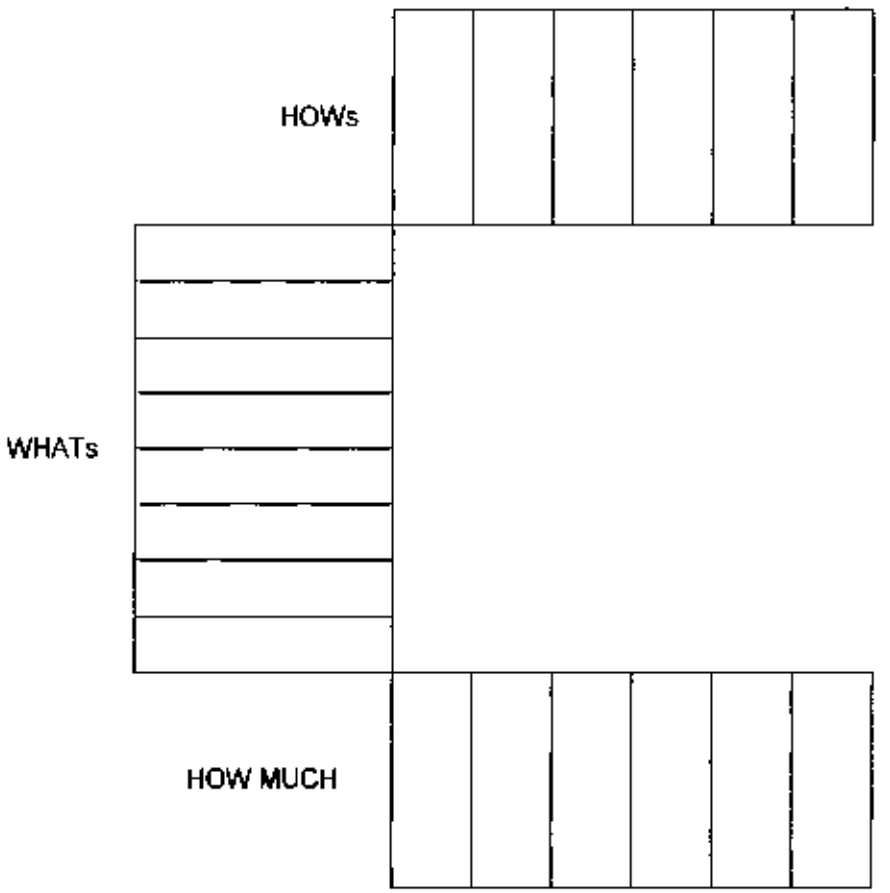


Figure 3.2: Refinement of the QFD chart

3.5 House of Quality

QFD employs a "What-How" matrix listing customer wants (the "What"), technical requirements (the "How"), and competitive assessment using customers subjective perceptions and the firm's own objective engineering measurements.

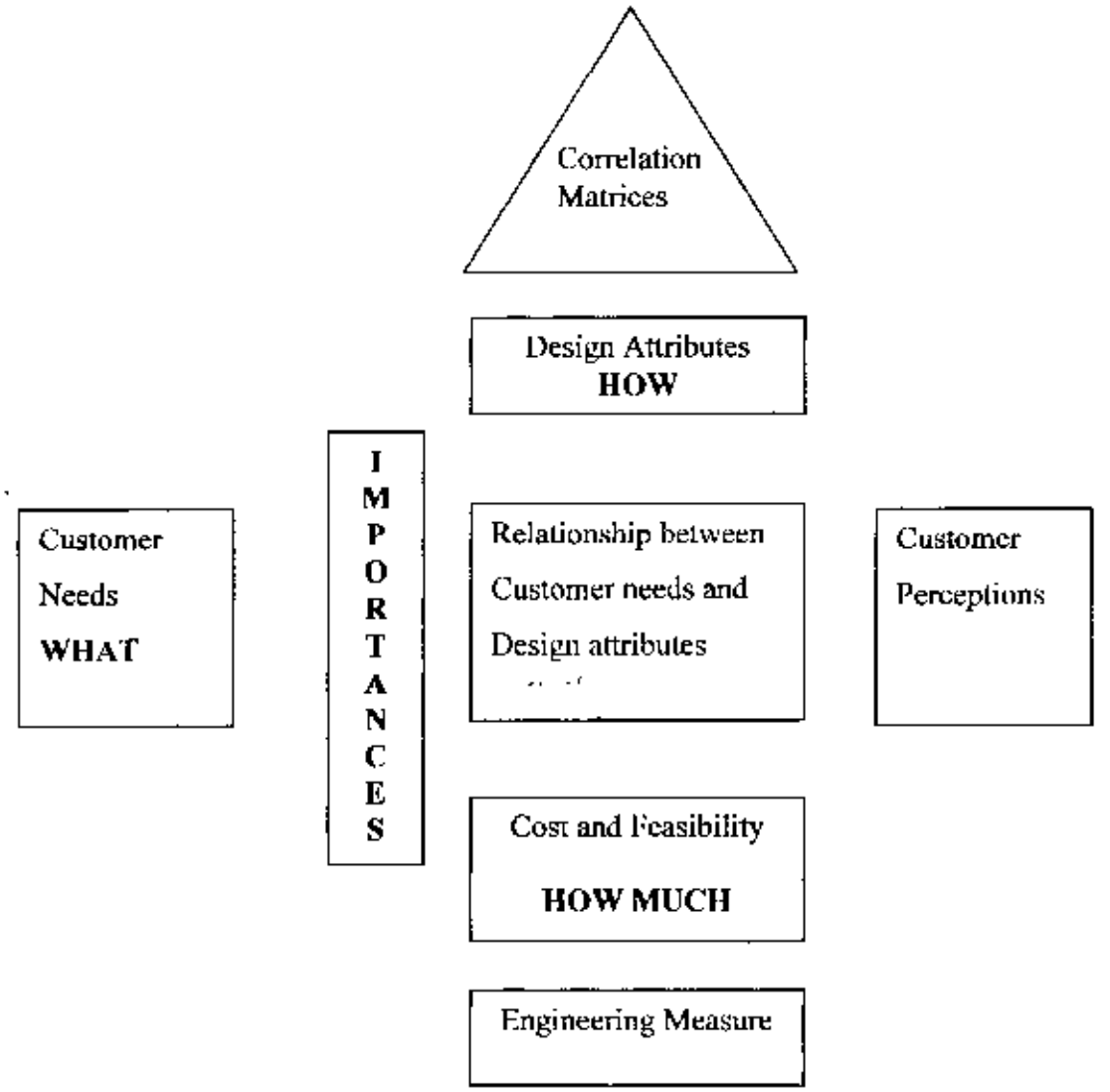


Figure 3.3: House of Quality

Thus, QFD provides a way to integrate and subordinate specialized function departments into coordinated, collaborative activity that provide customer value. Which many organizations will chose not to use such a structured technique, they will have to write operational definition that clearly articulate the means of providing value to customer. These definitions will have to be translated into process and operation to produce the product and services. QFD simply provides the structured methodology that promotes communication among the specialized experts who must do this work.

3.6 Out line of the functioning of the Textile market

QFD is oriented towards involving a team of people representing the various functional departments that have involvement in product development: Marketing, Engineering, Quality assurance, Manufacturing, Test Engineering, Finance, Product support. This study is centered on the commercialization of the final manufactured polyester yarn. This can be carried out by the Beximco Synthetics Limited to qualified or non qualified customer that is subjected to the controlled or regulated market by the retailing customer to wholesaler customer.

Customer needs are gathered, they have to be organized. The mass of interview notes, requirements documents and customers data needs. With in this context, it is worth emphasizing that in the case of the qualified customer, who chooses the retailing; company and it is therefore he who decides. Moreover, in an environment of growing competition, the way to difference form the competition and gain the loyalty of customer is by offering a product/ service with a greater perceived value, from the point of view of the customer. So, pressure is then exerted by the regulated rate customer who could, at some future point, gain access to the liberalized market.

The circumstances, together with state supervision, compel the distributing and retailing companies to development product/ service that satisfy the customer. Consequently, they have to know there customer, listen to and understand them, anticipate and take into account all there expectations [16]. Thus, the distributing and retailing companies of polyester yarn must consider the need to establish a methodology which will allow them to identify local point of there organization as well as which process, customer service channels or other service they should improve. The aim would be to satisfy the expectation of there customers, with a continuous quality improvement. Figure 3.4 represent the final outline of the functioning of the textile market.

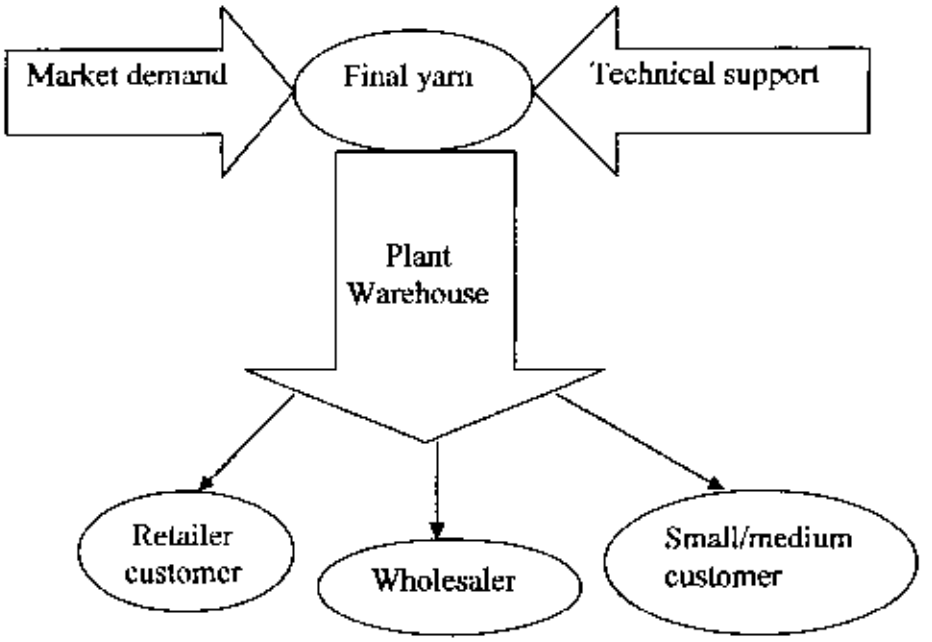


Figure3.4: Final outline of functioning of the textile (polyester yarn) market.

3.7 Quality in the Textile sector

There is a strong correlation between the quality of the service, the level of customer satisfaction and the profitability for the company. According to Philip Kotler [19] ' higher standards of quality lead to higher levels of satisfaction in the customers, which at the same time increase the possibility of higher prices and frequently, lower costs. Consequently, programmes for the improvement of quality normally increase the company profitability'.

It can define quality as away of management that consist of satisfying the expectations of the customer while maintaining the required profitability for the company.
Quality is a strategic variable that can provide the company with a competitive advantage [22]. Moreover, it constitutes the main subject dealt with in this article. Therefore, before going any deeper into this study, it is important that we define just what we are referring to when we talk of quality and by which aspect it is determined.

Quality is the defined by the value perceived by the customer, in the present case when a contract is signed to supply yarn and to use the service of the company. This perceived value, according to the Levit model (explained by Jim Clemmer) [22], is determined by three aspects:

a. The basic product or service offered. These are made up of expectation related to the supply of our basic product of Polyester yarn, in the term stipulated in the contract, as this is what makes the machines, light, computer, washing machine etc.
b. The support necessary in order to offer a product or a service. This is made up of expectation related to work on the network to supply yarn, to contracting, to the subsequent modification of the contract terms and collect the VOC from different type of customer.
c. Personalized attention, also called the Enhancement service, in that it exceed the customer expectation. It can consist of an option, a novelty, a benefit, a characteristics, etc. which the customer does not expect and therefore appreciates. In the case of supplying yarn, due to the monopolistic characteristic it has had up to now, a determined image has neither been created, nor has it been necessary between the suppliers. Thus the effort towards the creation of an image from a large part of the third ring.

Figure 3.5 represent the ring of perceived value as applied to the service of supplying polyester yarn. The previous standards are represented by the circle, with the inner ones corresponding to the product or service and the outer ones to personalized attention.

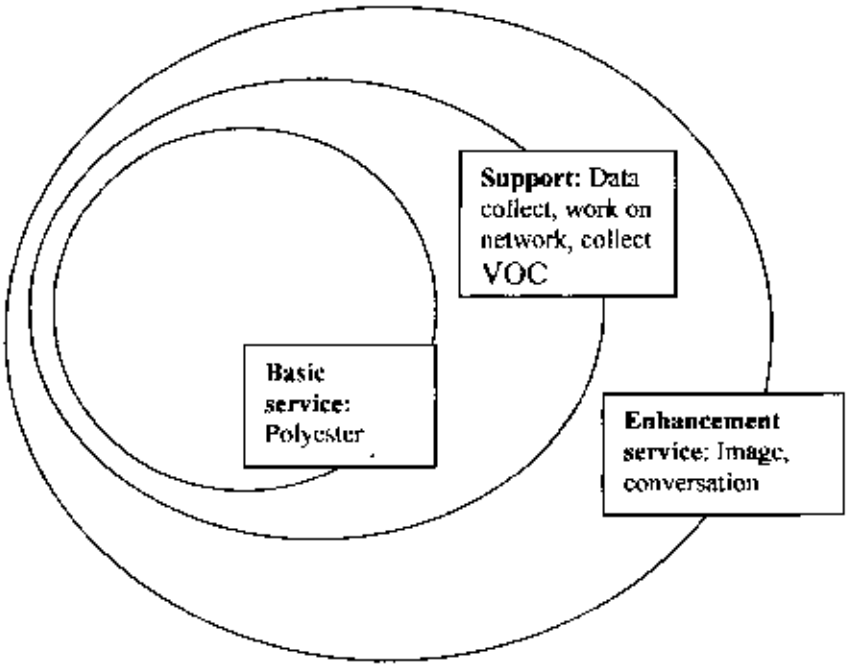


Figure 3.5: The rings of perceived value by T.Levitt

CHAPTER- FOUR

INVESTIGATION, RESULTS AND ANALYSIS

4.1 Stage followed in investigation

4.1.1 Analysis of the expectation or demand of the customer

The expectation of the customer have to be gathered, analyzed and dealt with. Starting point of the segmentation have been made by this company and the results of investigation made on quantity as seen by the different segments of customer, basically on process, channels of attention and the image of the company. This stage includes:

a) Identifying and arranging of customer in order of importance (segmentation of the market)

The group into which BEXIMCO segments the market is:

⇒ Merchant or large customer

⇒ Small and medium sized customer

⇒ Retailer customer

Table 4.1: Different types of demand came out during the customer survey

Name of Customer: Mahmuda Enterprise
Address: Sonargaon, Narayangonj
Types of Customer. Medium

Sl No.	Demand
1	Broken Filament
2	Feasible Cost
3	Continuous Market Supply
4	Avoid loss Winding
5	Package weight range should be 3 5-4 kg
6	Avoid Rotomistake problem
7	Bobbin should be different for each grade of yarn
8	Package soldenng should be 10-12 degree
9	Avoid cross winding problem
10	To be consider high shining of yarn
11	Marketing officer appointed to market for collect the VOC
12	For any clams of yarn to be changeable

Name of Customer Azam Enterprise,
Address Hasnabad Rail station bazar, Shop# 65, Narshingdhi.
Type of Customer: Small/ Retailer

Sl No	Demand
1	Free from Broken Filament
2	Avoid Out Roller problem
3	Avoid Over length problem
4	Avoid claim less quality (CLQ)
5	Avoid Rotomistake problem
6	Continuous Market supply and easily available
7	Package soldering angle maintain properly
8	Total package weight 3.5-4 kg
9	To be clear about bobbin color for different denier yarn
10	Evaluate the accurate grade of yarn
11	Price of yarn should be similar from different supplier of yarn
12	Always To be collect VOC from small type of customer
13	To be ensure that Delivery of yarn for small customer directly from plant.
14	Shine of Yarn should be high

Name of Customer: Hazi Yarn House
Address: Hasnabad Old Market, Station road, Narshingdhi
Type of customer: Large/ whole seller

Sl No	Demand
1	Package weight should be in limit
2	To be avoid Rotomistake
3	To be avoid broken filament
4	Continuous Market supply
5	To be avoid short package
6	To be collect VOC from different type of customer
7	To be avoid elasticity of yarn

Table 4.2: Summery on survey report from different customer demand

Sl No.	Demand	Rate (%)
1	Broken filament	80
2	Continuous Market supply	65
3	Package weight	55
4	Weak yarn	50
5	Information Collect	48
6	Bobbin Color	46
7	Rotomistake	48
8	Loss winding	42
9	Cross Winding	40
10	Tight winding	40
11	Length of bobbin	47
12	Package soldering angle	49
13	Cost feasible	56
14	Shinning of yarn	41
15	CLQ yearn avoid	32
16	To be ensure for any claim it is changeable	38
17	Marketing officer appointed	25

b) Identifying and listing the customer's expectations. Answering the question 'what does the customer wants? These are usually known as WHAT's'

There are many customer requirements found from the survey together to obtain the significant factor that have most influence on the global satisfaction of the customer (the expectation or WHATs). Among them most potential identified customer requirements are in the followings:

1. Broken filament
2. Continuously market supply
3. Bobbin color should not be changes
4. Weak yarn avoid
5. Cost should be feasible
6. Roto mistake
7. Package weight
8. Cross winding
9. Shining
10. Tight winding
11. Loss winding

12. Bobbin length and soldering angle.

13. Information collects from market by electronic media.

C) Putting the customer expectations in order: level of importance. (Considering each expectation on scale of 0 to 80)

Once the factor and their ratings are obtained, an analysis of multiple regression is made to obtain the level of importance of the customer expectation or WHATs (coefficient), grading them from 0 to 80. The aim is to put the WHATs in order of importance.

For the analysis of customer's requirements, the requirements are arranged with respect of different strategic:

According to operation:

Table 4.3: Customer requirements in respect of merchant or large customer

No	Requirements	Weight
1	Broken filament	80
2	Continuously market supply	68
3	Package weight	55
4	Information collect from market by electronic media	45

Table 4.4: Customer requirements in respect of small or medium customer

No	Requirements	Weight
1	Broken filament	70
2	Continuously market supply	55
3	Bobbin color should not mixing	15
4	Weak yarn should be avoid	60
5	Roto mistake	20
6	Cross winding	25
7	Tight winding	40

Table 4.5: Customer requirements in respect of retailer/end user customer

No	Requirements	Weight
1	Broken filament	80
2	Continuously market supply	68
3	Package weight	35
4	Bobbin color should not mixing	55
5	Weak yarn should be avoid	51
6	Roto mistake	45
7	Cross winding	28
8	Tight winding	25
9	Bobbin length and soldering angle	22
10	information collect	58
11	Loss windings	20
12	Shinning	22
13	Cost should be feasible	47

4.1.2 Definition of the service

In the second stage of the QFD the aim is to answer the question "Which service should be developed?", or rather 'Which part of the service should be improved in in order to satisfy all the expectations of the customer?'. To do this, we will proceed to:

1. Identify the basic aspect and processes of distributing companies, or the phases of the same which from part of the service and which have an influence on the expectation of the customer (these are the basic processes previously defined in the section entitled Textile as a set processes).
2. Identify and enumerate the technical or functional specification of the processes: definition of the internal quality indicators. These are known as the 'HOWs', and are measurable and controllable elements through which the demand of a customer can be satisfied.

At this stage, an analysis of the distributing and retailing companies of Textile sector is made in order to find out their internal quality indicator -taking as a basis of a company from the sector and that is BEXIMCO. There follows an analysis of the customers 'selecting those internal quality indicators that initially are most related to the customers'

expectations. For those expectations that do not have their internal quality indicators officially approved, the most suitable indicator should be defined.

4.1.3 A study of the relation ship between the customers, expectations and the internal quality indicators

The relationship between the expectations and the internal quality indicators is established, by means of numerical grading according to there strength using to the traditional system [13]: 9- a strong relationship, 3- a medium relationship, 1- a weak relationship and 0- no relationship.

This part of the process, as stated by Knowles (2002) [17], is often the most time consuming and difficult, as it involves the experts exploring their knowledge and experience in order to establish the correlations between the requirements or expectations of the customer and the quality indicators.

Personal interviews have therefore been held with some professionals from BEXIMCO who were asked to asses the relationship between the expectations and the internal quality indicators.

Table 4.6: The internal quality indicator against expectation for large customer

No	Expectations(WHATs)	Internal quality indicators
1	Broken filament	Spinneret
		continuous power supply
		Electric Heater for machine
		Skilled manpower
2	Continuous market supply	Proper utility support
		All data collect digitally
		Time to time communication to customer
3	Package weight	Closed supervision by production officer
		Travers Guide
4	Information collect from market by electronic media	Trained marketing officer

Table 4.7: The internal quality indicators against expectation for small/medium customer

No	Expectations (WHATs)	Internal quality indicators
1	Broken filament	Spinnert
		continuous power supply
		Electric Heater for machine
		Skilled manpower
2	Continuous market supply	Proper utility support
		All data collect digitally
		Time to time communication to customer
3	Bobbin color should be different	Closed supervision by production officer
4	Weak yarn may not allow	Conning oil
5	Roto mistake	Air pressure for intermingle yarn
		Belt and Pulley
6	Cross winding	Travers guide
7	Tight winding	Belt and Pulley
		Trained production officer

Table 4.8: The internal quality indicators against expectation for retail/end user customer

No	Expectations(WHATs)	Internal quality indicators
1	Broken filament	Spinnert
		continuous power supply
		Electric Heater for machine
		Skilled manpower
2	Continuous market supply	Proper utility support
		All data collect digitally
		Time to time communication to customer
3	Package weight	Travers Guide
4	Bobbin color should be different	Closed supervision by production officer
5	Weak yarn may not allow	Conning oil
6	Roto mistake	Air pressure for intermingle yarn
		Belt and Pulleys
7	Cross winding	Travers guide
8	Tight winding	Belt and Pulleys
		Trained production officer
9	Bobbin length and soldering angle	Travers Guide
		Skilled machine operator
10	Cost should be feasible	Always communication to market for others price
11	Shining	Conning oil

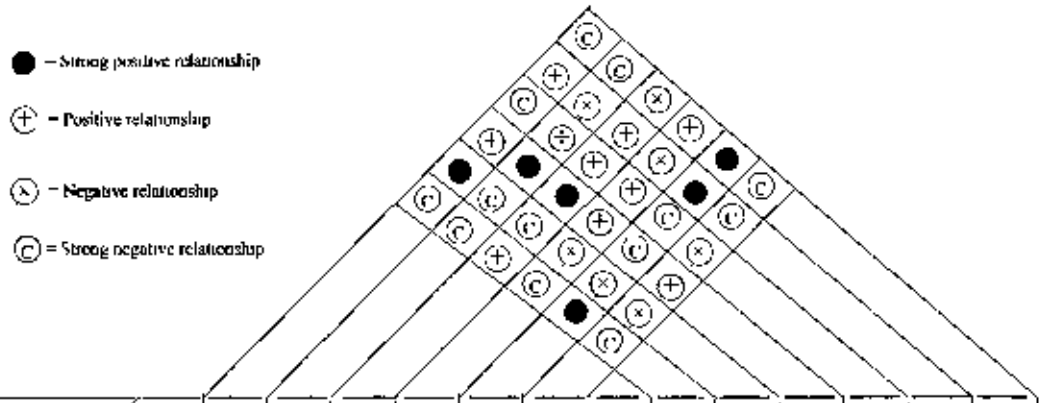
According to the QFD methodology, the correlation between WHATs and HOWs is univocal (0, 1, 3 or 9). Nevertheless, in the interviews with the experts and due to the fact that opinion is qualitative and refers to a service, the grades given are usually different and at time present a considerable dispersion. Once the grades have been given by all the experts and taking into account the frequency of each one, the average grading given has been taken as the measurement of the distribution center of each internal quality indicator for each expectation.

After completing the first series of interviews with the experts, the deviation have been calculated and a revision made of those result that present the greatest dispersion. So in this cases a second series of interviews with some of the experts was carried out, where confusion has been defected regarding the significance or range of the internal indicators. After a new assessment, the dispersion in the results has been considerably reduced, improving the reliability of the model used.

For each of the segments of customer previously defined, a matrix of the correlation between the mentioned customer's expectations and the internal quality indicators of the process analyzed has been made.

Figure 4.1, 4.2, 4.3 are the QFD matrix showing the correlation between the expectations or WHATs and the internal quality indicators or HOWs for the customers analyzed segment.

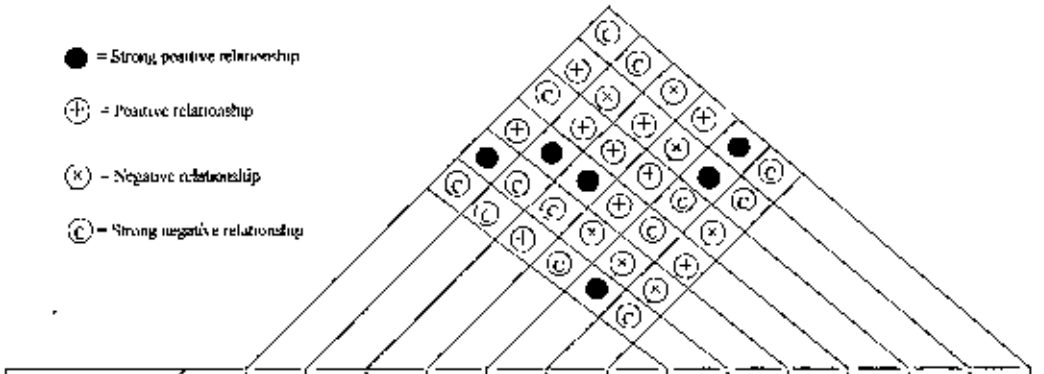
The internal quality indicators against expectation for small/medium customer



HOWs → / WHATs ↓	Importance	Electric Heater	Cooling Oil	Spunrest	Traverse Guide	Continuous Power	Belt &Pulley	Air Pressure	Closed Supervision by P.O	Skilled manpower	Trained Officer (QA)	Utility Support	All Data Collect Digitally	Issue to Time Inform to Customer
Broken Filament	70	3	0	9	1	3	1	0	3	3	0	1	1	0
Weak Yarn	60	9	3	0	0	1	0	0	1	0	1	0	0	0
Tight Winding	40	0	0	0	3	0	9	3	1	3	9	0	1	0
Cross Winding	25	0	0	0	9	0	0	0	0	9	0	3	1	0
Continuously Market Supply	55	0	0	0	0	9	0	0	0	0	0	9	9	9
Roto Mistake	20	0	0	0	0	1	3	9	3	1	0	0	0	0
Bobin should not Interchanged	15	0	0	0	0	0	0	0	9	1	3	3	3	1
Absolute Weight		750	180	630	415	785	490	300	905	590	465	685	685	510

Figure 4.1: The QFD matrix showing the correlation between the expectation or WHATs and the internal quality indicator or HOWs for small/ medium customer.

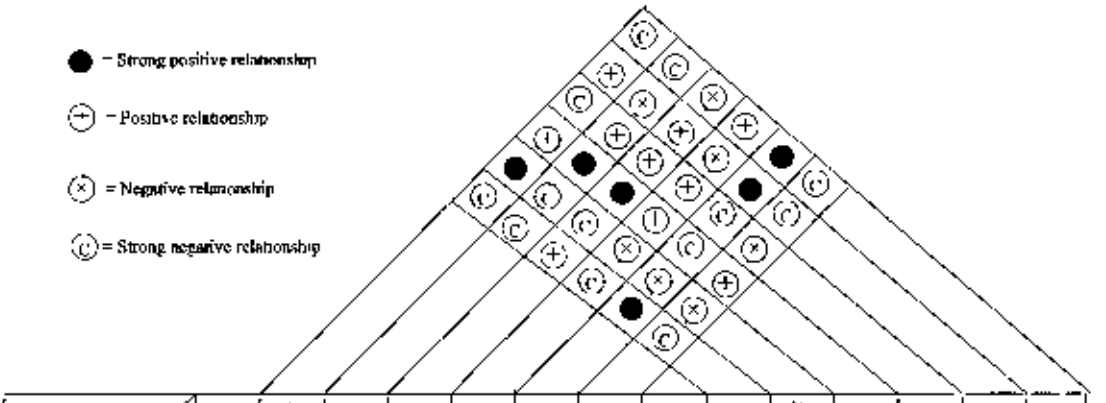
The internal quality indicators against expectation for retail/end user customer



HOWs → / WHATs ↓	Importance	Electric Heater	Cleaning Oil	Spanner	Traverse Guide	Continuous Power	Belt & Pulley	Air Pressure	Closed Supervision by P.O	Skilled worker to operator	Trained Officer (Q/A)	Help Support	All Data Collect Digitally	Time to Time Inform to Customer
Broken Filament	80	3	0	9	1	9	1	1	3	3	3	1	1	0
Weak Yarn	51	9	3	0	0	9	0	0	1	0	1	0	0	0
Tight Winding	25	0	0	0	3	0	9	3	1	3	9	0	1	0
Loose Winding	20	0	0	0	3	0	9	3	1	3	9	0	1	0
Cross Winding	28	0	0	0	9	0	0	0	1	9	0	3	1	0
Cost	47	0	0	0	0	0	0	1	0	0	1	0	3	9
Continuously Market Supply	68	0	0	0	0	9	0	0	0	0	0	9	9	9
Roto Mistake	45	0	0	0	0	1	3	9	3	1	0	0	0	0
Hobin should not Interchanged	55	0	0	0	0	0	0	0	9	1	3	3	3	1
Shuning	28	3	9	1	0	3	0	0	0	0	0	0	0	0
Package Weight	35	0	0	3	3	3	0	0	9	3	3	0	0	0
Length of bobbin and Soldering angle	22	0	1	0	9	1	3	0	3	9	1	0	1	0
Absolute weight		783	427	783	770	1921	686	667	1431	1030	965	941	999	1090

Figure 4.2: The QFD matrix showing the correlation between the expectation or WHATs and the internal quality indicator or HOWs for retail/ end user customer.

The internal quality indicator against expectation for large customer



HOWs → / WHATs ↓	Importance	Electric Heater	Cooling Oil	Spinner	Traverse Guide	Continuous Power	Belt &Pulley	Air Pressure	Closed Supervision by P.O	Skilled manpower	Trained marketing Officer /QA officer	Utility Support	All Data Collect Digitally	Time to Time Inform to Customer
Broken Filament	80	3	1	9	0	1	3	1	1	3	0	0	0	
Package weight	55	0	0	0	3	9	1	0	9	1	1	0	3	0
Continuously Market Supply	68	0	0	0	0	9	0	0	0	0	0	9	1	
Information collect from market	45	0	0	0	0	0	0	0	3	0	3	0	1	
Absolute weight		210	80	720	165	692	295	55	780	295	190	612	278	609

Figure 4.3: The QFD matrix showing the correlation between the expectation or WHATs and the internal quality indicator or HOWs for large/ whole sale customer.

4.1.4 Arranging the internal quality indicators or HOWs in order of importance

The objective of distinguishing between and weighing up the various levels of correlations is to arrange the internal quality indicators according to their importance. The aim is to progress front the customer's expectations to the prioritizing of the service's quality indicators, taking into account the relatives weight of the former. Thus both the preference of the different segments of customers that are analyzed and the strategy of the company will be respected at the same time.

Within the quality indicators or HOWs most important to each segment of customers, a value judgment of the same as made. To do this, the weight of the expectation or WHATs and the reliability of the averages of the correlation of each WHAT's with each HOWs is taken into account, according to the difference in the judgment of the experts.

4.2 Result Obtained

The objective in applying the QFD is to identify the most relevant and reliable internal indicators for each segments of the customers.

To this end, a chart has been made for each segment of customers in which the HOWs or quality characteristics have been classified from greatest to least according to the absolute weight obtained by adding the relatives weight of each expectation. The most little relevant internal quality indicators are identified shown in the bellows table.

Table 4.9: Greatest to least internal quality indicators for wholesaler/large customers

Internal quality Indicators or HOWs	Absolute weight	Weight percentage
Spinneret	720	16%
continuous power supply	692	15.3%
Electric Heater for machine	240	5.32%
Skilled manpower	295	6.53%
Proper utility support	612	13.56%
All data collect digitally	278	6.16%
Time to time communication to customer	609	13.5%
Closed supervision by production officer	710	15.73%
Travers Guide	165	3.65%
Trained marketing officer	190	4.21%

Table 4.10: Greatest to least internal quality indicators for small/medium customers

Internal quality indicators or HOWs	Absolute weight	Weight percentage%
Spinnert	630	10%
continuous power supply	785	11.25%
Electric Heater for machine	750	10.72%
Skilled manpower	590	8.4%
Proper utility support	685	9 8%
All data collect digitally	685	9.8%
Time to time communication to customer	510	7.3%
Travers Guide	415	6%
Closed supervision by production officer	505	7.2%
Conning oil	180	2.5%
Air pressure for intermingle yarn	300	4.3%
Belt and Pulley	490	7%
Trained quality officer	465	6 6%

Table 4.11: Greatest to least internal quality indicators for retailer/end consumer customers

Internal quality indicators or HOWs	Absolute weight	Weight percentage%
Spinnert	783	6 2%
continuous power supply	1921	15.5%
Electric Heater for machine	783	6.3%
Skilled manpower	1030	8.3%
Proper utility support	941	7.5%
All data collect digitally	999	7 9%
Time to time communication to customer	1090	8.7%
Travers Guide	770	6.2%
Closed supervision by production officer	1431	11.5%
Conning oil	427	3.5%
Air pressure for intermingle yarn	667	5.3%
Belt and Pulleys	686	5.5%
Trained quality officer	965	7.8%

4.3 Analysis of the result

Subsequent to the application of the QFD methodology to the distributing companies, an analysis of the result from the field of Quality management is carried out.
Emphases are placed on the relationship execution of the internal processes, the quality in customer's services channels and an adequate configuration of image. This analysis is divided in to two groups:

a) The QFD and the value perceived by customer

b)The QFD as a tool for studying the internal quality indicators of the processes., customer service channels and image.

(a) The QFD and the value perceived by customer

After carrying out a comparative analysis of the value perceived by the customer, explained by means of Levitt's and the expectation of the customer studied in the QFD methodology, it is obvious that Levitt;s rings group together different factors. However, these groups are not prioritized of the mentioned factors for the customer.

A clear case of this is that of the small/medium and retailer/end user which constitute in the third ring are more important then those of the first and second rings. In this type of customers with a lower consumption rate, the yarn supply (first ring), while still important, and is taken for granted.

Only in this case of large / wholesale customer, with a high rate of consumption, does the expectation referring to the first ring (yarn supply) have top priority ratings, above that of image.

b)The QFD as a tool for studying the internal quality indicators of the processes., customer service channels and image

Regarding the most relevant internal indicators, the study that has been made infers that there are no key indicators that would translate the expectation of all the segments, and that improving the most relevant indicators would ensure a vast improvement of the expectation of any customers who is consumer by Beximco synthetics yarn. Each customer should be analyzed

I. **Large/ wholesaler customer:** Formation of customer service staff or of the account manager and 'Information on the incident in the network'. Three of this stands out as a referring directly to the first ring of value perceived by the customer polyester yarn supply. Also we are providing this group is annual conference on new grades and types of yarn. offering and regulation etc.

II. **Small/ medium customer:** The most relevant internal quality indicators common group are period of time from payment of customer and obtaining permits. Also communicating to the new end user for finding the defect and probable solution.

III. **Retailer/ end user:** Our marketing department all time working in the field level and they are communicating to the end user. Also they are collecting the voice of customer what is there demand. Then they are informing to our technical team and our technical team implement there knowledge for meet the customer, demand.

CHAPTER-FIVE

CONCLUSION

Understanding the true needs of customers requires work on the part of designers and planers. It has never been an easy task, just ask anyone who has designed a product for what the customer thought he wanted, only to find out that the product was still not acceptable. Going to the analyzing the voice of customer has come to be tried and true way of getting a complete and accurate set of both the spoken and unspoken requirements of the customer, for later deployment with QFD into an assured design and delivery of the product, service and even business process.

The company has to identify the central of its organization. and also which process, attention channels or other services have to be improved in order to satisfy its customer's expectations. In this thesis it has found that electric heater, cooning oil, continuous power supply, air pressure, trained officer and operator are the most weighted internal quality indicators for continuous market supply for all group of customer. On the other hand, always communicating with customer and collecting information, time to time inform customer about the product, cost are most weighted for small type of customer. In the same way. it can be seen how the quality indicator could take on a different importance according to the segment of customer analyzed.

Summarizing, it can be confirmed that the satisfaction of the customer studied is the object of any economic activity. But, as demonstrated in this article, the characteristic that make up the satisfaction are different for each group and could evolve with time. Therefore, the customer is the only measure of quality and only by knowing the customer's expectations and managing activities towards satisfying them will we optimize the use of our resources.

Quality function deployment is an extremely useful methodology to facilitate communication, planning, and decision making with in a product development team. It is

not a paper work exercise or additional documentation that must be completed in order to proceeds to the next development milestone. It not only bring the new product closer to the intended target, but reduce development cycle time and cost in the process.

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