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SUPPLY CHAIN QUALITY MANAGEMENT TO IMPROVE ORGANIZATIONAL PERFORMANCE FOR MANUFACTURING INDUSTRIES

A thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Masters of Science in the Department of Mechanical Engineering (Industrial Engineering Chair)

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MECHANICAL ENGINEERING DEPARTEMENT
INDUSTRIAL ENGINEERING CHAIR

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DECLARATION

I hereby declare that this study; "Supply Chain Quality Management to Improve Organizational Performance for Manufacturing Industries" is original work of my own. The study has not been submitted for award of any Degree or Diploma Program in this or any other University/Institutions. All the resource of materials used by this thesis has been properly acknowledged.

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Abstract

As competition moves beyond a single firm into the supply chain, researchers are beginning to explore quality management (QM) in a supply chain context. The literature suggests that supply chain management (SCM) consists of internal practices, which are contained within a firm, and external practices, which cross organizational boundaries integrating a firm with its customers and suppliers.

This research assess the current practice of supply chain quality management in Ethiopian manufacturing industries using questionnaire survey, guided interview and author's direct observation. The investigation showed that some companies have begun the concept of SCM & QM practices independently, but most of them are doing in traditional manner. Among 54 respondent companies for the survey only 27.8% defined SCQM on the context of their company, this shows manufacturing industries are poorly practicing QM along their SC. The major problems identified in the manufacturing firms include: under capacity production, lagging to fill market demand, lack of quality raw material supplier, absence of long-term relation with supplier/customers, occurrence of bottle neck partner along the SC, usage of total cost as the only performance measurement system and did not give due consideration for employee satisfaction, product quality, on time delivery and customer satisfaction.

Further, the study tried to investigate how supply chain management-related quality practices lead to improved organizational performance and examined the practices that precede and mediate those relationships. After assessing current level of practice, general supply chain quality management model for Ethiopian manufacturing firms is proposed.

Finally, to make this research practical and realistic, actual case study was conducted on Faffa Foods Sc. The current system was analyzed and areas for improvement are identified. The improvement areas include: supply system, to save cost of materials rejected due to low quality i.e. suppliers cost 44,265.32Birr for transportation as well as companies incur labour cost, equipment cost and time for checking impurities, and distribution system, to minimize customer complain due to delay. Then the general SCQM model was customized for the case company's supply chain and it decomposes into sub sections. At the last, conclusion, recommendation and future works are provided.

Keywords: Supply chain management, Quality management, Supply chain quality management, Organizational performance, Ethiopian manufacturing firms, Faffa Foods Sc.

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Acronyms

ACSI: - American Customer Satisfaction Index

ADLI: - Agriculture Development Led Industrialisation

APS: - Advanced Planning System

CCP: - Critical Control Point

E-commerce: - Electronic Commerce

EDI: - Electronic Data Interchange
ERP: - Enterprise Resource Planning

FDI: - Foreign Direct Investment

FFSC: - Faffa Food Share Company

HACCP: - Hazard Analysis and Critical Control Point

JIT: - Just-In-Time

KPI:-Key Performance Indicator

MRP:-Materials Requirement Planning

MRPII: - Material Resource Planning

PASDEP:- Plan for Accelerated and Sustained Development to End Poverty

PMS: -Performance Measurement System

QM: - Quality Management

SC: - Supply Chain

SCM:-Supply Chain Management

SCQM:-Supply Chain Quality Management

SQM: - Supplier Quality Management

SPSS:-Statistical Package for the Social Sciences

TQM:-Total Quality Management

[ ]:- The numbers in [ ] indicate the reference material on page 112

Chapter One

1.1 Background and Justification of the Research

The purpose of this thesis is to address management of quality throughout the whole supply chain and to investigate relationship between supply chain quality management practices and organizational performance. To achieve the anticipated purpose this thesis uses survey result from Ethiopian manufacturing industries.

Over the last 50 years, a transition from the producers' market to the customers' markets has occurred. This transition began in the 1960s with an increasing role of marketing in the conditions of mass production of similar products to an anonymous market. This period is known as the economy of scale [8]. After filling the markets with products, the quality problems came to the forefront of enterprise management.

In the 1970s, total quality management (TQM) was established. The increased quality caused the individualization of customers' requirements in the 1980s. This was the launching point for the establishment of the economy of the customer. This period is characterized by efforts for optimal inventory management and a reduction in production cycles.

In the 1980–1990s, handling a high product variety challenged enterprise management. Another trend was the so-called speed effect. The speed of reaction to market changes and cutting time-to-market became even more important. Consequently, the optimization of internal processes simultaneously with external links to suppliers was rooted in the concepts of lean production and just-in-time. Throughout the 1990s, companies concentrated on development approaches to core competencies, outsourcing, innovations and collaboration. These trends were caused by globalization, advancements in IT and integration processes into the world economy [25].

But till 1980s, the products were not very complex and hence companies could manufacture them in their own premises. Hence the TQM philosophies hovered around improving quality within the companies. By the time the world settled to apply TQM within the premises of companies, a new challenge began to surface. According to this challenge, it became necessary to outsource majority of the components of products and services. Hence more than the management, the suppliers began to play major roles in determining the success and

failure of the products and services. Particularly in the 1990s, the paradigm of SCM was established [8].

Today, it is very difficult to see a company without depending upon its SCM department for effective and profitable development of products, processes and service [9]. Since SCM field has changed the way of manufacturing the items under one roof to the supplying of the items by numerous suppliers, this change has made the task of achieving higher degree of quality a complex one. In order to face this challenge, during the recent years, researchers have started to work in the direction of integrating principles and concepts of TQM with SCM [18].

Competition now is not only found at the firm level. Business competition now exists as supply chains seek to gain advantage over competing supply chains. This level of competition requires a much greater level of coordination among chains or networks of suppliers, distributors, producers, and customers [5, 15, 17]. As a result, this study adopts Supply chain quality management (SCQM) which is defined as a systems-based approach to performance improvement that leverages opportunities created by upstream and downstream linkages with suppliers and customers.

Therefore, as competition moves beyond a single firm into the supply chain, focus is shifting from management of internal practices alone. Instead, quality managers must integrate their firms' practices with those of customers and suppliers.Integrating QM and supply chain management (SCM) will be important for future competitiveness (Flynn and Flynn, 2005; Matthews, 2006; Robinson and Malhotra, 2005) cited in [38].

According to Robinson and Malhotra (2005), understanding quality management in a supply chain environment requires a transition from the product to the process-oriented perspective towards quality [31].

In the past decade however, Ethiopian companies have begun to recognize not only the need for continual quality improvement and meeting the needs of their immediate customers, but also the necessity of competing quickly and efficiently in ever changing markets. As a result, SCM has come to the forefront as a philosophy by which firms can operate inter-organizationally, and merge both strategic initiatives and upstream and downstream processes in order to achieve business excellence. Therefore, this study strengthens it by spreading quality management practices, techniques and tools through the whole supply chain.

1.2 Statement of the Problem

In Ethiopian some companies have already begun the concept of supply chain management (SCM) & quality management (QM) practices independently but most of them are doing in traditional manner. In addition, Ethiopian manufacturing firms faced the following major problems identified are:

- They are producing under their full capacity.
- They are lagging to fill market demand.
- There are a bottleneck partners in their SC.
- They did not have quality raw material suppliers.
- They did not have a long-term relation with their suppliers and customers.
- There was no clearly defined and structured way to select suppliers
- They use total cost as their only performance measurement system, did not give due consideration for employee satisfaction, product quality, on time delivery and customer satisfaction.
- They did not have a mechanism to take feedback from customers.

This shows they have a very weak SC and they did not meet their customer needs. This results the customer to focus on foreign goods. But currently the competition has been shifted from single firm level to a supply chain. Therefore, this thesis shows the role of quality management practice for a SC to be competitive in the dynamic global market and to increase organizational performance.

Further this thesis answers the following question:

- Are our companies ready for quality improvement initiatives at supply chain level?
- How we can assess whether our companies in the SC is ready to implement a quality improvement initiative? And,
- Do integrating quality management practices in SC improve organizational performance?

1.3 Objective of the Study

The general objective of this study was to integrate or extend quality management practices and principles into the supply chain to improve organizational performance.

Specific Objectives:

- To identify the critical factors (or variables) for SCQM and their causal linkages to organizational performance.
- To evaluate the readiness of a SC company to start the improvement process under the quality perspective.
- To maximize the overall value generated i.e. the difference between the worth of the final product as perceived by the customer and the effort undertaken within the supply chain to produce it, by taking Faffa Food Share Company as a case.
- To access the current performance of the case company.
- To formulate a model for supply chain quality management for Ethiopian manufacturing firms in general and Faffa Foods Share Company as a case.

1.4 Methods, Material and Procedures of the Thesis

The methodologies used by this thesis to achieve the intended objective are as follow:

- **Literature review on the subject matter:** sources reviewed to conduct this thesis include journals, books and trusted websites.
- **Data collection procedures:** the relevant data's are collected from Ethiopian manufacturing industries. The companies investigated are nearby Addis Ababa to simplify data gathering procedure. Since, it covers 40.26% (2008/09 CSA survey), this shows it will be good representative for Ethiopian manufacturing industries.
- **The survey instrument:** This study involves measuring both observable variables and unobservable constructs. Company size, process type, and ISO certification are observable data that can be measured directly. Time-based efficiency, cost-related efficiency, customer satisfaction, and business performance are latent constructs requiring indirect measurement. This is done through different methods including, questionnaire, guided interview and observations. In addition, electronic data retrieval is used for secondary data's.

Further, this research uses some tools of TQM that are effective for SCQM. Like:

- Fish bone chart/diagram investigate the causal linkage of some parameters and:
- Pareto chart to find out the key factors.

❖ **Data analysis:** the collected data's are analysed systematically to reach reasonable final output, draw concrete conclusion and propose possible recommendations.

❖ **Formulating SCQM model:** at the last a model for supply chain quality management is developed.

Generally, the following figure shows the scematic used to conduct this thesis.

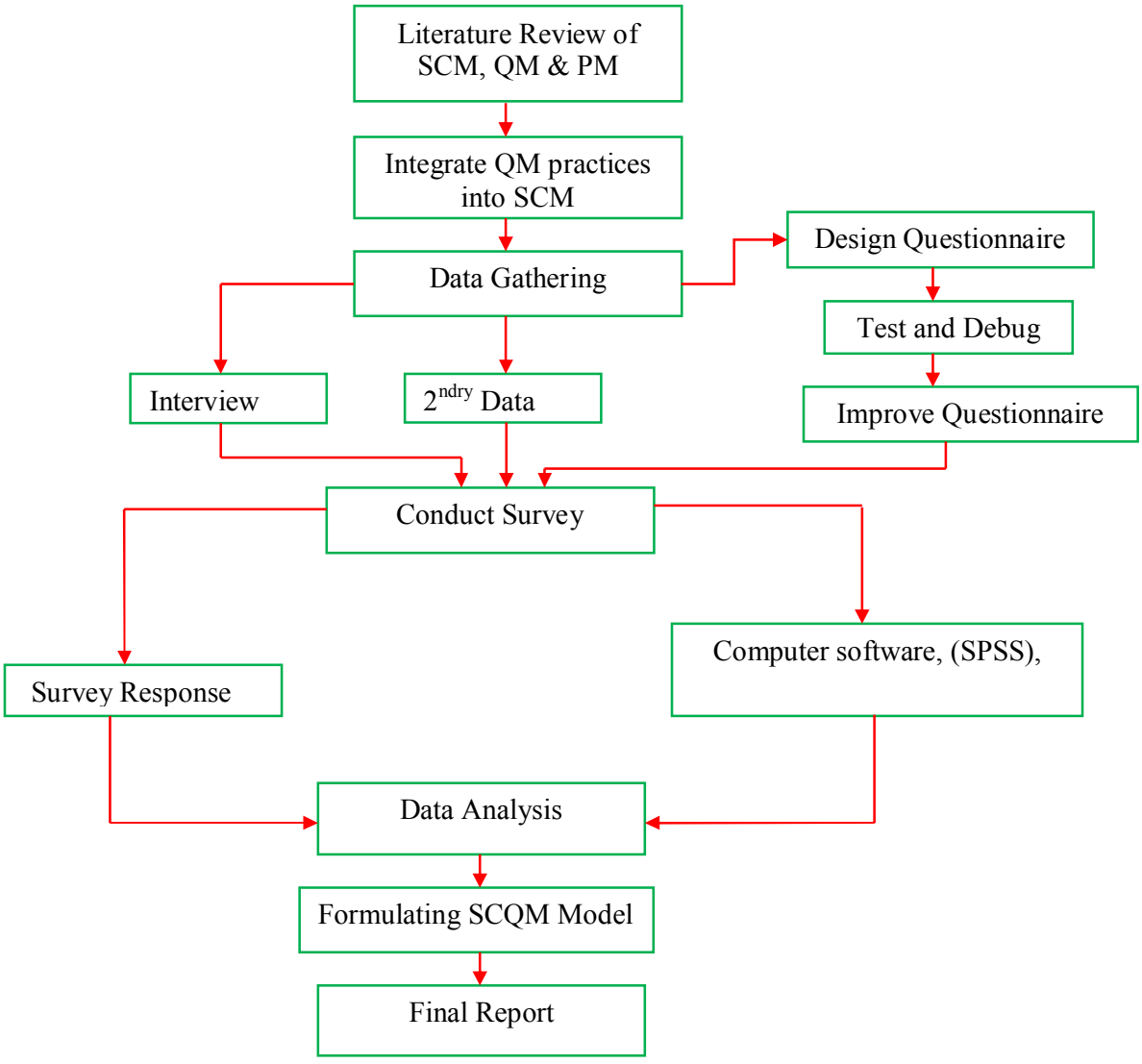


Fig. 1.1 Flow chart of the research procedure

1.5 Expected Contribution to the Body of Knowledge

Owing to local conditions, the Ethiopian manufacturing industries faces certain supply chain problems. As stated by an officer of the public education department of the Quality and Standard Authority of Ethiopia, among 260 product samples displayed at an exhibition in Addis Ababa, only fifteen were domestic products. Local firms were unable to participate, primarily because of quality problems with their products. He added that domestic products that failed to compete in the local market certainly would not succeed in the international market; consequently, Ethiopia's existence as a nation was in jeopardy. Failure in quality means a failure to survive as a nation, according to this critic [3].

Therefore, this study aims to identify supply chain quality problems and their extent which Ethiopian manufacturing industries have to deal with. Possible causes will be identified and remedies suggested to manufacturers in the industry to overcome identified supply chain quality problems.

Since the field of SCM is extremely dynamic, the study of literature, trends, new developments and the research will contribute to the body of knowledge and provide new insight into this field.

Chapter Two

Literature Review

Development of Quality Management in Supply Chain

2.1 Introduction to Supply Chain and Supply Chain Management

Supply Chain

There are different arguments for the term supply chain. For instance, as stated by Joel Sutherland there are three different common views of the supply chain [13].

1. "Supply chain" is just another term for "logistics."
2. Supply chain includes other functions such as purchasing, engineering, production, finance, marketing, and related control activities in the single company.
3. The supply chain is all the functions in definition #2 plus those in a company's suppliers' suppliers and a company's customers' customers as well extending far outside the traditional enterprise.

A more general definition is given by James B. Ayers, Hand book of supply chain, which defines Supply chain as: Life cycle processes comprising physical, information, financial, and knowledge flows whose purpose is to satisfy end-user requirements with products and services from multiple linked suppliers [18].

As a conclusion supply chain can be defined as the "network of retailers, distributors, transporters, storage facilities and suppliers that participate in the sale, delivery and production of a particular product" [13].

Supply Chain Management

SCM was initially related to the management of inventory within a supply chain. This concept was later broadened to include the management of all functions within a supply chain. According to Chopra and Meindl (2001), "supply chain management involves the management of flows between and among stages in a supply chain to maximize total profitability". This definition suggests that SCM involves management of the flows of products, information, and funds upstream and downstream in the supply chain. SCM also entails making decisions about the locations of production facilities, which products to produce, how to produce them, and finally, how to distribute these products.

As Figure 2.1 shows, a network usually will not only focus on flows within a (single) chain, but will have to deal with divergent and convergent flows within a complex network resulting from many different customer orders to be handled in parallel. In order to ease complexity, a given organization may concentrate only on a portion of the overall supply chain. As an example, looking in the downstream direction the view of an organization may be limited by the customers of its customers while it ends with the suppliers of its suppliers in the upstream direction.

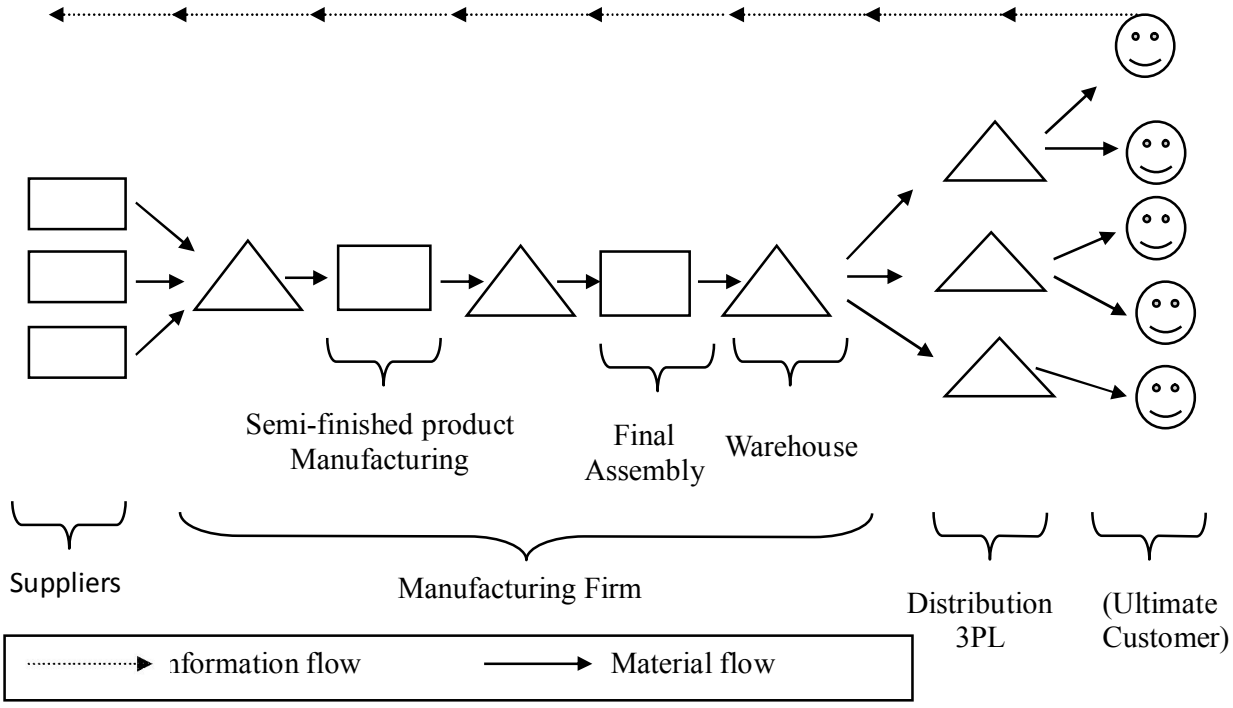


Fig. 2.1 Schematic of Supply chain considered in the study (adapted from [9])

The objective governing all endeavours within a supply chain is seen as increasing competitiveness. This is because no single organizational unit now is solely responsible for the competitiveness of its products and services in the eyes of the ultimate customer, but the supply chain as a whole. Hence, competition has shifted from single companies to supply chains. Obviously, to convince an individual company to become a part of a supply chain requires a win-win situation for each participant in the long run, while this may not be the case for all entities in the short run. Alternatively, a firm may increase its competitiveness by fulfilling a pre-specified, generally accepted customer service level at minimum costs.

We are now able to define the term Supply Chain Management as the task of integrating organizational units along a supply chain and coordinating material, information and financial

flows in order to fulfil (ultimate) customer demands with the aim of improving the competitiveness of a supply chain as a whole.[9,6]

2.1.1 Building Blocks of Supply Chain Management

The House of SCM as shown in figure.2.2 illustrates the many aspects of SCM. The roof stands for the ultimate goal of SCM – competitiveness – customer service indicates the means. Competitiveness can be improved in many ways, e.g. by reducing costs, increasing flexibility with respect to changes in customer demands or by providing a superior quality of products and services.

The roof rests on two pillars representing the two main components of SCM, namely the integration of a network of organizations and the coordination of information, material and financial flows. The figure also shows that there are many disciplines that formed the foundations of SCM.

The two main components which incur some degree of novelty will now be broken down into their building blocks. Firstly, forming a supply chain requires the choice of suitable partners for a mid-term partnership. Secondly, becoming an effective and successful network organization, consisting of legally separated organizations calls for actually practicing inter-organizational collaboration. Thirdly, for an inter-organizational supply chain, new concepts of leadership aligning strategies of the partners involved are important.

The coordination of flows along the supply chain can be executed efficiently by utilizing the latest developments in information and communication technology. These allow processes formerly executed manually to be automated. Above all, activities at the interface of two entities can be scrutinized, while duplicate activities (like keying in the data of a consignment) can be reduced to a single activity. Process orientation thus often incorporates a redesign followed by a standardization of the new process.

For executing customer orders, the availability of materials, personnel, machinery and tools has to be planned. Although production and distribution planning as well as purchasing have been in use for several decades, these mostly have been isolated and limited in scope. Coordinating plans over several sites and several legally separated organizations represents a new challenge that is taken up by Advanced Planning (Systems).

Subsequently, the house of SCM in greater detail will be described, starting with the roof, followed by its two pillars and ending with some references to its foundations.

2.1.1.1 Customer Service

Customer service is a multi-dimensional notion. According to a survey conducted by La Londe and Zinszer (Christopher 2005) there are three elements of customer service [9]:

- Pre-transaction
- Transaction and
- Post-transaction elements.

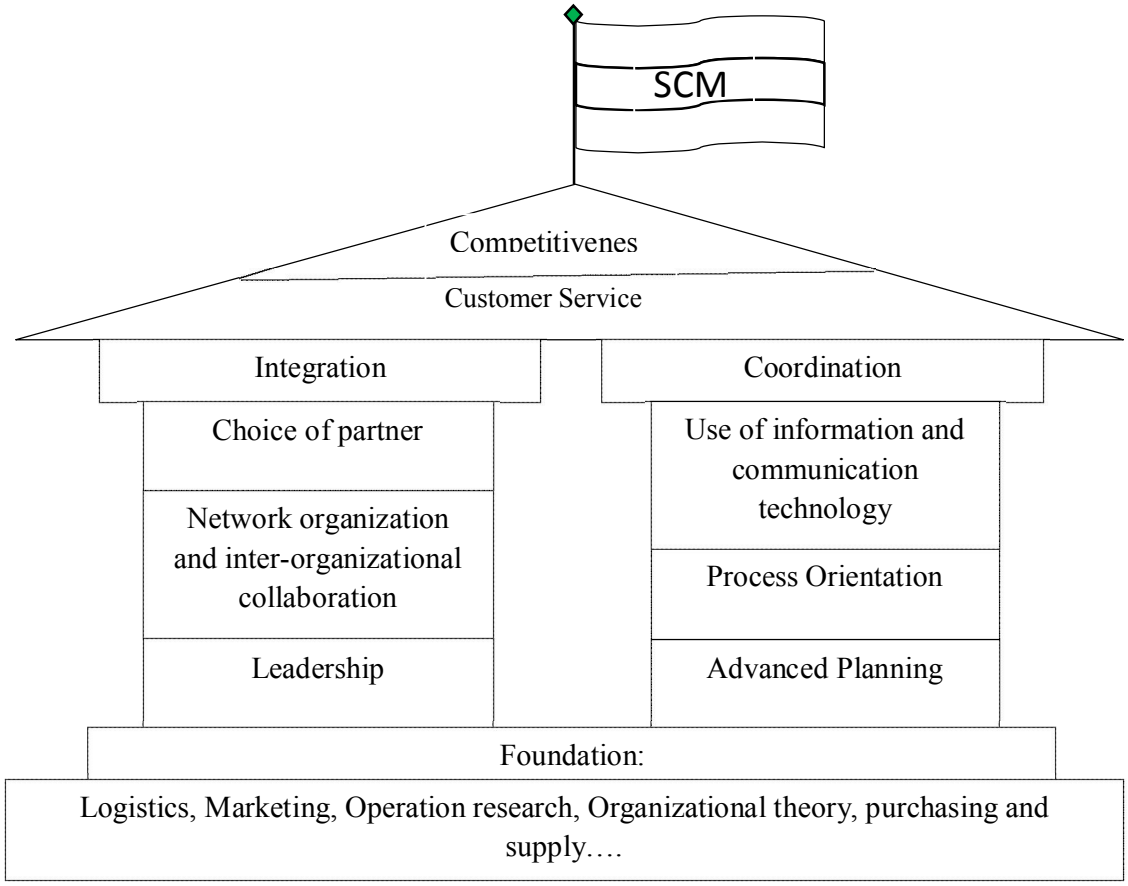


Fig. 2.2 House of SCM [9]

Pre-transactional elements relate to a company's activities preceding a contract. They concern customer access to information regarding the products and services a firm offers and the existence of an adequate link between organizations involved. Obviously, for standard products ordered routinely (like screws), an impersonal purchase via the Internet may be sufficient. Large projects, however, like a construction of a business building will require several, intense personal links between the organizations involved at different levels of the

hierarchy. Finally, flexibility to meet individual customer requirements may be an important element for qualifying for and winning an order.

Transactional elements are all those which contribute to order fulfilment in the eyes of a customer. The availability of products (from stock) may be one option. If a product or service has to be made on demand, order cycle times play an important role. During delivery times a customer may be provided with information on the current status and location of an order. The delivery of goods can include several additional services, like an introduction into the use of a product, its maintenance, etc.

Post-transactional elements mostly concern the service provided once the order is fulfilled. This includes elements like repairing or exchanging defective parts and maintenance, the way customer complaints are dealt with and product warranties.

2.1.1.2 Supply Chain Integration

As has been stated above, a supply chain in the broad sense consists of several legally separated firms collaborating in the generation of a product or service with the aim of improving the competitiveness of a supply chain as a whole. Integration refers to the special building blocks that cause these firms to collaborate in the long term, namely

- Choice of partners,
- Network organization and inter-organizational collaboration,
- Leadership.

The choice of partners starts with analysing the activities associated with generating a product or service for a certain market segment.

Firstly, activities will be assigned to existing members of a supply chain, if these relate to their core competencies. Secondly, activities relating to standard products and services widely available on the market and with no potential of differentiation in the eyes of the ultimate customers will be bought from outside the supply chain. Thirdly, for all remaining activities, a partner to join the supply chain has to be looked for in the course of a make-or-buy decision procedure. [9, 14, 44]

Selection criteria should not be based solely on costs, but on the future potential of a partner to support the competitiveness of the supply chain. A suitable organizational culture and a commitment to contribute to the aims of the supply chain will be of great importance.

Inter-organizational collaboration is a necessity for an effective supply chain. A supply chain is regarded as a cross between a pure market interaction and a hierarchy. It tries to combine

the best features of the two. Ideally, each entity within a supply chain will concentrate on its core competencies and will be relieved from stringent decision procedures and administrative routines attributed to a large hierarchy. Information and know-how is shared openly among members. Competition among members along the supply chain is substituted by the commitment to improve competitiveness of the supply chain as a whole.

Although legally independent, entities within a supply chain are economically dependent on - each other. Obviously, the structure of a supply chain will remain stable, only if there is a win-win situation for each member – at least in the long run.

Leadership, being the third building block of integration, is a delicate theme in light of the ideal of self-organizing, poly-centric actors forming a supply chain. It is discussed in section 2.3.1.1

In general, there are four different stages in achieving an integrated supply chain Christopher, 1994. Figure 2.3 summarizes these stages and shows the development of an integrated supply chain from an organization where all functional areas are independent to a supply chain that includes several organizations [17].

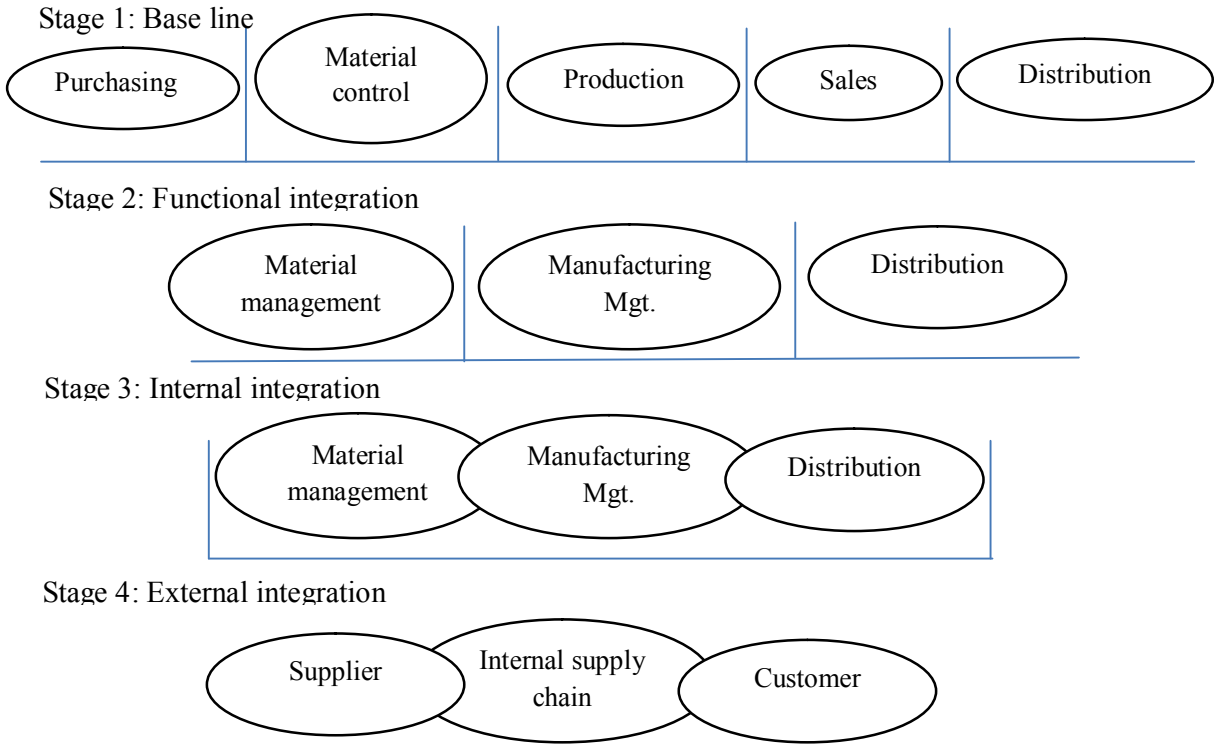


Fig.2.3 Stages for an integrated supply chain (source: Christopher 1994 [17])

Stage one show the internal structure of an organization without any integration. All business functions are independent of each other and try to optimize their operations without realizing

the effects of their operations on other business functions. In stage two, functional areas, which are related to each other, are integrated. Purchasing and materials control, for example, are integrated into materials management, and production and sales are integrated into manufacturing management.

However, there is still no integration of materials and manufacturing management. This kind of integration is realized in the third stage when all functions within the organization are integrated into a supply chain within the organization.

In stage four, external linkages are formed with suppliers and customers. The supply chain now includes suppliers and customers with the "objective to maximize the overall value generated" (Chopra and Meindl, 2001). In this case, value means the difference between the worth of the final product as perceived by the customer and the effort undertaken within the supply chain to produce it [6].

Vertical Integration: It is the degree to which a firm owns its upstream suppliers and downstream customers. In an vertically integrated supply chain system, the organization can control every component of the chain and can make various changes to the system to optimize the chain very easily.Because it can have a significant impact on a business unit's position in its industry with respect to cost, differentiation, and other strategic issues, the vertical scope of the firm is an important consideration in corporate strategy. Expansion of activities downstream is referred to as forward integration, and expansion upstream is referred to as backward integration. The concept of vertical integration can be visualized using the value chain as illustrated below:

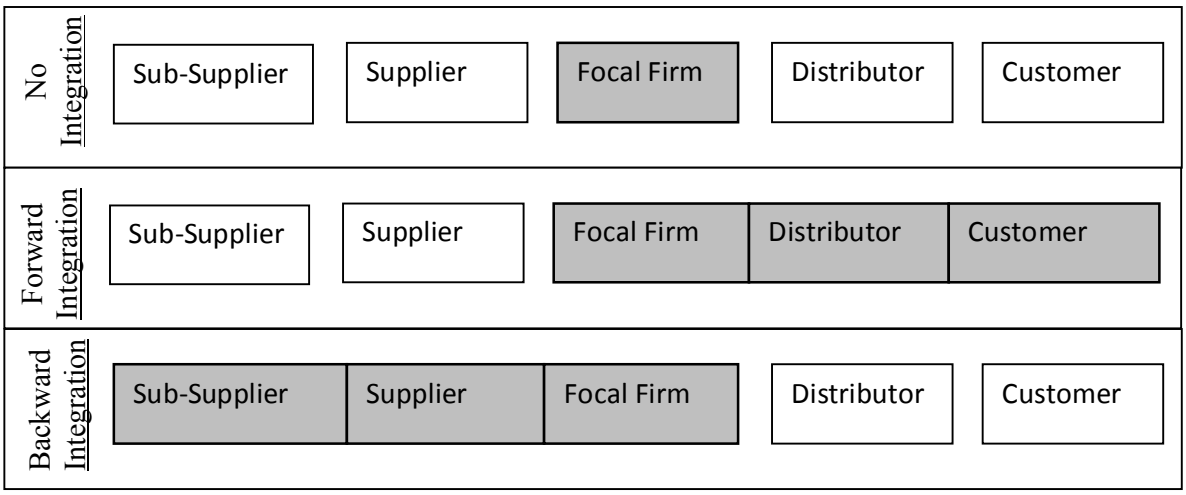


Fig. 2.4 Example of Backward and Forward Integration

Horizontal Integration: Horizontal integration is the widening of a business at the same point in the supply chain. In a horizontally diversified supply chain the tendency will be to optimize only the functions that the organization is involved in, thus conscious efforts must be made by the various participants in the supply chain for the integration of their respective components in the supply chain. If an organization can be identified as the major/dominant partner in the supply chain, then this organization has to take an initiative in seeking the co-operation of the other participants in the supply chain. The advantages of horizontal integration can lie in reaching the customers (if you are already selling them one thing, use the opportunity to sell more) but can include economics of scale in purchasing, logistics and operations. A larger business is often able to do things more cheaply than a smaller one, other things being equal. Anything that helps save costs if the scale of operations increases is an economy of scale. There are many sources of economies of scale, which ones are important depend on the industry (and company) in question. Common economies of scale include: [12]

- spreading administrative overheads over a bigger operation
- purchasing power to get better deals from suppliers
- lower costs in manufacturing - e.g., if a bigger factory has lower costs per unit produced
- better logistics leading to lower distribution costs

Supply chain collaboration: Collaboration is about organisations and enterprises working together and can be viewed as a concept going beyond normal commercial relationships.

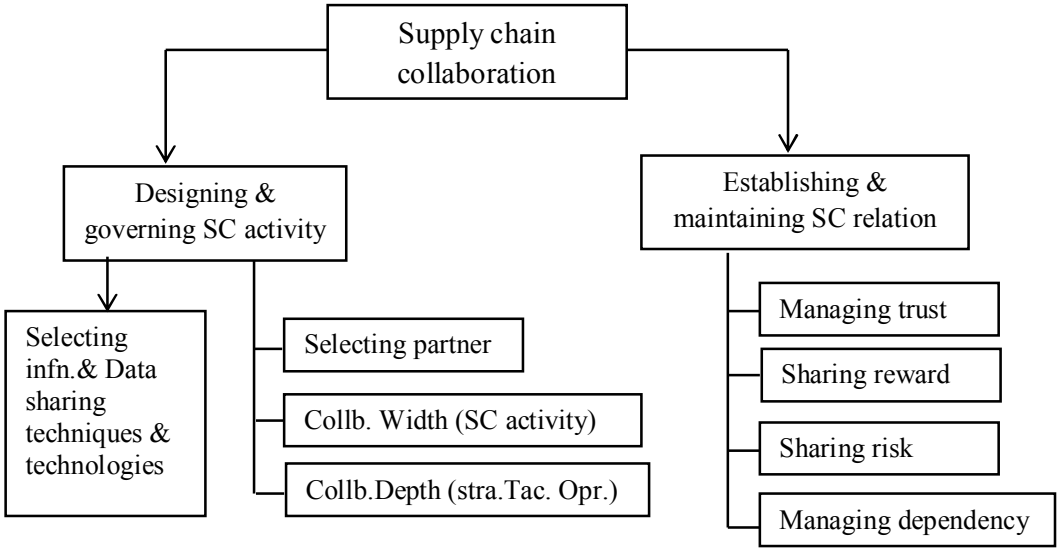


Fig. 2.5 Framework of supply chain collaboration [12]

Collaboration appears as enterprises recognise cases where working and operating alone is not sufficient to resolve common problems and to achieve the desired goals. Collaboration between supply chain partners is one of the issues which lately have received increased attention in the supply chain literature. The general frame work for supply chain collaboration is as shown in figure 2.5.

The first pillar in the frame work is related to the design and government of supply chain activities consisting of three elements. The first element is about taking the decision of selecting the appropriate partner. The second element involves selecting the activities on which collaboration will be established (width). Companies need to determine the specific activities upon which they will collaborate, since not all the activities require the same amount of involvement and close relationship. After selecting the activities the third element is to identify in what level companies will collaborate. At here level approach namely strategic, tactical, operational, is rather essential, since companies seldom choose or decide to collaborate across all decision taking levels. Finally, another important element for the design and governing of supply chain activities includes the decision of selecting the appropriate technique and technology to facilitate information sharing.

The second pillar concerns the establishment and maintenance of supply chain relationships. It includes the less tangible, but equally important, elements of relationships. The risk and reward sharing balance will be probably one of the crucial factors which will guide companies towards close collaboration. An interaction of other elements, such as trust, power and dependence, has been also identified in the literature to play an influential role in companies' decision to collaborate.

2.1.1.3 Coordination

The coordination of information, material and financial flows – the second main component of SCM – comprises three building blocks:

- Utilization of information and communication technology,
- Process orientation and
- Advanced planning.

Advances in information technology (IT) made it possible to process information at different locations in the supply chain and thus enable the application of advanced planning. Cheap and large storage devices allow for the storage and retrieval of historical mass data, such as past sales. These Data Warehouses may now be used for a better analysis of customer habits as

well as for more precise demand forecasts. Graphical user interfaces allow users to access and manipulate data more easily.

Communication via electronic data interchange (EDI) can be established via private and public nets, the most popular being the Internet. Members within a supply chain can thus be informed instantaneously and cheaply. As an example, a sudden breakdown of a production-line can be distributed to all members of a supply chain concerned as a so-called alert.

The second building block, process orientation, aims at coordinating all the activities involved in customer order fulfilment in the most efficient way. It starts with an analysis of the existing supply chain, the current allocation of activities to its members. Key performance indicators can reveal weaknesses, bottlenecks and waste within a supply chain, especially at the interface between its members. A comparison with best practices may support this effort. As a result, some activities will be subject to improvement efforts, while some others may be reallocated.

Advanced planning – the third building block – incorporates long-term, mid-term and short-term planning levels. Software products – called Advanced Planning Systems – are now available to support these planning tasks. Although an Advanced Planning System (APS) is separated into several modules, effective information flows between these modules should make it a coherent software suite. Customizing these modules according to the specific needs of a supply chain requires specific skills, e. g. in systems and data modelling, data processing and solution methods.

APS do not substitute, but supplement existing Enterprise Resource Planning (ERP) systems. APS now take over the planning tasks, while an ERP system is still required as a transaction and execution system (for orders).

2.1.1.4 Relating SCM to Strategy

According to Porter, 1998 a “strategy is the creation of a unique and valuable position, involving a different set of activities.” A company can obtain a unique and valuable position by either performing different activities than its rivals or by performing similar activities in different ways [9, 18].

Now it should be clear that a favourable SC strategy always has to be specific in considering a SC’s potentials. Copying recipes drawn from benchmarking studies or an analysis of success factors may be a good starting point but will not result in a unique and valuable position. In any case, a SC’s strategy will guide the specific design of building blocks best serving a SC’s needs.

2.1.1.5 Foundations

For operating a supply chain successfully, many more ingredients are needed than those that have been reported in the literature in recent years in subjects like

- logistics and transportation,
- marketing,
- operations research,
- organizational behaviour, industrial organization and transaction cost economics,
- Purchasing and supply, etc.

2.2 Quality Management and Its Application in Supply Chain

2.2.1 Theories and Trends in Quality Management

In many literatures quality management is strongly integrated with suppliers/supply chain. The fourth item of Deming's (1986) 14 points suggests in his book 'Out of the crisis': "Move towards a single supplier for any one item on a long-term relationship of loyalty and trust" [42].

Zhihai Zhang (1963) in his research on 'Implementation of total quality management' the second quality practice is supplier quality management which says companies must established long-term cooperative relations with suppliers, give due attention for quality in selecting suppliers, always participates in supplier activities related to quality, always gives feedback on the performance of suppliers' products and regularly conducts supplier quality audit [44].

In Crosby's (1995) book: "Quality without tears", he writes about this operation: "Suppliers are educated and supported in order to ensure that they will deliver services and products that are dependable and on time" [40].

Therefore, the above literature's emphasized supplier impact on quality management and organizational performance. However, the quality management concept is always focused on only one organization, which is bordered inside a single company, taking into account the direct suppliers but not the supply chain as a whole.

The development of the ISO standards reveals that quality management has expanded from the evaluation and selection of suppliers to the control of related processes, from single

company-oriented to throughout supply chain-oriented. Figure 2.6 illustrates the developing trend of quality standards -- from single-company to across many companies.

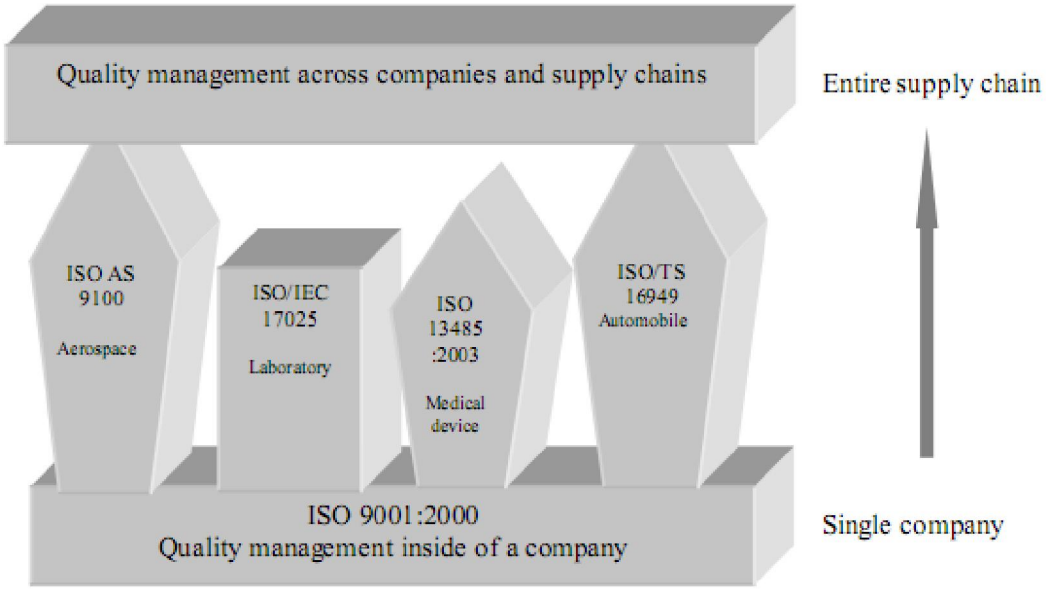


Fig. 2.6 Development trend of quality standards [42]

The requirements for quality express the needs or translate the needs into a set of quantitatively or qualitatively stated requirements for the characteristics of an entity to enable its realization and examination [42]. The entity has been defined as the product, process and system, and the quality requirements are represented as the specification, process capability and system standard, e.g. ISO 9000 Series. But quality requirements, quality assurances and the controls of cross-company activity related to a supply chain still call for a great deal of research. Figure 2-7 shows the quality management objects in development.

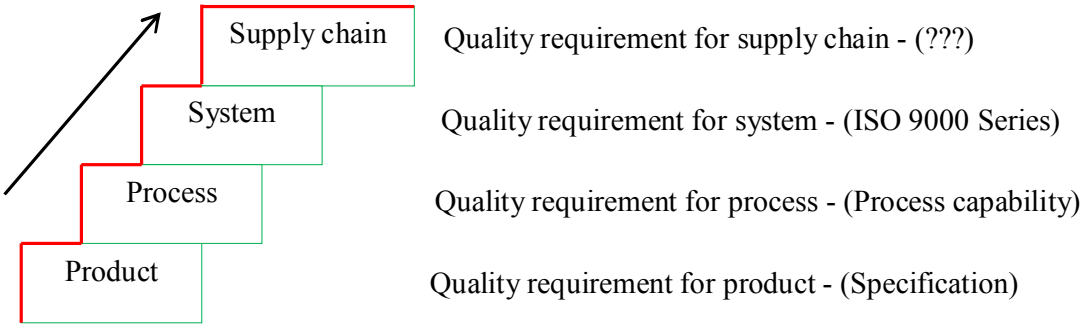


Fig. 2.7 Quality management objects in development

2.2.2 Quality Management Role in Supply Chain

As Ismail Sila (2006) said, companies still have to focus on internal quality issues, but the external component of quality now has to be managed carefully as well. A first step in the direction of QM in supply chains can be seen in the way companies manage quality with direct partners in their supply chains [17].

C. J. Robinson 2005 and M. K. Malhotra stated: "The quality practices must advance from traditional firm centric and product-based mind-sets to an inter-organizational supply chain orientation involving customers, suppliers, and other partners" [31].

In the early stage, products were not very complex and hence companies could manufacture them by their own. In that time "quality challenges were predominantly specification or process led and linked to equipment being unable to produce components and products of quality desired by customers to a desired specification in a reliable fashion. This was largely an enterprise challenge". But now the challenge is changed and the quality of a product or service depends not only on a single firm rather each stage in the value chain [17, 27, and 40].

Different researchers have different arguments on quality management of supply chain in manufacturing firms. Quality issues can cause a tremendous disaster for complete supply chain by breaking on going production. Once a supply chain is interrupted, it is extremely difficult to back in order.

A study at Georgia Tech School of Management found out that "from 1989 to 1998 supply chain incidents caused company stock value to drop 20 per cent over a 180-day period, more than any other external or internal cause"[16].

On the other hand there are a lot of researches that emphasized the importance of managing quality on the entire supply chain. Zhihai Zhang (1963) in his research on implementation of TQM states "Quality management is not like business process re-engineering (BPR): they focus on small, incremental improvement but not on Tremendous, radical or monumental breakthrough." In addition, according to research by Best Practices LLC [Best 2005], the company's savings from their largest quality project for the supply chain ranged from $10,000 to a height of $50 M. The average savings are $ 5 M [40].

Therefore, as stated above competition has been shifted from single firm level to supply chain and no company can exist alone in today's dynamic market by satisfying the ever changing

customer needs. This shows the borderless economic system is becoming a reality. So, the best weapons for organizational survival and successful competition in the 21st century are product or service quality. Quality is an industry's only insurance that it can compete successfully, whether in regional or world markets. This study has its own contribution to Ethiopian manufacturing industries to manage quality in their supply chain and show its impact on organizational performance.

2.2.3 Similarity and Difference between SCM and TQM

Total quality management (TQM) and supply chain management (SCM) have both played an increasing role in strengthening organizational competitiveness. In the continually changing global market, quality products alone are no longer enough. New challenges now include a focus on supply to determine the right time and place for product delivery (Chin et al., 2004; Robinson and Malhotra, 2005) [2].

The comparison includes a discussion of the philosophical perspectives, goals, integration, and evolutions of the two approaches. It is not always easy to implement either TQM or SCM on its own. Hence, the difficulties and risks increase when they are integrated. Understanding the conceptual similarities and differences of both approaches however, could improve the conditions for integrated implementation by achieving synergy and avoiding failure.

Philosophical Perspective:

TQM has been defined in many ways, particularly as a management philosophy Perry and Sohal, 2001 “that encourages cost reduction, the creation of high quality goods and services, customer satisfaction, employee empowerment, and the measurement of results”

Similarly, SCM could also be understood as a management philosophy. For instance, Lummus and Vokurka 1999, states that “SCM is an integrating philosophy to manage the total flow of a distribution channel from supplier to ultimate customer” [21, 28, 35].

Goal:

Ultimate Goal: Both TQM and SCM aim to achieve customer satisfaction. There are many strategies to accomplish this ultimate goal. Basically, customers require better product quality, faster delivery and cheaper costs, or quality-delivery-cost (QDC). Organizations must meet these requirements to achieve customer satisfaction.

Primary Goal: Crosby (1984) defined quality as defect avoidance. The British Standards Institute (BSI, 2000) EN ISO 9001: 2000 defined quality as the degree to which a set of

inherent characteristics fulfils requirements. TQM focuses more on quality conformance by aiming to deliver error-free products and services.

Unlike TQM, SCM basically satisfies customers in terms of delivery or time-based performance.

Although TQM and SCM share the same ultimate goal, which is customer satisfaction, their primary goals are different, as implied by the emphasis on "quality and supply." Better quality and a faster delivery always lead to lower costs.

Origin and Evolution:

From Quality Inspection to TQM: Quality management (QM) first focused only on quality inspection, and then included QC, quality assurance (QA) and finally TQM. The traditional QM approach was reactive and result-oriented, whereas the modern approach to QM is broader and now also emphasizes quality at source or process control, at every stage, to prevent any errors that could cause defects. The latter is a proactive process-oriented approach (Mehra and Agrawal, 2003) [2, 23].

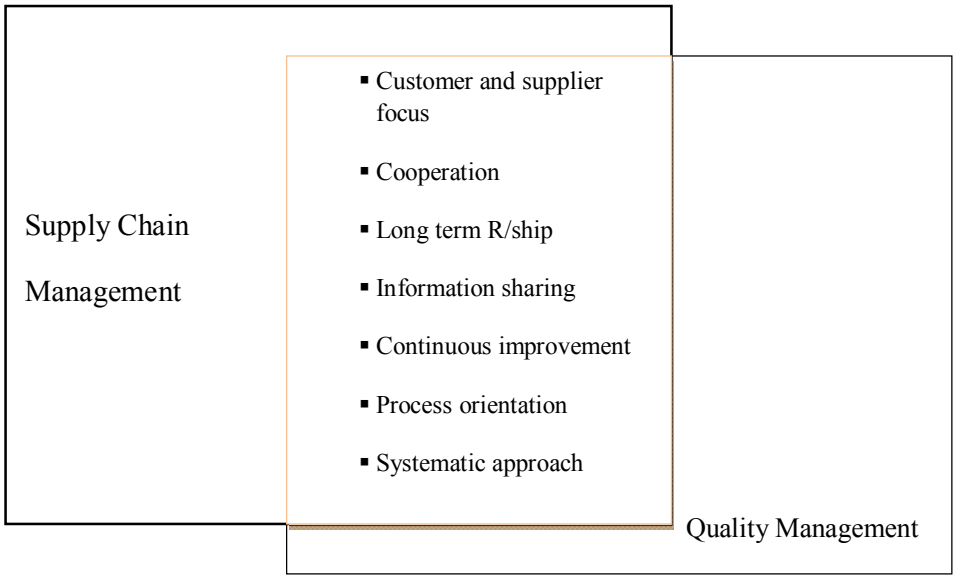


Fig.2.8 Overlapping features of SCM and TQM [2, 20]

From Logistics to Seamless SCM: SCM first appeared in 1982. It originated from the way in which Toyota managed relationships with suppliers and customers (Cox, 1999) and then it shared many common practices with Toyota's JIT [2]. Initially, SCM focused on logistics. After that, its evolution was still along the lines of physical distribution. The wider scope encourages synergy and cross-functional collaboration among all partners: customers, suppliers, marketing, purchasing, production, and logistics.

It could be observed that the stages within the SCM maturity levels started when a stronger relationship developed among the internal functions. Therefore, since SCM starts from a weak coordination among the internal functions, it matures into an ultimate integration among external business partners. Ideally, the entire supply chain should be viewed as a single system, or the so-called "seamless supply chain" (SSC), which is defined as "the state of total integration in which all players think and act as one" (Towill et al., 2002,). If TQM represents a superior QM, SSC could be a superior form of SCM [2, 23, 29].

Table 2.1 Similarities and differences between TQM and SCM

Concept	TQM	SCM
Perspective (example)	Management philosophy and large-scale management system	Management philosophy and large-scale management system
Original function	Quality inspection	Logistics
Evolutional stage	Inspection – QC- QA-TQM!	Logistics- SCM- SSC
Maturity stage (example)	(1) Unaware (2) uncommitted (3) initiator (4) improver and (5) achiever	(1) Baseline (2) functional integration (3) internal integration and (4) external integration
Ultimate goal	Customer satisfaction	Customer satisfaction
Primary goal	Specification-based performance or quality (Q)	Time-based performance or delivery (D)
Ultimate integration	Both internal and external Integration	Both internal and external Integration
Primary integration	Internal participation (executives and employees)	External partnership (suppliers and customers)

(Source: Assadej Vanichchinchai and Barbara Igel, 2009)

2.3 Supply Chain Quality Management

2.3.0 Introduction

Kuei and Madu, 2001 defined supply chain quality management (SCQM) with three simple equations where each equation represents the letters that make up SCQM. The definition is as follows:

- SC=a production–distribution network;
- Q=meeting market demands correctly, and achieving customer satisfaction rapidly and profitably; and
- M=enabling conditions and enhancing trust for supply chain quality.[5]

Supply chain management (SCM) and total quality management (TQM) are two of the important tools that manufacturing companies used to achieve competitive advantage. Some of the important capabilities that these companies seek to acquire through the use of these tools to be able to compete effectively include quality, efficiency, and innovation. Quality is an important factor in the value-adding process involved in the production and delivery of products along the supply chain. The production of defect-free components and parts that meet the requirements of customers along the supply chain is critical for the quality of the final products. Sustaining quality efforts throughout the chain also has significant implications for reducing costs, Forker et al., (1997). In addition, by making QM an integral element of the supply chain, companies can avoid being simply reactive to the requirements of their supply chain customers and can strive to meet their demands more proactively Love et al., 2003 [2, 17, 42].

Each entity in a supply chain is both a supplier and a customer. Thus, it is important to have a customer focused corporate vision in place while striving to implement the TQM and SCM practices effectively both upstream and downstream. This customer driven vision can produce a number of competitive advantages for the supply chain by helping improve productivity, reducing inventory and cycle time, and boosting customer satisfaction, market share, and profits [17, 14, 44].

According to Ross (1998), important changes in the business environment shifted the focus to supply chain quality. He said that, there were three general trends causing these changes. First, TQM focused on the improvement of quality within individual organizations. Since companies received products or services from their upstream supply chain partners and delivered them to their downstream chain partners, it became obvious that companies had to

expand their quality initiatives to other partners in the supply chain to realize the full potential of quality improvement. A second trend evolved out of the deregulation in the transportation sector. Companies that were simply producers or transportation specialists now recognized that they could serve a bigger market by offering value-added channel services. To take advantage of the new markets, these companies needed to have a better understanding of supply chains and focus on service quality. The last trend that led to an increased emphasis on supply chain quality was triggered by the decision of many organizations not only to focus on internal logistic activities but also to expand these activities outside their organizations. This expansion of logistics activities was necessary, because management concepts such as just-in-time (JIT) and supplier management or new technologies such as bar coding required active involvement of supply chain members (Ross, 1998). Thus, all these trends had an influence on SCQM.

Companies still have to focus on internal quality issues, but the external component of quality now has to be managed carefully as well. A first step in the direction of QM in supply chains can be seen in the way companies manage quality with direct partners in their supply chains. However, this practice must be expanded to include the entire supply chain. Thus, SCQM can be seen as "the latest stage in the total quality movement" (Ross, 1998). It can be defined "as the participation of all members of a supply channel network in the continuous and synchronized improvement of all processes, products, services, and work cultures focused on generating sources of productivity and competitive differentiation through the active promotion of market winning product and service solutions that provide total customer value and satisfaction" (Ross, 1998). This definition integrates the elements of quality management into SCM. Since a product flows from one supply chain member to another, its quality is influenced by all members in the chain. The supply chain members also affect the quality of the information flows and the quality of processes used along the chain. Note that, in this study, the term SCQM refer to all quality improvement activities that take place within a supply chain [5, 17, 38, 20].

Despite its importance and implications for supply chains, SCQM has not been sufficiently covered in the literature. In the QM literature, the focus has mainly been on the practices and performance of the producers of end products. The SCM literature, however, has mostly analysed the relationship between supply chain integration and levels of inventory Forker et al., 1997. Nonetheless, several previous studies were conducted that analysed QM in supply chains. Using survey data from manufacturing companies, Forker et al. (1997) found that, when properly implemented in the upstream portion of the supply chain, QM had a very

strong effect on supplier quality performance, indicating the importance of QM in the value chain. A study by Romano and Vinelli, 200, showed that downstream supply chain quality performance could also be improved by implementing QM practices across the chain. This study analysed both upstream and downstream supply chain effects of this QM practices in Ethiopian manufacturing industries context.

2.3.1 Supply Chain Quality Management Based on the TQM Principles

2.3.1.1 Leadership

One of the fundamental aspects of leadership is the ability to foresee desired future states or goals and have the influence to bring about changes in people and systems in pursuit towards those goals. This aspect is applicable not only at the top management, but also to all levels of the supply chain: i.e. supply chain, organizational, functional and individual. Therefore, the effectiveness of quality management depends on effective leadership because quality effort can get actual effect only with the recognition and support of the leadership. In supply chain circumstance, the core enterprise play as the leadership since it establishes the development strategy and operation targets of supply chain affect the actual efficiency and effectiveness of the quality effort of all the other members. Therefore, the core enterprise must act as leadership to consider adequately the needs and expectation of the other members, establish a clear, realizable and coincident holistic target, and then lead and inspire the other members to strive jointly for the target [15].

Classification of Leadership

Leadership in an organization can be defined over four levels: supply chain level, organizational (corporate), process (functional) and individual. The higher level provides strategic direction and the lower levels perform the execution of those strategies, in addition to developing their own sub-level strategies.

Leadership at the **supply chain level**: Leadership at any level primarily relates to having influence on something else: people or systems. The ability to influence in a supply chain depends very much on communication and organizational structures. Communication is easier within a particular level or with adjacent levels of an organizational structure as compared to un-connected levels. In the case at hand, communication would be easier and accurate within an organization than between two organizations. This would perhaps be the case even if the organizations do not have a TQ or similar culture. Leadership at the supply chain level therefore forms the link between the organization and the supply chain.

Leadership at the **organizational level**: Also termed as corporate leadership, it is shouldered by the top management of a firm - the board of directors, CEOs, presidents etc. At this level the function of leadership is to shape the organization. This can be in the form of development of a specific culture, reorganizing organizational structure, developing corporate strategies and goals etc. On the whole, corporate leadership deals with the overall present and future states of the organization.

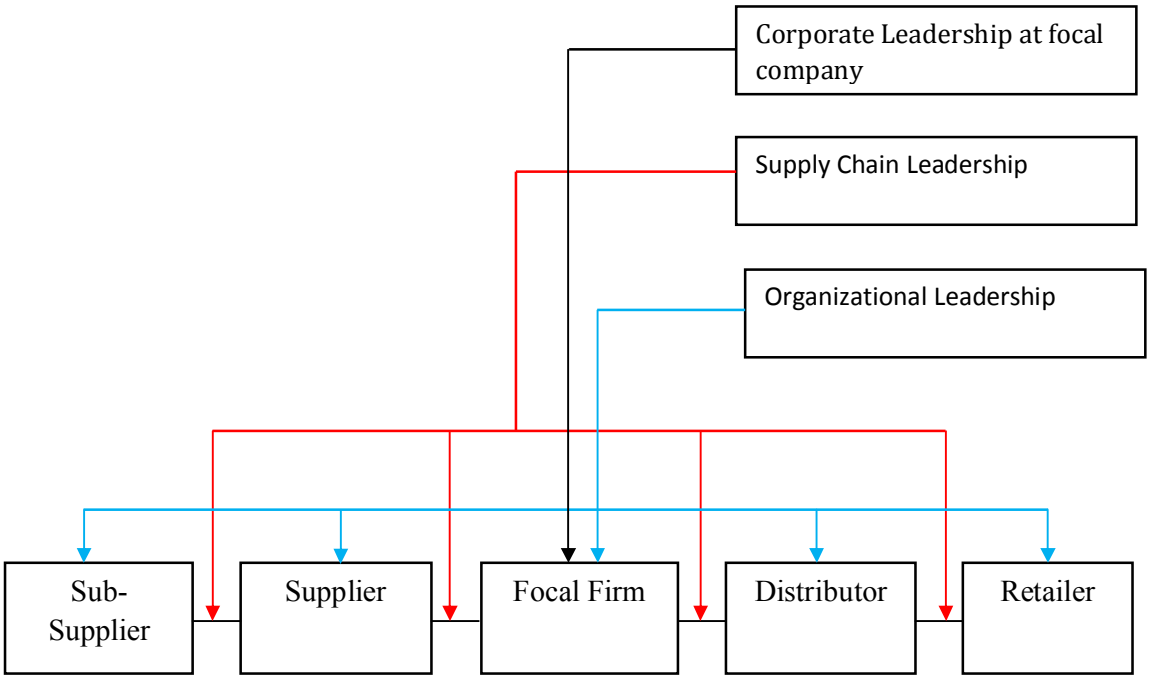


Fig. 2.9 Schematic diagram of Leadership in a SC (source: Hemanshu J. Hemani, 2004)

Leadership at the **functional level**: This level may consist of upper to middle management personnel of an organization. At this level, the primary leadership functions of such personnel in their respective departments are to manage the process level work and report to the top management. This level forms the top-down and bottom-up link between the process level activities and the corporate level. Leadership includes communicating organizational vision to lower levels, formulating plans for development and deployment of operational strategies, developing teams, maintaining functional excellence etc. From the bottom-up perspective, the main leadership functions include maintaining accurate picture of the process level situations and communicating it to the corporate level.

Leadership at **individual level**: Leadership at individual level should ideally be sustained by the organizational culture rather than depend on the traits of individuals. The culture should enhance leadership in such a way that every employee has the vision, empowerment, intuition,

self-understanding and value congruence in his/her respective sphere of work. At the individual level, leadership is the function of personal capability and initiative in working towards a progressive and efficient work output and environment [11, 13, 15, 44].

2.3.1.2 Involvement of People

The exertion of enthusiasm and creativity of all the employees is the precondition of the actual effect of quality management. In supply chain circumstance, an up-and-coming excelsior work atmosphere should be established to inspire the enthusiasm and creativity of the employees of all the members. Each employee should understand his/her role and responsibility in the supply chain system, solve the problems forwardly as master ship, and learn the principles, skills and technologies of TQM and ISO9000 [15, 35].

2.3.1.3 System Management

The application of system approach in quality management is to view the quality management system as a big and holistic system, identify and manage the sub-systems respectively. Then, the coordinated effect and mutual promotion among the sub-systems will make the whole effect greater than the sum of the improvement of each sub-system and improve the validity and efficiency of the realization of final targets. In supply chain circumstance, enterprise should confirm the mutual dependence relationship among the processes in supply chain system, break the boundary among supply chain members, construct and integrate the processes in supply chain system [25, 43].

2.3.1.4 Continual Improvement

Enterprise must improve the quality of product and service continually and reduce the cost to make customer satisfactory. In supply chain circumstance, the pressure of continual improvement is more and more pressing because the market competition is more and more hard. Not only the core enterprise but also the other members, such as suppliers, sellers, and logistics providers, must improve their product and service respectively so as to construct the continual improvement of products and services all over the supply chain process [13, 44].

2.3.1.5 Process Management

The focus of modern quality view is the process quality management but not the product itself of traditional quality view. It is the requirement of the quality management system of

ISO9004:2000 and the essential difference of modern and traditional quality view. In each step of supply chain, there are many correlative processes, such as procurement, logistics, production, inventory, selling, service, etc [33, 44].

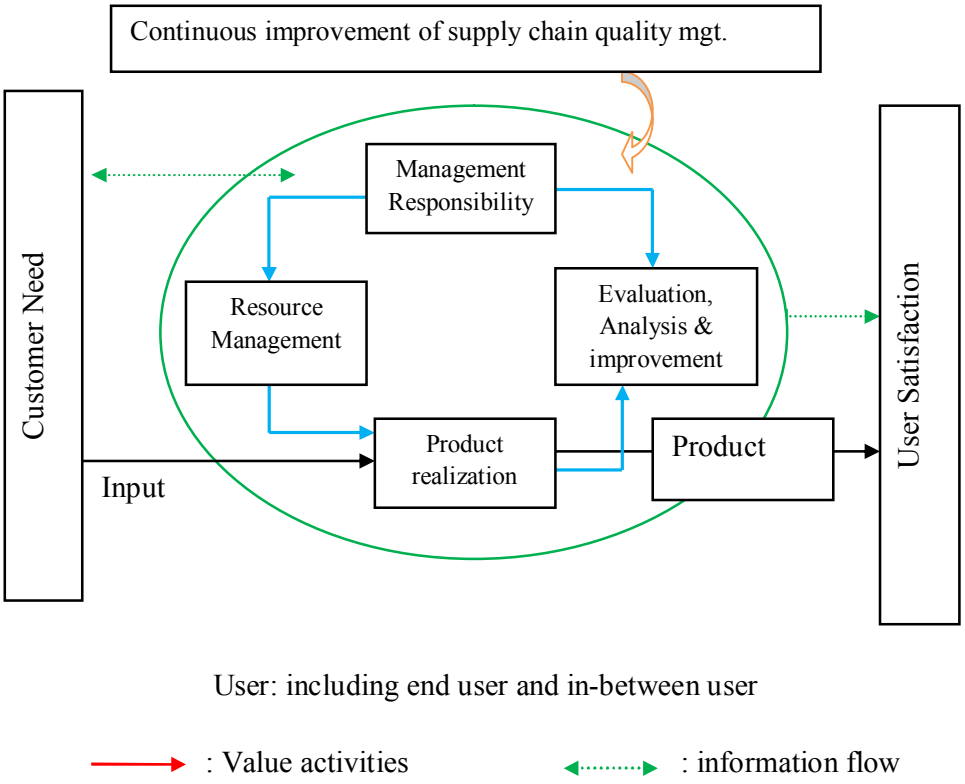


Fig. 2.10 Supply chain quality management system based on the principle of process management (source: Chinho Lin 2005)

2.3.1.6 Factual Approach to Decision Making

The sufficient and adequate data and information is the foundation of making right and effective decisions. Up to now, many enterprises have begun to collect and deal with all kinds of data and information by utilizing many advanced information technology, e.g., EDI, MRPII, ERP, Intranet/Extranet/Internet, so as to provide foundation for making effective decision. In supply chain circumstance, enterprise should collect data and information of not only itself but also the other members of supply chain to record and analyse the current operation situation of each member. Therefore, the potential problems in any step of supply chain can be found duly according to the results of data analysis. Then, the corresponding correct and timely decision can be made to avoid or rectify the problem [15].

2.3.1.7 Mutually Beneficial Supplier Relationships

Organization and its supplier are mutually dependent. Maintaining the mutually beneficial relationships between them can improve the ability of creating value both of them. In supply chain circumstance, the product quality is performed and ensured by all the members of supply chain because the production, sales and service process must be performed by all the members. Therefore, the task of supply chain quality management is not only to establish the product inspection system and comprehensive evaluation system of suppliers, but also to strengthen the mutual beneficial partner relationships with suppliers. The core enterprise must realize the following activities:

- Identify and select the main suppliers, reduce the scale of supply system, and realize small supply base management;
- Investigate the requirements of customers and develop new product jointly with suppliers;
- Share information, technology, and resource with suppliers;
- Admit the improvement and achievement of suppliers;
- Take joint improving activities with suppliers;
- Ensure the conformity of quality system between core enterprise and the other members, including basic conformity (e.g. program files, technology specification, process interface) and advanced conformity (e.g. quality target, quality policy, and quality culture).

In fact, there is a new trend in the international practices of supply chain management. Namely, more and more large-scale enterprises have pay attention to the management and development of suppliers, e.g. providing capital, technology, human resource, equipment and training for suppliers, sending quality teams to help suppliers improve their processes, and sharing the yields of continual improvement with suppliers [11, 44].

2.3.1.8 Supplier Quality Management

In this study, the term supplier quality management (SQM) is used to describe various management efforts for managing supply function through establishing close and long-term buyer-supplier relationship in order to improve the overall organisational performance. Previous study has identified three critical areas of a SQM system, namely supplier selection, supplier development and supplier integration [28, 38, 40]. Table 2.2 describes the characteristics of these components.

Supplier Selection

A SQM system requires a fundamental shift in buyer-supplier relationship, from an arm's length model to the long-term business partnership. This makes companies select suppliers based on quality rather than price or schedule. According to industrial interviews, many local leading companies always select a supplier who is customer-oriented; because customer oriented thinking lets a company improve continuously to satisfy customer needs.

A customer-oriented supplier should have the following characteristics. These characteristics include a reliable quality assurance system (Saraph et al., 1989); effective control of operations for maintaining expected quality (Hahn et al., 1990); build in quality in day-to-day activities (Curkovic and Handfield, 1996); continuous quality improvement; awareness of quality policy within the company (Landeros et al., 1995); and the international quality certifications (Curkovic and Handfield, 1996), such as the ISO 9000, the BS 7850, the QS 9000 and the Malcolm Baldrige Quality Award criteria [39].

Supplier Development

Besides supplier selection, supply development is another critical area in a SQM system. Supplier development is group of activities taken to improve supplier quality with assistance to operations improvement in supplier side. These activities involve evaluating supplier, recognizing supplier achievement with awards and certifications, providing training and technical assistance and establishing effective communication between member organizations. Furthermore, companies must demonstrate a proactive attitude and commitment to the supplier development activities [39].

Table 2.2 Characteristics of critical areas in a SQM system

Critical area	Characteristics
Supplier selection	Criteria for selecting a supplier by evaluating its ability to provide quality products
Supplier development	Processes taken to identify, measure and improve supply quality, and assist the continuous improvement on operations in supplier side
Supplier integration	Joint efforts conducted by both buyer and supplier to improve quality continuously

Supplier Integration

The third critical area in a SQM system is supplier integration that improves quality by conducting joint development activities with suppliers. In contrast to supplier development, supplier integration is a mutual activity. Both buyer and supplier contribute to this activity. The dominant attributes in supplier integration include mutually sharing strategic information and benefit establishing long-term buyer supplier relationship with mutual trust. Therefore, both parties (buyer and supplier) will conduct joint problem solving activities to improve the quality in both parties [39].

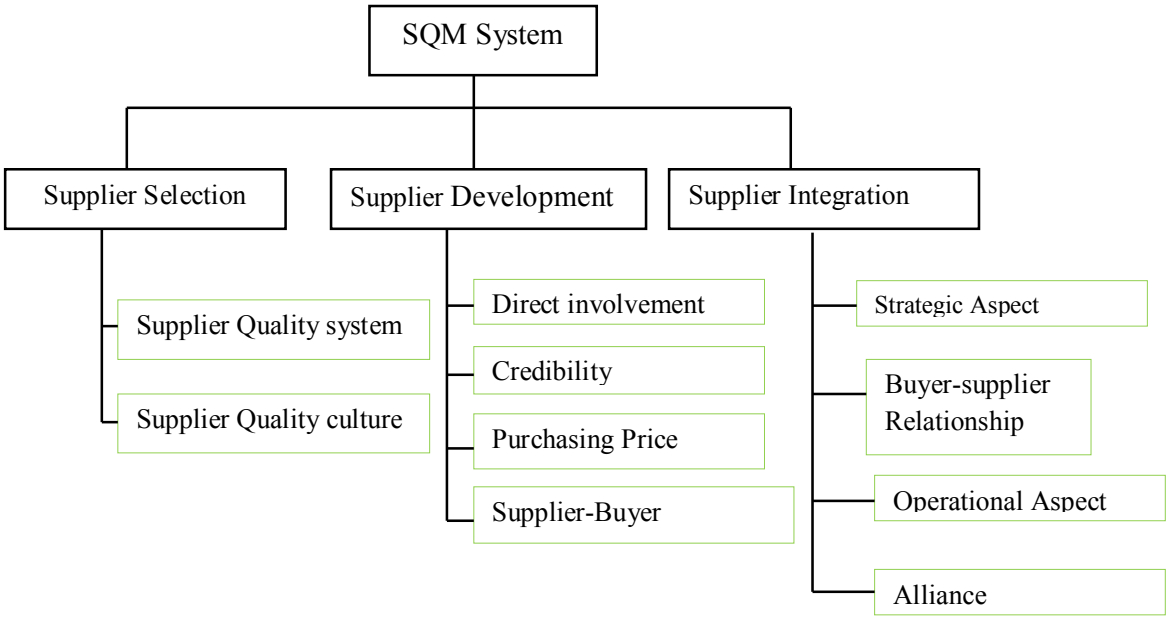


Fig. 2.11 Critical constructs in a SQM system [39]

2.3.2 Benefits of Supply Chain Quality Management

The benefits of successful supply chains are direct and measurable: lower product costs, lower inventories, higher quality, faster response times, fewer stock outs, and higher on-time deliveries. Other benefits that are more difficult to measure and verify include increased market share, improved customer satisfaction, increased customer retention, and a more competitive position overall. In speaking of global strategies, Edward Davis and Robert Spekman suggest that "the extended enterprise is really about creating a defensible long-term competitive position through strong supply chain integration, collaborative behaviour's, and the deployment of enabling information technology."[30]

2.4 Future Trends in Supply Chain Management

O'Marahm 2007: reports that the supply chain profession is experiencing a period of rapid change and increasing influence. It has been studying and encouraging this movement for almost 20 years. The Supply Chain Top 25 for 2007 (table 2.3) lists in which large, public companies have adopted this shift and in course turned their focus to supply chain management in order to achieve competitive differentiation, financial return and demand-driven operational and innovation excellence.

Table. 2. 3 The supply chain top 25 for 2007

1.Nokia	14. Johnson & Johnson
2.Apple	15.Pepsico
3.Procter & Gamble	16.Johnson Controls
4.IBM	17.Texas Instruments
5.Toyota motor	18.Nike
6.Wal-mart Stores	19.Lowe's
7.Anheuser-Busch	20.GlaxoSmithKline
8.Tesco	21.Hewlett-Packard
9.Best Buy	22.Lockheed Martin
10.Samsung Electronics	23.Publix Super Markets
11.Cisco Systems	24.Paccar
12.Motorola	25.Astra Zeneca
13.The Coca-Cola Company	

(source: Michelin Juliana, 2009)

Wisner et al 2005 acknowledge that businesses are beginning to realise the benefits and challenges that accompany an integrated supply chain. As competition intensifies, products, technology and customers change, the priorities for the supply chain must also change. These changes will require supply chains to become more flexible in order to respond quickly to changes in the business environment.

Hugo et al 2004 and Wisner et al 2005 have identified the following trends that are emerging as driving forces in supply chain management: [24]

2.4.1 The Knowledge Revolution

Hugo et al 2004, acknowledge that information containing relevant facts about competitors and suppliers is easily available using electronic data transfer and internet communications

media. Decision making based on facts is replacing the habitual negotiation methods. In the future, information and technology are expected to continue playing a major role in SCM decision making.

Wisner et al 2005 concur that with all the advances and improvements in communication technology, manufacturing and transportation, increasingly more businesses worldwide have the capability to produce and sell high-tech components and products faster as demand develops.

2.4.2 Continuous Improvement Requirements

Continuous improvement refers to the continuous quest for product and process improvement through a series of small progressive steps. This is an integral part of both JIT and TQM.

Hugo et al 2004, maintain that intensified competition and customer demands in the market require continuous improvement across all major performance categories. These include continuous improvements in internal and external cycle time, cost, quality and delivery performance. In addition, the reduction of time, especially during product and process, will become increasingly important.

2.4.3 Lean Thinking

The majority of businesses are implementing the lean management way to ensure successful implementation of the SCM approach. In the beginning, lean principles and practices were used by the Japanese automotive industry (Toyota). These practices are generally associated with manufacturing. However, lean thinking is relevant to SCM in both manufacturing and service providers (Hugo et al 2004; Stevenson 2007).

2.4.4 Cycle and Response Time

According to Plenert (2007), time is vital in a global strategic network, because it is the key to competitive success. Supply chain management, together with lean methodologies, reduces cycle time and therefore increases response time. Wisner et al (2005) state that time value is created when customers receive their products at the right time. In this way, for example, the transportation function can create time value by determining how quickly products are delivered and how long they are held in storage, prior to delivery.

2.4.5 A Values-Based Infrastructure:

Achieving SCM objectives to the advantage of all the businesses involved in a supply chain is tough. It becomes particularly difficult when a large group of ethical structures across the world are involved.

2.4.6 The Greening of Supply Chain Management

Wisner et al (2005) acknowledge that producing, packaging, moving, storing, repackaging and delivering products to the final customer can pose a significant threat for the environment in terms of packaging that has to be discarded, carbon monoxide emissions, noise, traffic congestion and other types of industrial pollution. Subsequently, firms and their supply chain partners are working harder to decrease environmental difficulties and are adapting a more proactive approach to reducing negative environmental consequences in their supply chains. Supply chain management is an area in which environmental issues can have a direct impact. Various authors have identified the following concerns supply chain professionals need to address:

- the recovery, recycling and reuse of materials and waste products
- the safe disposal of waste products
- supplier selection policies to support businesses that comply with environmental standards
- the safe testing of products and materials
- concern about noise, spray, dirt and vibrations in the operation of transporting facilities

Supply chain professionals will therefore be required increasingly in the future to procure environmentally preferable products that:

- contain fewer toxic materials
- minimise waste
- contain recycle content
- contain plant-based materials

2.4.7 Virtual Supply Chain Management

Changes in the international markets are forcing businesses to continually redesign and reconstruct their supply chains in order to satisfy customers. As technology changes, so too will products and services. Hence the time to pull products and services through the supply chain to reach the ultimate consumers must be fast. Stevens (2006), states that this requires a responsive, agile supply chain that can adapt quickly to changes in the international markets and whose span of control expands outside the four walls of the factory, deep into the supply base.

Virtual SCM includes the enormity of sharing knowledge in creating value, where EDI, email, the internet and the World Wide Web play a crucial role. This is possible through the establishment of intra-organisational communication in which all relevant information is available on intranet facilities. Information between businesses is shared via inter-organisational communication using the internet (Hugo et al 2004).

2.5 Supply Chain Risk

However, risk itself within the context of the supply chain may be categorized in a number of dimensions:

- Disruptions to the supply of goods or services, including poor quality, which cause downtime and consequent failure to satisfy the customer's requirements on time.
- Volatility in terms of price may result in difficulties in passing on price changes to the customer and potentially have consequences in lost profit.
- Poor quality products or service, either upstream or downstream, may impact on the level of satisfaction of the customer with consequences for future revenues and possibly more immediate claims for financial compensation.
- The reputation of the firm, often generated by issues not directly related to the supply chain itself, may pose risks. Inadvertent comments by senior executives or the failure to endorse certain protocols may damage the reputation of the organization.

2.5.1 Models and Methods for Supply Chain Risk Management

Although supply chain engineering methods have advanced rapidly in sophistication over the past two decades, the application of modelling and methods to explicitly consider and manage uncertainties and risks in supply chain activities are required for firms to advance to the next

level of sophistication. The ability to identify, assess, manage, mitigate and control the impact of disruptive events within the extended supply chain sits at the heart of comprehensive supply chain risk management. Supply chain risk management models may be categorized into four categories:

1. Deterministic analytical models, which include mathematical programming models (e.g. linear, nonlinear, integer, dynamic programming). Applications to supply chain include scheduling production, distribution planning, raw material sourcing, facility location, inventory level setting, replenishment timing and order quantity specification, and resource balancing.
2. Stochastic analytical models, where at least one of the variables involves uncertainty, and is assumed to follow a particular probability distribution. Examples of supply chain applications include inventory and production management problems, where demand and yield are represented as random variables respectively.
3. Economic models, which tend to be focused on buyer-supplier relationships. These models have a traditional base in determining the financial risks to either sellers or buyers, given various assumptions.
4. Simulation models, which are (usually) data driven representations facilitated by sampling from specified probability distributions.

2.6 Performance Measurement System

2.6.1 What is Performance Management?

There are a wide range of definitions for performance objective, performance goal, performance measure, performance measurement, and performance management. To frame the dialog and to move forward with a common baseline, certain key concepts need to be clearly defined and understood, such as [22]:

Performance Objective: This is a critical success factor in achieving the organization's mission, vision, and strategy, which if not achieved would likely result in a significant decrease in customer satisfaction, system performance, employee satisfaction or retention, or effective financial management.

Performance goal: A target level of activity expressed as a tangible measure, against which actual achievement can be compared.

Performance measure: A quantitative or qualitative characterization of performance.

Performance measurement: A process of assessing progress toward achieving predetermined goals, including information on the efficiency with which resources are transformed into goods and services (outputs), the quality of those outputs (how well they are delivered to clients and the extent to which clients are satisfied) and outcomes (the results of a program activity compared to its intended purpose), and the effectiveness of government operations in terms of their specific contributions to program objectives.

Performance management: The use of performance measurement information to effect positive change in organizational culture, systems and processes, by helping to set agreed-upon performance goals, allocating and prioritizing resources, informing managers to either confirm or change current policy or program directions to meet those goals, and sharing results of performance in pursuing those goals.

Output measure: A calculation or recording of activity or effort that can be expressed in a quantitative or qualitative manner.

Outcome measure: An assessment of the results of a program compared to its intended purpose.

2.6.2 Performance Measurement Parameters

In 1978 and 1984, A.T. Kearney, Inc. established four stages of organizational sophistication in performance measurement of physical distribution activities. More specifically, this study shows the following four-stage classification scheme by taking Ethiopian firms as a case study [4]:

1. Stage I organizations: inactive; use simple measures (e.g. total cost) to assess system performance.
2. Stage II organizations: reactive; use measures of productivity to measure performance.
3. Stage III organizations: proactive; have meaningful goals; most use engineered standards to measure performance.
4. Stage IV organizations: exhibit completely integrated information, production, storage, transportation, and distribution systems, allowing for seamless communication across all supply chain functions.

In addition Christopher 1998, suggested that while there are many indicators of performance that can be deployed in an organization, there are a relatively small number of critical dimensions that contribute more than proportionally to success or failure in the market, which

he named key performance indicators (KPI). According to Bunte et al. (1998) (in marketing), performance indicators should relate to both effectiveness and efficiency of the supply chain and its actors. Van der Vorst (2000) (in logistics) makes a distinction between performance indicators on three main levels [14, 33]:

1. The supply chain level (e.g. product availability, quality, responsiveness, delivery reliability and total supply chain costs);
2. The organization level (e.g. inventory level, throughput time, responsiveness, delivery reliability and total organizational costs); and
3. The process level (e.g. responsiveness, throughput time, process yield and process costs).

Li and O'Brien (1999) (in manufacturing) proposed a model to improve supply chain efficiency and effectiveness based on four criteria:

1. Profit;
2. lead-time performance;
3. delivery promptness; and
4. Waste elimination.

The Supply Chain Council (2004), which developed the Supply Chain Operations Reference (SCOR) Model. This Model advocates a set of supply chain performance indicators as a combination of:

- reliability measures (e.g. fill rate, perfect order fulfillment);
- cost measures (e.g. cost of goods sold);
- responsiveness measures (e.g. order fulfillment lead-time); and
- asset measures (e.g. inventories) (Supply Chain Council, 2004).

Lai et al. (2002) distinguished three dimensions of supply chain performance in transport logistics:

1. service effectiveness for shippers;
2. operational efficiency; and
3. Effectiveness service for consignees.

Within these dimensions they identified four performance indicators:

1. responsiveness;
2. reliability;

3. costs; and
4. Assets.

Beamon (1999) (in manufacturing) suggested a system of three dimensions:

- resources (i.e. efficiency of operations);
- output (i.e. high level of customer service); and
- Flexibility (i.e. ability to respond to a changing environment).

This literature review shows that many efforts have been made to develop a performance measurement system (PMS) for various supply chains and organizations. Despite their importance, little attention has been paid in the literature to integrated PMS. As to some researchers thought there is no integrated measurement system exists in supply chains that combine different aspects of performance (e.g. financial and non-financial, qualitative and quantitative) into one measurement system: therefore, this study aim to fill this gap and to shows performance measurement in Ethiopian firm context.

The conceptual framework, described in the next Figure, consists of four main categories of performance measurement which are efficiency, flexibility, responsiveness and quality.

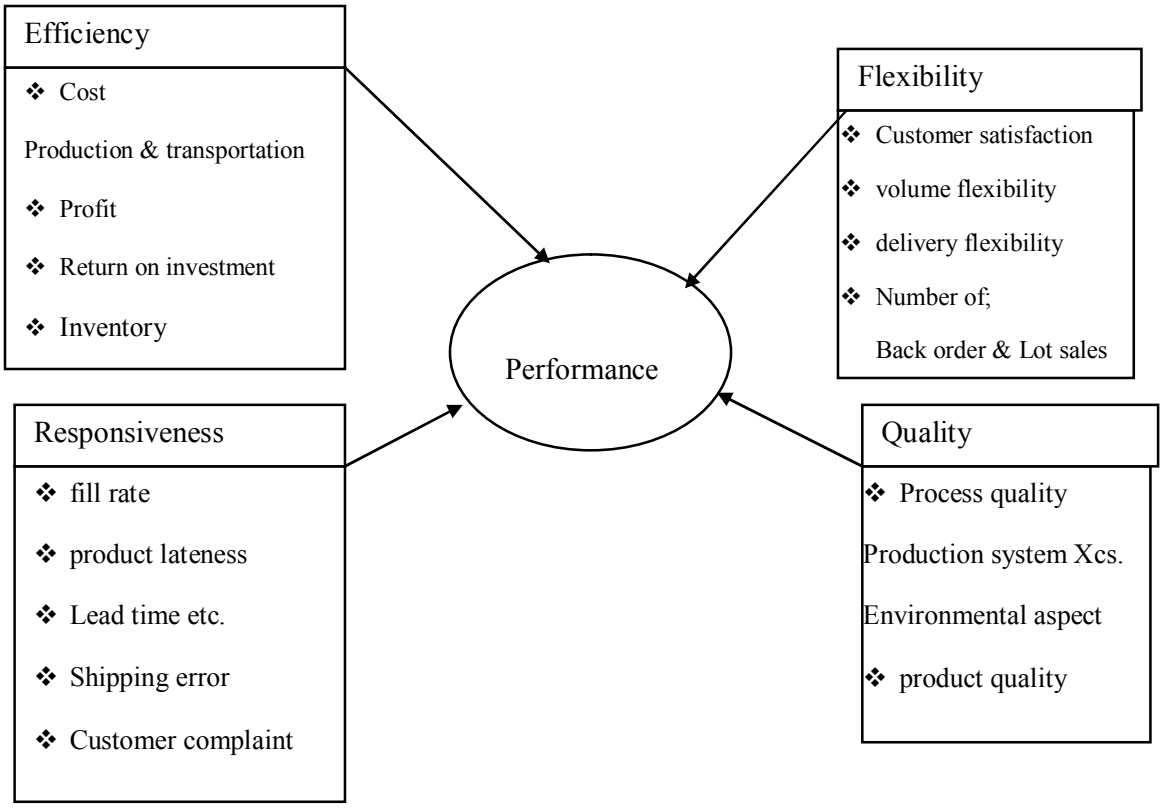


Fig. 2.12 Conceptual frame works of supply chain performance categories and indicators. (Source: Lusine H. Aramyan 2007)

Levels of Measurement and Scaling for Survey Analysis

Level of Measurement: In survey analysis there are different levels of measurements: nominal, ordinal, interval and ratio and so the treatment given to them here will be discussed. However, it is an important topic since the type of scale used in taking measurements directly impinges on the statistical techniques which can legitimately be used in the analysis.

Nominal scales: - Is the crudest of measurement scales, classifies individuals, companies, products, brands or other entities into categories where no order is implied. Indeed it is often referred to as a categorical scale. It is a system of classification and does not place the entity along a continuum. It involves a simply count of the frequency of the cases assigned to the various categories, and if desired numbers can be nominally assigned to label each category.

Ordinal scales: - It involves the ranking of individuals, attitudes or items along the continuum of the characteristic being scaled. From this scale the researcher knows the order of preference but nothing about how much more one (individual, attitude or item) is preferred to another. In addition, positional statistics such as the median, quartile and percentile can be determined.

Interval Scales: - It is only with an interval scaled data that researchers can justify the use of the arithmetic mean as the measure of average. The interval or cardinal scale has equal units of measurement, thus making it possible to interpret not only the order of scale scores but also the distance between them. However, it must be recognized that the zero point on an interval scale is arbitrary and is not a true zero. This of course has implications for the type of data manipulation and analysis we can carry out on data collected in this form. Most of the common statistical methods of analysis require only interval scales in order that they might be used. One of the methods used here is Likert scales. It is a psychometric scale commonly involved in research that employs questionnaires. It's what is termed a summated instrument scale. This means that the items making up a Liken scale are summed to produce a total score. In fact, a Likert scale is a composite of itemized scales. Typically, each scale item will have 5 categories, with scale values ranging from strongly agree to strongly disagree with neutral response at the middle.

Ratio Scales: - The highest level of measurement is a ratio scale. This has the properties of an interval scale together with a fixed origin or zero point. Ratio scales permit the researcher to compare both differences in scores and the relative magnitude of scores.

Chapter Three

The Global and Ethiopian Manufacturing Industry

3.1 Overview of Global Manufacturing Industry

Even if production of handicraft has existed for many millennia, modern-style manufacturing is generally regarded as beginning around 1780 with the British Industrial Revolution, period marking the introduction of mass production, improved transportation, technological progress, and the industrial factory system, spreading thereafter to Continental Europe and North America, and subsequently around the world.

Manufacturing, as branch of industry accounts one-quarter of world's economy, is a wealth creating sector of an economy, while service sector tends to be wealth consuming. Each production operation is a process of changing the inputs into outputs while adding value to the entity. In manufacturing system, one must differentiate value-adding operations from non-value adding operations, such as transporting, storing and inspecting. It is necessary to minimize, if possible to eliminate, the non-value adding operations. Manufacturing systems include series of activities like: planning, design, procurement, production, inventory, marketing, distribution, sales, and management. [1]

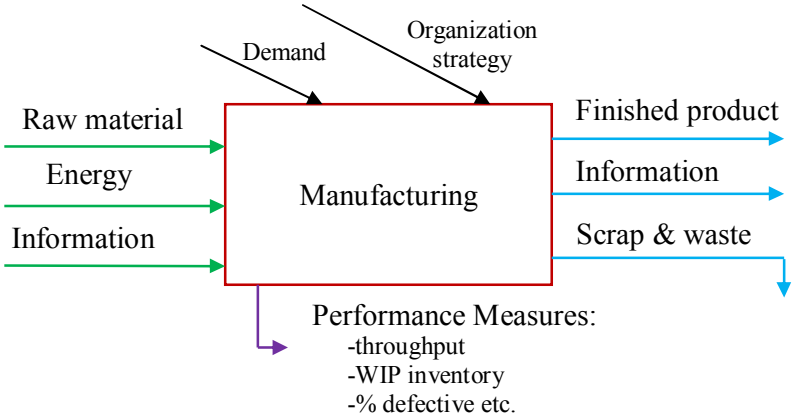


Fig. 3.1 General model of manufacturing system

3.1.1 Evolution of Manufacturing Paradigms

The manufacturing environment is in permanent change adapting to the customer demands, advances in information and automation technologies and economic trends. According to the Merriam-Webster dictionary a manufacturing paradigm can be defined as "a philosophical

and theoretical manufacturing framework of a scientific school or discipline within which theories, principles, laws, generalizations and experiments are formulated."

Before the 20th century, the craft production was the dominant type of production, characterized by skilled workers that used general purpose tools to produce exactly what the customers asked for, being the production level close to the one-at-a-time. The industrial revolution introduced machinery in production, helping in the first phase the craft production to be more productive, by using machinery to support some craftsman work.

In the beginning of 20th century, Henry Ford decided to build a car that everybody could own and drive. However, at that time most cars were customized for the client or built one at a time in limited quantities, following the craft production type. Based in the Taylor's theories, he introduced in 1913 at Highland Park plant in Michigan, the revolutionary concept of mass production, characterized by the production of the same product in large scale using a rigid assembly line to produce a car composed by identical interchangeable parts. [1]

The mass production model requires stability and control in the input variables, markets, and the labour force. In the 1970s and 1980s, these parameters became less stable, with common economic fluctuations, increase of the consumer power, homogeneity of the market eroded and start of the global competition. At this time the concept has been shifted from mass production to mass customization. And customers give due attention to product and service quality. This thesis address customer needs by formulating SCQM model.

3.2 Main Features of Industrialisation and Policy Environment in Ethiopia

3.2.1 Early Industrialization

Ethiopia has had a very long history of handicrafts production, but modern industry is of quite recent origin. Manufacturing started to develop in Ethiopia around the turn of the century with the emergence of a strong central government, political stability, the installation of the railway to Djibouti and the strengthening of Ethiopian foreign relations. The increasing settlement of foreign citizens from Armenia, Greece, Italy and India also brought entrepreneurial capacity. By 1927 there were about 25 factories in the country (which included at that time the current territory of Eritrea). These factories were in large majority set up by private entrepreneurs.

During the imperial era three consecutive five years development plans were launched to guide the economic policy. But industrial sector was small and characterized by production

for domestic market mainly to substitute imports. The role of government as a direct producer was limited and most of the 273 establishments (90.5%) were wholly privately owned. [39]

3.2.2 The Derg Regime (1974 – 1991)

In this period no significant expansion took place in the industrial sector during the 17-year regime. The participation of the private sector was discouraged through the imposition of capital ceilings and preference was given to government owned enterprises in the allocation of foreign exchange, market access, subsidies and the like.

In 1991the contribution of agriculture to GDP was 56.3% and of industry only 9.4 % (this had decreased from about 14% in the mid-80s).Furthermore, exports and imports also showed a declining trend; for example, the value of exports declined from 10.6% of GDP in 1980/81 to 5.5% in 1990/91. The impact of Ethiopia's period of command economy on industry has thus been one of stifling activities. The industrial sector has not expanded in any substantial way. Nevertheless, specific, especially protective, regulations may have been beneficial for certain sub-sectors, such as the ban on export of raw hides and skins.

3.2.3 Current Industrialization Development

The process of the development path of the current regime is similar to the Dergue regime, development starts with agriculture and expands to other sectors, particularly manufacturing. However, the development strategy of the current government operates under the free market environment which makes the role of the private sector more significant.

Despite the modest performance of the Ethiopian economy since 1991, no structural transformation of the economy was achieved and it remained on the whole very dependent on the agricultural sector. The main economic policy of the EPRDF was 'Agriculture Development Led Industrialisation' (ADLI), whereby the agricultural sector is considered to serve as the driving force for the rest of the economy.

Without much notice, the services sector has for the first time in the country's history overtaken agriculture as the largest segment of the Ethiopian economy. This reverses a centuries-long economic structure, wherein agriculture was the dominant sector, followed in a distant second place by the services sector, and lastly a very small industrial sector. The recent release of FY 2008/09 GDP statistics, however, revealed that the service sector is now clearly

at top, comprising 45.1 percent of GDP, followed by agriculture at 43.2 percent, and Industry at just 13.0 percent. [10, 37, 39]

Table 3.1 Economic sector recent growth rate

Economic Sector Recent Growth Rate		
Sector	2008/2009	Average past 5yr growth %
Agriculture	6.4	9.8
Industry	9.9	9.6
Service	14.0	14.3

With respect to Industry, its role in the Ethiopian economy is notable for its near-static share over the last decade. The share of industry has been close to13 percent (plus or minus one percentage point) for the past decade. Contrary from what would seem to be the case from the rapid period of fast growth, the share of Industry has show a consistent trend decline in the past five years, falling from 14.0 percent of GDP in FY 2003/04to 13.0 percent of GDP in FY 2008/09. Within industry, this mainly reflects a drop in the role of small scale and cottage industries, electricity & water, and construction (each down by 3 percentage points during this period), which more than fully offset small gains seen in large and medium scale manufacturing and mining & quarrying activities.

In recent years the Ethiopian Government has made significant effort to enhance the policy content of the trade and industry sector. It plans to enlarge the policy scope from a few export-oriented industries to the inclusion of import substitution industries which have high domestic demand, and also because it is strengthening policy measures and institutions for industrial support.

The Ethiopia Trade and Industry Minister currently engaged in preparing Plan for Accelerated and Sustained Development to End Poverty (PASDEP) II (2010/11-2014/15).

3.2.3.1 Priority Sectors

To achieve the expected goal this study access the five year industrial policy set by government. In recent years the Ethiopian Government has made significant effort to enhance the policy content of the trade and industry sector. It plans to enlarge the policy scope from a few export-oriented industries to the inclusion of import substitution industries which have

high domestic demand, and also because it is strengthening policy measures and institutions for industrial support.

The Ethiopia Trade and Industry Minister currently engaged in preparing Plan for Accelerated and Sustained Development to End Poverty (PASDEP) II (2010/11-2014/15). In response to the outcome of past promotion, rising policy capability or changing domestic and international situations Ethiopia industrial policy modify PASDEP I priority list. [10]

Therefore, the following export-oriented industries can continue to be supported in the next five years plan. These are:

- Leather and leather products
- Agro-processing
- Textile and garment, and
- Floriculture.

In addition, the following import substitution industries also added to the priority sector list:

- Steel
- Metal processing
- Cement
- Glass
- Consumer soap and detergent ("chemicals")
- Popular medicine ("pharmaceuticals") and others.

3.3 Constraints for development of Industrialization

Industrial development of Ethiopia has faced a lot of constraints. Knowing these constraints helps to identify weak and strong side/gaps and draw concrete solution measures. Some of the constraints are as follows:

- Problem of infrastructure like roads, energy, water supply, telecommunication, health facilities and other facilities.
- Low agricultural out puts, due to traditional farming, unable to fit demand for industrial raw materials and foreign exchange requirements.
- The industrial sector has low level of inter/intra supply chain.
- Absence of clustering technology.
- Inadequate institutions to create skilled man power.
- Low level of privatization

Chapter Four

Data Collection and Analysis of Ethiopian Manufacturing Industries

4.1 Introduction

In order to manage quality in the entire supply chain for Ethiopian manufacturing industries, first it is beneficial to investigate the current status and quality awareness deeply. Once knowing the extent in which quality management dimensions practiced and critically analysing techniques, principles and procedures for supply chain quality management and their relation with organizational performance, a model for SCQM developed. Therefore, in this chapter data collection methods and analysis will be discussed.

4.2 Goal of the Research

In supply chain the organizations are only as strong as their weakest link, so the challenge is to integrate all functions effectively. All partners in a supply chain must understand and able to implement similar quality standards. [40]

Therefore, taking this in mind this study identifies the current level of quality management practice, in Ethiopian manufacturing industries supply chain in general and Faffa Foods Sc. as a case, and their relation with organizational performance. Further, SCQM model was developed for both of them.

4.3 Why the Study Focus on Manufacturing Industries?

As mentioned in section 3.2.3, the services sector overtaken agriculture as the largest segment of the Ethiopian economy and lastly a very small industrial sector.

This shows, even though the countries next five year policy is industrialization, current status of industries was low. Therefore, it is rational to do research on manufacturing industries.

4.4 Research Design

The role of research design is to connect the questions to data. Design sits between the two, showing how the research questions will be connected to the data, and the tools and procedures to use in answering them. Research design must follow from the questions and fit them with data. The design is the basic plan for a piece of empirical research, and includes

main ideas such as strategy, sample, and the tools and procedures to be used for collecting and analysing empirical data [44]. In this section, the research strategies and general research sample are described. In addition other aspects such as tools and procedures used for collecting data, detailed sample determination for the questionnaire survey, the structured interviews, and the case study are presented.

4.4.1 Research Sample

Manufacturing industries in Ethiopia (Addis Ababa) were selected for investigation because they cover 40.26% of total and it will be good representative. And secondary data's were collected from other sources like CSA and ministry of industry. Some of industrial groups and their respective number in Addis Ababa are shown below:

Table 4.1 Industrial groups and their respective numbers at Addis Ababa

Se.No	Industrial Group	Number
1	Manufacture of food products and beverages	255
2	Manufacture of tobacco products	1
3	Manufacture of textiles	29
4	Manufacture of wearing apparel, except fur apparel	34
5	Tanning and dressing of leather; manufacture of footwear, luggage and handbags	53
6	Manufacture of wood and of products of wood and cork, except furniture	16
7	Manufacture of paper, paper product and printing	102
8	Manufacture of chemicals and chemical products	55
9	Manufacture of rubber and plastic products	61
10	Manufacture of other non-metallic mineral products	121
11	Manufacture of basic iron and steel	13
12	Manufacture of fabricated metal products except machinery and equipment	45
13	Manufacture of machinery and equipment N.E.C	3
14	Manufacture of motor vehicles, trailers & semi-trailers	10
15	Manufacture of furniture; manufacturing N.E.C	89

(Source: CSA 2008/2009)

4.4.2 Data Collection Methodology

To conduct empirical research qualitative or quantitative data collection methods can be used. Both methods have their own strength and draw backs. A qualitative data collection method need detailed know how of the subject area to be studied and requires an open ended question to be filled by experienced experts on that area. On the other hand, quantitative data collection methods requires the use of standardized instruments so that the varying perspective and experiences of the people can fit a limited number of predetermined response categories, to which numbers are assigned. The advantage of quantitative method is to measure the reaction of many people to a limited set of questions.

Therefore, in order to achieve the objectives of this research both qualitative and quantitative data collection methods are used. Among the methods used structured questionnaire covers the most portions. The questionnaires were divided into parts as: awareness level, supply/ manufacturing/distribution system quality assessment and performance measurement. In addition, each part contains series of items to analyze quality parameters at each level in detail (see appendix 1). In this research a total of 70 manufacturing companies are surveyed by questionnaire survey and 54 companies respond to the questionnaire. Therefore, the study achieves 77.14% of its expected plan. The researcher also conducted industrial interview, document review and direct observation for some of the companies.

4.5. Data Analysis and Presentation for the Survey

To implement supply chain quality management (SCQM) in manufacturing industries and understand its effect on organizational performance every partner along the entire supply chain should have knowledge about the concept.

4.5.1 Awareness level of Supply Chain Quality Management

Among the 54 companies surveyed 63% of the respondents say yes and the rest 37% no about their awareness for the term supply chain quality management. Even though most of respondents said they have awareness for SCQM only 27.8% of them define it on the context of their company, others 25.9% & 46.3% define poorly and leave at all respectively. As it was understood from the survey the main problem faced by companies was they did not have skilled manpower. Using a five point likert scale the general awareness level of respondents are shown in the figure below:

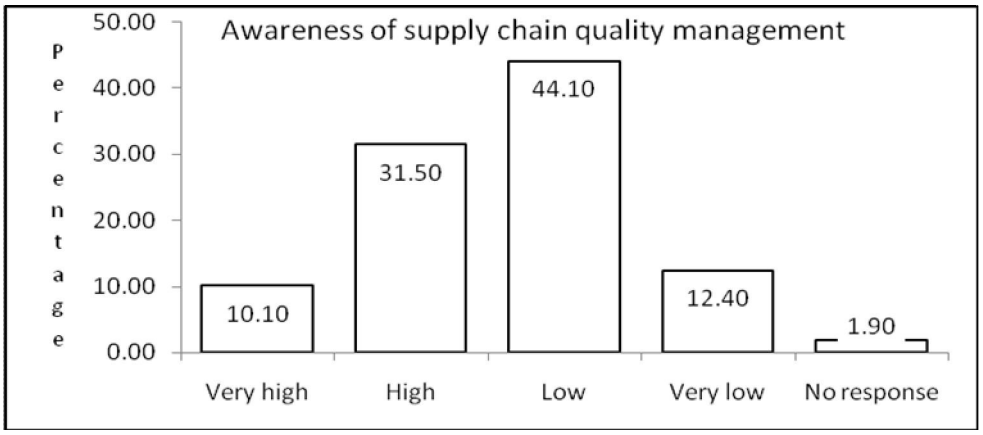


Fig. 4.1 Awareness level of SCQM in Ethiopian manufacturing firms

4.5.2 Supply System Quality Assessment

From the analysis it was observed that most of the companies manage only their immediate suppliers. A result of interviewed persons shows that, the main focus of manufacturing companies was on short term profit. Instead of forming long term relationship with suppliers most companies prefer to buy input materials at minimum price. Even though, some of them know the theoretical importance of quality tools, techniques and principles, they did not apply it practically.

The survey result shows that from the total samples taken 44.4%, 18.5%, 3.7% of companies manage and know their first tire, second tire, and third tire suppliers respectively. While the rest 22.2% of them did not manage their supply chain partners at all and 11.1% have not an understanding about supply chain. The following pie chart shows companies level of management along their supply chain.

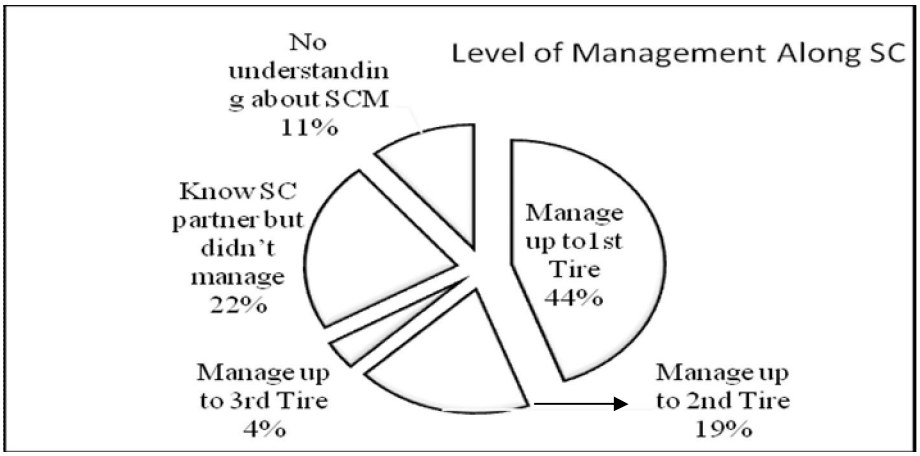


Fig. 4.2 Level of management along sc partners

In addition, to maintain high quality supply chain companies must have structured supplier quality policy manual and supplier quality assessment procedure manual. But from the

investigation it was observed that 38.9% of respondents have supplier's quality policy manual and 61.1% did not have. With respect to supplier's quality assessment procedure manual only 42.6% have while the rest 57.4% did not.

As it has been shown above most of the companies have documentation problems. They did not have a written document, they talk more about their company but when they asked written/documented data they do not have an answer. The following parameters are used to form high quality supply system and each has their own sub-parameters.

Supplier selection: A supplier quality management (SQM) system requires a fundamental shift in buyer-supplier relationship, from an arm's length model to the long-term business partnership. This makes companies select suppliers based on quality rather than price or schedule. According to questionnaire survey these supplier selection parameters and their current practice in percentage in Ethiopian manufacturing companies with weight poor, fair, good, very good and excellent are as follows. These weights are gained from five point likrt scale questionnaire survey.

Table 4.2 supplier section criteria current practice in Ethiopian manufacturing industries

Supplier selection criteria	Level of current practice (%)					
	Poor	Fair	Good	V. good	Excellent	MI
Integration of quality in supplier's daily activity	7.4	42.6	33.3	13.0	1.9	1.9
supplier's readiness for continuous improvement	5.6	29.6	42.6	9.3	11.1	1.9
supplier's organize quality improvement activities	11.1	40.7	29.6	13.0	3.7	1.9
supplier's technical capabilities to ensure quality	0.00	33.3	33.3	14.8	16.7	1.9
Quality certified suppliers	24.1	16.7	11.1	20.4	16.7	11.1
Suppliers quality control system	0.00	31.5	40.7	11.1	14.8	1.9
Communication quality information	11.1	29.6	22.2	16.7	18.5	1.9
Cumulative percentage	59.3	224	212.8	98.3	83.4	22.5
Average	8.47	32	30.4	14.04	11.91	3.21

Note: MI=Missing Item

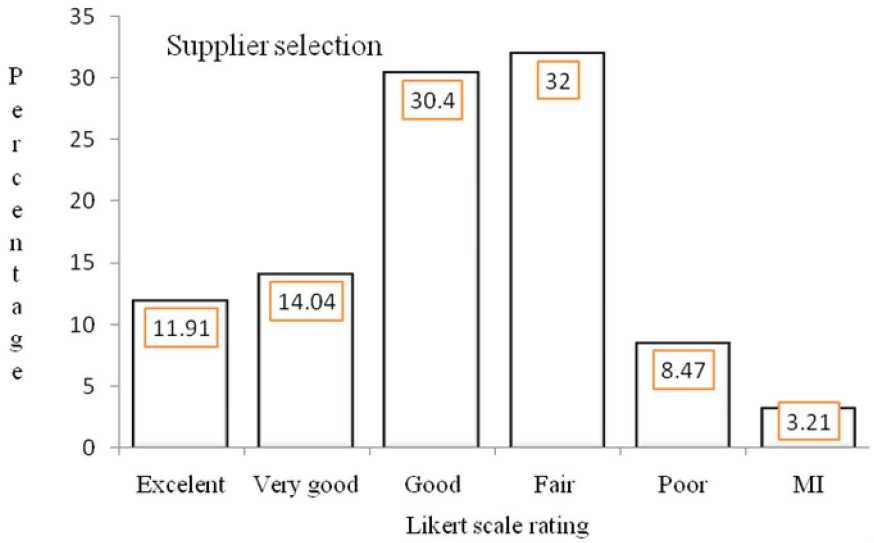


Fig. 4.3 Supplier selection based on quality principles

Supplier development: Besides supplier selection, supply development is another critical area in a SQM system. Supplier development is group of activities taken to improve supplier quality with assistance to operations improvement in supplier side. The current practices regarding to supplier development in Ethiopian manufacturing companies are described below with weights similar to that of supplier selection.

Table 4.3 supplier development criteria current practice in Ethiopian manufacturing industries

Supplier development criteria	Level of current practice (%)					
	Poor	Fair	Good	V. good	Excellent	MI
Continuous evaluation of supplier's quality	5.6	24.1	29.6	24.1	14.8	1.9
Technical assistance to supplier quality	16.7	42.6	20.4	16.7	-	3.7
Provide suppliers with necessary resources	16.7	31.5	22.2	20.4	7.4	1.9
See suppliers as extension of its operations	7.4	48.1	18.5	18.5	5.6	1.9
Give training to suppliers	37.0	18.5	20.4	22.2	-	1.9
Periodical review of purchasing policy	7.4	14.8	13.0	35.3	27.8	1.9
Give priority to quality during purchasing	-	38.9	27.8	9.3	22.2	1.9
Collaborative purchasing requirement dev't with suppliers	9.3	22.2	29.6	29.6	7.4	1.9
Invite suppliers to participate in company activities	7.4	33.3	14.8	35.2	7.4	1.9
Cumulative percentage	107.5	274	196.3	211.3	92.6	18.9
Average	11.94	30.44	21.81	23.47	10.28	2.1

Note: MI= Missing Item

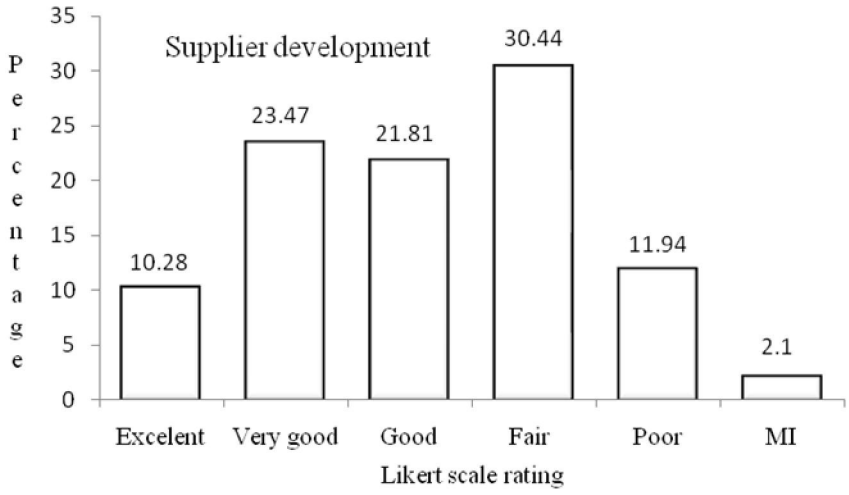


Fig. 4.4 Percentage of supplier development for SQM system

Supplier integration: The third critical area in a SQM system is supplier integration that improves quality by conducting joint development activities with suppliers. In a similar manner, parameters and their respective weight are as follows:

Table 4.4 supplier integration criteria current practice in Ethiopian manufacturing industries

Supplier integration criteria	Level of current practice (%)					
	Poor	Fair	Good	V. good	Excellent	MI
Set business strategies jointly with suppliers	1.9	27.8	31.5	37.0	-	1.9
Company mission aligns with supplier's business directions	5.63	22.2	46.3	18.5	-	7.4
Willingness of the company to share strategic data	9.3	33.3	37.0	9.3	9.3	1.9
Involvement of suppliers in product design	7.4	14.8	38.9	37.0	-	1.9
Long term partnership with suppliers	1.9	24.1	37.0	18.5	16.7	1.9
Mutual trust between the company & its suppliers	7.4	42.6	22.2	5.6	20.4	1.9
Win-win relation between the company & its suppliers	7.4	44.4	14.8	18.5	13.0	1.9
Jointly solve quality problems with its supplier	5.6	38.9	25.9	16.7	11.1	1.9
Total	46.53	248.1	253.6	161.1	70.5	20.7
Average	5.82	31.01	31.7	20.14	8.81	2.59

Note: MI= Missing Item

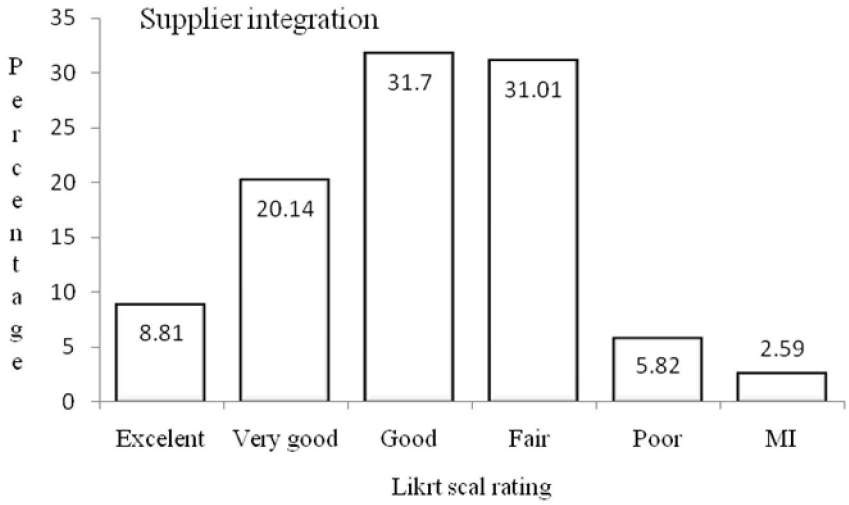


Fig. 4.5 Percentage of supplier integration for SQM system

4.5.3 Manufacturing System

The questionnaire survey shows that most of Ethiopian manufacturing firms are currently producing under their full capacity. And they are lagging to fill their market demand. Only 11.1% of the respondents exactly fulfil the market demand while 83.3% of respondents contribute a little to the demand expected to be filled by them and the rest 5.6%‘s did not know about it. As per the interview of respondents, the main problems for under capacity production were frequent power frailer, raw material shortage during mean time of production and capital constraint.

The other thing must be considered at manufacturing level is difficulty of changing organizational culture and adopting quality concepts at each functional units of the company. 66.7% of the respondents say that it is not difficult to change organizational culture while the rest 22.2% believes that it is difficult. The major reason for this difficulty is that most workers work for payment and every employee did not have decision power instead performing what ordered by their manager.

In addition, 70.4%, 75.9% of respondents respectively benchmark best practice of other companies and internal functional units. The industrial interview shows the major functional units being benchmark with in a company includes quality control, marketing, production and purchasing departments. These departments are relatively better in practicing quality management.

Further, most of the companies use total cost as their main cost estimation. But currently ABC costing is state of the art for manufacturing companies cost estimation. It is a breaking down of a process into sub-activities and estimating cost incurred by each activity. Then the total cost of the process is a sum of costs incurred by all activities. From survey investigation it was observed that 38.9% of the respondents says that their company was practicing ABC costing and the rest 61.1% not.

Subcontracting and outsourcing are also major practices performed at manufacturing level. If demand exceeds company's production capacity then they forced to outsource some activities to a third party.

Table 4.5 Frequency of respondents for outsourcing and subcontracting

	Respondents answer	Frequency	Percent
Outsourcing	Yes	13	24.1
	No	39	72.2
	Leave at all	2	3.7
Subcontracting	Yes	9	16.7
	No	43	79.6
	Leave at all	2	3.7

Product Design Quality Management in Supply Chain: Selecting the right kind of quality tools in which a company can use to ensure product development is one aspect of managing quality at supply chain level. Some of the tools and their percentage of practice (from samples of 54 taken) in Ethiopian manufacturing companies are as follows: Quality function deployment (QFD), Failure mode and effects analysis (FMEA), six sigma, statistical process control and others.

Table 4.6 Frequency of companies Quality tools usage for product development

Quality tools		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	QFD	11	20.4	25.6	25.6
	FMEA	4	7.4	9.3	34.9
	Six sigma	9	16.7	20.9	55.8
	SPC	15	27.8	34.9	90.7
	Others	4	7.4	9.3	100.0
Total		43	79.6	100.0	
Missing Item		11	20.4		
Total		54	100.0		

In addition, the following parameters must be fulfilled to have high quality supply chain by managing quality at product development/design level. The current percentage practices of these parameters from questionnaire survey are as follows. The weight ranges are fair, good and very good respectively:

- Participation of raw material suppliers in product development/design. 35.2%, 31.5%, 31.5%.
- Customers' idea or interest of quality considered in new product development.20.4%, 18.5%, 59.2%.
- Different departments in a company participate in new product development.5.6%, 44.4%, 48.2%.
- Network/Internet usage for cooperation in the design process.26.0%, 33.3%, 38.9%.
- Production equipment suppliers must involve in the early stage of product development.18.6%, 50.0%, 26.0%.
- Moderate emphasise of cost in the product development process. 31.5, 46.3, 16.7%.

Production Process Quality Management in the Chain: In a manufacturing supply chain, the products or materials that one company/functional unit has produced and supplied are the incoming material for the next manufacturer/functional unit. The quality of the material directly affects further manufacturing processes. Therefore, it is very important for manufacturers to monitor the incoming quality and make the quality data available in real-time.

To ensure the efficient operation and quality within the entire manufacturing supply chain, quality management for production in an MSC is related to real production control and quality data sharing between partners and with the support of the integrated plant-floor/ERP systems.

To achieve high quality production process across the entire supply chain the following parameters must be fulfilled. The survey result shows their current practice in Ethiopian manufacturing companies with their respective weight ranges from fair, good and very good. They are:

- Production schedule is made by coordinating suppliers and customers 27.8%, 18.5%, 48.1%.
- Process control is implemented in the production system.9.3%, 18.5%, 68.6%.
- You obtain real time quality information from suppliers. 22.2%, 46.3%, 24.4%.

- You give real time quality data to customers & suppliers. 22.2%, 50.0%, 22.3%.
- By coordinating with supplier's inventory reduced in both sides. 53.8%, 22.2%, 18.5.
- By coordinating with suppliers production flexibility improved.18.6%, 31.5%, 44.5%.
- Process capability can meet production requirement.7.4%, 25.9%, 61.1%.
- Production equipment's are well maintained. 13.0%, 22.2%, 59.2%.

Inventory Management & Technology Used: When we talk about inventory management the first thing that comes in mind is warehouse. Manufacturing companies may have enclosed or open warehouse for their raw materials and finished products. Quality level of the warehouse depends on type's production, for example in pharmaceutical companies quality management of its warehouse is a must and it needs high precision while in cement companies the raw material warehouse may be open.

From the survey 94.4% of the respondents have enclosed warehouse for their raw materials and 90.7% of respondents have enclosed warehouse for finished products.

The industrial interview of manufacturing firms show that most of Ethiopian manufacturing companies didn't manage their work-in-process inventory. A few of them use buffer as a means for work in process inventory.

The other thing to be considered for inventory management is planning, forecasting and replenishment of inventory will be done in co-ordination with suppliers and customers. From the survey 11.1%, 37.0%, 33.3%, 14.8% of respondents practice it with weight very high, high, low and very low respectively.

To optimize inventory management system manufacturing companies use software's like: Enterprise Resource Planning (ERP), Material requirement planning (MRP), Material resource planning (MRPII) etc. In order to smoothn flow of material and information this soft wares must be integrated with suppliers and customers of a firm. From survey result 14.8% of respondents already use ERP and 27.8% are in progress to use. In addition, 61.1% of respondents use MRP and 14.8% of respondents in progress to use. But only 35.2% of respondents MRP consider suppliers/customers capacity and few respondents ERP integrated with suppliers/customers. The major reason for this weak integration is that most companies didn't have constant suppliers/customers and they didn't have skilled persons to do so. Even some companies didn't know their suppliers at all.

The major information exchange systems along a supply chain are telephone, fax, email, carrier, internet, and electronic data interchange (EDI). The industrial interview shows that most companies use telephone as basic information exchange system and few of them

especially those who have foreign suppliers/customers use email, fax and EDI. The questionnaire survey shows that only 37.0% of respondents use EDI while the rest 59.3% didn't and 5.6% of respondents didn't know EDI at all.

The last but not least method for inventory reduction is implementation of just in time (JIT). But current practice of JIT system in Ethiopian manufacturing companies was almost insignificance. Only 3.7% of respondents practice JIT while the rest 90.7% did not and 5.6% didn't know.

4.5.4 Distribution System Part

Delivery is the process by which the supplier transfers the finished goods to its customer meeting planned or actual demands. That means, the products should be delivered with the right material, in the right amount and at the right time, i.e. Just-in-Time (JIT).

The internal JIT system can only be operated successfully if the material being fed into it has a sufficient quality and is delivered on time. To guarantee sufficient quality from the suppliers, a quality management system in-house coupled with collaborative forecasting as well as advanced logistics is essential for reaching this goal.

From the survey in Ethiopian manufacturing firms, only 3.7% of respondent companies has been implemented JIT system while the rest 90.7% did not and 5.6% abstain from filling the questionnaire. With regard to relation to customers 77.8% of respondent companies have long term relation and 22.2%'s have short term. But only 31.5% of respondent companies assess the quality system of their customers (specifically their whole sellers and retailers). In addition the following parameters should be considered to have quality distribution system. The parameters and their respective weight which ranges from Poor, Fair, Good, Very good, Excellent are as follows:

- Effectiveness of your logistic system. 7.4%, 11.1%, 27.8%, 38.9%, 9.3%.
- Delivery of your products based on customer needs (place). 5.6%, 9.3%, 27.8%, 40.7%, 11.1%.
- Coordination of suppliers and customers to shorten lead time.1.9%, 24.1%, 31.5%, 29.6%, 7.4%.

4.5.5 Performance Measurement

Employee Satisfaction: Employee satisfaction is defined as the degree to which employees like their jobs; it is simply how employees feel about their jobs and different aspects of their jobs. It is the extent to which employees like (satisfaction) or dislike (dissatisfaction) their jobs.

Employee satisfaction is not a static state but is subject to influence and modification from forces within and outside an individual, which are his or her own personal characteristics and the immediate working environment. In one firm, some employees may be satisfied and others may not. Individuals differ in how they respond to work conditions. While some employees may be highly satisfied with a particular job, other employees may find the same conditions extremely dissatisfying. An important issue surrounding employee satisfaction is: Will employee satisfaction increase or decrease as a result of a better benefit package, a new training program, or some other change in human resource practices? Many factors may affect employee job satisfaction.

Among them are, for example, working environment, relationships with supervisors and colleagues, promotion opportunities, pay, equality, job characteristics, compensation and reward systems, and job security. [43]

From the questionnaire survey investigation 63% of respondents conduct employee satisfaction survey and the rest 37% did not. Employee satisfaction levels of the manufacturing firms are shown in table below:

Table 4.7 Employees satisfaction level of Ethiopian manufacturing firms

Sr.No	Satisfaction level	Frequency	Percentage (%)
1	Extremely unsatisfied	4	7.40
2	Fairly satisfied	1	1.90
3	Satisfied	22	40.70
4	Very satisfied	7	13.00
5	Missing	20	37.00
6	Total	54	100.00

Customer Satisfaction: After the literature on customer satisfaction was reviewed, it became evident that there is no consensus on how to measure customer satisfaction. According to Fornell (1992), The American Customer Satisfaction Index (ACSI) is a national index for providing a standardized measure across industries that can be used for comparative purposes.

The ACSI measures the quality of the products and services as experienced by customers who consume them.

And defined customer satisfaction as an overall post purchase evaluation of all experiences including transactions, product use, and service received. Deming (1986) suggested that the goal of firms should be to constantly improve their services and products for the customers. Customer satisfaction is dependent on a comparative judgement against some standard related to the lack of confirmation of expectations. Thus, dissatisfaction may be due to inherently poor services or products, or perhaps to the continuation of a once-acceptable level of services or products that no longer meet customer expectations, due to competitive marketing of improved standards or changing customer tastes.

The survey result shows that only 30.6% of respondents conduct customer satisfaction survey while the rest 69.4% respondents did not know the needs of their customers. The reason for this is that most companies didn't have a mechanism for getting feedback from their respective customers. Further they did not have skilled employee to conduct the survey and they consider it as a big task and so costly.

For those companies which conduct the survey, the researcher identified parameters to measure their customer satisfaction level based on a five point licker scale which ranges from 1-extremely unsatisfied to 5-extremely satisfied.

Table 4.8 Customer satisfaction level for Ethiopian manufacturing firms

Parameters / Satisfaction Level	Product quality	Service quality	Delivery time	Delivery place	After sales service
	Percentage (%)	Percentage (%)	Percentage (%)	Percentage (%)	Percentage (%)
Extremely unsatisfied	0.00	0.00	0.00	0.00	6.7
Fairly satisfied	0.00	0.00	0.00	13.3	0.00
Satisfied	33.3	40.0	53.3	26.7	40.0
Highly satisfied	40.0	46.7	20.0	33.3	40.0
Extremely satisfied	26.7	13.3	26.7	26.7	13.3

(Source: Survey response)

Product Quality: The functionality of product quality should be based on the definition of quality: Some of quality definitions are [6, 17].

- Juran: "Fitness for purpose" or" Quality is customer satisfaction."
- Deming: "Quality should be aimed at the needs of customer, present and future."
- Crosby: "Conformance to requirement"
- Feigenbaum: "Total composite product and service characteristics of marketing, engineering, manufacture and maintenance through which the product and service in use will meet the expectations of the customer."
- Taguchi: "The loss impart to the society from the time a product is shipped."
- ISO 9000:2000: "The degree to which a set of inherent characteristics fulfils requirements."

Based on the literature related to the various measures of product quality, in this study, seven items were used to measure product quality of Ethiopian manufacturing firms. These are: Performance, conformity rates, reliability, durability, internal defect rates, internal failure costs, and external failure costs. Their respective percentages of current practice in the manufacturing firms are shown in the table below.

Table 4.9 Product quality measures

Parameters / Satisfaction Level	A	B	C	D	E	F	G
	%	%	%	%	%	%	%
Worst in the	0.00	0.00	0.00	0.00	0.00	6.7	0.00
Below average	0.00	6.7	0.00	6.7	20.0	26.7	26.7
Average	26.7	40.8	13.0	20.0	40.0	33.3	46.7
Above average	53.3	33.3	60.0	40.0	26.7	20.0	20.0
Best in the class	20.0	20.0	20.0	33.3	13.3	13.3	6.7

(Source: survey response)

Note:

A. Performance
B. Conformity rate
C. Reliability
D. Durability

E. Defect rate

F. Internal failure costs as a percentage of annual output

G. External failure costs as a percentage of annual sales

Strategic Business Performance: Strategic business performance consists of annual sales, sales growth, profits, market share, and exports. Annual sales refer to the total volume of industrial products sold in currency terms within one year, even though the sold products were made in a different year. Annual sales include the value of the sold finished products, sold semi-finished products, industrial services rendered to other firms, products provided for a firm's own construction or well-being department, self-made production equipment among other items. Annual sales growth refers to the ratio of annual sales difference between this year and the previous year, divided by the annual sales volume in the previous year. Profits refer to the total profits gained by the firm. Market share refers to the percentage of a firm's product output compared with the same kinds of product output produced by all firms in the same industrial sector. Market share, in this study, refers to local market share (among Ethiopian manufacturing firms). Exports include the value of various products and services sold in foreign countries. Only 5.6% of respondent companies export their products while the rest 83.3% are providing for local markets and 11.1% are not responding the questionnaire.

4.5.6 Cause and Effect Analysis

After assessing the current level of practice of supply chain quality management in Ethiopian manufacturing industries it is important to identify the cause for each problems. Even though, different elements of supply chain quality management are practiced at different level in manufacturing firms, no company has implemented it structurally. These causes fragmented quality supply chain i.e. some companies are better at supply side and poor at manufacturing and/or distribution, while others are poor supply system and quality manufacturing or distribution system. Based on guided interview, questionnaire survey and direct observation for poorly performing firms, the author summarizes the reason using cause and effect analysis.

Therefore, the following diagram shows the cause and effect analysis of this poor supply chain quality management and its impact for organizational performance.

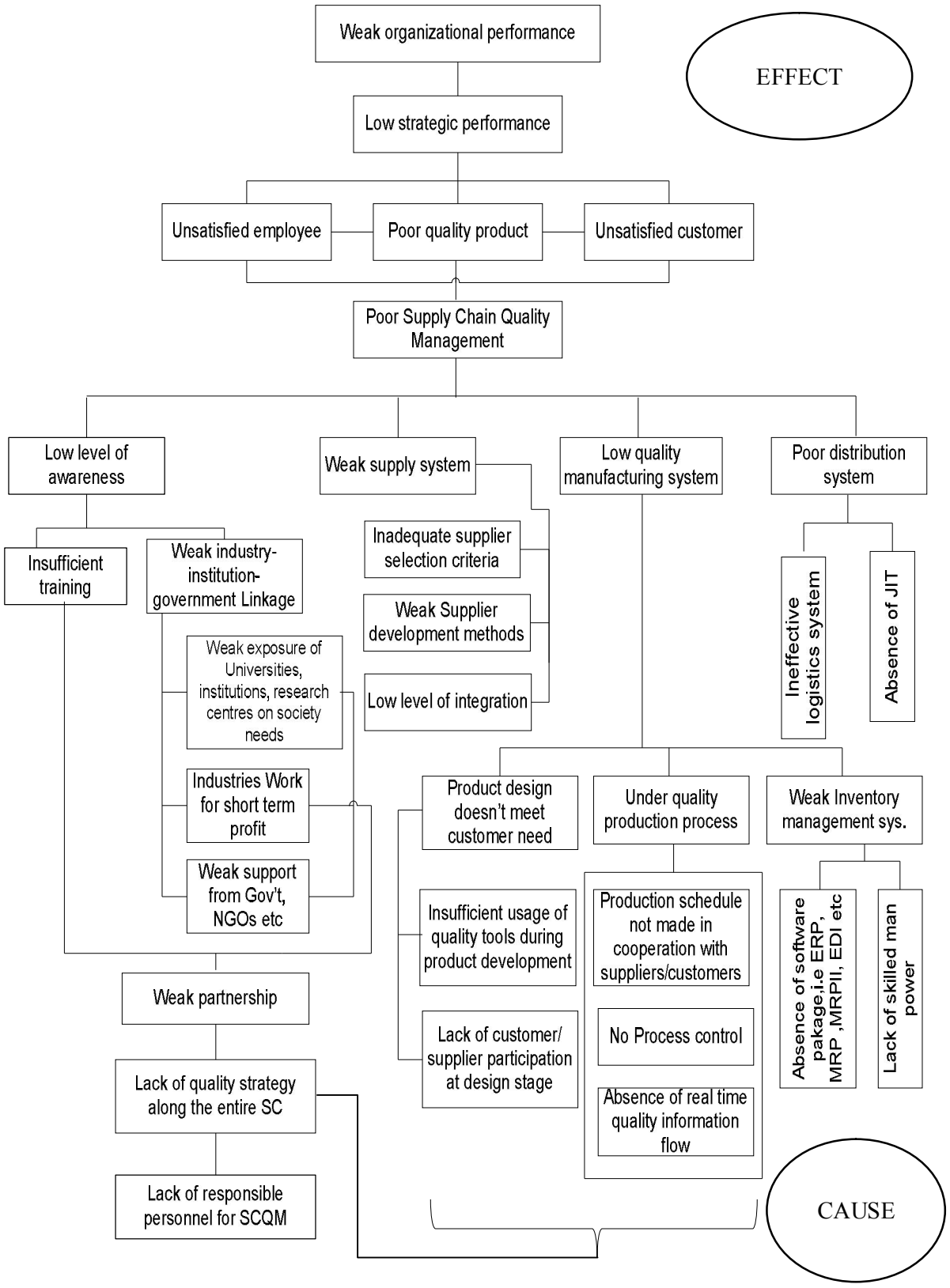


Fig. 4.6 Cause and effect analysis of SCQM in Ethiopian manufacturing firms

Short Summary of the Analysis:

The above analysis is based on elements of supply chain quality management and organizational performance. Elements of SCQM consists three major parts supply system quality management, manufacturing system quality management and distribution system quality management. Each of these parts has component elements with their respective parameter items.

Table 4.10 Current level of practice of SCQM elements

SCQM practices		No. of items	Percentage practice of elements					
			Poor	Fair	Good	V.good	Excellent	MI
Supply side	Supplier selection	7	8.47	32	30.4	14.0	11.91	3.21
	Supplier development	9	11.94	30.44	21.81	23.47	10.28	2.1
	Supplier integration	8	5.8	31.01	31.7	20.14	8.81	2.59
Mng. syste	Product design	6	4.48	15.75	33.07	32.42	14.46	3.13
	Production process	8	3.00	19.91	29.39	28.7	26.4	5.59
Distribution side		3	4.97	14.83	29.03	36.4	9.27	5.5

In addition, organizational performances are measured by product quality, employee satisfaction, customer satisfaction and strategic business performance. The survey result showed that only 30.6% and 63.0% of respondents companies know satisfaction level of their customers and employees respectively while 54.27% of companies achieve product quality above average.

Performance Measurement	No.of items	Level of practice (%)		
		Unsatisfied	Satisfied	Missing
Customer satisfaction	5	4.00	96.00	72.22
Employee satisfaction	-	46.30	53.70	37

Table 4.10 shows that manufacturing firms are weak at supplier selection and development while they have good progress at supplier integration, product design and production process. Therefore, by comparing with performance parameters we can conclude that supplier selection and development have positive relation with employee satisfaction. Further, product quality and customer satisfaction have positive relation to supplier selection, product design and production process.

Chapter Five

5. Supply Chain Quality Management Model for Ethiopian Manufacturing Firm

In this chapter a frame work for supply chain quality management will be discussed. It includes quality management in the supply side (i.e. quality management of 1st tier, 2nd tier, and 3rd tier etc. suppliers), quality management of focal firm and the distribution system. The bases for this model development are problems observed during questionnaire survey, guided interview and researchers direct observation in Ethiopian manufacturing industries.

As stated by most of quality gurus the final goal of quality management is to satisfy the ultimate customer. Therefore, the main thing for development of this model is to identify stages of supply chain (i.e. every stage in the chain is suppliers for the next stage and customers for the preceding stage). After that for each stage its internal and external suppliers/customers with their respective requirements specified. Finally for each stage a corresponding quality model will be developed.

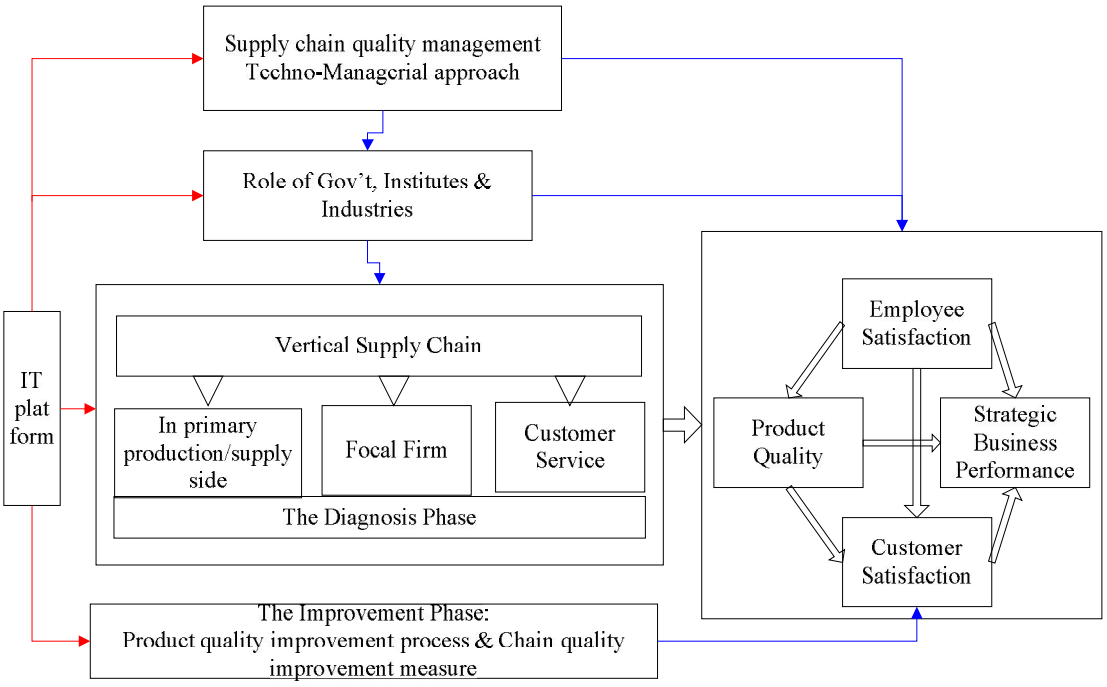


Fig. 5.1 General Model for supply chain quality management & organizational performance (Adapted from [41, 44])

5.1 The Role of Government, Institutes, and Industries

Currently in Ethiopia most of the companies are working independently and their main focus were to get short term profit. There was no formal partnership between industries and institutes' rather than having a consultant of individual personnel. But to have a long lasting quality along the entire supply chain it should not be a one time and single companies concern. Therefore, the government, industries, and institutes must work in cooperation.

Government Role: without government role it is difficult to have high quality supply chain. Since the government is a policy maker, it must give due consideration for quality. From survey conducted most manufacturing firms have capital constraints. Therefore, government must give loans and coordinate firms' into cluster to strength their financial power. In addition, it should control import export goods. Further experience of other Asian and European countries are shown in section 6.3.2

Role of Institutes and Research Centres: With regard to institutes, currently in Ethiopia, there was a good start relationship established between Universities, vocational colleges and industries. But it doesn't go beyond paper work and some industrial tours by students and staff members. Therefore, this research paper proposes that universities must work in cooperation with industries. As observed from the survey of Ethiopian manufacturing firms, most of the manufacturing companies didn't have research and development department and those who have the department lacks skilled personnel. In addition, almost all of the companies' view of quality was focused on product quality only.

5.2 Techno-Managerial Approach for SCQM

To achieve high quality supply chain we must consider the technological advancement and managerial aspect at each supply chain partner.

Technological Approach: It addresses concerns of technical systems in managing supply chains. The effective management of technology and quality is the key to increased quality and enhanced competitive position in today's global environment. The main focus of this approach has two folds. One aspect is to select state of the art machineries, equipments, information system etc. And the second aspect is to implement quality management systems and/or quality control techniques like SPC, SQC, QA system etc.

Managerial Aspect: It deals with the social components of the supply chain. Managerial issues are very important in quality improvement processes. The main thing to be considered under managerial aspect is formation of team which are responsible managing quality along the supply chain.

Team-Building: To achieve high quality supply chain in manufacturing companies, every participant companies must concentrate on its core competencies and out sources its non-core business, forming a cooperative network of business alliances.

An effective organization of a manufacturing supply chain coordinates all the different individual companies in a chain as quickly as possible without losing any of the quality or customer satisfaction. To reach this goal, the companies in the chain that seem to work independently should function together as an extended enterprise.

As defined by Parker, 2002, supply chain integrator can maintain product coherence from concept to customer often across numerous firm boundaries. This differs from those found in traditional supply chain management, which has focused primarily on issues of cost, delivery and inventory control [26].

Therefore, the focal company act as a facilitator to build a network of organizations in which every participant from supplier's supplier to customer's customer actively involved. In coordination with key partners of the supply chain the focal company should also establish quality standards which are expected to be fulfilled by every participant.

Organizational Structure of SCQM

An integrated supply chain management enables firms to identify the efficient inventory level while increasing inventory turnover by utilizing logistics database. Also, it increases logistics efficiency and flexibility through quality and productivity enhancement, efficient machine operations, and production space reduction. In addition, firms can have a stronger market position and greater customer satisfaction from better responsiveness to customers, and economies of scale from the best and stable relationship through long-term strategic alliances and networks with suppliers [34].

As stated by Bowers ox et al. (1992), firms need to adopt new systems that cannot be observed in the traditional organization structure where independent functional areas such as production and marketing prevail, in order to shift to integrated supply chain management.

This means that an independent department can be required to control and adjust more effectively supply chain activities. Also, in case of creating a new independent department, the determination on operational role and hierarchical relationship within organization between new SCM department and existing departments should be followed. And various industrial and environmental characteristics of each firm should be recognized. The following figure shows proposed organizational structure of supply chain quality management team.

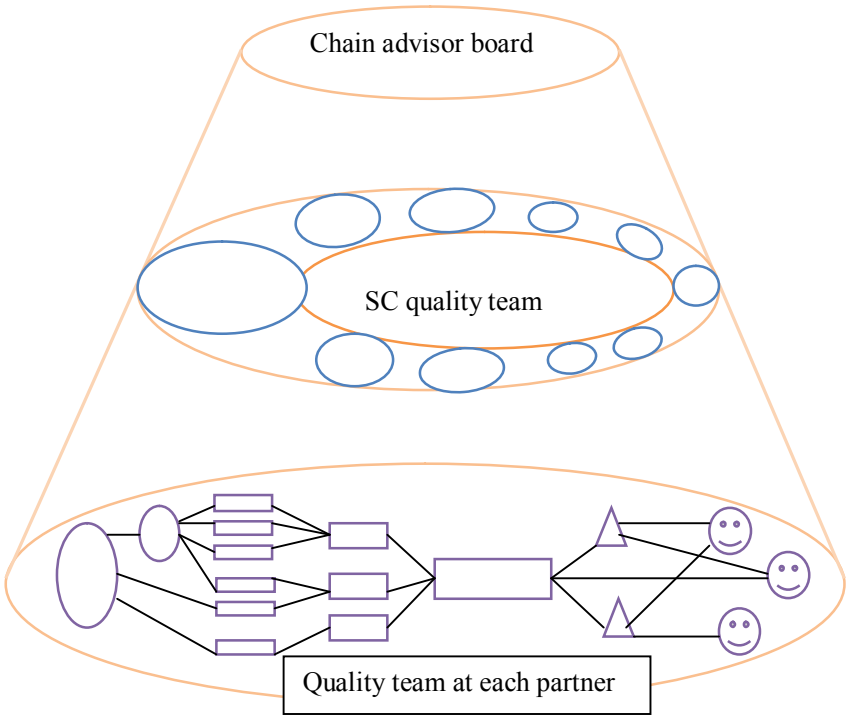


Fig. 5.2 Supply chain quality management organizational structure (Adapted from [40]).

Chain Advisor Board: The chain advisor board, in which all key suppliers and other partners participate, consists executive personnel's of the chain i.e. chief executive officer (CEO), president etc. They balance the interest of individual members with that of the integrated chain. They set strategic quality policies and supervise supply chain quality team.

Supply Chain Quality Team: They are representatives of focal company, key suppliers and key customers. They are divided into four main functional units. These are: chain managers, chain auditors and chain coordinators.

- **Chain Managers:** Since the main actors for supply chain quality management is the focal firm, chain manager is people who come from the focal firm and monitor quality activities along the entire supply chain. The chain managers are responsible to create link between supply chain partners and facilitate their cooperation's.

- **Chain Coordinators:** They are representatives of key suppliers and customers i.e. professional persons at every partner of the supply chain. Their main task is to establish a link between the chain and their own companies. They discuss each and every supply chain and quality issues with chain managers. They implement the decisions and polices set at supply chain quality team meeting to their respective companies.

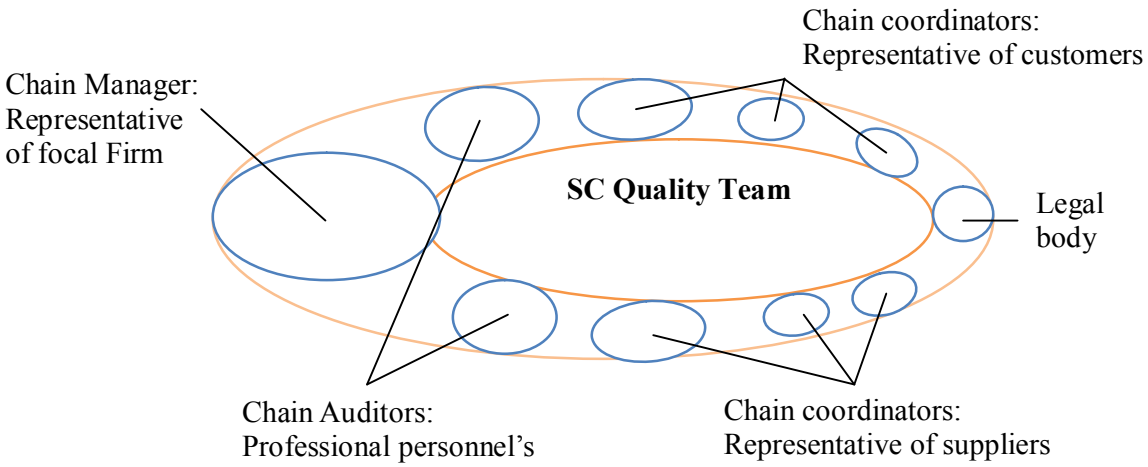


Fig. 5.3 Supply chain quality team structure

- **Chain Auditors:** They are professional members of supply chain quality team. They also invite third party quality auditors as well as the people from the chain advisory board when necessary. Their tasks are as follows [Stegemann 2001]

  - Implementation of the cross-company quality audit
  - Evaluation of general cross-company quality improvement processes and
  - Confirmation and monitoring of corrective and improvement measures.

- **Legal Body:** they are lawyers who are responsible for any legal issues. One difficult aspect of supply chain is absence of responsible body for the risk occurred in the chain. Even thought the focal firm is considered as an actor for coordination of partners for supply chain quality management, it shouldn't take all risks occurred. Therefore, the supply chain by itself must be responsible for each and every activity it did through its legal body. For instance, if a given supply chain causes environmental pollution for some regions; it should take corrective measures of the pollution and be punished according to legal law of the country if there was punishment.

Quality Team at Each Company: These are experts at the individual company who are responsible to achieve high quality systems with in their respective companies. This quality team includes personnel's from different functional departments of a single firm. They supervise and control quality activities at company levels and shop floor levels. They are responsible for checking quality of incoming materials, finished products as well as work in process. In addition these teams are expected to change organizational culture by giving training and prepare workshops, which enhance quality skill of employees within the company.

5.3 Supply Chain Process Quality Model

Today's changing industry dynamics have influenced the design, operation and objectives of supply chain systems by increasing emphasis on: improved customer service levels, reduced cycle time, improved quality of products and services, reduced costs, integrated information technology and process flows, planned and managed movement, and flexibility of product customization to meet customer needs. Therefore, improving the quality of all supply chain processes results in reduced costs, improved resource utilization, and improved process efficiency.

DeToro and Tenner (1997) provide a step-by-step approach to process improvement. Their model is based on the principles established by Crosby, Deming, Juran and Feigenbaum. The steps involved in their continuous improvement process are [4]:

1. Understand the customer: Understand the requirements of the end customer and assess the organization's ability to meet these requirements.
2. Assess efficiency: Gather data on internal process measures and determine whether the process is meeting such demands as cost, cycle time or variability.
3. Analyse the process: Determine the efficiency and effectiveness of the process. At this step, the appropriate improvement path must be identified: continuous improvement, benchmarking, or reengineering. If continuous improvement is the appropriate path then step four is performed.
4. Improve the process: Plan-do-study-act is used as an approach to improve the process.
5. Implement changes: Make necessary adjustments.

6. Standardize and monitor: Track performance, monitor process and continually improve.

One of quality management of a supply chain is a process quality model. This model provides a procedural approach for assessing, improving, and controlling the quality of the supply chain process. The model can be used to assess the performance of a supply chain system and assist in identifying problem areas, and provide a framework for continuous improvement of supply chain systems. The general frame work of the model is shown in the figure below and it consists of seven integrated modules.

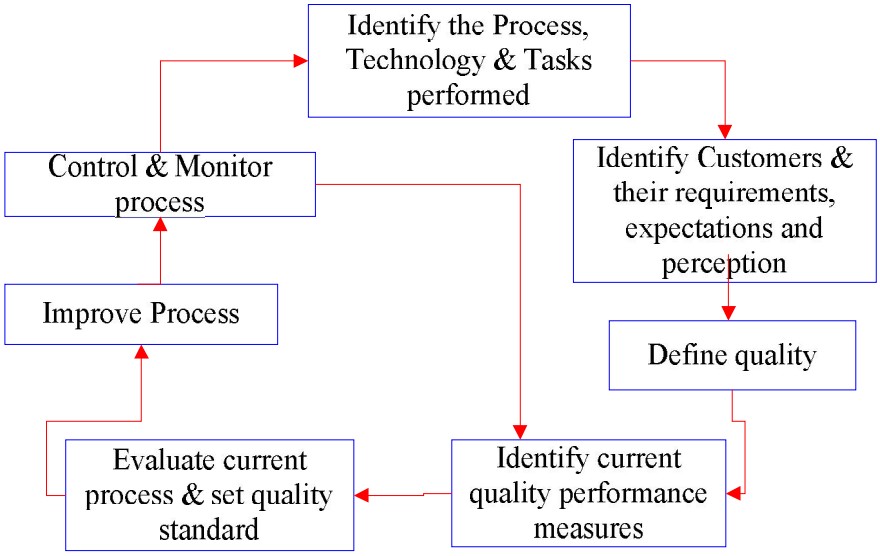


Fig. 5.4 Supply chain process quality model [4]

5.3.1 Define the Process and Activities being Performed

In this stage the main task is to define the current system and all activities that are currently performed. There are a number of graphical tools that are useful in determining the tasks performed in the supply chain process, such as flowcharts, flow process charts, Gantt charts, and relations diagrams. After the activities have been identified, then the activities are assigned to process stages. These stages may include inbound and outbound transport, warehousing, production planning/inventory control and customer service.

5.3.2 Identify Customers and their Requirements, Expectations, and Perceptions

This stage is used to identify the external and internal customers and their requirements, expectations, and perceptions. The external customer(s) are the consumer(s) of the end

product. The internal customer(s) are the departments that require goods/services from another department within the organizational boundaries.

5.3.3 Define Quality

There are numerous definitions of quality. For example, Deming (1986) defines quality as a product or service "… that helps somebody and enjoys a good and sustainable market". Juran and Gyrna (1980) coined the phrase "fitness for use by the customer" as a definition of quality. Crosby (1980) bases his approach to quality on four absolutes: "Quality is conformance to requirements", "Quality is caused by prevention", "The performance standard is no defects", and "The measure of quality is the price of non-conformance".

Feigenbaum (1981) defines quality as "the total composite product and service characteristics of marketing, engineering, manufacture and maintenance through which the product and service in use will meet the expectations of the customer". Each definition maintains at its core that quality is defined by the customer.

Therefore, each organization should create a quality definition based on the requirements of its customer. The definition should be a reflection of the types of tasks involved and the requirements and expectations of the customers.

When developing a system definition of quality, the following questions must be answered:

- What are the goals of the supply chain process? (Objectives.)
- What are the internal and external customer requirements/expectations from the supply chain process? (Customer requirements.)
- What is our competitors' definition of quality? (Benchmarking.)

The goals of the supply chain process should be consistent with and supportive of organizational goals. If the current supply chain process has a definition of quality that does not reflect the stages of the process and the needs of the customers, then the gaps should be identified and the definition refined. The definition of quality should encompass the customer requirements and expectations for each stage in the process.

5.3.4 Identify Current Quality Performance Measures

This module facilitates an understanding of the types of process quality measures that are currently being employed. First, the gaps associated with the various supply chain stages and customer requirements are identified. Next, these gaps must be translated into measurements, and then the aspects of quality for the process may be identified. Performance measurements used in this study includes product quality, customer/employee satisfaction and strategic business performances. As stated by Bardi et al., (1996), the following parameters are also used to measure performances.

- Reliability – concerns the time between failed delivery of products;
- Order accuracy – concerns the probability the correct order is taken, arrives or departs from the warehouse on time;
- Worker standards – the engineered standards for workers inside the warehouse;
- Customer satisfaction – concerns whether the internal or external customer is satisfied with his/her service;
- Worker quality – concerns safety issues, damaged goods, etc;
- Cost – the resulting cost incurred in a supply chain system by stages or throughout the entire system.

5.3.5 Evaluate Current Processes and Set Quality Standards

The purpose of this module is to evaluate current performance and set standards for cost, productivity, and service objectives.

In Module 5.3.4, the gaps in the measurement process were identified. In Module 5.3.5, quantitative quality standards are developed. The first step is to examine the representative data (measurements) collected in Module 5.3.4. Before the standards are established, the process must be in control. A process is considered in control when there are no occurrences of special causes. The sources of special causes are assignable to a cause that usually does not occur often within a process. The other type of variation present in a process is common causes. These are chance causes that process experience every day. When only this type of variation is present, the process is said to be in control. Therefore, all special variation should

be eliminated before quality standards are established. Once the process is in control, current data may be used to develop quantitative process standards.

5.3.6 Improve Process

The function of this module is to improve the processes. The first step within this module consists of identifying and prioritizing improvement areas. Once these areas have been prioritized, then the areas that must receive immediate attention are identified, considering time and cost restrictions.

The purpose of continuous improvement is to reduce the amount of common cause variation present in the process. In planning the improvement, hypotheses must be made concerning the causes of variation. Once the causes have been identified, then a plan should be implemented to eliminate the cause.

Next, these causes should be tested to determine whether the solution reduces variation. After the experiment has been tested, the improvement should be implemented throughout the process. The process should be tested again to determine whether it is in control; after the process is in control, then the quality standards are reset for the improved process.

5.3.7 Control and Monitor Process

The final step is to control and monitor the process. There are numerous quality tools that can be used in this step. Some examples of these tools are given in the Table below:

Table 5.1 Quality tools used to control and monitor a process

Tool	Purpose
Control chart	Process variability analysis
Cause and effect diagram	Process troubleshooting analysis
Histogram	Process variable frequency analysis
Scatter diagram	Process variable relationship analysis
Run chart	Process trend analysis

After formulating general model for manufacturing industries, the next chapter shows how to adopt it for companies in focus by taking Faffa Foods Share Company as a case.

CHAPTER SIX

Case Study: Faffa Food Share Company (FFSC)

6.1 Background of FFSC

6.1.1 Establishment

Fafa food share company (FFSC) is located in Addis Ababa, Ethiopia, specifically at Akaki Kaliti sub city, kebele 12/13, Saris Abo. It is a pioneer of food processing industry in Ethiopia. By the year 1962 the company was established as an Ethio-Swedish joint venture with the objective of reducing the risk of malnutrition among children in Ethiopia by producing low-cost and high protein weaning food. In 1974, the factory was expanded in a modern way with the investment of Birr 4.2 million, provided by Swedish government. As a result, the capacity had risen from 400 metric tone /year to 12,000 metric tone/ annum. As the importance of the products was recognized by the public and their demand increased the factory was renovated and expanded in 1984 by Swedish Government and the factory itself with the investment of Birr 4.4 million to meet the rising demand. As a result, the capacity had reached 21,600 metric tone / annum.

The factory has been reestablished as a share company on October 11, 1999 by transforming the previous public enterprise with a total capital of birr 38,594,000. It had also undergone rigorous expansion and innovation works to satisfy the ever-growing demand of the society and currently the capital is grown to birr 48,710,752 The company also has implemented Integrated food safety and quality management system (ISO 22,000-2005), certified by RSA SABS.

6.1.2 Objectives of the Company

The company Faffa food Share Company has the following objectives;

- To produce and sell various kinds of pre-cooked baby foods, semi-cooked supplementary foods, protein enriches & fortified flours, emergency foods and related products foods of high nutritional value;
- To renovate and expand the existing facilities and establish new factories as may be necessary;
- To engage generally in any other business conductive to the attainment of its purpose

6.1.3 Organizational Structure

Faffa food Share Company has a total of eight departments which are directly inter linked to the general manager. It has also board of directors for which the general manager and audit committee report to. The general organizational structure of the company is shown on appendix 5:

6.1.4 Raw Materials and Products

The company divides its product into two major categories (Products for relief purpose and products for commercial purpose) in order to serve its two markets. Therefore, the company uses local and foreign raw materials to produce these products. The table below shows in detail the products and raw materials used.

Table 6.1 Raw materials and products of Fafa food share company

Products			Raw materials	
For commercial purpose		For relief purpose	Local	Foreign
Faffa commercial	Corn snack	Fafa relief	Wheat	Vitamins
Famics com	Corn flex	Famicsbms	Corn, yellow corn	Minerals
Ediget milk with metal	Cerifam	Ediget milk	Soya bean	Powder milk
Ediget milk with plastic	Favena		Sugar, Milk	Vanilla
Dubbe floor	Wheat floor		Packaging material.	Iodized salt

In order to have products that satisfy final consumer, value must be added on these raw materials and have been changed to finished product form. Once products are produced, it should be delivered to customers at right time, on the right place and with reasonable price. Therefore, to achieve these, the company must follow up/assess quality of its upstream suppliers and downstream customers. And also work in cooperation with other companies.

6.1.5 Existing Facilities and Capacities of the Company

The company has one big plant located in Addis Ababa whose role is to produce the required product by processing the row material. And there are six container shops to distribute the finished products in Addis Ababa and five distribution centers in different regions. But there are no any purchasing centres for raw materials. The capacities and roles of some of the existing facilities are given below.

6.1.5.1 Plant Capacity: The design and attainable capacity of the plant was 21,600 tons and 19,000tons per year respectively. The company has four production lines; the four production lines with their respective capacity are shown in appendix 6.

6.1.6 Production Process of the Company

The company has four major production lines with their respective four different raw material inputs. These production lines pass through a single mixer at which different ingredients mixed together to produce a desired output. After mixing ingredients together they pass their own processing step for each product type. Appendix 7 shows general production process of Faffa Foods Share Company.

6.1.7 Supply Chain of Faffa Food Share Company

A supply chain encompasses all the activities, functions and facilities involved in producing and delivering a product and/or service, from suppliers (and their suppliers) to the customers. The supply chain management (SCM) paradigm is geared towards optimizing each component of what used to be called (Production and Operations management (production, warehousing, inventory, transportation and distribution etc.)) and the inter-links between these components synergistically [2]. In the 70's and the 80's, various models for production and operations control and management were developed: Just-In-Time (JIT), Inventory management model, Zero Inventory (ZI) model, Total Quality Management (TQM) etc. [1]. These models focussed on the various components of the supply chain in isolation, this implies that these models were oriented towards the optimization of a sub-part of the system whereas the SCM paradigm aims at the optimization of the full chain. The generic form of SC is as shown below consisting three main components:

Fig. 6.1 Generic SC Networks

A fundamental premise of supply chain management is to view the network of facilities, processes, and people that procure raw materials, transform them into products, and ultimately distribute them to the customer as an integrated chain, rather than a group of separate, but somewhat interrelated, tasks. The importance of this integration cannot be overstated because

the links of the chain are the key to achieving the goal. Every company has a supply chain, but not every company manages their supply chain for strategic advantage.

In the past, companies that practice supply chain management report significant cost and cycle time reductions. For example, Wal-Mart Stores Inc. announced increases in inventory turns, decreases in out-of-stock occurrences, and a replenishment cycle that has moved from weeks to days to hours [32].

But now the competition among supply chains becomes very tough and companies integrate quality management along the chain to fulfil and/or exceed their customer needs. Therefore, before taking any improvement measures and proposing a model that fits the company under investigation, it is important to see the existing system.

6.1.7.1 Links within the Supply Chain

Within supply chain management, information, systems, processes, efforts, and ideas are integrated across all functions of the entire supply chain. Supply chains become more complex as goods flow from more than one supplier to more than one manufacturing and distribution site. The possibility of outside sources for functions like assembly and packaging are also options in the chain.

The basic tasks of a company do not change, regardless of whether or not it practices supply chain management. Suppliers are still required to supply material, manufacturing still manufactures, distribution still distributes, and customers still purchase. All of the traditional functions of a company still take place. The ultimate difference in a company that manages its supply chain is their focus shifts from what goes on inside each of the links, to include the connections between the links.

Since Faffa Foods Share Company is a food processing industry and its major raw materials supplied from local suppliers. Therefore, its supply chain should begin from the farmers who produce input raw materials (cereal crops) and ends to end customers. The main participants of the company's supply chain are discussed below:

Suppliers: The Company has local suppliers for direct raw materials & packing materials and foreign suppliers for vitamins and minerals, machinery's, equipments and accessories. But the company uses cost as major criteria for supplier selection and most of the time it purchases

raw material from the market directly. The major input materials suppliers are as follows in the table below:

Table 6.2 Major suppliers and their respective place

Owner	Location	Input material
Local suppliers		
Government farm	Arsi	Wheat and Barlin
	Wollega	Maize
	Balle	Wheat, Barlin, oat(aga)
	Upper awash	Maize
Privet investors	Bir-sheleko	Maize, Soya bean
Merchants	Gojam	Wheat, barline, maize
	Sedama	Maize, soya bean
Companies	Metahara sugar factory, Classic Plastic packing & carton box factory	Sugar, packing materials
Foreign suppliers	China, Japan	Machinery & equipment
	China, India	Milk powder , vitamins and mineral , Iodized salt

Customers: The ultimate goal of supply chain is satisfying end customers. In addition, it works to maximize profit and minimize cost. The main thing to be considered here is selecting and forming a good relation with potential customers. The current potential customers of the company are the following:

- Petram company
- Christian relief development association (CRDA)
- EURON Aid
- Lutheran world association
- World food program
- Local NGO's like Abebech Gubena, Dembosko, Wogen Adine etc.
- Governmental organizations, like Oromia, Afar, Somalia danger prevention
- Save the children
- Whole sellers in Addis Ababa

Even though, these customers buy the company's product, it doesn't mean there was a good relation in between. The company provides its product as per the order comes from potential customers. In addition it uses its six sales outlets in Addis Ababa as a show room and they didn't have a capacity to fill the market demand. This shows the company didn't work hardly to achieve good relationship with its customer.

End Users: end users are the majority of consumers which use the products of the company. The main end users include: Hotels and restaurants, Bread and cake backers and Individual users.

The main thing here to consider is creating a dependable consumer for company products. To achieve this, the company must improve its distribution channel that satisfies customers need in terms of time and place.

The general structure of the company's customer relationship is as shown in the figure below. It consists Faffa Food Share Company as a centre followed by potential customers with their respective sub-distribution channel.

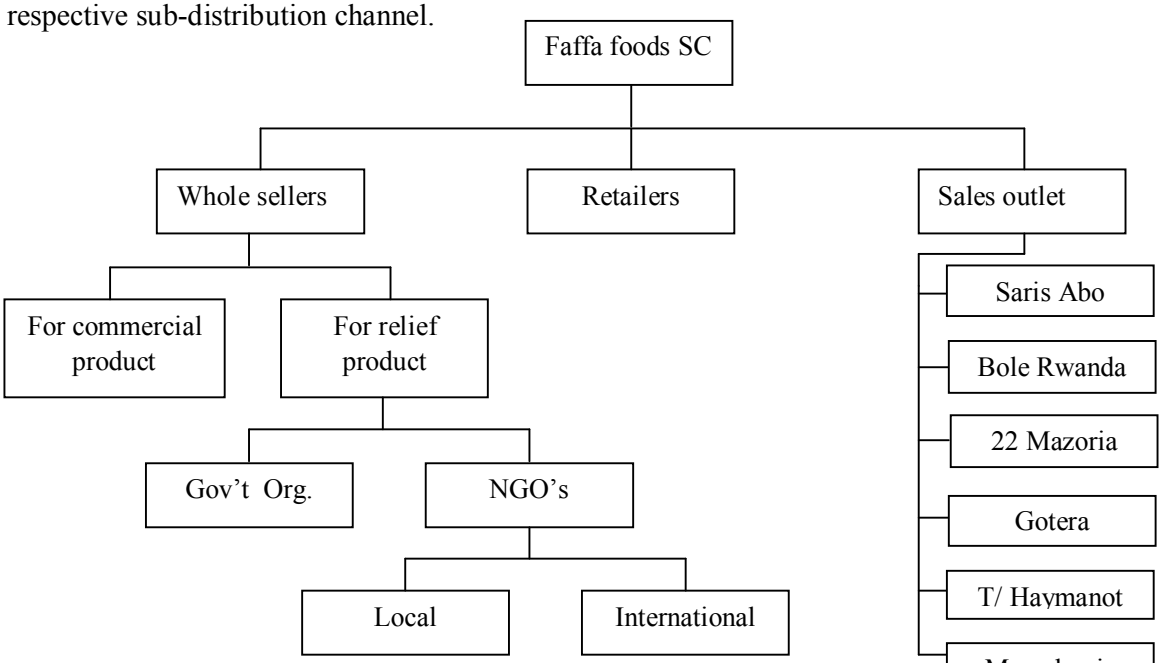


Fig. 6.2 Potential customers of the company

Manufacturing Firm: In the manufacturing firm the main task that must be considered is determining the functional units and their relationships. Information and material flow with in departments are also basic components. From the survey that has been conducted in Ethiopian manufacturing firms, the company Faffa has relatively better internal integration among

departments. The current functional departments are as follows: Planning, Marketing, Sales and logistics, Finance, Production, Quality, Administrative unit.

Supplementary Industries: Since the company produces food products it needs accurate packing materials. Therefore, there should be integration with plastic manufacturing firms. In addition there are several transporting vehicles in the company. This needs to have good relation with vehicle maintenance garages and fuel oil supply organizations.

After identifying supply chain partners of the company in detail, it is better to show the company's supply chain diagrammatically. The figure below shows current supply chain of the company.

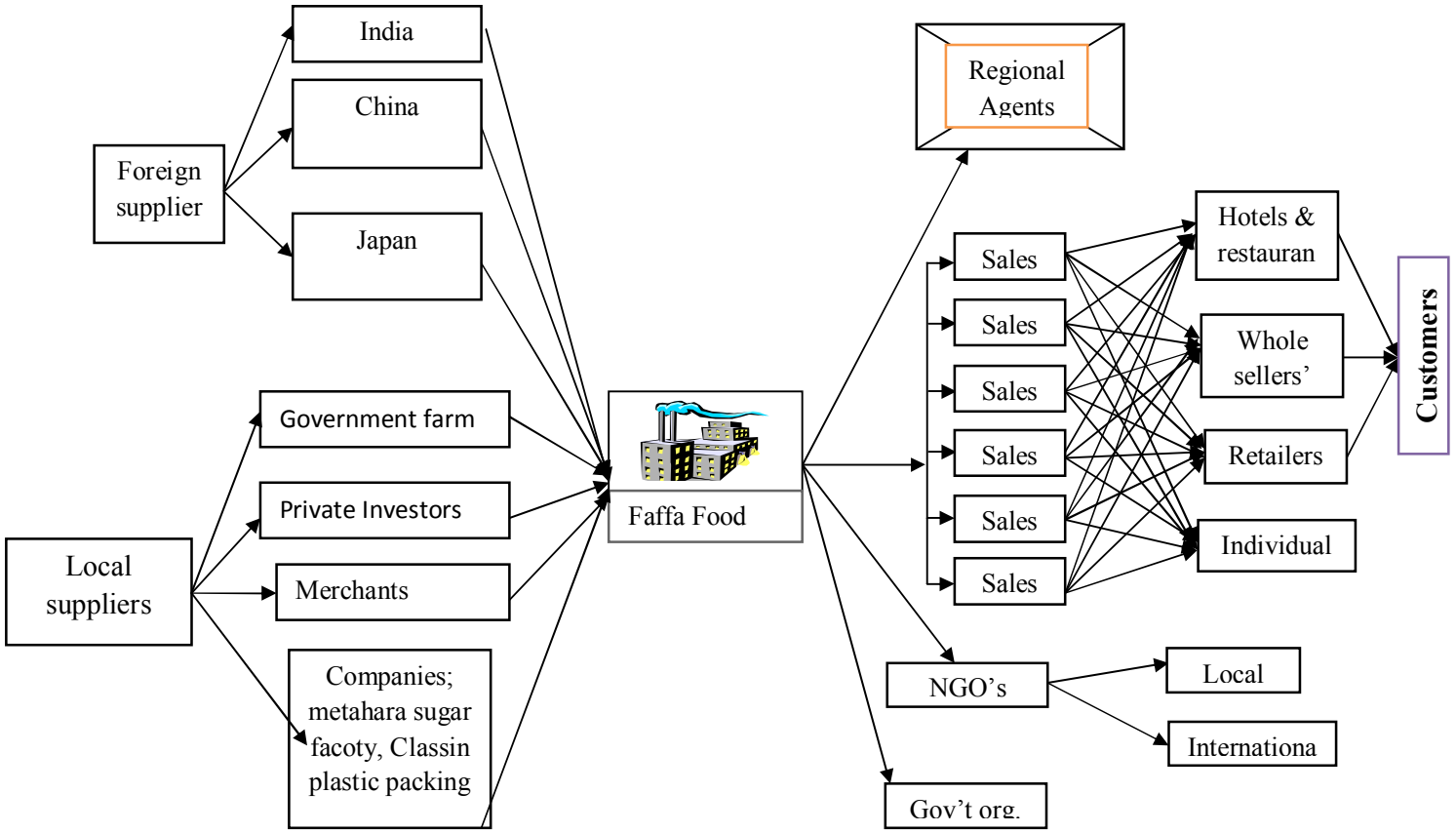


Fig. 6.3 Supply chain of Faffa Food Share Company

Note:

Sales 1:- Saris Abo

Sales 2:- Bole Rwanda

Sales 3:- 22 Mazoria

Sales 4:- Gotera

Sales 5:- Techle Haimanot

Sales 6:- Messalemia

6.1.8 Problems Identification in the SCQM of FFSC.

6.1.8.1 Problem of Integration

To talk about supply chain management of any manufacturing/processing company the following three systems must be fulfilled. These are:

1. Supply system
2. Manufacturing system
3. Distribution system

In food processing companies such as Faffa Food Share Company, the supply system includes raw material suppliers (local and foreign suppliers), packing material suppliers, machinery, equipment and accessory suppliers, input martial warehouses, etc.

And the manufacturing system consists production lines on which the raw material has been changed into finished products. Faffa Food SC. has four major production lines for which their respective products passed. While the distribution system comprises different distribution channels. These are finished product warehouses, regional depots, sales agent, plant sales, whole sellers, retailers and end users (consumers).

But the main problem observed in Faffa Food SC. is that these three systems are not well integrated. The company didn't have constant suppliers. They just purchase raw materials, by preparing tender, from individual merchants. In addition, the company have weak quality specification to select suppliers and give more concern on the cost of purchased material. Therefore, this weak integration level brings the following problems:

- With in the company there are frequent delays of orders between functional departments. From the interviewed employees 70% said that they are just working their intended task independently. And these causes' productions break down during peak demand period.
- No responsible body for problems occurred. Instead of digging out a solution for problems, each department push the burdens to its supply department.
- On customer side there is always delay, when two orders come at the same time. At this time the company prioritized customers and this causes loss of trust.

- Purchasing costs become very high. Most of local raw materials like maize, wheat, chick pea, soya bean etc. are produced in seasonal manner and their purchasing price also varies from season to season.
- High capital tied up because they purchase a large quantity and store it. This is the result of lack of dependable supplier. As it has been got from the purchasing department average estimate of yearly raw materials purchased are as follows:

Table 6.3 Average annual inventory level

Ser.No.	Raw material	Quantity (quntal)	Unit price	Capital tied up
1	Maize	50,000	680	34,000,000
2	Wheat	30,000	700	21,000,000
3	Chick pea	5,000	1,100	5,500,000
4	Soya bean	3,000	2,850	8,550,000
5	Oat (aja)	500	3,200	1,600,000
6	Barline	500	1,200	600,000
7	Others	2,000	--	800,000
Total				**72,050,000**

(Source: Company's data)

Note: the quantities and unit price used are average value, which considers seasonal price fluctuations of raw material and yearly consumption of the company.

Therefore, the company tied up 72,050,000Birr for raw materials stored at warehouse. For the case of finished products there is no significance capital tied up. The reason for this is that, since most of the customers are NGO's and government organizations, their relation is order based.

6.1.8.2 Problems on Technology, Size and Capacity Utilization

Technology: It is difficult to make a sweeping generalization on the type and quality of technology being employed in the food industry in Ethiopia. This is because some factories are using state-of-the art modern technology while others like Faffa Food SC. are using old and obsolete technologies. Therefore, the company have to contend with the problems often associated with high maintenance cost of old machinery and equipment. The company Faffa

incurs around 4,500,000Birr for maintenance due to frequent breakdown of old production machines including purchase of spare parts.

Since the cost of labour is rather low, many food-processing factories appear to have adopted for labour-intensive and semi-automated technologies. Even though Faffa Food Sc. have rehabilitated and/or expanded their facilities, there are still many old technologies. The technology or machinery and equipment have for the most part been imported from lower cost countries such as India.

Size: Production capacities and number of employees are the most important variables that determine the size of the food processing industries. As it is seen from CSA 2002, that the 68 large-scale food industries comprising one-third of the total number of food manufacturing enterprises, employ more than 88% of the employees and generate more than 94% of the GVP (gross value of production) of the food industry. But when we come to the company under investigation the major problem is it lacked skilled personnel for its respective production process. The table below shows educational status of employees.

Table 6.4 Employee's educational level

Ser. No.	Employees educational status	Number
1	Study up to grade 10	123
2	Certificate	83
3	College diploma	34
4	1st degree & above	57
5	Total	297

From the table it can be seen 41.41%, 27.95%11.45% of employees are grade 10 graduates, certificate and college diploma respectively. Only 19.19% of the employees have required skill for their respective field. Further most of the trainings were given to department heads and administrative bodies not for shop floor workers.

Capacity Utilization: Capacity utilization in the food processing industry is somewhat low averaging, 58% in 1998/99. It varied from as low as 17.6% for manufacture of animal feeds to 78% for sugar. Other industrial groups that operated at capacities below 50% include other food products (28%), vegetable oils (34%), meat, fruits and vegetables products (37%) and grain mill products (46%). [43]

The company Faffa is currently producing under its capacity i.e. 22,732.8 tones/year. The main reason for this is that it doesn't manage its suppliers properly and the three production lines wait each other for a single mixer. The last five year actual production compared with that of planned production is described as follows:

Table 6.5 Capacity utilization of Faffa Food Sc.

Year (E.C)	1999	2000	2001	2002	2003	Average
Planned production (tones)	20418.4	21709.6	21032.9	21619.8	19947.2	20945.64
Actual production(tons)	8073.45	10,514	8455.26	8,382	8,701	8825.142
Percentage achieved	36.54	48.43	40.02	38.77	43.62	41.476

(Source: company's data)

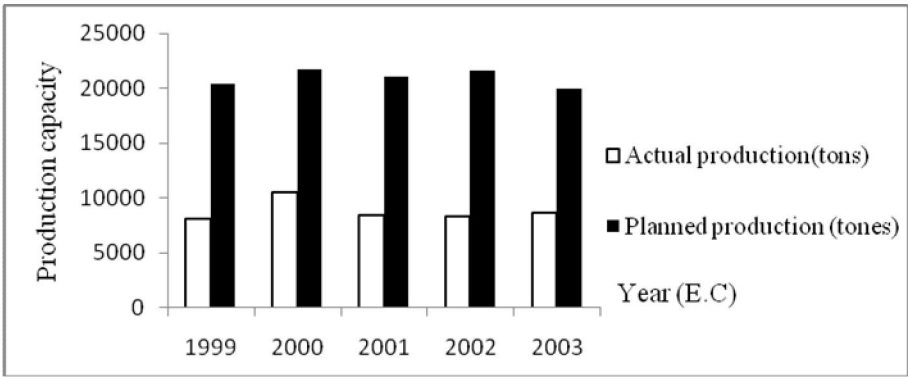


Fig. 6.4 Comparison of actual and planned production of the company

This shows that the company's production process has a fluctuating trend. The reason for this is that frequency of orders decrease from major customers (NGO's and government organizations), because of famine and drought occurrence decrement.

6.1.8.3 Problem of Information Flow

In the today's competitive market smooth information flow is a crucial thing to be considered along the entire supply chain. The current state of the art of information flow in a food processing industries is highly sophisticated. At the same time they are using advanced technologies/software like ERP, EDI, MRP, MRPII etc and every partner knows the status of the other. For instance, marketing department knows the quantity of finished products in the warehouse and the production department has up-to-date information about availability of input materials. In this system the quantity, quality and shipping time of input materials/finished products, available space in the warehouse, availability of transport

vehicles etc. are known by every functional departments in the company. Therefore, smooth information plays a great role to create better coordination among the chain.

But in the company which is under investigation the information sharing, between the departments of the company and between the suppliers and distributors, is not smooth. It is report based approach information flow which causes the following problems:

- It takes long time to communicate each other.
- It is difficult to know exact quantity of materials (raw material and finished product) in the warehouse. This may cause high holding cost and/or shortage of material during peak demand.
- It needs unnecessary labour force to move the reports here and there.
- Creates unsatisfied employee due to routine paper work.

6.1.8.4 Problems of Quality

As it was observed from the survey and industrial interviews of Ethiopian manufacturing industries, they are producing low quality product as compared to other countries. In this section, we can see the major quality problems that face Ethiopian food processing companies by taking Faffa food Share Company as a case. Quality problems along the SC will be discussed below.

1. Quality problems at supply side

As we have seen above the company has two major suppliers local and foreign. Most of the quality problems that faced the company are those raw materials from local suppliers. Therefore, these quality problems are different at different levels of the company's supply chain. Those problems are shown below:

Problems at Primary Production/ Farm: Most of Ethiopian primary producers/farmers are using a traditional way of farming to cultivate cereal crops. Except government farms and private investors, traditional farmers didn't properly use fertilizers and pesticides'. These results in low farm output, insect attacked and immature output. The following figure shows cause and effect analysis for low quality of farm products.

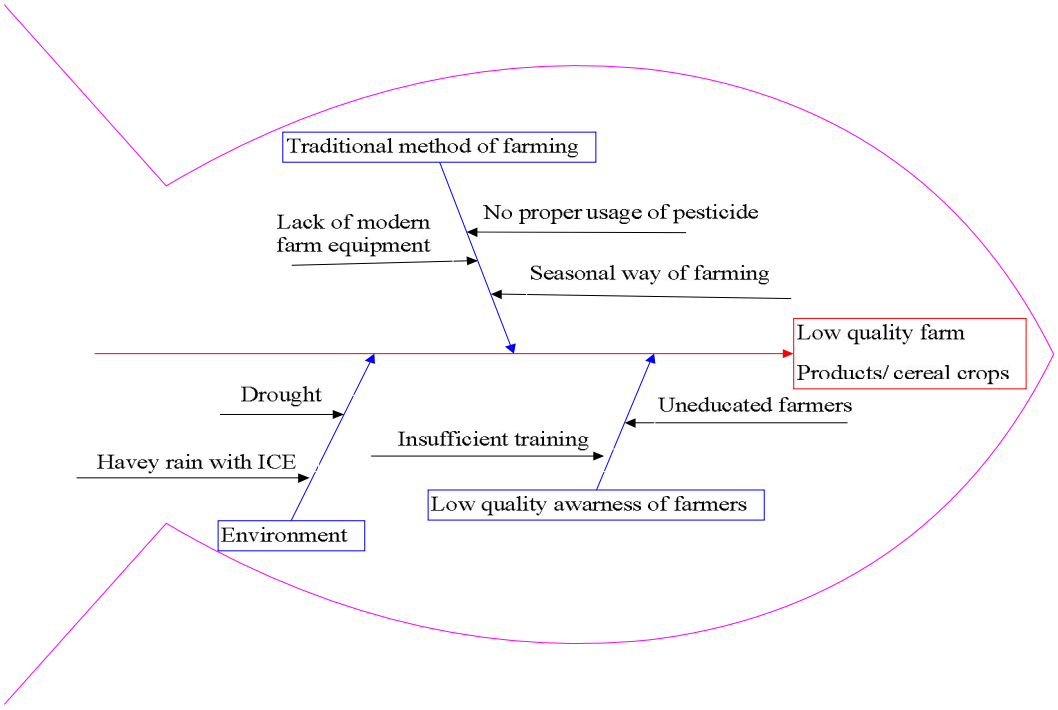


Fig. 6.5 Cause and effect analysis of low quality raw materials

In addition there are many quality problems at supply side which include: not buying good quality materials at the right time, raw material price fluctuation due to supply chain uncertainty i.e. seasonal supply, storage, transportation and cheating by farmers.

Loss at supply-focal firm stage

Material loss: due to poor quality the company rejects many quintals of input raw material.

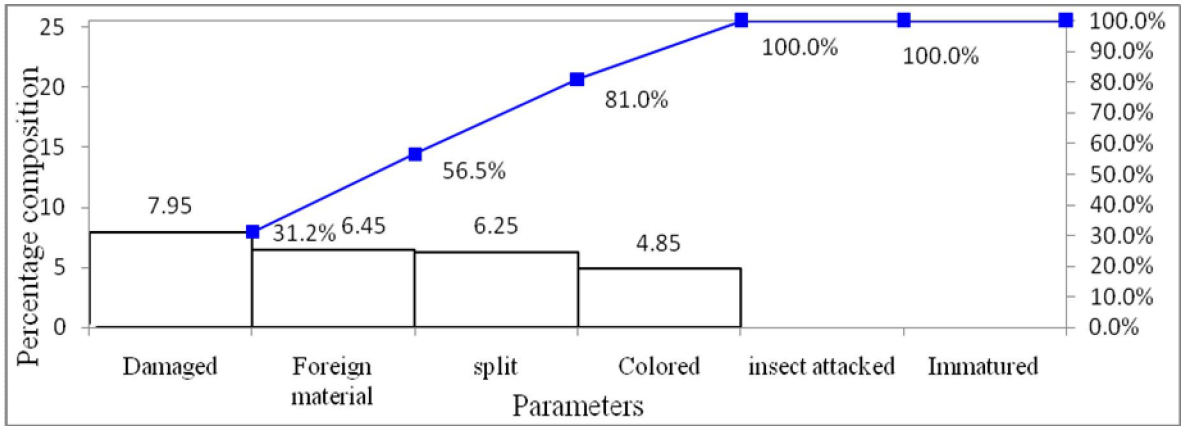
These are determined by physical and chemical laboratory of the firm. The major raw materials with their respective quality parameters and quantities rejected are described below:

Soya Bean: the company Faffa allowed maximum total impurity of 23% for the entrance of soya bean. This total impurity is summation of six component parameters that are checked independently. The priority of the six quality parameters are determined by taking sample of actual testing results as follows.

Table 6.6 Soya bean quality defect measures

S.No	Parameter	Req.	Test Result (%)										Mean	Priority
			1	2	3	4	5	6	7	8	9	10		
1	Foreign	5.0	6.0	6.5	6.0	4	4	10	10	4	10	4.0	6.45	2
2	Damaged	5.0	11	7.0	6.5	5	14	5	8	4	5	14	7.95	1
3	Splits	10.0	6.0	7.5	8.0	5.0	6.0	6.0	6.0	6.0	5.0	7.0	6.25	3
4	Insect damaged	-	-	-	-	-	-	-	-	-	-	--	--	
5	Immature	-	-	-	-	-	-	-	-	-	-	--	--	
6	Colored	3.0	2.0	4.0	3.5	10	2	5	2	13	5	2.0	4.85	4
	Total	23.0	25	25	24	24	26	26	26	27	25	27	25.5	

(Source: company's laboratory result)



6.6 Pareto analysis for Soya bean defects

This result shows that raw material damage (with mean of 7.95) is the most frequent quality problem that faced the company while foreign material (6.45) and split (with mean 6.25) followed it. The reasons for these are damage at the time of transportation and poor collection at farm

The quantity of rejected soya beans due to these quality problems with their respective capital tied up for the suppliers in the last five years is listed below. The price of one quintal soya bean ranges from 2260 to 3200birr. Therefore,

Capital tied up = rejected quantity * sales price/quintal.

Table 6.7 Quantity of rejected soya bean and cost incurred per year

Year	1999	2000	2001	2002	2003
Rejected(in quintals)	3,524.02	2,889	2,045.42	4,818	3,985.36
Capital tied up	9,620,574.6	7,886,970	5,583,996.6	13,153,140	10,880,033

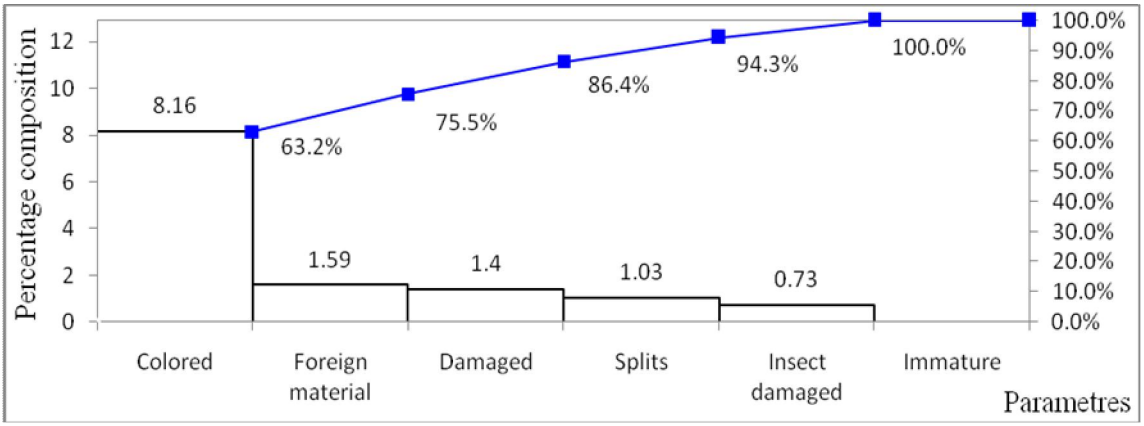
This shows that, raw material soya bean, suppliers of Faffa Foods Sc. has faced averagely 3,452.36 quintals or 10,250,303.80 birr capital tied up and 13,809.44birr cost of transportation which include wages to load/unload truck, driver's daily payment and fuel cost.

Chick Pea: Similarly the maximum allowed total impurity of chick pea is 10%, which is summation of six parameters as shown below. The priority of these six parameters is determined from a sample of test results.

Table 6.8 Chick pea quality measures

S. No	Parameter	Req.	Test Result (%)										Mean	Priority
			1	2	3	4	5	6	7	8	9	10		
1	Foreign material	1.0	1.0	0.8	0.9	0.8	2.0	1.0	2.6	2.3	2.0	2.5	1.59	2
2	Damaged	2.0	1.5	1.4	1.5	1.5	5.0	2.0	1.0	1.3	1.3	1.0	1.4	3
3	Splits	1.5	1.0	1.0	1.0	1.0	1.0	1.3	1.0	1.0	1.0	1.0	1.03	4
4	Insect damaged	1.5	0.4	1.3	1.2	1.2	1.0	1.0	0.2	0.5	0.3	0.2	0.73	5
5	Immature	-	-	-	-	-	-	-	-	-	-	-	-	
6	Colored	4.0	3.5	12.8	8.0	8.0	5.5	3.8	8.6	10.2	10.7	10.5	8.16	1
	Total	10.0	7.4	17.3	12.6	12.5	14.5	9.1	12.4	15.3	15.3	15.2	13.2	

(Source: company's laboratory result)



6.7 Pareto analysis for Chick pea defects

This result shows that 63.2% of chick pea quality problem is due to color while the rest insect attacked; split, damaged and foreign material covers 36.8%.

The quantity of rejected chick pea due to these quality problems with their respective capital tied up for suppliers in the last five years is listed below:

Table 6.9 Quantity of rejected chick pea and cost incurred per year

Year	1999	2000	2001	2002	2003
Rejected(in quintals)	523	654	356	866	1,475.85
Capital tied up	575,300	719,400	391,600	952,600	1,623,435

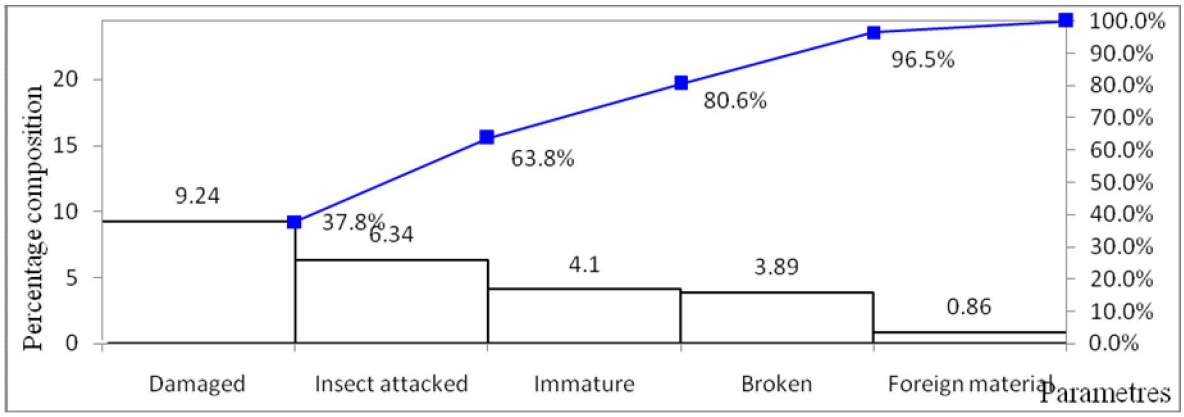
This shows that, raw material check pea, suppliers of Faffa Foods Sc. has faced averagely 774.97 quintals or 1,099,368 birr capital tied up and 3,099.88birr cost of transportation which include wages to load/unload truck, driver's daily payment and fuel cost.

Corn/Maize: In a similar manner the company allowed 18.5% of total impurity level for corn. For corn there are five major parameters measured to check its quality. These parameters with their respective priority are described below:

Table 6.10 Quality parameters of corn/maize

S. No	Parameter	Req.	Test Result (%)										Mean	Priority
			1	2	3	4	5	6	7	8	9	10		
1	Foreign material	1.0	0.8	0.8	1.2	0.8	0.7	0.8	1.2	0.5	0.7	1.1	0.86	5
2	Damaged	5-8	10.2	8.7	4.6	10.2	7.0	10.8	6.8	11.6	12.1	10.4	9.24	1
3	Broken	5.0	3.8	4.0	3.4	3.4	3.0	2.8	4.0	4.8	4.6	4.1	3.89	4
4	Insect attacked	1.5-3	5.7	4.2	6.8	6.5	5.6	4.4	5.0	8.9	8.5	7.8	6.34	2
5	Immature	6.0	4.0	3.2	4.2	4.0	4.2	3.2	5.5	4.5	4.2	4.0	4.1	3
	Total	18.5	24.5	20.9	20.2	24.9	20.5	20.4	22.5	30.3	30.1	25.4	20.0	

(Source: company's laboratory result)



6.8 Pareto analysis for Corn/Maize defects

This result shows that insect attacked and damage, which covers 63.78%, are the major factors for raw material rejection while the rest immature, broken and foreign takes 36.22%.

And the quantity of rejected corn/maize due to these quality problems with their respective cost for the last five years is listed below:

Table 6.11 Quantity of rejected corn/maize and cost incurred per year

Year	1999	2000	2001	2002	2003
Rejected(in quintals)	5,634	3,998	4,862	4,856	5,004
Capital tied up	3,831,120	2,718,640	3,306,160	3,302,080	3,402,720

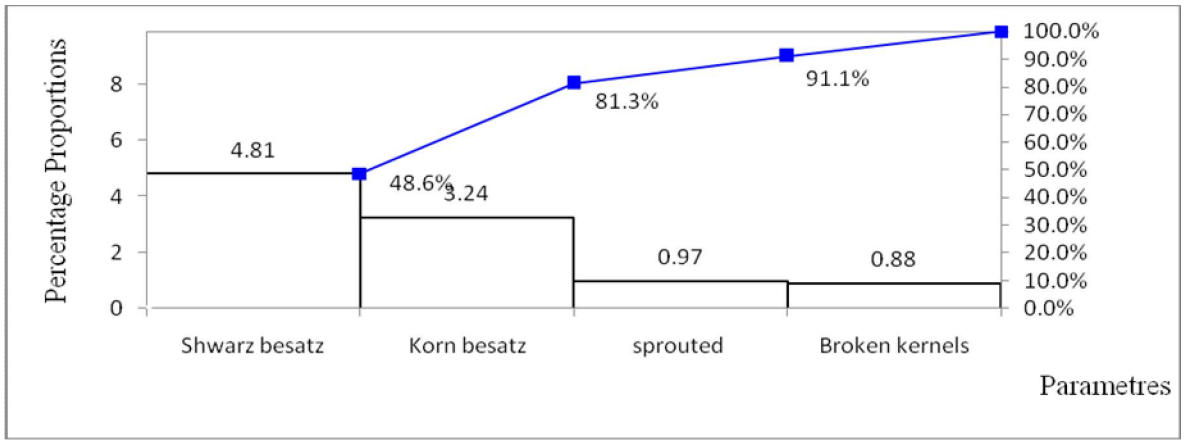
This shows that, raw material corn/maize, suppliers of Faffa Foods Sc. has faced averagely 4,871 quintals or 3,616,920 birr capital tied up and 19,484birr cost of transportation which include wages to load/unload truck, driver's daily payment and fuel cost.

Wheat: Also the company allows 9.5% total impurity for acceptance of wheat. In addition there are four quality parameters measured at the entrance. The table below shows this parameters and their priority.

Table 6.12 Wheat quality parameters

S. No	Parameter	Req.	Test Result (%)										Mean	Priority
			1	2	3	4	5	6	7	8	9	10		
1	Korn besatz	3.0	4.0	3.2	4.0	3.0	3.4	1.5	2.5	2.6	4.2	3.0	3.24	2
2	Shwarz besatz	5.0	4.8	4.7	4.5	4.5	4.7	4.9	4.7	5.8	3.7	5.8	4.81	1
3	Broken kernels	0.5	0.4	1.2	-	1.4	1.3	1.2	1.3	0.3	1.2	0.5	0.88	4
4	sprouted	1.0	0.5	0.7	1.5	1.0	0.4	1.4	1.5	1.6	0.7	0.4	0.97	3
	Total	9.5	9.7	9.8	10.0	9.9	9.8	11.0	10.0	10.3	9.8	9.7	10.0	

(Source: company's laboratory result)



6.9 Pareto analysis for Wheat defects

This result shows that broken kernels and korn besatz which cover 81.33% are major problems for rejection of wheat while sprouted and shwarz besatz followed by covering 18.67%.

And the quantity of rejected wheat due to these quality problems with their respective cost for the last five years is listed below:

Table 6.13 Quantity of rejected wheat and cost incurred per year

Year	1999	2000	2001	2002	2003
Rejected(in quintals)	1,325	520	658	5,977	1,360.15
Capital tied up	927,500	364,000	460,600	4,183,900	952,105

This shows that, raw material check pea, suppliers of Faffa Foods Sc. has faced averagely 1,968 quintals or 939,803 birr capital tied up and 7,872birr cost of transportation which include wages to load/unload truck, driver's daily payment and fuel cost.

Generally suppliers cost 44,265.32birr for transportation of rejected input materials. In addition, the company Faffa incurs labor cost, equipment cost and time for checking these impurities which didn't predicted so far.

2. Quality Problems at Manufacturing Firm

The company Faffa has well awareness about quality management. It has implemented hazard analysis and critical evaluation process (HACCP) system and also it was ISO 22000 certified company. But the gap identified in the firm is that the company didn't extend its quality management practice along chain partners. All quality effects are practiced with in the wall of the company. Still now the firm didn't work towards quality improvement of its supply chain partners i.e. the company didn't see its suppliers/customers as extension of its process. Further some of quality problems observed at the company include:

- Inappropriate working environments,
- Faffa Food Company uses only one single mixer to all production lines, therefore due to the frequent change of input materials and inadequate cleaning system the final product quality lowers.
- The wheat flour mill was too old and it has got frequent frailer, this results shortage of wheat flour during peak production time.
- The company also has inadequate water well rehabilitation system, this leads to shortage of water during summer season.
- The company uses outdated steam boiler which needs high fuel consumption and faced frequent frailer which takes long time for maintenance, this interrupts production process. The current state of the art for steam boiler is electrical steam boiler which costs around Birr 400,000

- ❖ The company has outdated packing and printing machines, the current machines are working manually, even the company currently uses writing of expiration date manually this leads too long time to write compared to automatic writing machines and causes spoilage of foods due to hand contaminations.
- ❖ The laboratory weighting machines lacks accuracy due to long time usage; this causes incorrect proportion of input materials and then lowers quality of final output.

3. Quality Problems at Distribution Channel

The final delivery system for relief product was better than that of supply side. The reason for this is those major customers (NGO's and government organizations) have capabilities to take a product by their own. Raw material suppliers with their respective lead times are described in the following table.

Table 6.14 Input materials of FFSc and the way they supplied to the company with their respective lead times

S. No.	Raw materials	Suppliers	Location	Shipment	Lead times
1	Wheat, oat Maize, Barline	Government farm	Arisi, wollega, Bale, Upper Awash	Shipment per month	2 week
2	Maize, Soya Bean	Private investor	Bir-sheloko	Shipment per month	2 week
3	Maize, Wheat, Barline, Soya bean	Merchants	Gogam, Sidama	Shipment per month	1.5 week
4	Packing material, Sugar	Classic Packing factory, Metehara sugar factory	Around Addis Ababa	Shipment per month	1 week
5	Machinery & equipment	Foreign suppliers	China, Japan	Shipment per yr.	6 month
6	Vitamins & Menerals, Milk powder	Foreign suppliers	China, India	Shipment per 6month	4-5 month

The other thing to be considered is delivery lead time and production lead times. The company's six sales outlets and their respective lead times (including load/unload) are described as follows:

Table 6.15 Warehouse capacities and Lead times of the six sales outlet of the company

S. No	Distribution centres/ Location	Capacities of the warehouse (quintals)	Lead times
1	Saris Abo	50	0.30hr
2	Bole Rwanda	50	2.30hr
3	22-mazoria	50	2.30hr
4	Gotera	50	1.30hr
5	Techle Haymanot	50	3.00hr
6	Messalemiya	50	3.30hr

While for commercial products, the company has six selling shops in Addis Ababa, which are unable to fill market demand. The reason for this is that, the capacities of these six sales shops were very small as shown in table below. They act as a show room. These causes lack of dependable and long lasting local customers.

Table. 6.16 Annual sales at six sales outlets

S. No.	Sales shop	Annual sales in quintals						
		1999	2000	2001	2002	2003	Mean	In.Tunover
1	Saris Abo	1300.65	1299.8	1279	1178	951.38	1201.766	24.03
2	Bole Rwanda	189.35	208.6	197	228.9	98.36	184.442	3.69
3	22-mazoria	479	470.6	469	471	346.27	447.174	8.94
4	Gotera	463	458.6	449	467	293.11	426.142	8.52
5	Techle Haymanot	1205	1254.5	1187	1304	897.48	1169.596	23.39
6	Messalemiya	354	343	321	325	100.7	288.74	5.77
Sub-Total		**3,991**	**4,035.1**	**3,902**	**3,973.9**	**2,687.3**	**3,718**	**12.39**
Gross sales		**89,654**	**98,897**	**97,037**	**79,712**	**92,591**	**91,578**	
Percentage (%)		4.45	4.08	4.02	4.98	2.90	4.060	

Source: company's marketing & sales department

From the above table we can conclude that, with regarding to market segmentation, the company was performing weakly. Averagely the company contributes 4.060% of its annual sales to local market and the rest for NGO's and government organizations.

In addition, even though the company has five distribution centers which are located in different parts of the country currently all are closed. The major reason was transportation cost i.e. their trucks has the capacity to ship 400quintals but regional distribution centres need 20 to 40 quintals at a time. Therefore, they assumed that it was costly and regional agents must be closed. As a result the distribution centres are not performing their intended use but they can be used by re-evaluating the network and the system.

Inventory Turnover of the Company: This ratio shows how many times the inventory of a company is sold and replaced over a specified period.

Generally calculated as: $\frac{\text{Sales}}{\text{Inventory}}$

But, it can also be calculated as: $\frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$

Annual inventory turn over of the six sales outlet at Addis Ababa can be computed as annual sales at each sales outlet divided by their respective annual inventory. But each of the six sales outlets holds 50quntals inventory annually. Annual inventory turn over of them was tabulated in table 6.16. Therefore, annual inventory turnover of the company can be calculated as:

$$\text{Inventory turnover} = \frac{\sum \text{annual sales at six sales outlet}}{\text{Average Inventory (6*50quntal)}} = \frac{3718 \text{ quintals}}{6*50 \text{ quintals}} = \mathbf{12.39}$$

Generally, a higher inventory turnover ratio is considered a positive indicator of operating efficiency, since inventory that remains in place produces no revenue and increases the cost associated with maintaining those inventories. From table 6.16 it can be seen that Saris Abo. and Techle Haymanot sales outlets have higher inventory turnovers and this shows that they have higher contribution to operating efficiency.

Chapter Seven

7.0 Proposed Models of Supply Chain Quality Management for Faffa Food Sc.

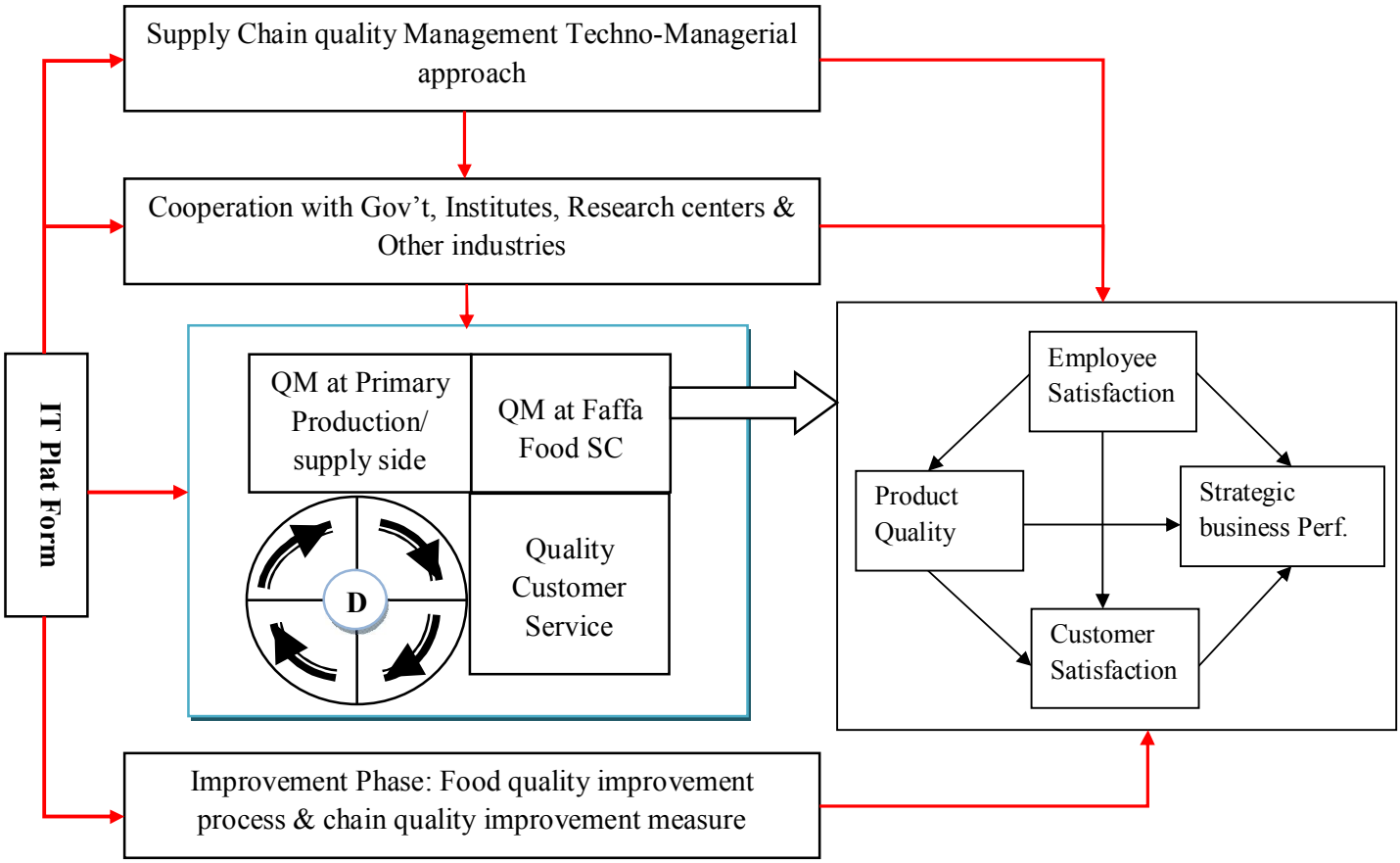


Fig. 7.1 Supply Chain quality management Model for Faffa Food Share Company (adapted from [41, 44])

Note: D = Diagnosis Phase

7.1 Supply Chain Quality Management Techno-Managerial Approach

This phase show that the company must be capable of up to date technologies and information system. As it was shown in the problem statement the company uses old machineries and report based information sharing. But to achieve high quality system there must be state of the arte equipments and appropriate information sharing mechanism using software's like MRP, MRPII, ERP, EDI etc. This software's enables the company to access on time status of every internal and external partner. On the other hand managerial aspects and their current practice are discussed below in section 7.4

7.2 Cooperation with Government, Institutes, Research Centres & Other Industries

Government Role: Food safety experts from Asia (India, the Philippines, Thailand), Africa (Morocco, Burkina Faso, Ghana, Mauritania, Senegal), Latin America (Brazil, Costa Rica, Guatemala), and representatives of France, Germany, the United Kingdom, WB, FAO, WHO, and members of the European research community emphasize that food quality control cannot be applied successfully in each country without the support of government and industry (Hanak et al., 2002) [36].

In addition, as stated by Belay. T. may 2007; Ethiopia's industrial development strategic policy is designed primarily to use domestic agricultural products (raw materials) for local industrial production. It appears planned ultimately to link agriculture and industry: agriculture produces industrial inputs, and industry produces agricultural inputs. For example, farms produce wheat for food processing companies, while chemical industries produce fertilizer. The policy-makers (government) thought this would facilitate industrial development which, in turn, would create an adequate market for domestic products in the country under private ownership. In addition to creating favourable conditions for private investors in various sectors of industries.

Role of Institutes and Research Centres: Since Faffa Foods Sc. is a food processing firm institutes and research centres play a great role on product quality and technological advancement. Departments like chemistry, biology and food engineering has direct link to product quality. While IT departments contribute to smooth flow of information and mechanical/electrical engineering contribute for design and installation of production equipments etc. The following figure shows the role of government, institutes and industries for quality improvement at supply chain.

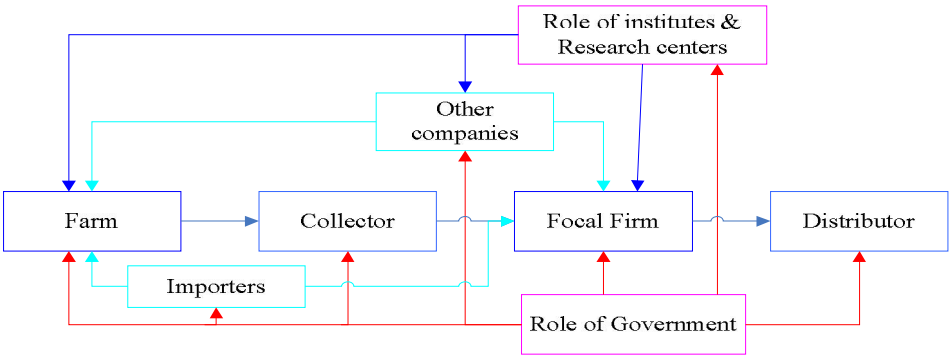


Fig. 7.2 Role of government, institutes and industries

7.3 QM at Primary Production/ Supply Side

Faffa Foods Share Company is a food processing firm and it uses most of its major raw materials from local suppliers which are traditional farmers. Therefore, to have a sustainable quality system along the chain the journey for quality must start at the cultivation of cereal crops and animal husbandry which are inputs for the company. By the time the company Faffa didn't have a long term relation with its suppliers, and didn't manage its supplier beyond the 1st tire currently as mentioned above. But the main thing to be considered here to achieve high quality suppliers is that the company must work hardly on suppler selection, supplier development and supplier integration. The details of these three parameters with their respective sub items are discussed in section 4.5.2. The following figures show the existing and proposed supply systems.

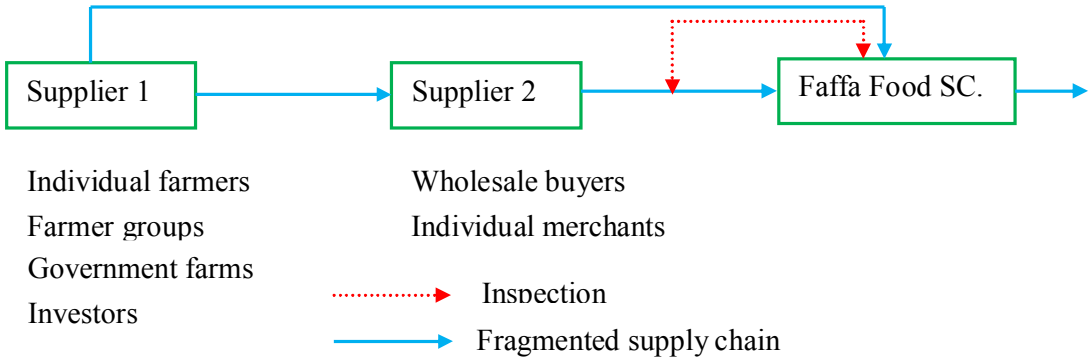


Fig. 7.3 Exiting supply system of Faffa Food Share Company

As mentioned in the problem statement the company uses only inspection for the incoming raw materials. It has not constant suppliers and select suppliers price wise. Therefore, the following model shows supply system quality management for the company. Supplier 1 represents farmers who cultivate cereal crops, at these stage main issues to be considered is usage of irrigation to prevent frequent occurrence of draught, usage of fertilizers and pesticides on time. These activities prevent occurrence of immaturity and insect attacked input materials. While supplier 2, indicates those wholesale buyer and individual merchants who buy raw materials directly from supplier 1/farmers. Their main responsibility is to transport materials from farmers to the company. Some of the quality aspects considered here are on time delivery with the required place and reasonable price, maintaining quality of materials transported i.e. preserve it from insects, moisture to prevent sprouted ness and damage.

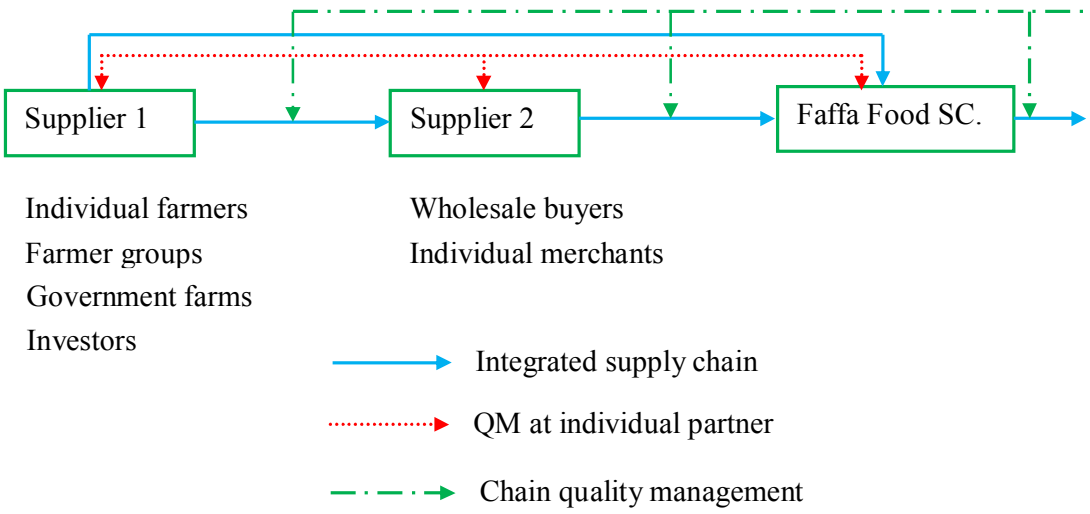


Fig. 7.4 Proposed supply system quality management

7.4 Quality Management at Focal Company/ Faffa Food SC

The two major systems that must be implemented at company level in food processing firms are total quality management and HACCP system. But the company has good quality practice relative to other in the same sector. Faffa Foods Share Company has been implemented HACCP system and it was ISO 22000 certified company. Therefore, here it is necessary to use improvement methods, techniques, tools and formulate models for maintaining strong practice and improving both weak and strong practices because QM is a continuous improvement. Since the focus of this study is supply chain quality, here we will see quality management at the focal company. The quality management system applied at all levels of the company including product design, production process, inventory management and technology used and finally at distribution system.

7.4.1 A Framework to Implement Quality Management

As stated by Zhihai Zhang, in his research on implementation of total quality management, there are 11 elements of total quality. In this thesis the current level of practice of each element are analyzed. These are management leadership, supplier quality management, vision and plan statement, evaluation, process control and improvement, product design, quality system improvement, employee satisfaction, recognition and reward, education and training, customer focus. The framework to implement the model was shown in the figure 7.6 and the following table shows current level of practice at Faffa Food Sc.

Table 7.1 TQM elements level of practice at Faffa Food Sc.

Quality practice	Cumulative mean	% practiced	Level
Leadership	4.177	83.54	Strong
Supplier Quality Management	3.075	61.5	Weak
Vision and plan statement	3.86	77.2	Strong
Evaluation	3.71	74.2	Strong
Process control & improvement	3.48	69.6	Weak
Product development	3.76	75.2	Strong
Quality System	3.26	65.2	Weak
Employee Participation	3.67	73.4	Strong
Recognition and reward	3.57	71.4	Strong
Education and training	3.17	63.4	Weak
Customer focus	3.15	63	Weak

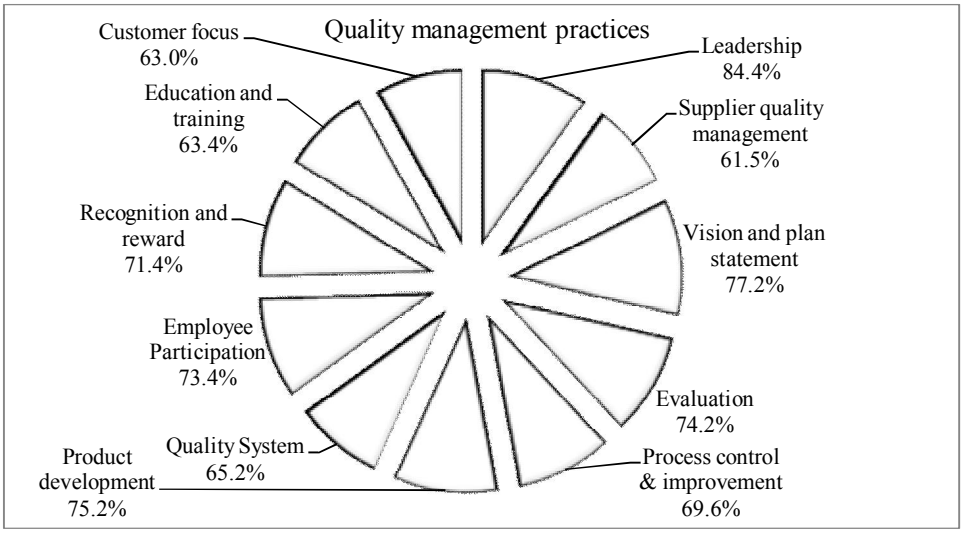


Fig. 7.5 level of quality practice at Faffa Food SC.

Management Leadership: The Company Faffa has relatively a good position at administration. The general manager actively participates in quality management activities and coordinates department heads and shop floor workers for improvement. From the guided interview it was obtained that 84.4% of elements of leadership practiced at the company.

Supplier Quality Management: As it was seen in the problem statement the company has poor supply system. The company's past trend show that it doesn't have a long term relationship with suppliers. They select suppliers that provide with fewer prices and considering quality as a second parameter to be checked later. The above analysis shows that it was the least practiced (61.5%) element from the 11 elements of TQM

Vision and Plan Statement: The company has long term mission and vision statement which states as follow:

Vision: the vision of the company is to play a leading role in building mentally and physically capable generation by producing high nutritional value products while, becoming internationally competitive business entity.

Mission: the mission of the company is to produce and sell various kinds of pre-cooked baby foods, semi-cooked supplementary foods, protein enriched & fortified flours, emergency foods and related products of high nutritional value in response to the growing demands of consumers. Looking into the future, the company is planning to produce new products.

Process Control and Improvement: Even if the company have a well-organized laboratory, they didn't use statistical process control techniques (SPC) to determine weather the process is in control or out of control. Therefore, by missing quality control techniques it is difficult to achieve process quality which is one aspect of total quality management.

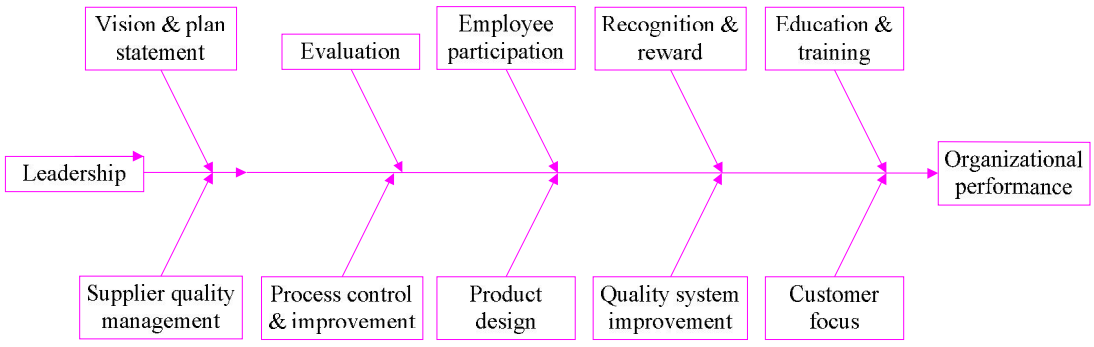


Fig. 7.6 Frame work for total quality management

Product Development: The company achieves 75.2% of elements of product development. It is the best quality practices practiced in the company. For instance, Ediget milk was the company's own product which is not produced by other companies.

Quality Improvement System: Since the company was ISO 22000 certified, it has a well-documented quality system. But the main problem here is that the company didn't follow the document and it is just put as a paper work only. Theoretically they know about quality, but in the real situation the company doesn't use quality tools, techniques and methods.

Employee Participation: Every employee has the power to control quality on process and work in collaboration with the supervisors. They have the right to come up with their own working problems because they don't afraid being fired from the company. But, actually the company didn't have structured quality circles and there is no job rotation in the company.

Evaluation: The company regularly evaluates its employee satisfaction level. Employees are evaluated to improve their performance not for criticism. And quality related information are widely displayed at shop floor level.

Recognition and Reward: The company give bonus for their employees as per the profit gained. Further, every employee has the right to get permission when he/she got personal problems.

Education and Training: As mentioned above most of the employees in the company are under grade 10 and certificate. By this situation the company does not have enough material for their employees to upgrade their status. In addition, training provided for employees are very few and on specific task not on quality issues. And those participate the training are departments heads not shop floor workers.

Customer Focus: Still now the firm has enough demand for their product. But they did not conduct any type of market analysis i.e. they didn't conduct market survey to understand what their customers need. Customer expectations, future requirements, and competitors' offerings remained unclear to a certain extent for product developers.

7.4.2 Processes of Model Implementation

Once revised the current quality practice, then the second step is to understand the Customer, identifies and organizes customer needs and establishes how the organization will meet those needs. Next, the leadership of the organization takes a detailed Review of the Critical Processes i.e. the 11 quality practices that drive the organization in its efforts to meet the needs of its customers. Figure below displays the primary processes of implementing TQM, consisting of seven steps.

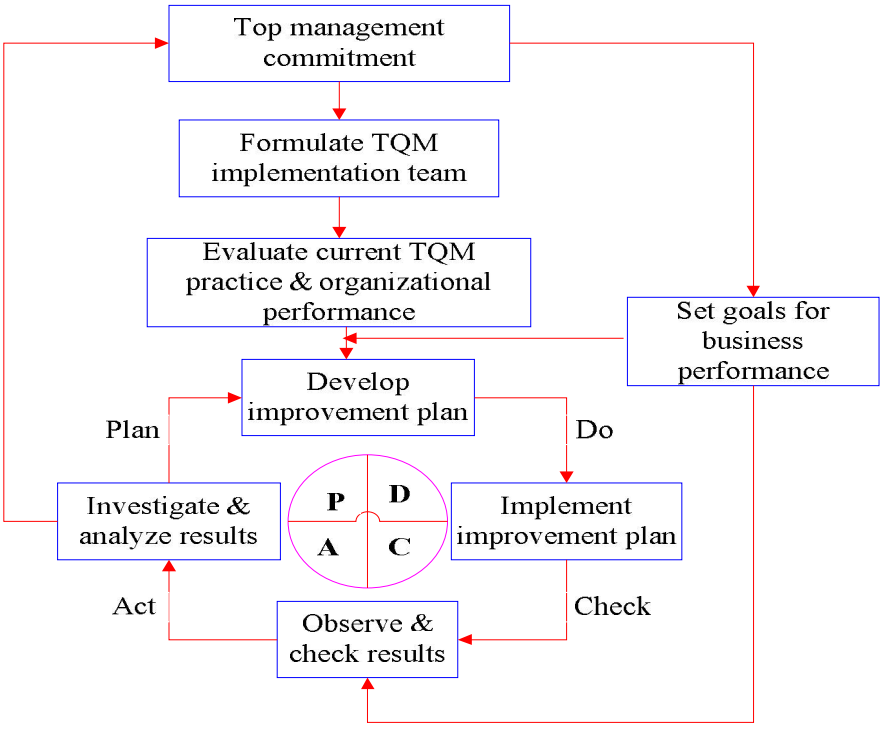


Fig. 7.7 Proposed TQM Implementation Processes adapted from [44]

Some of the reason that this implementation process needed are:

- ❖ To illustrate an overview of TQM so as to communicate a new vision of the organization.
- ❖ It forces management to address a substantial list of key issues which otherwise might not be addressed.
- ❖ It gives an insight into the organizations strength and weakness.
- ❖ Most importantly, to support implementation and to improve the chances that TQM adoption will be successful.

7.5 Distribution System Quality Management

Quality management involves being proactive in performing the right activity the right way the first time, and continuing to perform tasks to the required level. In logistics, that could translate in to strategies aiming to make order cycle times shorter and more predictable, as well as maintaining certain levels of in-stock availability and certain fill rates on customer orders. [33]

It is important to note that the quality level delivered to final customer is the result of the quality management practices of each partner of supply chains, and hence each partner plays an important role in the production and distribution process. Therefore, it should be recognized that an essential ingredient of successful supply chain management is high quality logistics throughout supply networks.

There is evidence to suggest that improving the quality of all logistics operations and supply chain stages results in reduced costs, improved resource utilization, and improved system efficiency (Beamon and Ware, 1998).

As stated by Millen and Maggard, 1997, there are about eight components that must be considered to have a quality distribution/ logistics system. [40] These are as follows:

- On-time delivery
- Total support of customer needs
- Consistency of order cycle
- Error-free transactions
- Accurate inventory information
- No goods damaged in handling or delivery
- Defined procedures and work instructions
- Reliable suppliers

In the case of the company under investigation, they didn't worry about quality of their logistics system. From the above eight components they tried to achieve only the three components i.e. on-time delivery, Error- free transaction and to some extent inventory information.

7.5.1 Organization and Involvement

This shows the organizational structure for distribution system quality management and the peoples involved in it. But the system considered in this thesis is distribution systems quality management of the manufacturing firm/ Faffa Food SC. in collaboration with its suppliers and customers, not for an independent logistics provider organization.

The form of organizational structure used for supporting quality of the logistics system includes:

- Steering committee of senior staffs' management: - which controls and monitor the activities to be done.
- Departmental functional quality circles:- these are personnel's from functional departments of the company. They are responsible for setting quality specifications for

the respective activities done i.e. they analyzed and set what quality aspect must be seen during raw material entrance, inbound logistics, materials in/out flows in the warehouse, outbound logistics and the like.

There are also four approaches which could be used to administer a logistics quality program. But the two most frequently used approaches were "Specific employees dedicated to quality projects" and "all employees having some quality project responsibilities". While the rest are each manager have his/her own approach organizationally and quality is managed through an external department. The figure below shows quality management of distribution channel.

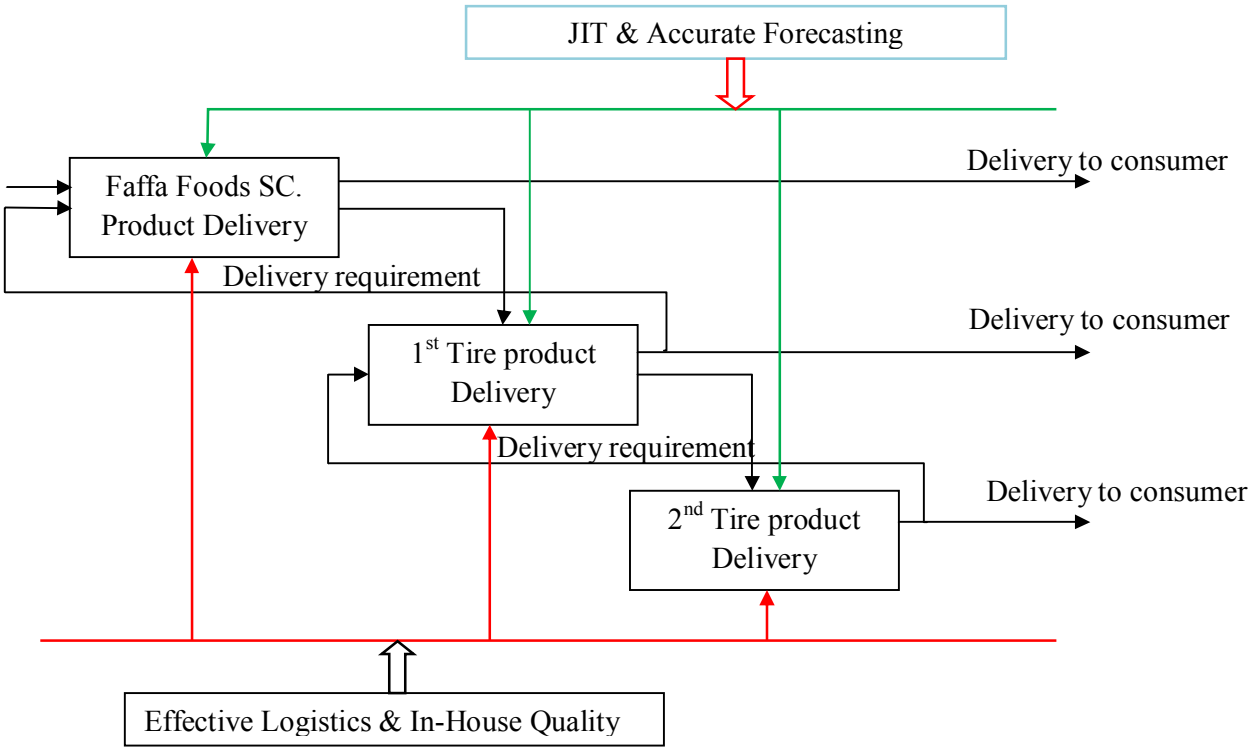


Fig. 7.8 Proposed distribution system quality management adapted from [40]

Note: 1st Tire product deliveries include the six sales outlets at Addis Ababa, regional sales agents, government organizations and NGO's. And 2nd Tire product deliveries include holes and restaurant, whole sellers, retailers and individual users

But in the case where the distribution channel expands beyond 2nd Tire product delivery the model repeats itself in the same manner.

Every partner along the distribution channel is a customer of its preceding member and supplier of the succeeding member. And satisfying the ultimate customer is the final goal of total quality. Therefore, each partner is expected to fullfil the requirements of the succeeding

member. As mentioned above these requirements/specifications are set by members of quality circles (expert from different departments).

7.6 The Diagnosis Phase

This phase is a base for supply chain quality management. Since quality management is not a onetime work rather it is a continual improvement, digging out quality problems along the chain is the main task expected from supply chain quality team. At this phase every partner in the chain and every employee at each partner should be involved to search problems and report it for supply chain quality team. Since Faffa Food SC. which is under investigation, is food processing firm the main problems that must be identified by the quality team are as follows:

Problems related to quality of input materials:

Identified by physical laboratories include:

- ❖ Occurrence of foreign materials
- ❖ Damaged and or broken, splitting
- ❖ Sprouted seeds(it starts germination)
- ❖ Insect attacked seeds and wives damaged
- ❖ Immature and colored seed

Identified by chemical laboratories include:

- ❖ Nutrition value
- ❖ Moisture and Ash content
- ❖ Fat and protein content
- ❖ Carbohydrate level
- ❖ Energy/chlorine Value

Problems related to customer service include on time delivery, order fill rate, delivery place etc. In addition they must assess quality problems of suppliers, the company and its distribution system.

7.7 Improvement Phase

Once quality problems are identified in the diagnosis phase, the next step is to find a solution. It is obvious that in a quality movement there is no fixed goal post to be reached once and stop there. There is always an improvement. The following figure shows process to be followed.

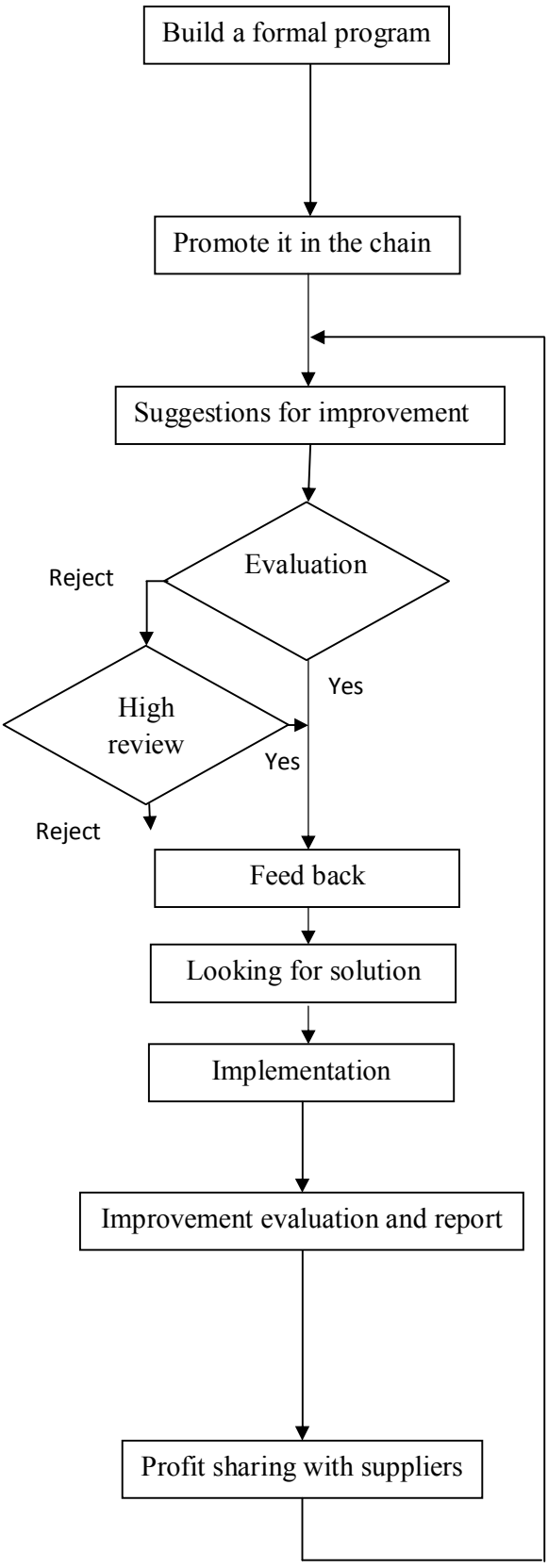


Fig. 7.9 Proposed Improvement process (Adapted from: [40])

Process	Activities	Actors
Build a formal program	Establish a program with the goal , Develop communication plan & Build a measurement system	Supply chain quality team
Promote it in the chain	Map to supplier and customers	Supply chain quality team
Suggestions for improvement	Give suggestion and idea by all partners in the chain	Suppliers/customers
Evaluation	Quickly evaluate the viability	Supply chain quality team
High review	High review by management in focal Firm	Management of focal firm or customers
Feed back	Feed back to provider	Supply chain quality team
Looking for solution	Find improvement solution	Suppliers & Supply chain quality team
Implementation	Place the solution	Focal firm or suppliers and customers
Improvement evaluation and report	Review the result & generate report card to CEO of suppliers	Supply chain quality team
Profit sharing with suppliers	Eg. suppliers keep part of cost saving Eg. Focal firm (customer) returns back a percentage of the suppliers total revenue in terms of approved cost reduction items	Focal firm or suppliers and customers

7.8 Benefits of Applying Supply Chain Quality Management

It is obvious that applying quality management techniques in any business has positive impact on organizational performance. Taking this in mind, the company can prevent defects at source and save the following costs. This includes:

- Saving supplier's transportation cost, 44,265.32birr, per year due to rejection raw materials by quality problem.
- Saving labour cost, equipment cost, administration cost, time at the company due to checking up of these rejected raw materials.
- The company can reduce 4,500,000Birr/yr of maintenance cost including purchase of spare parts for frequent failure of old production machines.
- The company can prevent 72,050,000Birr capital tied up for local raw materials purchase and use it for other investments i.e. it will get benefit from time value of money.

In addition:

- The company will have dependable suppliers and avoid loss of trust by creating long term relation.
- It will have a smooth information flow along the entire chain.
- Order lead times as well as production lead times significantly reduced.
- By using costs saved above for training, giving incentives, the company can create satisfied employee.
- Once it uses state of the art equipments and works with satisfied employee, ultimately product quality will be achieved.
- These all leads the company to create satisfied ultimate customers. Once the company enters in the heart of core customers it will have good position in to day's dynamic market.

Therefore, the above analysis shows that managing quality along the supply chain has a positive impact on organizational performance. But since quality management is a continual improvement process and ever lasting, improvements are incremental not dramatic change like BPR.

Chapter Eight

Conclusion, Recommendation and Future Work

8.1 Conclusion

In the 21st century product or service quality is an industry's only insurance that it can compete successfully, whether in regional, national or world markets. Based on the analysis and interpretation of survey result the following conclusions are forwarded.

From the survey questionnaire on Ethiopian manufacturing industries, it can be concluded that:

- Even though most of respondents in Ethiopian manufacturing industries say they have supply chain quality management awareness, only 27.8% define it on the context of their company.
- Most of the manufacturing firms manage only their immediate or first tier suppliers.
- Most of manufacturing firms select their suppliers based on price not quality.
- From those companies that manage their suppliers, 20.14% very good, 31.7% good and 31.01% fairly practiced supplier integration parameters.
- Most of the firms are lagging to fill market demand. The survey result shows that only 11.1% of respondent companies fulfil their market demand while the rest 83.3% contribute a little and 5.6% didn't know their product demand at all.
- Most of the companies use traditional total cost analysis method and only 38.9% know ABC costing method.
- Input material suppliers didn't participate in product development process.
- Most of the companies have weak inventory management system and few companies use advanced soft wares.
- Long lead time was frequent problems that cause customer compliance.
- Regarding to employees satisfaction, 53.7% of respondent companies have satisfied their employee.

Similarly, for the case company (FFSC) several results have been investigated.

- The company didn't have a smooth information flow. That is, the company's main information transfer mechanism was a report based approach and to some extent telephone for personal contact.
- The six sales outlets at Addis Ababa for the company have a very small capacity and can't fulfil the local market demand.
- Among these six sales outlets, Bole Rwanda has small sales out put averagely, 98.36 quintal per year. This shows that the company can't compute with supermarkets around there and can't satisfy needs of customer's especially high income consumers.
- The company have to contend with the problems often associated with high maintenance cost of old machinery and equipment. And it costs averagely 4,500,000Birr per year for maintenance.
- The company lacks reliable raw material suppliers especially for local inputs. Due to this poor quality the company rejects 3,452.36 quintals Soya bean, 774.97 quintals chick pea, 4,871 quintals corn/maize and 1,968 quintals wheat yearly.
- Due to rejection of major input raw material (Soya bean, chick pea, corn/maize and wheat) because of quality problems, suppliers cost 44,265.32birr for transportation annually.
- Foreign input materials such as vitamins, minerals and milk powder has relatively good quality.
- In addition, the company didn't use any quality control tools. Inspection was the only method that the company use to check quality from input materials through work in process and finished goods.

Therefore, after investigated the above results, this research formulates supply chain quality management model for Ethiopian manufacturing industries in general and Faffa Food Sc. in particular and analyzed its causal linkage with organizational performance. Further, the model for the case company was decomposed into supply system, manufacturing system and distribution system in order to implement the model easily. In addition, employee satisfaction, product quality and customer satisfaction are also included in this research; to the traditional performance measurement systems (total cost).

8.2 Recommendation

To minimize the costs incurred and to obtain benefits from high quality system Ethiopian manufacturing firms must implement supply chain quality management. Once it can be implemented companies can create satisfied employees, produce quality products and improve strategic business performances by satisfying ultimate customers. Integrating quality along the chain is not a difficult task. The basic concept here is that companies along the entire supply chain must work for continual improvement. The main thing to be done is creating awareness about the term supply chain quality management. Therefore, to compute in today's dynamic market, companies must manage quality along the entire supply chain rather than with in a single firm.

Further, based on the above conclusions and to avoid failure of applying the model the following recommendations are forwarded by the author.

For Ethiopian manufacturing industries in focus:

- To achieve high quality supply chain every partner must be aware for the term by preparing periodical training program.
- Companies should manage their suppliers starting from primary producers.
- Companies must also consider quality, delivery time & trust, capability to select suppliers rather than price or schedule.
- Companies should improve supplier quality by giving assistance to operations improvement in supplier side.
- In addition, they must improve quality by conducting joint development activities with suppliers.
- Further manufacturing firms must bench mark best practice of other companies and/or internal functional units.
- They must use activity based costing (ABC) system for cost analysis.
- They must use quality tools like QFD, FMEA, Six sigma and others during product design.

- To improve inventory system and get up to date information companies must use software's like EDI, ERP, MRP, MRPII etc

For the case company (FFSC) in focus:

- The company must avoid thinking to improve quality with in the walls of it and see its suppliers and customers as extension of the company's business unit.
- The company must use business software's like ERP, MRP & MRPII, and EDI etc for smooth follow of information and getting up to date information about its partner.
- It must substitute obsolete machineries by new to minimize high cost of maintenance and improve production capacity.
- The company must revise its supplier selection criteria and avoid unnecessary rejection of input materials which causes loss of trust by their suppliers.
- The company should focus on local market and increase capacity of sales centres.
- It expands its distribution channels to regional states to create awareness of its products to all over the nation.
- It must work more on door to door distribution to create satisfied customer.

8.3 Research contribution and Future work

The major contribution of this research is identifying current practice of supply chain quality management elements in Ethiopian manufacturing firms and formulating SCQM model for them. Also the study develops SCQM model for Faffa Food Sc. as a case to show the practicality of the study.

The core concept of this study is to create insight about the term SCQM in manufacturing industries and help them to improve organizational performance. The models developed in the study can be adopted by other industries.

Further studies can be done on:

- SCQM for service industries
- SCQM for manufacturing or service industries to improve supply chain performance.
- Cost benefit analysis to implement the model

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Appendixes

Appendix 1: Questioners for survey

Addis Ababa Institute of Technology

Department of Mechanical Engineering

Graduate program in Industrial Engineering

SUPPLY CHAIN QUALITY MANAGEMENT SURVEY IN ETHIOPIAN MANUFACTURING INDUSTRIES.

I would be very grateful if you could spend a few minutes answering the attached questionnaire.

I am currently conducting a research on "**Supply Chain Quality Management to Improve Organizational Performance**" under Addis Ababa Institute of Technology. The purposes of the study are to investigate the current level of awareness about quality in a supply chain, and by integrating quality management into a supply chain to increase companies' competitiveness and performance. The information gained from the survey will hopefully be useful for the success of the thesis.

I would also like to assure you that all responses given will be treated as **STRICTLY CONFIDENTIAL!!** and used for academic purposes only. If you need further clarification, please feel free to contact my advisor at address below.

I would like to thank you for your kind cooperation. **Thank you..!!**

Yours sincerely,

Mehari Beyene

Tel:09-10-00-68-70

Email: mbt.371@gmail.com

Advisor:

Dr.-Ing. Daniel Kitaw (Associate Professor of Mechanical Engineering)

Addis Ababa Institute of Technology

Tell: +251-911-229-880

Part I: Preliminary Information

Respondent Personal Information in the company

1. Name(optional) _____
2. Position_____,
3. Experience year _____,
4. Department_____,
5. Qualification_____.

Company Profile:

6. Name of your company_____.
7. Year of Established _____
8. Initial capital of investment _____Birr,
9. Address: Tell _____, E-mail_____
10. Number of employees currently working in the company_____.

Part II: Assessment of Supply Chain Quality Management

Please answer the following questions based on you company situation and your own judgement. If the space is not enough, you can write your answer on the back of the paper.

Section 1: Awareness of supply chain quality management

1.1. Do your company have awareness about supply chain quality management? Yes☐ No☐

1.2. If your answer is yes for Q 1.1, what comes to your mind when you hear supply chain quality management? Explain briefly._____.

1.3. Define supply chain quality management in the context of your company._____.

1.4. Is there a responsible body for supply chain quality management in your company? Yes☐ No☐

1.5. If your answer is yes for Q 1.4, do they have a required quality skill? Yes☐ No☐

1.6. Which departments are responsible for supply chain quality management in your company?_____

1.7. Do you have quality strategy in the entire supply chain? Yes☐ No☐

1.8. Does your company ISO 9000 certified? Yes☐ No☐ , if your answer is yes when_____.

1.9. Does your company implemented total quality management? Yes☐ No☐, if yes when?_____, mention if there is other quality certification_____.

1.10. Does your company have an organizational structure? Yes ☐ No☐

1.11. Does your company have a written or documented quality data? Yes ☐ No☐

1.12. Does your company use quality cost analysis method along its supply chain? Yes ☐ No☐

1.13. If your answer is **yes** for Q1.12, what are the different costs incurred? _____

1.14. If your answer is **No** for Q 1.12, what cost analysis method your company use?

_____

1.15. Does your company identify quality problems along its supply chain? Yes ☐ No☐

1.16. If your answer is **yes** for Q.1.15,

a. What are they? _____,_____,_____

b. Does your company solve the identified Quality problems? Yes ☐ No☐

c. If your answer is yes for Q.b, describe how you solve_____.

d. If your answer is no for Q.b, describe the reason why _____.

1.17. Please list your company's supply chain partners _____,_____, _____,___

1.18. Does your company work in cooperation with other companies of the same sector? ☐Yes, ☐No

1.18.1. If your answer is yes for Q1.18, what benefit gained from cooperation?_____

1.18.2. If your answer is No for Q1.18, what was the reason?_____.

1.19. What is the level of quality awareness in your supply chain partners? Very high ☐ High ☐ Low ☐ Very low ☐

Section 2: Supply System Part

2.1 Up to which supplier your company manages?

☐ 1st tier supplier, ☐ 2nd tier supplier, ☐ 3rd tier supplier, ☐ No at all

2.2 Does the company have complete supplier quality policy manual? Yes ☐ No☐

2.3 Does the company have quality assessment procedure manual? Yes ☐ No ☐

Please rate the following questionnaire as follow (according to your company current condition).

5 = Excellent / High *2 = Fair / Low*

4 = Very good / Moderate *1 = Poor / none*

3 = Good / Little

And give short or brief answer for subjective questions.

Supplier selection:	1	2	3	4	5
2.4 Integration of quality throughout your supplier's daily activities.	☐	☐	☐	☐	☐
2.5 Your supplier's readiness to work for continuous improvement.	☐	☐	☐	☐	☐
2.6 Your supplier's organize quality improvement activities.	☐	☐	☐	☐	☐
2.7 Communication of quality policy within your suppliers.	☐	☐	☐	☐	☐
2.8 Your supplier's technical capabilities to ensure quality.	☐	☐	☐	☐	☐
2.9 Your suppliers have international quality certificates like ISO 9000.	☐	☐	☐	☐	☐
2.10 Your suppliers have effective quality control for their operations.	☐	☐	☐	☐	☐

2.11 The following parameters are also used to select suppliers, rate according to your company.

1- Least emphasized, 5-highly emphasized	1	2	3	4	5
Quality					
Price					
Order fill rate					
Delivery Time					
Capacity					
Reliable					
Trust					

Supplier development:

	1	2	3	4	5
2.12 Do you think there is positive relation between supplier's performance and company's long term competitiveness?	☐	☐	☐	☐	☐
2.13 Your company's continuous evaluation of supplier's quality.	☐	☐	☐	☐	☐
2.14 Your company's technical assistance to supplier quality.	☐	☐	☐	☐	☐
2.15 Your company provide suppliers with necessary resources.	☐	☐	☐	☐	☐
2.16 Your company see suppliers as extension of its operations.	☐	☐	☐	☐	☐
2.17 Your company give training to suppliers.	☐	☐	☐	☐	☐
2.18 Your company's commitment to allocate resource for supplier training.	☐	☐	☐	☐	☐
2.19 Periodical review of purchasing policy by your company.	☐	☐	☐	☐	☐
2.20 Do you give priority to quality during purchasing?	☐	☐	☐	☐	☐
2.21 Purchasing requirements developed in collaboration with suppliers.	☐	☐	☐	☐	☐
2.22 A two-way communication between you & your supplier.	☐	☐	☐	☐	☐
2.23 Do you invite suppliers to participate in company activities?	☐	☐	☐	☐	☐

Supplier integration:	1	2	3	4	5
2.24 Your company set business strategies jointly with suppliers.	☐	☐	☐	☐	☐
2.25 Your company mission aligns with suppliers business directions.	☐	☐	☐	☐	☐
2.26 Willingness of your company to share strategic data.	☐	☐	☐	☐	☐
2.27 Involvement of suppliers in product design and development process.	☐	☐	☐	☐	☐
2.28 Your company's long term partnership with suppliers.	☐	☐	☐	☐	☐
2.29 Mutual trust between your company & its suppliers.	☐	☐	☐	☐	☐
2.30 Win-win relation between your company & its suppliers.	☐	☐	☐	☐	☐
2.31 Do you jointly solve quality problems with your supplier?	☐	☐	☐	☐	☐

Section 3: Manufacturing System part

3.1 What is the production capacity of your company's output (units/hr.)?

Designed	Attainable	Actual

3.2 Do you think your company fulfil the market demand? Exactly ☐, a little ☐, No ☐

3.3 Is it difficult to change organizational culture & adopt quality concepts? Yes ☐, No ☐

3.4 If your answer is yes for Q 3.3, what are the problems? _____.

3.5 Do you benchmark best practice of other companies? Yes ☐, No ☐

3.6 Do you benchmark best practice of departments within your company? Yes ☐, No ☐

3.7 If your answer is yes for Q3.6, which department practiced quality well? _____.

3.8 Does your company use activity based costing (ABC) system? Yes ☐, No ☐

3.9 If your answer is No for Q3.8, what costing system do you use? _____.

3.10 Does your company outsource some operation to other company? Yes ☐, No ☐

3.11 If your answer is yes for Q3.10, which activities your company outsource?
_____.

3.12 Does your company give some activities to subcontractors? Yes ☐, No ☐

3.13 What type of production your company do?

☐ Bach production ☐ Mass production ☐ Job shop

Product Design Quality Management in Supply Chain

3.14 Which kind of tools does your company use to ensure the product development?

☐ Quality function deployment (QFD) ☐ Failure mode and effects analysis (FMEA)

☐ Six sigma ☐ statistical process control ☐ others

Rate the following according to your company: (5-Highly agreed, 4-Slightly agree,
3-Agreee 2-Slightly Disagree 1-Highly disagreed) 1 2 3 4 5

3.15 Raw material suppliers participate in product development/design. ☐ ☐ ☐ ☐ ☐

3.16 Customers idea or interest of quality considered in new product development. ☐ ☐ ☐ ☐ ☐

3.17 Different departments in a company participate in new product development. ☐ ☐ ☐ ☐ ☐

3.18 Network/Internet usage for cooperation in the design process. ☐ ☐ ☐ ☐ ☐

3.19 Involvements of production equipment suppliers in the early stage of product development. ☐ ☐ ☐ ☐ ☐

3.20 Cost is emphasized in the product development process. ☐ ☐ ☐ ☐ ☐

Production process quality management in the chain 1 2 3 4 5

3.21 Production schedule is made by coordinating suppliers and customers ☐ ☐ ☐ ☐ ☐

3.22 Process control is implemented in the production system. ☐ ☐ ☐ ☐ ☐

3.23 You obtain real time quality information from suppliers. ☐ ☐ ☐ ☐ ☐

3.24 You give real time quality data to customers & suppliers. ☐ ☐ ☐ ☐ ☐

3.25 By coordinating with supplier's inventory reduced in both sides. ☐ ☐ ☐ ☐ ☐

3.26 By coordinating with suppliers production flexibility improved. ☐ ☐ ☐ ☐ ☐

3.27 Process capability can meet production requirement. ☐ ☐ ☐ ☐ ☐

3.28 Production equipment's are well maintained. ☐ ☐ ☐ ☐ ☐

Inventory management & technology used

3.29 Does your company have enclosed warehouse for raw materials? Yes ☐, No ☐

3.30 If your answer is No for Q3.29, what is the reason? _____.

3.31 Does your company have enclosed warehouse for finished products? Yes ☐, No ☐

3.32 How can you manage work-in-process inventory? _____.

3.33 Planning, forecasting and replenishment of inventory done in co-ordination with suppliers and customers. ☐ Very high ☐ High ☐ Low ☐ Very low

3.34 Information exchange in your supply chain is through

☐ Telephone, ☐ Fax, ☐ Email, ☐ carrier, ☐Internet, ☐ Others

3.35 Does your company use Enterprise Resource Planning (ERP)?

☐ Yes, ☐ No, ☐ In progress to use

3.36 If your answer is yes for Q3.35, does your company ERP integrated with suppliers & customers? ☐ Yes, ☐ No, ☐ In progress to integrate

3.37 Does your company use Material resource planning? ☐ Yes, ☐ No, ☐ In progress

3.38 If your answer is yes for Q 3.37, does it consider suppliers capacity? ☐ Yes, ☐ No

3.39 Does your company use electronic data inter change (EDI) for information sharing with suppliers and customers? Yes ☐, No ☐

a. If your answer is No for Q3.39, what is the reason? _____.

3.40 Does your company implement just-in-time system (JIT)? Yes ☐, No ☐

Section 4: Distribution System part

4.1 What are your customers?(you may choose more than one) Whole sellers ☐, Retailers ☐, end users ☐, others ☐

4.2 Do your company have long term relation with its customers? Yes ☐, No ☐

a. If your answer is yes for Q4.2, how can your company maintain this long term relation? _____.

b. If your answer is No for Q4.2, what is the reason? _____.

4.3 Do you assess quality system of your customer's (whole seller/retailer)? Yes ☐, No☐

a. If your answer is yes for Q4.3, list problems you observe?

_____.

b. What remedial action your company take for problems listed in Q.a,

_____.

4.4 What mechanism do your company use to get feedback from customers?

_____.

4.5 Do you have got product damage during delivery? Yes ☐ No ☐

4.6 If your answer is yes for Q.4.5,

a. Percentage when receiving raw material from suppliers_____%.

b. Percentage when delivering product to customers_____%.

Rate the following according to your company:

(5-Excelent, 4-Very good, 3-Good, 2-Fair, 1-Poor)	1	2	3	4	5
4.7 Effectiveness of your logistic system.	☐	☐	☐	☐	☐
4.8 Coordination of suppliers and customers to shorten lead time.	☐	☐	☐	☐	☐
4.9 Delivery of your products based on customer needs (place).	☐	☐	☐	☐	☐

4.10 Is there an association in which your company was a member? Yes ☐, No ☐

a. If your answer is yes for Q4.10, please list them?

_____.

4.11 Does your company have partnership program with institutions, government organizations, NGOs, private sectors etc.? Yes ☐, No ☐

a. if your answer is yes for Q4.11,please list them

_____.

4.12 List your company's readiness and area of interest in partnership.

_____.

Part III: Performance measurement

1. Employee Satisfaction

1.1. Do you conduct employee satisfaction survey? Yes ☐ No ☐

1.2. If your answer is yes please state level of employee satisfaction in your company. (1-extremely unsatisfied to 5-extremely satisfied). ☐ ☐ ☐ ☐ ☐

1.3. Does your company provide training, incentives& rewards, experience sharing for employees? Yes ☐ No ☐

2. Customer Satisfaction

2.1 Do you conduct customer satisfaction survey? Yes ☐ No ☐					
The following parameter's show customer satisfaction level please rate according to your company.1-extremely unsatisfied,5-extremely satisfied	1	2	3	4	5
2.2 Quality of product					
2.3 Service quality					
2.4 Delivery time					
2.5 Delivery place					
2.6 After sales service					

3. Product Quality

The following parameter's show product quality please rate according to your company's primary products compared with other companies in the same industrial sector.(1: Worst in the industry; 2: Below average; 3: Average; 4: Above average; 5: Best in the industry)					
	1	2	3	4	5
3.1 Performance					
3.2 Conformity rate					
3.3 Reliability					
3.4 Durability					
3.5 Defect rate					
3.6 Internal failure costs as a percentage of annual output					
3.7 External failure costs as a percentage of annual sales					

4. Strategic Business Performance

4.1. Strategic business performance between 1997 and 2002.

Year (E.C)	1997	1998	1999	2000	2001	2002
Annual sales(Birr)						
Sales growth (%)						
Profit (Birr)						
Local market share (%)						
Actual Annual output (Qty)						
Expected Annual output						
Resource actually used						
Resource planned to be used						

Market share = your company output divided by the biggest company output in same sector.

4.2. Do you export your product? Yes ☐ No ☐

4.2.1. If your answer is yes for Q4.2, what is your?

	1997	1998	1999	2000	2001	2002
Export (birr)						
Percentage of annual sales gained from export (%)						

4.2.2. If your answer is yes for Q4.2, to which countries your product export? _____.

4.2.3. If your answer is no for Q 4.2, what is the reason? _____.

4.3. Does your company use balance score card as performance measurement system?

☐Yes ☐No

4.3.1. If your answer is yes for Q4.3, what benefit do you have from it? _____

4.3.2. If your answer is no for Q4.3, what is the reason? _____

Appendix 2: List of companies surveyed.

Sr.No	Company	Address
1	Kadisco Chemical Industry	0114-39-10-37
2	Mebruk P.P Factory	0114-39-25-58
3	Gelan Metal Industry	0111-39-25-63
4	Roha Pack Plc.	0911-65-66-80
5	Ras Dashen Shoe Factory	0116-29-31-67
6	Ethiopian Plastic Sc.	0913-13-80-53
7	Bright Paint factory	-
8	Haile Michael General importer and Distributor	0116-29-34-23
9	Abuson Industries Plc.	0913-64-03-92
10	Legesse Plastic Factory	0114-19-52-74
11	Romanat Textile Packing	034-55-91-32
12	Hibret Machine Building industry	0115-51-09-61
13	Metal Fabrication Industry	0911-79-58-53
14	Muluneh Kaka coffee exporter	0114-39-39-37
15	Techno Printings Printing enterprise	0116-51-91-14
16	Plastic Shoe Factory	0911-66-47-64
17	Classic Plastic Packing & carton box factory	0114-19-62-62
18	Hakkmat Plastic Factory	0114-19-76-76
19	Amba Pharmaceutical Plc.	0114-19-63-63
20	Trans Ethiopia Plc.	-
21	Maichew Partide Board	-
22	Messebo Building Materials production Plc.	0344-40-96-00
23	Ujo Printing Plc.	0116-29-14-31
24	Kangaro Shoe Factory	0910-47-06-32
25	Walia Steel Industry	0113-87-10-72
26	DH. Geda Flour Factory	0911-45-52-36
27	Gift Nail Manufacturing Industries Plc.	0912-85-20-11
28	Leather Industry Development Institute	
29	Techno Mack Plc	0911-22-71-48
30	Universal food complex	0114-39-36-40

31	Kotebe Metal tools Industry		0911-75-79-54
32	Faffa Foods Sc		
33	Akaki spare parts and hand tools s. co.	44	Akaki textile factory s. co.
34	Bruh tesfa plastic factory	46	Akaki garment factory
35	DH. Geda paint factory	47	Universal plastic factory
36	DH. Geda steel factory	48	Mesfin industrial engineering
37	Ma thermo plastic industry plc	49	Haile garment
38	Aster nega printing	50	Pecock shoe factory
39-45	Basic metals and engineering industries six companies surveyed	51	Nifa silk paint factory
		52	BGI Ethiopia
		53	Adiay Abeba
		54	Birhanenna selam printing press

Appendix 3: Guided interviews

1. What method does your company use to measure organizational performance?
2. Do you believe that employee satisfaction, product quality and customer satisfaction have direct relation with organizational performance?
    a. If your answer is yes what must be fulfilled to create:
        i. Satisfied employees
        ii. High quality product and
        iii. Delighted customer
3. Do you believe it is possible to implement quality management along the entire SC?
4. What constraints do you expect to be happening in implementing supply chain quality management at the following stages?
    a. Supplier side
    b. At manufacturing firm and
    c. Distribution side
5. Do you think Ethiopian manufacturing firms have low awareness level of quality along their SC?
    a. If your answer is yes what is the reason behind?
6. Do you think that forming partnership with other companies, institutions and NGO's will help to make high quality supply chain?

7. Do you think that most of the manufacturing firms are producing under their full capacity?
    a. If your answer is yes what are the reasons?
8. What opportunities and constraints comes to your mind when you think manufacturing in Ethiopian?

Appendix 4: List of interviewed personnel's.

During the questionnaire survey there was a guided interview conducted parallelly to persons of different position. The following table shows the detail.

Sr.No	Name of interviewee	Company	Position
1	Ato. Seifu Shemsu	Mebruk P.P. factory	D/G/manager
2	Ato. Shigute.	Kadisco chemical industry	G/manager
3	W/r Mestawot	Gelan metal industry	Supervisor
4	Ato. Teshome Kifle	Roha Pack Plc.	Marketing & Sales head
5	Ato. Amannuel Endale	Ras dashen shoe factory	Production manager
6	Ato. Legesse Gulma	Ethiopian Plastic Sc.	Production head
7	Ato. Abito Fentaw	Classic Plastic packing & carton box factory	G/manager
8	Ato. Seifu Nesbibu	Hakkmat Plastic factory	Personnel Administration
9	Ato. Daniel Getahun	Ujo Printing Plc	Production Head
10	Ato. Eyob	Kangaro Shoe Factory	Purchasing Head
11	Ato. Abera	DH. Geda Flour factory	Supervisor
12	Ato. Ashenafi Fentahun	Walia Steel Industry	Sales & marketing Manager
13	W/ro. Meseret.	Techno Mak Plc.	G/manager
14	Ato. Messay.	Gift Nail manufacturing industry	Production manager

Appendix 5: Organizational structure of Faffa Foods Sc.

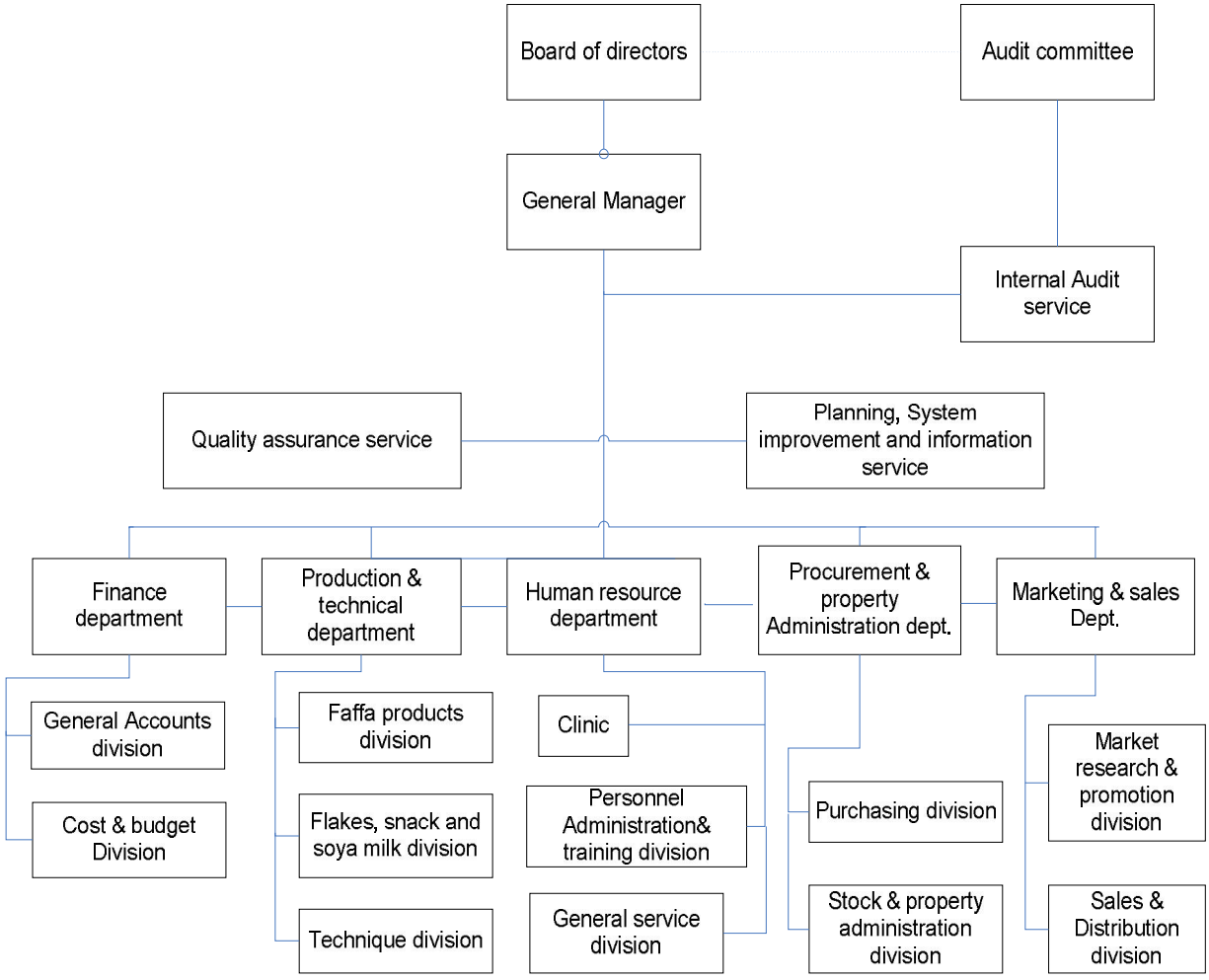

Fig. Organizational structure of Faffa Food Sc

Appendix 6: Attainable production capacity of the four production lines at Faffa Foods Sc.

Line	Capacity (in tones)
Line one	627.122
Line two	254.34
Line three	1019.8
Line four	12834.476
Total	14735.738

Source: company data

Appendix 7: General flow process of the company Faffa

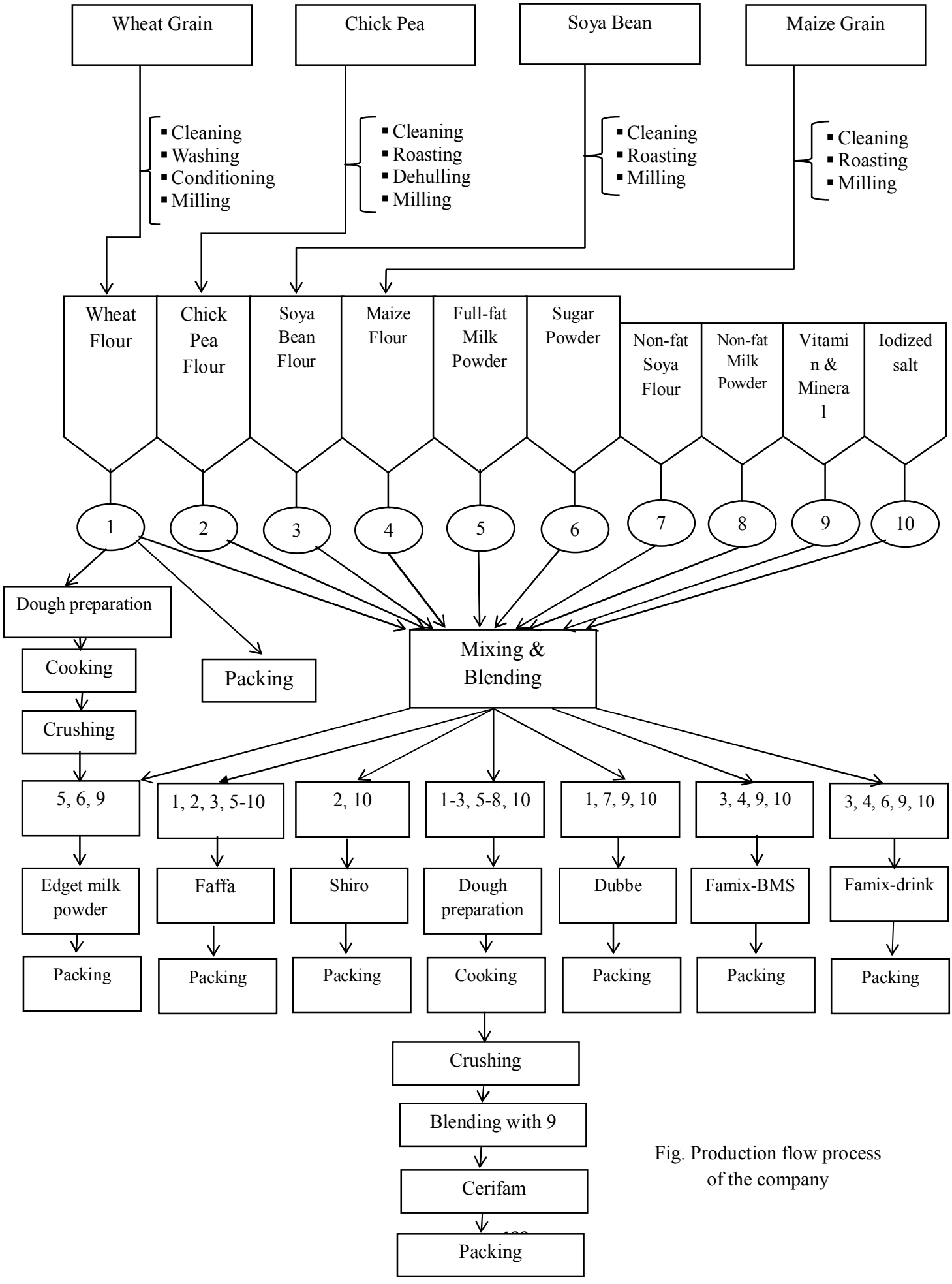

Fig. Production flow process of the company