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Study of Supply Chain Quality Parameters

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Abstract

Supply chain quality management practices have resulted in to a new era for the industries of different cross sections and specialization globally. Few researches have been conducted in this area. Industries and practitioners cannot even think of compromising with the quality in today's context resulting into severe losses and product recall. In order to avoid serious damage to the brand and image of the organization due to lack of quality the quality of supply chain as a whole can be a good measure. In this paper authors investigated the supply chain quality of the five different industries such as Automotive, Petrochemical, Pharmaceutical, FMCG and Perishable goods on the basis of quality parameters. The quality parameters give a better understanding to find out which parameter should be focus for designing a quality supply chain with respect to specific industry.

Keywords: suppy chain, quality management, quality parameters

1. Introduction

Supply chain term was first coined in the early 1980s to describe the range of activities coordinated by an organization to procure and manage supplies (Oliver & Webber, 1982). Supply chains encompass the companies and the business activities needed to design, make, deliver, and use a product or service. Businesses depend on their supply chains to provide them with what they need to survive and thrive.

"A supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves." (Chopra and Meindl, 2001).

Customers have so much choice nowadays from an enormous field of competitors that delays in supply mean delays for the customers who probably are not willing to wait when they can obtain the same or similar substitute product elsewhere. Based on the above facts it is observed that the supply chain management has become important and critical aspect to the profit making of any organization. But, the quality management issues have also impacted the performance of supply chain in one way or other. Therefore one must understand the meaning of quality management.

The quality definition as specified by Joseph Juran, "Quality is the fitness of use" i.e. it is the value of the goods and services as perceived by the supplier, producer and customer. The measure also pertains to the degree to which products and services conform to specifications, requirements and standards at an acceptable price. Some of the definitions of Quality, provided by quality gurus are as follows:

1. Quality is conformance to requirements (CROSBY)
2. The efficient production of the quality that the market expects (DEMING)
3. Quality is what the customer says, it is (FEIGENBAUM)
4. Quality is the loss that a product costs to the society after being shipped to the customer (TAGUCHI)

As per the above definitions for quality, Quality management in supply chain can be defined as conformance to requirements. Therefore we can say that the quality requirements from the supplier's point of view may be an efficient and seamless flow of activities and resources to the manufacturer so that the optimum gains in terms of profit and highest rating from the manufacturer can be achieved for maximum possible time. The quality requirements from the manufacturer's point of view may be the optimum integration and utilization of resources to satisfy the

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internal as well as the external customers in terms of goods and services offered.

2. Literature Review

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. Supply chain management involves the management of flows between and among stages in a supply chain to maximize total profitability" (Chopra & Meindl (2001). 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 (Sila Ebrahimpour, & Birkholz, 2006).

The areas of Supply chain which has been researched predominantly includes Supply chain Performance (Ou, Liu, Hung, & Yen, 2010; Papakiriakopoulos & Pramatari, 2010; Kim. Kumar, & Kumar, 2010; Fantazy, Kumar, & Kumar, 2009), Supply chain collaboration, Supply chain Integration (Karkoszka, 2011; Lin & Gibson, 2011), Supply chain agility (Agarwal, Shankar, & Tiwari, 2007), Supply chain Network design etc. As a result, it has been discovered that this subject requires radical thinking because the vastness of the topics is neither well defined nor easily implemented. Empirical quality management (QM) research has evolved over the last 20 years. Empirical research has defined and measured QM practices (Ahire, Golhar, & Waller, 1996; Flynn, Schroeder, & Sakakibara, 1994; Nair, 2006; Saraph, Benson, & Schroeder, 1989; Sila & Ebrahimpour, 2005). Numerous studies have investigated the relationships among QM practices and various aspects of a firm's performance (Adam et al., 1997; Ahire & O'Shaughnessy, 1998; Dow, Samson, & Ford, 1999; Kaynak, 2003). As competition moves beyond a single firm into the supply network of multi firms, focus is shifting from management of internal practices alone to the management of external firms. Quality managers must integrate their firms' practices with those of customers and suppliers (Flynn & Flynn, 2005; Kannan & Tan, 2005; Robinson & Malhotra, 2005; Sila, Ebrahimpour, & Birkholz, 2007). Integrating QM and supply chain management (SCM) will be important for future competitiveness (Flynn & Flynn, 2005; Matthews, 2006; Robinson & Malhotra, 2005).

Supply chain quality management (sharma, Agarwal, & Garg. 2013) has been explored by researchers where six hypotheses related to Supply chain quality management developed through literature review and tested using survey data from US manufacturing companies (Sila Ebrahimpour, & Birkholz, 2006). Relationship between supply chain quality management practices and organizational performance have been researched and it was found that organizational performance could be enhanced through improved supply chain quality management (Kuei, Madu, Lin, & Chow, 2001; Gilaninia, Delafrooz & Zarezadeh, 2012; Malik, Sinha, & Blumenfeld, 2012). Robinson and Malhotra, (2005) defined the concept of supply chain quality management as the formal coordination and integration of business processes involving all partner organizations in the supply channel to measure, analyse and continually improve products, services (seth, Deshmukh, & Vrat, 2006), and processes in order to create value and achieve satisfaction of intermediate and final customers in the marketplace. They also found out its relevance to academic and industrial practice and proposed a Quality-SCM framework. Cagnazzo, Taticchi & Brun (2010) identified role of performance measurement systems to support quality improvement initiatives at supply chain level. Carmignani (2009) modified interpretation of ISO 9001:2000 norm and introduced a research to determine a standard to implement a management system for a whole supply chain through the identification of the main supply chain processes and drivers. Peters (1999) discussed service quality and total quality management as a business strategy designed to add value to customers. Lo & Yeung (2006) in their work on managing quality effectively in supply chain extracted ten critical factors for describing a Supply Quality Management system. These factors could be clustered into three major groups namely supplier selection, supplier development and supplier integration. This study has not covered the relationship among supply quality management, supplier quality and buyer quality. (Kuei, Madu, Lin, & Chow, (2002) in their work developed a two stage frame work on supply chain quality and technology relate to only upstream of supply chain. Foster (2008) defined supply chain quality management (SCQM) to operationalize and understand the effect of increased emphasis on supply chain management on the practice of quality management. Reviewed current research in quality management and identified common themes found in the literature. Key quality management content variables identified are customer focus, quality practices, supplier relations, leadership, HR practices, business results, and safety. Based on these variables he proposed areas for future research in the field of supply chain quality management. Fynesa, Vossb, & Bu´rcac, (2005) in their work on the impact of supply chain relationship quality on quality performance developed a conceptual framework incorporating dimensions of SC relationships and quality performance. Kaynak & Hartley (2008) found that the inclusion of customer focus and supplier quality management in the QM

model supports the importance of internal and external integration for quality performance. Beamon & Ware (1998) proposed a process quality model for the analysis, improvement and control of supply chain and concluded that the coordination of logistics functions into integrated supply chain systems has increased the need for improved process quality. Improving the quality of all supply chain processes results in reduced costs (Ramudhin, Alzaman, & Bulgak, 2008), improved resource utilization, and improved process efficiency.

Considering the literature reviewed it is observed that researches has been hardly done on the supply chain quality management and there is hardly any giving insight about the quality of supply chain or the variables or parameters which are responsible to make the supply chain a quality supply chain.

3. Methodology

Based on the literature review and opinion of the experts from the five industry segments different parameters for quality of supply chain have been identified to obtain the priority in the quality parameters among different industry ANP modeling is performed. These parameters are Agility, Efficiency, Coordination, Integration, Collaborative planning, Product quality (Agus & Hajinoor, 2012; Tse & Tan 2012), Customer satisfaction, Supply chain information, Flexibility and Supplier quality. The parameters are judged according to the specific industry.

The parameters selected as above are considered as criteria and the industries are considered as the alternatives. As per ANP modeling the criteria vs. criteria is put in the pair wise comparison matrix and weightage is found out by comparing the both i.e. criteria and alternative as shown in figure 1. By pair wise comparison SAATY scale (1 to 9) the weightage of the criteria for each industry have been found out to measure the supply chain quality characteristics. Finally the alternatives ranking is found out by comparing both the criteria and the alternatives.

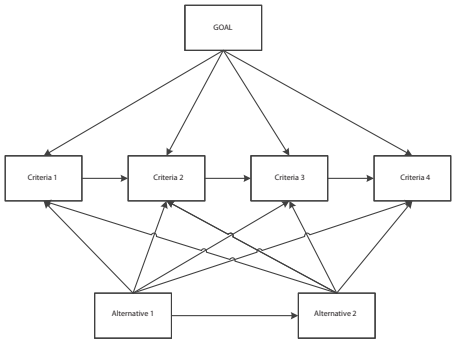

Figure 1. ANP Model.

As shown in table 1 the comparison of the criteria are done to find out the most significant to the least significant criteria for pharmaceutical industry. In the case shown below the inconsistency came out to be 0.0443 which is well below 0.1 and hence the matrix shown in table 1 can be considered as unbiased matrix. The above five supply chains in table 1 to 5 for different industries are as shown below. These tables clearly indicates that each supply chain is unique in nature and depends on number of dependent parameters such as location, logistics, design of supply network (Das & Sengupta, 2010), type of product etc. Common parameters are carefully chosen to compare supply chain with each other to see the characteristic of the supply chain as shown in figure 2.

Table 1: Pharmaceutical Industry: Inconsistency 0.0443

Name	Normalized	Weightage %
Agility	0.05	5.04
Efficiency	0.09	8.64
Coordination	0.06	0.22
Integration	0.06	8.31
Collaborative planning	0.08	4.69
Product quality	0.05	21.97
Customer satisfaction	0.22	26.74
Supply chain information	0.27	5.76
Flexibility	0.06	5.76
Supplier quality	0.06	7.32

Table 2: Perishable goods industry: Inconsistency 0.0898

Name	Normalized	Weightage
Agility	0.05	4.68
Efficiency	0.19	18.79
Coordination	0.09	8.68
Integration	0.09	8.93
Collaborative planning	0.04	3.93
Product quality	0.15	14.62
Customer satisfaction	0.21	21.04
Supply chain information	0.05	5.04
Flexibility	0.07	6.61
Supplier quality	0.08	7.70

Table 3: FMCG industry: Inconsistency 0.06436

Name	Normalized	Weightage
Agility	0.03	2.85
Efficiency	0.14	14.05
Coordination	0.05	5.13
Integration	0.06	5.66
Collaborative planning	0.05	5.19
Product quality	0.15	14.64
Customer satisfaction	0.30	29.86
Supply chain information	0.05	4.61
Flexibility	0.08	7.59
Supplier quality	0.10	10.42

Table 4: Automotive Industry: Inconsistency 0.06

Name	Normalized	Weightage
Agility	0.02	2.14
Efficiency	0.03	3.39
Coordination	0.08	7.92
Integration	0.07	6.92
Collaborative planning	0.10	9.57
Product quality	0.18	18.45
Customer satisfaction	0.27	27.00
Supply chain information	0.06	6.50
Flexibility	0.06	6.49
Supplier quality	0.12	11.63

Table 5: Petrochemical Industry: Inconsistency 0.06

Name	Normalized	Weightage
Agility	0.08	7.77
Efficiency	0.10	9.91
Coordination	0.13	13.00
Integration	0.08	7.76
Collaborative planning	0.05	4.91
Product quality	0.07	6.66
Customer satisfaction	0.25	24.73
Supply chain information	0.10	9.64
Flexibility	0.09	8.67
Supplier quality	0.07	6.96

The importance of each parameter for the supply chain of different industries is as shown from figure 3–13.

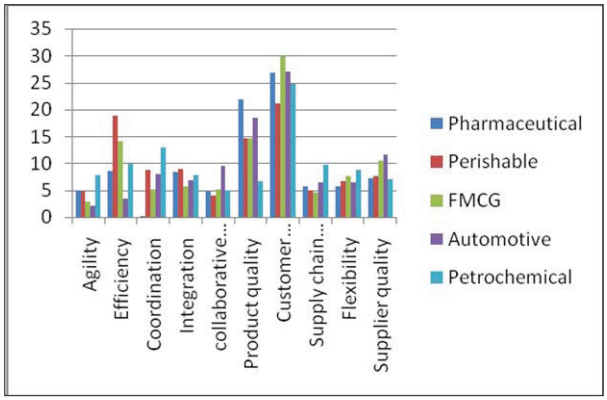

Figure 2. Parameter chart.

Table 6: Supply Chain Quality – Inconsistency 0.057

Name	Normalized	Weightage
Agility	0.032	3.188
Efficiency	0.052	5.208
Coordination	0.037	3.658
Integration	0.037	3.658
Collaborative planning	0.055	5.541
Product quality	0.224	22.443
Customer satisfaction	0.320	31.953
Supply chain information	0.036	3.601
Flexibility	0.037	3.692
Supplier quality	0.171	17.059

4. Result and Discussion

As shown in figure 2 agility is important for petrochemical industry. Perishable goods industry requires the efficient supply chain in order to prevent the losses due to damage of perishable nature of goods. Supply chain coordination is considered most important for the petrochemical industry. Supply chain integration is important for the perishable goods industry in comparison to other industries. Collaborative planning takes first place in case of automotive industries. Product quality is most important for the pharmaceutical industry as compared to the others. Interestingly customer satisfaction comes out to be approximately equal in case of all the organizations but equal but FMCG industry tops in that. It may be

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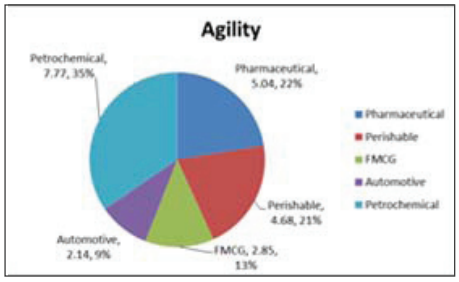

Figure 3. Agility – Inconsistency 0.074.

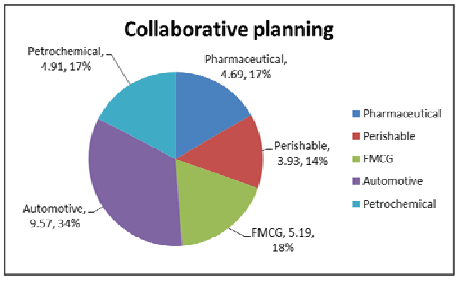

Figure 7. Collaborative planning – Inconsistency 0.070.

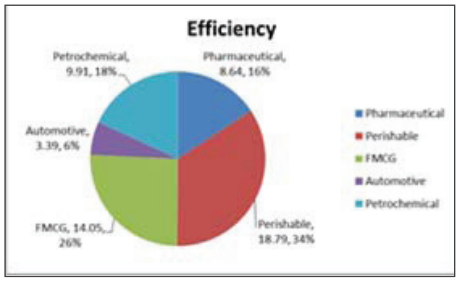

Figure 4. Efficiency – Inconsistency 0.055.

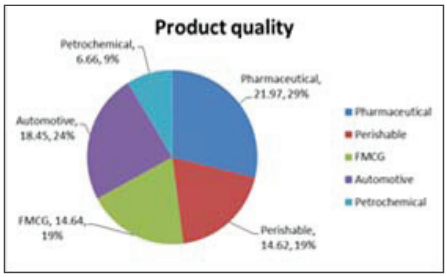

Figure 8. Product Quality – Inconsistency 0.096.

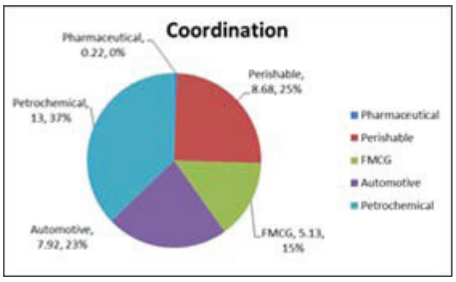

Figure 5. Coordination – Inconsistency 0.033.

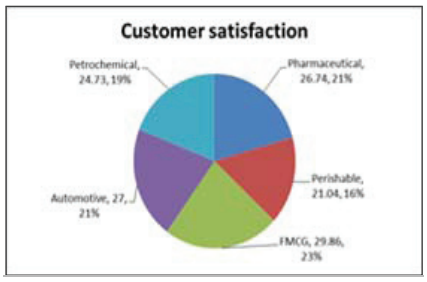

Figure 9. Customer Satisfaction – Inconsistency 0.078.

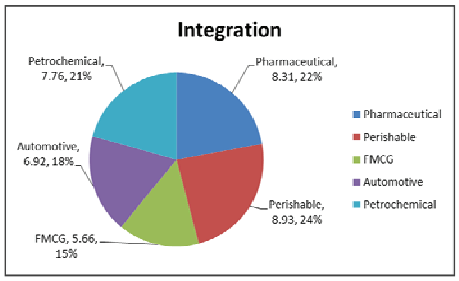

Figure 6. Integration – Inconsistency 0.078.

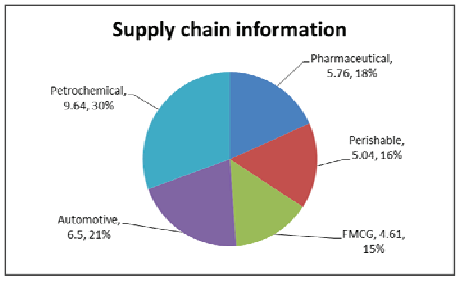

Figure 10. Supply Chain Information – Inconsistency 0.079.

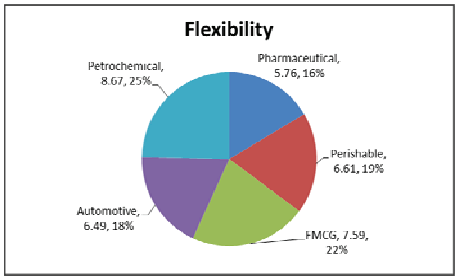

Figure 11. Flexibility – Inconsistency 0.065.

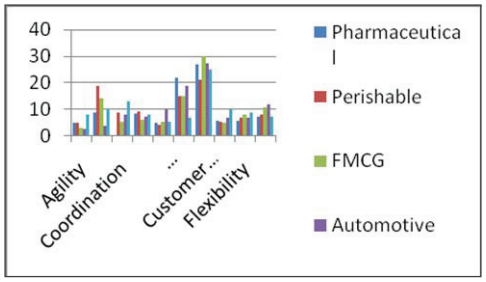

Figure 13. Parameter chart.

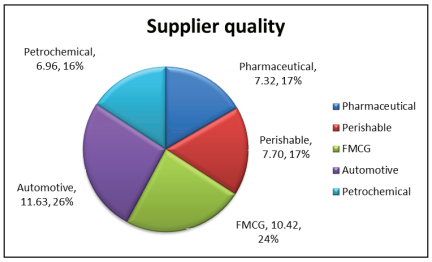

Figure 12. Supplier quality – Inconsistency 0.073.

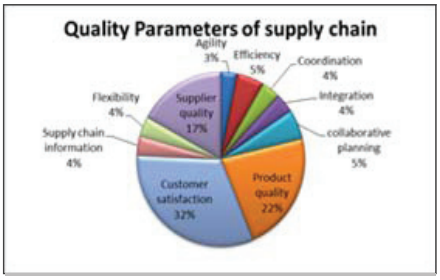

Figure 14. Quality parameters of supply chain.

because of easy availability of alternative products for the customer. Petrochemical tops in the supply chain information followed by automotive industry. Flexibility is approximately equally important for all the industries but petrochemical tops in it followed by automotive industry. Supplier quality is most important for automotive industry followed by FMCG.

As depicted in figure 14 customer satisfactions comes out to be the most important criteria for any of the five industries supply chain under consideration. Second to customer satisfaction is product quality followed by supplier quality. Interestingly the three criteria are interrelated to each other to a great extent i.e. customer can only be satisfied if the product quality is good and in order to have good product quality supplier quality should be good.

5. Conclusion

Supply chain quality can be considered a good measure for the health of the organization. If the quality of supply chain is good then the products will automatically be quality product and this will surely create a good brand image for the organization. The purpose of this study was to identify measurement parameters for supply chain quality that could be used by the manufacturers to design their supply chain focusing on the overall quality. There can be common parameters to judge the quality of different supply chains however the same parameters can be used to compare the various supply chains of an industry. In this paper authors investigated and identified the quality parameters for the supply chains of five industries namely automotive, petrochemical, pharmaceutical, FMCG and perishable goods. Customer satisfaction comes out to be the most important quality criteria.

Product quality, Customer satisfaction and supplier quality have emerged as the most important quality parameters of all the considered supply chains. Supply chain quality parameters identified in this paper are based on the literature review and interview with the experts in five industries. More number of supply chain quality parameters can be identified. In further research supply chain of Agriculture, Education, Health and Finance industries can be investigated on the basis of supply chain quality parameters. A descriptive analysis can be carried out to gauge the level of supply chain quality in these industries.

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