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"Enhancing Customer Satisfaction In India's Passenger Car Supply Chain: An Integrated QFD And Benchmarking Approach"

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ABSTRACT: This study integrates Quality Function Deployment (QFD) and benchmarking to optimize India's passenger car supply chain, prioritizing customer satisfaction. By analyzing customer requirements and benchmarking industry best practices, this research aims to improve supply chain efficiency, quality, and customer satisfaction.

Introduction: The Indian passenger car market demands exceptional quality, reliability, and customer satisfaction. To address this, manufacturers must align their supply chains with customer expectations. This research combines QFD and benchmarking to:

1. Identify critical customer requirements
2. Evaluate supply chain performance
3. Benchmark industry leaders
4. Implement improvements

Methodology

1. Literature review on QFD, benchmarking, and supply chain management
2. Customer surveys to determine key requirements
3. Benchmarking analysis of leading passenger car manufacturers
4. QFD application to prioritize improvements
5. Data analysis and interpretation

Expected Outcomes

1. Improved customer satisfaction
2. Enhanced supply chain efficiency
3. Increased quality and reliability
4. Competitive advantage through benchmarked best practices

Conclusion: This integrated QFD and benchmarking approach enables Indian passenger car manufacturers to prioritize customer satisfaction, optimize supply chain performance, and achieve industry excellence.

Keywords: *Benchmarking, Customer, Quality, Quality Function Deployment (QFD), Supply Chain Management (SCM);*

INTRODUCTION:

The Passenger cars are customer centric product. The passenger car manufacturing sector especially in India is found to be affected by the customer's preference related uncertainty factor in a large scale now-a-day. Due to this uncertainty factor sometimes production delay introduced in the car supply chain system, that in turn accumulates either backlog or the generation of obsolete inventory to be drained out in near future. Moreover, it has also been found from various literatures and published articles and also from daily newspapers that almost over a decayed of time passenger car manufacturers have been competing by differentiating the models as many as features possible. Therefore, the passenger vehicles (PVs) sales, in India, are down and are expected to face further pressure in the (Economic Time, August 2, 2019).

Next, but most important fact is the shock of World's **economic recession** hits the area of production/ manufacturing, inventory management, foreign Investment, capacity utilization and sales in industries such as passenger cars. The impact of economic variations on sales of cars have been analyzed along with the dimensions explaining the customers' buying pattern based on a total cost of ownership. The challenges presented by recent changes in the business environment have sharpened the focus on the need for robust approaches to supply chain improvement.

In an uncertain recovery, supply chain operations need to be more scalable and flexible as they anticipate economic recovery and increase capacity. Moreover, this can be easier to achieve coming out of a severe recession (Eric G. Olson, 2010). So, this paper is able to concentrate on some tips bases on recession recovery strategies.

Based on the above-mentioned scenarios and also based on some experiments, proof, etc. this paper aims to establish an appropriate supply chain management system for Indian passenger car industry. For doing this, the major tool employed here is Quality Function Deployment (QFD). The QFD approach is integrated here with Benchmarking to define a customer-based improvement strategy. The strategy should be based on some critical elements identified by quality analyses. Hope, by applying the approach used in this paper, the supply chain strategy makers and policy experimenters should take some strategic actions, putting them in a better position, so that the recovery will come soon.

RESEARCH OBJECTIVE(S):

The purpose of this research paper is to implement the integrated concept of Quality Function Deployment (QFD) Benchmarking Analyses as two important innovative quality tools. The stated approach is being undertaken to construct a customer-centric perspective for Indian Passenger Car supply chain management (SCM).

LITERATURE REVIEW:

Quality Function Deployment- Quality function deployment (QFD) was developed in Japan during the 1960s by Akao (1972) as a method for incorporating consumers' demands into product development.

Akao and Mazur (2003) defined QFD as a method for defining design qualities that are in keeping with customer expectations and then translating those customer expectations into design targets and critical quality assurance points that can be used throughout the production/service development phase. QFD is a widely used systematic process utilized by cross-functional teams to identify and resolve issues arising from the provision of products, processes, services, and strategies intended to enhance customer satisfaction Gonzalez et al. (2003). By employing QFD, manufacturers and service providers are able to translate customer expectations into measurable quality characteristics and create products and services which satisfy those requirements Hauser and Clausing (1988). Quality function deployment (QFD) is a methodology for the development or deployment of features, attributes, or functions that give a product or service high quality. QFD can be very helpful in answering the question "how to deliver quality products and services based on the needs of customers, or the voices of customers?" (Hwarng and Teo, 2001). The two fundamental purposes of QFD are:

(1) To improve the communication of customer expectations throughout the organization;

(2) To improve the completeness of specifications and to make them traceable directly to customer expectations and needs (Gonza´lez, 2001).

Several researchers have applied QFD to different service areas (Jeong and Oh, 1998; Trappey et al., 1996; Stuart and Tax, 1996; Cadogan et al., 1999; Pun et al., 2000; Peters, 1988; Gonzalez et al., 2003, 2005). Since the early 1990s, there have been a number of QFD applications in the education area, as can be seen in Table I. From these, the most related to this paper are: one case for an undergraduate statistics course (Duffuaa et al. 2003) and another one for the development of courses in higher education (Hwarng and Teo, 2001). However, it was originally used in product development and design. Griffin et al. (1995) have considered that QFD provides a means of communication among product life cycle stages. Benefits which arise from these and other reported QFD applications include lower design and service costs, fewer and earlier design changes, reduced product development time, fewer start-up problems, better company performance, more reliable input for marketing strategies, improved service quality and, above all, increased customer satisfaction (Jae et al., 1998; Franceschini and Rossetto, 1995).

The researchers, however, found a lack of quantitative tools that could add reliability and efficiency to the gathering of customer expectations and their subsequent translation into the critical elements of a passenger car supply chain system. sing

QFD methodology, the final processes/methods will produce the service that meets the original customer expectations (employers' expectations).

Benchmarking- Benchmarking is a continuous quality improvement process by which an organization can assess its internal strengths and weaknesses, evaluate comparative advantages of leading competitors, identify best practices of industry functional leaders, and incorporate these findings into a strategic action plan geared to gain a position of superiority (Hokey et al., 1997). Benchmarking can be defined as a process of comparison of some measure of actual performance against a reference or benchmark performance. There are three main aspects to the performance of a company: efficiency, productivity and quality. Benchmark results are used to identify, quantify and prioritize improvement opportunities offering the greatest potential return, while highlighting areas at risk due to under-spending. The end result is a factual basis and context for creating a business plan to drive change (Hokey et al., 1997). Benchmarking may be a one-off event, but is often treated as a continuous process in which companies continually seek to challenge their practices Benchmarking has two distinctive approaches: competitive benchmarking and process benchmarking. According to the American Productivity and Quality Centre, competitive benchmarking aims to measure organizational performance relative to the performance of competing organizations and consists of an ordered sequence of steps, (Hokey et al., 1997) Benchmarking is not complicated but it does seem initially difficult for organizations to learn from others and complete exercises successfully in order to deliver measurable improvements. Based on the researcher's experience, often the difficulties seem to have less to do with the technique of benchmarking than the pressures the organization and individuals are experiencing and their lack of a coherent plan for integrating change management.

Additionally, benchmarking facilitates strategic planning, providing a clearer focus for setting strategic company goals. While competitor benchmarking encourages an external focus, many authors (Rogers, 1993; Andersen and Camp, 1995; Whymark, 1998; Woodburn, 1999) emphasize the particular benefits of generic benchmarking in focusing on strategic company goals and thus increasing competitiveness.

The shift in emphasis from comparison of direct competitor performance measures to one of learning about best practices and identifying what can be achieved (Rogers, 1993; Andersen and Camp, 1995; Whymark, 1998; Woodburn, 1999) has further enhanced the role of benchmarking in achieving sustainable competitive advantage and superior performance. Furthermore, Porter (1994) recognized the stimulus for change generated by benchmarking activities and the potential gains possible for all stakeholder groups, while Schmidt (1992) examined the link between benchmarking and an increase in shareholder value. Benchmarking is used in this paper to compare the new program obtained in the QFD process with the top programs in supply chain management according to Rutner and Fawcett (2005) and to analyze the competitiveness of in today's academic market.

RESEARCH METHODOLOGY:

The general method adopted in this paper for the design of a supply chain management of passenger car sector in India, using QFD and Benchmarking is demonstrated in Figure 1 below:

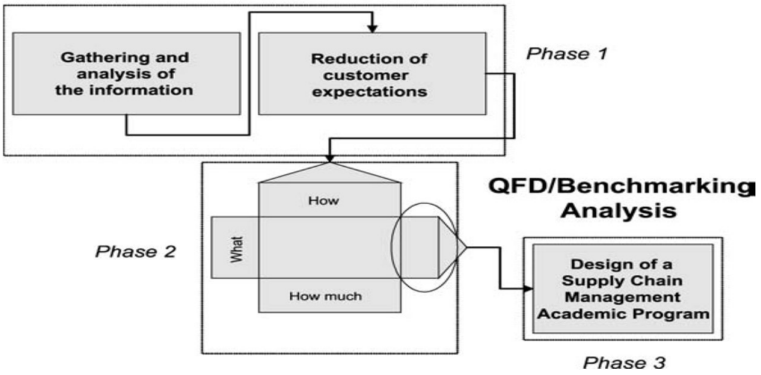

Figure-1: The basic design of a supply chain management process of passenger car sector using QFD and benchmarking

The basic strategy for designing the proposed supply chain is divided into three different phases. Those are as follows:

Phase 1- Gathering and Analysis of the Information – This phase is the collection phase of initial information about customer's expectations about the passenger car as purchasable product.

In this phase the data about the customer expectations are collected and analyzed considering the potential customers. In order to know customer expectations, a survey questionnaire should be distributed among a selected group of companies. The purchasing managers, plant managers and logistics managers, etc. can also be interrogated for the purpose of this construction.

The questionnaire will be structured in 3 sections (general information, customer expectations, and benchmarking questions). It is important to highlight that potential customer are the persons who are going to purchase passenger cars for their own use (first time/ or n times) in the area under this study.

In this research the data collection was done using almost 200 customers by judging their expectations. The data collected are then categorized and summarized in order to include the most influential and critical in the QFD matrix.

Statistical analyses i.e. factor analysis is performed in order to classify and also to reduce and prioritize these customer expectations. The outcome of this process is the clustering of customer expectations into common customer requirement categories. Using the Customer Window Quadrant (CWQ), customer expectations are summarized and categorized according to the order of importance.

Phase 2- QFD and Benchmarking Analysis- It is the construction phase of the QFD and Benchmarking in the perspective of Voice of Customer matrix (VOC). This should contain the development of the planning matrix of QFD will be used as a base for the formulation of the passenger car sectors under study.

When all the customer expectations are defined and categorized, the final number of customer expectations analyzed in this study is 40, after the reduction process. QFD and benchmarking analyses are applied then. The designed framework using the basic procedure of the QFD if illustrated in Figure-2, below:

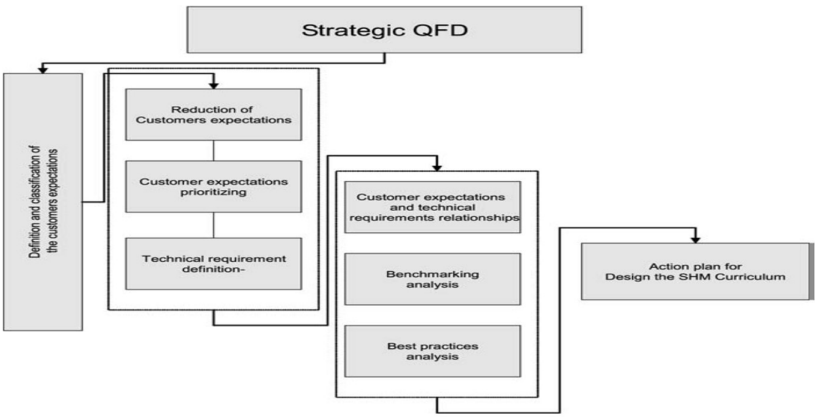

Figure-2: Strategic QFD

The conventional four-matrices of the QFD method designed for manufacturing companies (Hauser and Clausing, 1988) is altered slightly here. So that it can be applied to the passenger car supply chian design. Specifically, the four-matrix method was transformed into a three-matrix action-based method (Gonzalez et al., 2005). These three matrices included the following:

(1) House of quality (planning matrix) - Activities in this step include the following:

- Identifying the customers
- Identifying customer expectations and their importance
- Analyzing customer expectations (What)
- Identifying current methods and processes (How)
- Ranking the requirements
- Establishing correlations between customer and manufacturer's requirements to finally develop and analyze the House of Quality (HOQ) (Gonzalez et al., 2004).

(2) Critical parts matrix - This step corresponds to planning. The design of a supply chain management system of passenger car sector using the links between the customer's requirements identified in Step I to operational elements (this information came from the survey applied to some potential customers in Kolkata and surrounding area).

(3) Action plans matrix- In this step, an action plan is developed based on the information obtained from the previous two steps. The final action plan consists of the supply chain management of passenger car sector. In this phase, multiple factors are considered based on the information collected in the previous phases. These factors include the manufacturing organizational structure, technology requirements, and marketing strategy for motivating the customers to support the existing supply chain system.

Phase 3- This phase is the ultimate development of the supply chain considering all the critical parts and action plans matrices.

ANALYSIS & INTERPRETATION:

The integrated application of QFD and benchmarking enabled the policy makers to convert the research findings into some actionable strategies. The analysis and interpretation are as follows:

Developing a planning matrix-First and foremost it is required to identify the customers. In a broad sense, the potential car purchasers are the customer of any passenger car sector.

Identifying customers' requirements and importance- The first step in applying QFD methodology is to generate or identify the customer's expectations. In order to generate this important information, the various literature surveys is done primarily to know the general pulses of the customers and after that the primary data collection initiated through questionnaire methodology.

From Literature surveys, the result obtained is listed in the tables (Table-1 and 2) below:

Table-1: Customer's Choice Related Factors

Authors & Year	Study	Findings
Manish Kumar Srivastava, A.K. Tiwari,2013	The consumer behavior for A3 segment vehicles such as Honda City and SX4 in a particular region Jaipur.	The result shows that, while purchasing A3 segment car Customer give much importance to Safty, Brand Name and seating and driving comfort. Also word of mouth publicity and advertisements in car magazines are more effective communication medium for promotion of Cars.
Prasanna Mohan Raj,2013	Studied the factors influencing customers brand preference of the economy segment SUV's and MUV's.	The preference of a given brand can be explained in terms of six factors namely Product reliability, monetary factor, trendy appeal, frequency of non-price promotions offered, trustworthiness and customer feeling or association towards brand.
Nikhil Monga, Bhuvender Chaudhary, Saurabh Tripathi, 2012	This research attempts to answer some of the questions regarding brand personality of selected cars in India by conducting the market research. This personality sketching will help in knowing what a customer (or a potential customer) thinks about a given brand of car and what are the possible factors guiding a possible purchase. Similarly, the idea of measuring the customer satisfaction will serve the same purpose of determining the customer perception.	The study shows that brand perception is something which starts growing up before a car is purchased and goes on with its use and is reflected in the recommendations. The customer makes to his connections for the same car. Also, it is seen that the customer might not be using the car still he holds the perceptions about it.

Table-2: Customer's Influential Factors

Authors & Year	Study	Findings
Manish Kumar Srivastava, A.K. Tiwari,2013	The consumer behavior for A3 segment vehicles such as Honda City and SX4 in a particular region Jaipur.	The result shows that, while purchasing A3 segment car Customer give much importance to Safty, Brand Name and seating and driving comfort. Also word of mouth publicity and advertisements in car magazines are more effective communication medium for promotion of Cars.

Authors & Year	Study	Findings
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From these extensive literature survey, it can be stated that customer have different perspectives *viz.* exterior dimensions, interior dimensions, comfort dimensions and so on.

Moreover, from fickle mindedness is a common characteristic observe red in case of customer's buying behavior, i.e. Many times, it has been found that three out of five buyers said they had finalized their decision on the model, brand and fuel type before visiting the showroom. However, when the time came to make their final purchase, a significant number of consumers change their minds. A third of buyers, who said they'd decided about fuel type, changed their decision after talking to the salesperson, family and friends.

Research Questions(s)- Now, the question arises as:

- Do all categories of change sought by the customer have same impact on supply of desired car? (In case of -Change in colour/Change in interior design/Change in Exterior design/ Change in fuel consumption or all)
- Are the customers ready to wait for the time taken to incorporate the desired changes? (i.e., how fast the supply chain responds?
- To what extent brand loyalty matters?
- Does supply time meet response time?

Therefore, a questionnaire survey was carried out with premium passenger car users of several passenger car companies. In this questionnaire survey five (5) broad dimensions or aspects i.e., exterior, interior, rejection, economy, time to wait (brand loyalty) has been considered for analysis. The data so collected has been subjected to **Rotated Component Matrix** to identify the latent dimensions and variables associated with it. The loadings of the variables indicate the impact on the factors. From this analysis the correlations between each variable and the estimated components are identified, these are as follows-

- **Modernity Dimension (MD)** includes External-Modernity of the Design, Uniqueness of Design and Shininess/smoothness
- **Anterior view Dimension (VD)** includes Front Design, External –Color, Non- Availability of suitable Technical Specification, Overall Interior Design/Look, Adjustable Front-Seats, and Adjustable Head-Rests
- **Comfort-Dimension (CD)** includes Leg room, Seat Designs, Boot Space, and Dash-boards
- **Internal Design Factors (ID)** includes Design of Light and; Blinker, Uniqueness, Internal Modernity of Design, Interior-Color, and Back Design.

It is mentionable that as per customer survey the back design which was considers to be an external factor however got clustered with the variables related to interior design. Its contribution to the variance is moderate around 25%.

- **Economy-Dimension (ED)** includes After Sale Service, Fuel Efficiency, Price, and Brand Name
- **Rejection Dimension (RD)** includes No Desired Exterior, No Desired Interior, and No Desired color
- **Brand Loyalty (BD)**

Henceforth, there are seven (7) distinct factors having direct or indirect impact of Supply Chain Management of the company. This in turn will impact inventory, backlog and customer satisfaction.

Analyzing the customer expectations (What's)-. In this stage, in order to setup the Voice of Customer matrix, information coming from different sources is used. The results are stated below (Table-3):

Table 3: Voice of Customer Translated in Terms of Customer Needs and Priority

Serial No	Voice of Customer (VOC)	Customer Need	Importance of Customer's Need (Prioritization)
1	External-Modernity of the Design, Uniqueness of Design and Shininess/smoothness	Modernity Dimension	**2**
2	Front Design, External – Color, Non- Availability of suitable Technical Specification, Overall Interior Design/Look, Adjustable Front-Seats, and Adjustable Head-Rests	Anterior view Dimension	**3**
3	includes Leg room, Seat Designs, Boot Space, and Dash-boards	Comfort-Dimension	**4**
4	Design of Light and; Blinker, Uniqueness, Internal Modernity of Design, Interior-Color, and Back Design.	Internal Design Factors	**1**
5	After Sale Service, Fuel Efficiency, Price, and Brand Name	Economy-Dimension	**5**
6	No Desired Exterior, No Desired Interior, and No Desired color	Rejection Dimension	**6**
7	Desired or preferred brand	Brand Loyalty	**7**

Therefore, the customer expectations (called "What's" in the QFD language) is translated into critical elements (called "How's" in the QFD language). The critical elements are placed at the top of the HOQ. In order to determine the relationship between "what's" and "how's", the critical matrix is constructed, as shown in Table-4 below:

Table 4: Relationship between HOWs and WHATs

Serial No	HOWs / WHATs	Technical Improvement	Change in Look	Change in Interiors	Change in Color	Adding More Features	Price Modifications	Allow Customized Specifications
1	MD	3	3	3	3	3	2	3
2	VD	2	3	3	3	2	1	1
3	CD	2	1	3	0	2	1	2
4	ID	3	1	3	0	1	1	2
5	ED	3	1	1	0	3	3	2

Serial No	HOWs / WHATs	Technical Improvement	Change in Look	Change in Interiors	Change in Color	Adding More Features	Price Modifications	Allow Customized Specifications
6	RD	1	1	1	1	1	1	3
7	BD	1	1	1	2	1	0	1

3 – Strong relationship, 2 – moderate relationship, 1 – weak relationship, 0 –no relationship

In the critical matrix, these critical elements are divided into the 7 areas mentioned earlier viz. MD, VD, CD, ID, ED, RD, BD.

Analysis of the house of quality from the benchmarking perspective-This is done because there remain some of the unique customer expectations that have not been fulfilled yet in the market of supply chain management programs. Therefore, those are the future areas for creating competitive advantage.

Developing action plans-The present study indicates that some major action plans should be implemented in order to satisfy customer expectations, as follows:
(1) Focus on a technological i.e., engineering improvement that involves more analytical skills,
(2) Increase the number of features related to global issues of the supply chain of existing car markets,
(3) Have a balance among the interest areas selected by the customers, and
(5) Create continuous improvement teams that evaluate customer expectations and the competitions performance (benchmarking) periodically.

CONCLUSION:

However, this paper demonstrated the effectiveness of the applications of integrated techniques of QFD and Benchmarking in the automobile sectors, but the use of this approach can also be applied to other areas o other supply chain sectors, too. The most important of the approach is that there is to clarify who the customers are and what their expectations are. Future researchers can be benefited from this research by expanding the scope from automobile sectors to other industrial applications in order to comparatively analyze the applicability of the proposed tools. The application of same methodology to other areas of industry for developing a model for the identification of customers, supplier needs and also for other potential areas.

RECOMMENDATIONS:

Largest customer base is represented by the automobile manufacturing sector especially in India. So, the industry required a quick to response against the current down-term and also against the difficulties the manufacturers are facing now. With this proposed approach discussed, in this paper that addresses the current climate and future expectations, they should take some strategic actions, putting them in a better position, so that the better future of the business will come soon.

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