Investigation into Service Quality and Service Operations of Indian Automotive After-Sales Market

THESIS

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By

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<u>CERTIFICATE</u>

This is to certify that the thesis entitled "**Investigation into Service Quality and Service Operations of Indian Automotive After-Sales Market**" submitted by **Munish Pal Singh ID NO 2015PHXF0102P** for the award of Ph.D degree of the institute embodies original work done by him under our supervision.

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ABSTRACT

The automobile industry plays a crucial role in India's economy with respect to gross domestic product and providing employment to people directly and indirectly. Service quality is an essential aspect for any service provider, and automobile service industry is no exception. Here customers are much concerned about after sales service. The automobile industry has witnessed a limited development of service quality measurement scales. SERVQUAL remains the most widely used scale in studies undertaken on the automobile industry. Our research has a number of implications for both academicians and practitioners. Our research presents a benchmarkmark in identifying service quality dimensions in the Indian setting and enhancing customer satisfaction and achieving customer loyalty.

Our first contribution was in development of reliable AutoIND service quality measurement scale for Indian passenger car after-sales segment. This scale comprised of seven dimensions namely Tangibility, Reliability, Responsiveness, Empathy, Assurance, Service failure, and Service recovery with 37 items. Five original dimensions of SERVQUAL scale and two additional dimensions service failure and service recovery were identified in our scale. This scale assists in service quality measurement for Indian automobile industry. It results in enhancing customer satisfaction and achieving customer loyalty. Structural Equation Modelling (SEM) results indicated that all five SERVQUAL dimensions and service failure were found to have strong relationship with SQ. Service recovery had less impact towards SQ measurement against other six dimensions. Service quality has a strong relationship towards achieving customer satisfaction and further attaining customer loyalty. A mediation analysis was undertaken between service quality, customer satisfaction and customer loyalty. A partial mediation between service quality and customer loyalty was established. The results of the research identified the requirement to maintain service failure data by authorized service stations and institute a framework towards service recovery.

Our second contribution was in terms of service failure prediction in vehicle servicing using bayesian network. This model gives fair reliability and precision that can be used for real-time prediction of possible service failures. With real survey data, this model gives exceptional insights into how to make changes in the servicing system to achieve a lower failure rate and enhanced customer satisfaction. This information can be used to tackle the service failure issues and reduce probability of service failures. This way, service failure rate can be checked without spending excess time and resources by undertaking extra quality checks on each and every vehicle.The Bayesian model developed provides a practical approach for harnessing machine

learning and artificial intelligence towards predictive and prescriptive analytics. Service managers can deploy this model in real time, and with the real-time data coming in, they can get valuable insights as how to change their business processes according to operational requirements. This model can be used for getting realistic insights into operations of an authorized service station and identification of methods to improve it.

Third contribution was in terms of identification and modeling of factors influencing service recovery. The occurrences of disruptions in supply chain and analysing several factors responsible for these disruptions in supply chains were undertaken. This study brings out relative importance of each factor and its relationship with others factors using a mathematical approach with the application of DEMETAL technique. The study identified that out of 17 factors identified, proactive recovery capability, communication from suppliers in form of early warnings and focus on service outcome failures are the major enablers of service recovery. Customer commitment level, transparent communication with end customers, and automation are the factors on which the others have the highest impact. Moment of truth, modularization, and contingent rerouting factors have a weaker relationship with others and act independently.

Our research focused on the accomplishment of research objectives identified during course of research. Development of SQ measurement scale AutoInd, comprising of seven dimensions in Indian context has been undertaken. Analysis and impact of the seven SQ dimensions on customer satisfaction and customer loyalty for Automobile after-sales has been done. Development of Service Failure prediction model for automotive after-sales service has been achieved. Identification of the factors influencing Service Recovery and its impact on after-sales service with advancement to green technology in automobile has been undertaken. With the graduation of automobile sector from the existing non-renewable technology to renewable electric technology, the application of the research can be further taken as reference in further studies.

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LIST OF ABBREVIATIONS

SQ	-	Service Quality
AS	-	After-sales
CSI	-	Customer Service Index
GDP	-	Gross Domestic Product
OEM	-	Original Equipment Manufacturer
GVA	-	Gross Value Added
ML	-	Machine Learning
MDL	-	Maximum Descriptive Length
CPT	-	Conditional Probability Table
BN	-	Bayesian Network
MLE	-	Maximum Likelihood Estimation
AIC	-	Akaike Information Criterion
SEM	-	Sequential Equation Modelling
PLS	-	Partial Least Squares
DEMATEL	-	Decision Making Trial and Evaluation Laboratory
FDI	-	Foreign Direct Investment
ROI	-	Return on Investment
QFD	-	Quality function deployment
ROQ	-	Return on quality
EFA	-	Exploratory Factor Analysis
FAME	-	Faster Adoption & Manufacturing of Electric Hybrid Vehicles

Chapter No. 1
Introduction

1.1   Introduction to Service Quality and Indian Automobile Industry

During past times relationship formed between a customer and company was based on a product-centric view. In today's pretext these business view has changed and is based on the aim to concentrate on sustaining the relationship with the customers as these are values for both buyers and sellers (Shokouhyar et al., 2020). Keeping and maintaining the relationship with existing customers is more effective than creating new customers. It is an integrated approach towards managing relationships by focusing on customer retention and relationship development. As a result, companies have begun to use relationship marketing to improve their long-term sustainability and relationship. Managing a successful customer relationship implementation requires an integrated and balanced approach towards technology, process and people (Chen and Popovich, 2003; Pothal et al., 2021).

Service quality (SQ) is one of the fields that has been the subject of intensive academic research for over three decades. The growth in services economies is a result of, among other things, economic prosperity, lifestyle changes and the number and complexity of goods requiring services. SQ constituent has attracted the attention of researchers all over the world to determine universal set of determinants that determines SQ across section of services. Several researches have established SQ as an important determinant of customer satisfaction (Izogo et al; 2015, Baber 2018; Gupta et al; 2022), which, in turn, influences customer loyalty (Abdullah et al. 2014; Famiyeh et al., 2018; Vigneshwaran et al. 2021). Thus, when a firm delivers SQ that meets or exceeds customers' expectations, it is likely to result in higher customer satisfaction and loyalty. Schiffman et al. (2012); Izogo et al. (2015); and Tarabishi (2022), therefore, argues that SQ is a determinant of whether the consumer ultimately remains with the company (loyalty) or defects to a competitor. Thus, a service organization's long-term success is essentially determined by its ability to expand and maintain a large and loyal customer base (Kandampully, 1998; Balinado 2021) through SQ that meets or exceeds customer expectations.

An automobile is a unique product in that it has component of both product quality and service which accounts for overall experience of the customer (Bei et al., 2001; Gandhi et al., 2018; Gulzari et al., 2022). Customers are more aware of the type of services they receive and the expectations from the service providers are very high. Twenty-two percent of India's total Gross Domestic Product (GDP) is generated by the automotive industry. Global automotive

majors have entered India and have dramatically changed the country's passenger car production scenario. Changes to international technology design and adaptation have helped Indian car manufacturing to compete globally by facing worldwide challenges. Considering the high significance of services and their essential role in the automobile industry, this study examined customer satisfaction with after-sales service experiences in the automobile sector (Gupta et al., 2022). The automobile has entire spectrum of earnings during lifetime of customer. The customer experiences the ownership of the product, along with periodic maintenance service. A customer avails of service about three times a year as part of her vehicle's regular maintenance schedule, besides sending it in for intermittent repairs. In a 4-5year span, the after-sales service is experienced almost 12-15 times. Therefore, the service satisfaction has a significant effect on the loyalty of the customer. It is important to focus on service experience to elicit a customer's satisfaction. The satisfaction of the customer will, in turn, make her recommend the company to others, revisit the service centre, and re-purchase the product (Xu et al., 2017; Javed at al., 2022).

According to an AT Kearney study (2022), the automobile industry is a pillar of the global economy, a main driver of macroeconomic growth and stability and technological advancement in both developed and developing countries; further, it supports many auxiliary industries. The automobile industry in India accounts for 12% of the Gross Value Added (GVA) in the manufacturing sector. Recognized as a core sector, the automobile industry contributes 49% to India's manufacturing gross domestic product (GDP); 7.5% to the total GDP and accounting for 32 million jobs. For developing countries such as India, understanding the automobile industry's evolution in other countries offers a roadmap for the future. The core automobile industry vehicle and parts makers support a wide range of business segments, both upstream and downstream, along with auxiliary industries. This leads to a multiplier effect for growth and economic development. Over the past decade, traditional original equipment manufacturers (OEMs) have struggled to adapt to a digital mindset and techniques in their research and development efforts to achieve a software-defined vision. Too often, their progress stalls as they fail to challenge the status quo based on inefficient ways of working and outdated methods that focus on hardware engineering. The meteoric rise of challenger OEMs and new entrants show that software-defined automobiles give a company the power to make continuous innovation possible. The two wheelers segment comprising motorcycles, scooters, mopeds and electric two wheelers account for 80% of the total sales value, followed by passenger vehicles, which contribute 13% of the total value. The commercial vehicles and the three wheelers each account for 3% of the value. The government of India has encouraged foreign investment in automobile industry and allows 100% Foreign Direct Investment (FDI) under the automatic

route. The National Electric Mobility Mission Plan 2020 and make in India are major government initiatives benefitting the automobile sector. The segmentation of the automobile industry based on sales value is shown below.
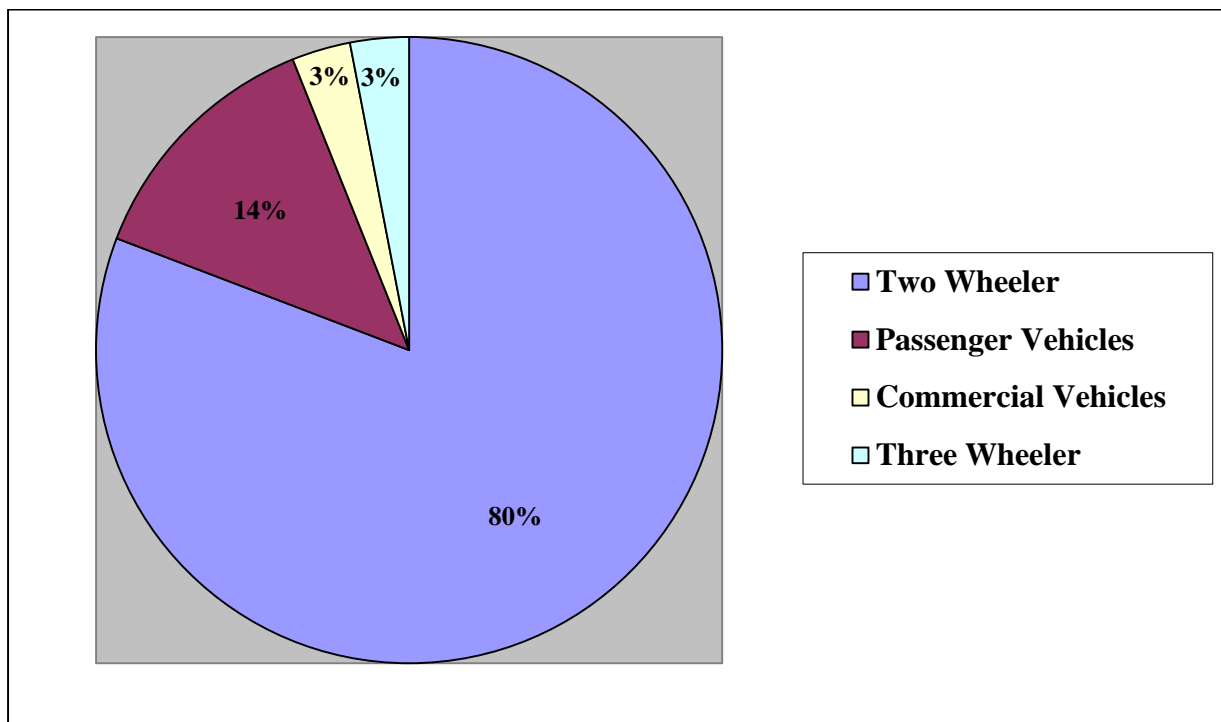
Figure 1.1 Segmentation of the Indian Automobile Industry (Shanglino, Sep 22)

1.2   Requirement of Service Quality in Automobile Industry

The automobile industry could become a huge industry all over the world because new models arrive in the market on a regular basis. Automobile majors try to administer changes in the design, development, manufacturing and marketing of their product. Assessment of SQ has been widely utilized in after-sales service, especially in the automobile industry (Balinado et al, 2021). Customer satisfaction is the key parameter to ascertain customer expectation from a particular brand of product. Customer satisfaction can be inferred from the percentage of total customers who make repeated purchases and their level of contentment with the purchase experience (Gupta et al., 2022). The greatest benefit of customer service is the quality that it delivers to the customers and which gets reflected in each service encounter. A customer's service expectations are formed from past experiences, word of mouth, and advertisement. In general, customers compare perceived service with expected service; if the former falls short of the latter, the customers are disappointed. The measures of SQ obtained through consumer surveys have become a widely used business performance measurement tool. This is because SQ is related to profitability, costs, customer satisfaction, and retention. The most important takeaway from the age of the customer is that consumers have more influence over the buying

process than they have had in the past. Delivering quality service is considered an essential strategy to ensure success and survival in today's competitive environment. A business with high SQ will meet customer needs whilst remaining economically competitive.

The typical lifetime value of a customer who purchases a passenger vehicle and avails service and body repair needs for her car for next five years is depicted in Table No 1.1 below. In the table, the amount assumed is an approximate and conservative estimate from research, and interaction with, passenger vehicle OEMs. The outcome of the data is that scheduled service contributes to 76% or three-fourth of the margin earned from each customer. The percentage of the net margin earned through purchase, insurance, and accessories that are mentioned are taken from vendors and the values vary according to the brand and cost of the vehicles. Therefore, it becomes critical to focus on the service experience of a customer, which is mandatory to enhance life and performance of the vehicle. The customer usually opts for insurance and accessories at the time of purchase.

Table No 1.1   Lifetime Value of Customer

S No	Activity	Amount spent (Rs)	% Net margin	Margin earned (Rs)	No of visits in lifetime	Lifetime Value (Rs)	Earned during
1	Purchase of car	3,50,000/-	1%	3,500	1	3,500	Sales
2	First yr insurance	10,500/-	10%	1,050	1	1,050	Sales
3	Car Accessories	10,000/-	15%	1,500	1	1,500	Sales
Total Margin earned through sales						**6,050**	**24%**
4	Service	3,000/-	15%	450	15	6,750	Service
5	Body repair	10,000/-	25%	2,500	2	5,000	Service
6	Annual Insurance renewal	7,000/-	10%	700	4	2,800	Service
7	Resale of secondhand car	2,00,000/-	2.5%	5,000	1	5,000	Service
Total Margin earned through service						**19,550**	**76%**

Source: Ankit et al., 2008 Service operation management : Managing customer satisfaction at MASS

It is suggested that different marketing strategies may be used to target different market segments to improve customer loyalty. SQ constituent has attracted the attention of researchers all over the world as they seek to define a universal set of determinants that affects the SQ across a section of services.

1.3 Service Quality

Quality has been defined differently by different authors. Some prominent definitions include "conformance to requirements" (Crosby, 1984), "fitness for use" (Juran, 1988) or 'one that satisfies the customer' (Eiglier and Langeard, 1987). As per the Japanese production philosophy, quality implies "zero defects" in the firm's offerings. Though the initial efforts towards defining and measuring SQ emanated largely from the goods sector, a solid foundation for research work in the area was laid down in the mid-eighties by Parasuraman, Zeithaml, and Berry (1985). In 1985, Parasuraman conceptualized SQ as a gap between consumer's expectations and perceptions and also inspired many other researchers to examine the services quality construct with this premise. However, their contribution has not gone unchallenged. Much of this interest has centered on the SQ gaps model and particularly the SERVQUAL instrument developed to measure SQ. They were amongst the earliest researchers to emphatically point out that the concept of quality prevalent in the goods sector is not extendable to the services sector. Being inherently and essentially intangible, heterogeneous, perishable, entailing simultaneity and inseparability of production and consumption, services require a distinct framework for quality explication and measurement. Unlike the goods sector, where tangible cues exist to enable consumers to evaluate product quality, quality in the service context is explicated in terms of parameters that largely come under the domain of 'experience' and 'credence' properties and are, therefore, difficult to measure and evaluate (Parasuraman, Zeithaml and Berry, 1985; Zeithaml and Bitner, 2001). One major contribution of Parasuraman, Zeithaml and Berry (1988) was to provide a terse definition of service quality. They defined service quality as "a global judgment, or attitude, relating to the superiority of the service" and explicated it as involving evaluations of the outcome (i.e., what the customer actually receives from the service) and the process of service act (i.e., the manner in which the service is delivered). In line with the propositions put forward by Grönroos (1982) and Smith and Houston (1982), Parasuraman, Zeithaml and Berry (1985, 1988) posited and operationalized SQ as a difference between consumer expectations of 'what they want' and their perceptions of 'what they get.' Based on this conceptualization and operationalization, they proposed a SQ measurement scale called 'SERVQUAL.' The SERVQUAL scale constitutes an important landmark in the SQ literature and has been extensively applied in different service settings.

Parasuraman et al. (1993) and Famiyeh et al. (2018) defined SQ as the discrepancy between consumers' perceptions of services offered by a particular industry and their expectations about others in the industry offering such services. If the perception of service is below the expectation of service, then customers judge the quality as low and if perception of service is equal or above the expectation of service, then customers judge the quality as high. Kotler and Keller (2009) defined service as an act or performance that one party can offer to another that is essentially intangible and does not result in the ownership of anything. They also stated that services have four distinctive characteristics, namely intangibility, inseparability, variability and perishability (Garga et al., 2016). Dehgan et al., (2013) defined SQ as the subjective comparison that customers make between the quality of service that they want to receive and what they actually get. Vijaykanth et al. (2014) and Ganesh (2020) defined SQ as the consumers' overall impression of the relative inferiority/superiority of an organization and its services. Therefore, SQ is the key to survival for all service-providing companies. With service, companies not only retain their existing customers but increase their chances of getting and attracting new customers.

1.4   Customer Satisfaction

Dehghan et al. (2021) defined customer satisfaction as a result of cognitive and effective evaluation, where some comparison standard is compared to the actually perceived performance. If perceived performance is less than expected, then the customer will be dissatisfied. On the other hand, if perceived performance exceeds expectations, the customer will be satisfied.

There is growing managerial interest in customer satisfaction as a means of evaluating quality. High customer satisfaction ratings are widely believed to be the best indicator of a company's future profits. Satisfaction can be broadly characterized as a post-purchase evaluation of product quality given pre-purchase expectation (Kotler, 1991; Yi, 2021). Good customer satisfaction has an effect on the profitability of nearly every business. When customers perceive good service, each will typically tell 9-10 people. It is estimated that nearly one half of American business is built upon this informal, "word-of-mouth" communication. The cost of gaining a new customer is ten times greater than the cost of keeping a satisfied customer. In fact, if the service incident is negative, the negative effects can last for years through repeated recollection and recounting of the negative experience.

Jhanshahi et al. (2020) stated that customer satisfaction has been defined in various ways, but the conceptualization that has achieved the widest acceptance is that customer satisfaction is a post-choice evaluative judgment of a specific transaction. They also identified three general

components of customer satisfaction: customer satisfaction is a response, the response pertains to a particular focus, and the response occurs at a particular time.

Urs et al. (2014) defined customer satisfaction as an individual's reaction in the form of sequence consisting of information processing and a valuation of the degree to which a service fulfils the functions it should possess. It also includes the feeling of happiness or joy of a service matching expectations and experiencing pleasure while consuming the service.

1.5   Service Quality and Customer Satisfaction

The link between SQ and customer satisfaction has been the focus of research. Sureshchandar et al. (2002) and Supriyanto et al. (2021) found that SQ and customer satisfaction were highly related; the two constructs are independent but closely related, and an increase in one is likely to lead to an increase in the other. Ladhari (2009) and Chatterjee et al. (2022) claimed that SQ is an important antecedent of customer satisfaction. Wang and Shieh (2006) and Twum (2022) found that except for responsiveness, all the remaining SERVQUAL dimensions explored have a significant positive effect on overall user satisfaction.

According to Berry and Parasuraman (1991) and Sharif et al. (2021), since customer satisfaction is influenced by the availability of customer services, the provision of quality customer service has become a matter of major concern for all businesses. Hence, customer satisfaction is typically defined as a post-consumption evaluative judgment concerning a specific product or service. It is the result of an evaluative process that contrasts pre-purchase expectations with perceptions of performance during and after the consumption experience. Anton (1996) and Sao (2022) elaborate that "customer satisfaction as a state of mind in which the customer's needs, wants and expectations throughout the product or service life have been met or exceeded, resulting in subsequent repurchase and loyalty." Customer satisfaction is the evaluation or feeling that results from the disconfirmation process. The Merchant Account Glossary points out that, "Customer satisfaction is an ambiguous and abstract concept and the actual manifestation of the state of satisfaction will vary from person to person and produce/service to produce/service." According to Schiffman and Kanuk (2004), customer satisfaction is the individual perception of the performance of the product or service in relation to his or her expectations.

1.6 After-Sales Market

These days, almost all companies are providing satisfactory after-sales service which helps to extend the lifecycle of products and extract the maximum value from high-value equipment. After-sales service is a high-margin business and accounts for a large chunk of corporate profits. Thus, companies are being persuaded of the benefit of paying more attention to their after-sales costs and service level. After-sales services have become a unique selling point, especially for players in the automobile industry. Since the lifecycle of a product in this industry is long, companies are likely to find more opportunities in after-sales service in the future.

After-sales service is commonly used to define services provided to the consumer of a product during its post-purchase life cycle. It is said that after-sales services are not only vital as a required intervention on a product or as mandated by law, but also a great contributor to a business' attempt to enhance its competitiveness. Examples of these after-sales services are mostly the repairs and maintenance of a product in automobile companies. Automobile companies deliver after-sales services through their retailer or dealers. Car producers, such as Toyota, Volkswagen, BMW, and many others utilize their retailers to deliver services, such as periodic maintenance and other repair services (Shokouhyar et al. 2020).

Decoding the diverse needs and expectations of Indian automobile customers key to improving satisfaction, a JD Power study finds that automotive manufacturers have collectively improved their after-sales service satisfaction. Service consistency varies greatly across the regions of the country, according to the JD Power 2020 India Customer Service Index (CSI) study of the mass market segment. Strong differences in customer behavior, preferences and expectations of their after-sales experiences contribute to the substantial disparity in regional areas. The study revealed that 82% of vehicle owners in the western region schedule an appointment for their service visit, while only 55% of customers in the Northern region schedule their appointment, affecting dealers' ability to effectively manage unscheduled workload and maximize throughput. In an astoundingly diverse market like India, where every region and state have its own unique characteristics and needs, dealers need to capitalize on every customer interaction opportunity to develop points of differentiation and deliver on those expectations.

1.7 Service Quality Instrument

Although some academic evidences suggest inconsistencies in SQ conceptualizations, measurement, and dimensional structure, especially within non-western settings SERVQUAL has till date remained the most widely applied (Baber, 2018; Etemad-Sajadi and Rizzuto, 2013; Taap et al., 2011; Ladhari, 2008). Balinado et al. (2021) and Taap et al. (2011) are of the view

that even though the literature on SQ is rich and varied, the SERVQUAL model still prevails as one of the best approaches in measuring SQ.

The relative importance of SERVQUAL dimensions is because of the fact that SERVQUAL can be used to evaluate the relative importance of the dimensions of quality in influencing customers' overall perceptions of a service. The relative weight that customers seem to give to each quality dimension can be determined. There are five SQ dimensions to measure SQ: tangibles; reliability; responsiveness; assurance; and empathy. The model contains 22 items for evaluating customer perceptions and expectations regarding the quality of service. A level of disagreement or agreement with a given item is rated on a Likert-type scale ranging from 1 to 7. The SQ using SERVQUAL model can be expressed using the following equation:

$SQ = \Sigma j = 1 \text{to } k \ (Pij - Eij)$, where:

SQ = overall service quality;

k = number of attributes;

Pij = performance perception of stimulus i with respect to attribute j; and

Eij = service quality expectation for attribute j that is the relevant norm for stimulus i.

1.8   Service Quality in Automobile Industry

Berndt (2009) explained proportions of SERVQUAL with respect to auto dealership. The author has taken into account five components of SQ reliability, which is a very significant dimension of SQ, where the dealership firms contact the customers and assure the delivery of a vehicle at a specific time; assuredness, that is, knowledge of the service provider and the way they interact with the customer arouses trust in the organization; tangibles, in the form of parking, signage, and layout of the dealership; empathy, which includes communications among the firm and its customers, and the form of interaction; and finally, responsiveness, that is, changes that are made with respect to the services according to the needs of the customers.

Katarne and Sharma (2010) and Vigneshwaran et al. (2021) measured the current SQ level of a typical automobile dealership in an Indian city. The satisfaction/ dissatisfaction of the customer was measured using standard statistical tools and an attempt has been made to find out reason(s) of dissatisfaction by applying root cause analysis. The results of the study show that a delay in delivery is the most critical reason responsible for customer dissatisfaction or perception of poor SQ level.

Asadollahi et al. (2011) pondered over the benefit of quality and consumer loyalty for a vehicle brand in Indian and foreign companies. The study was done in two stages. Client gratification was the focus area in phase one and the second phase consisted of associated research. There was an isolated examination of the gratification of customers on different factors.

When it came to Indian firms, there was no difference between the factors, but the foreign-based companies had a lot of differences.

SQ and customer satisfaction in automobile after-sales services in two Iranian companies (Bahman Group and Irankhodro) by Mather et al. (2007) and Morgana (2021) and one foreign company (General Motors group) was also studied. The results of the degree of customer satisfaction with after-sales service for these companies in every five dimensions were analyzed separately. The two Iranian companies had no significant difference in all the dimensions but showed a meaningful significant difference with other foreign companies in all the SQ dimensions.

Jajaee and Ahmad (2012) said that the fastest-growing sector in India is the automobile industry. They stated that fulfilling the needs of the customers is important in every industry, so they conducted a SERVQUAL analysis to find the difference between the wants and observations of the customers. Shuqin and Gang (2012) studied the association of sales potential. Their survey revealed that the empathy factor influenced customers, but responsiveness did not. Customer perceptions towards the service providers were affected if customers were well satisfied, thereby enabling trust in the company.

Jhanshahi et al. (2011) and Baarimeh (2017) conducted research to find the relationship between customer service and product quality with customer satisfaction and loyalty in the context of the Indian automotive industry. The results indicated that customer service and product quality has been influential on customer satisfaction and also there is a positive relationship between customer service and product quality with customer satisfaction and loyalty in the context of the Indian automotive industry. Jajaee et al. (2012) conducted a study on the perceived SQ in Australian automobile insurance industry by employing the SERVQUAL scale. The results indicated that the relation is positive and an increase in SQ results in enhancing customer satisfaction.

Urs et al. (2014) studied the gap between expected and perceived quality measured through SERVQUAL method to investigate automobile servicing in Karnataka. Two independent samples of personal vehicle users and fleet vehicle users were selected for comparative analysis and a considerable gap was found in Expected and Perceived quality for factors like Reliability, Responsiveness, and Empathy.

Al-Shammari & SamerKanina (2014) and Ganesh (2020) examined SQ in the Saudi Automotive Company and they concluded that that the most important quality dimensions from the customer's viewpoint were Assurance and Tangibles followed by the Reliability, Responsiveness, and Empathy dimensions.

1.9   Service Operations

Service processes require participation of the customer, without whom the customer service processes cannot take place. The fact that the service provider is dependent on customer participation causes difficulties in managing service processes efficiently and effectively because a customer's contributions can only be influenced up to a certain extent by the provider (Flieb et al., 2004; Wirtz et al., 2021).

Moreover, some service processes require the participation of the customer during all or some service operations. The customer may take an active part in the service operation, such as in self-service restaurants. Participation can also be limited to a more passive form of involvement, a requirement of physical presence, such as in medical surgery; a need for the customer to be mentally present such as in education; or the need to start and stop a process, such as in car repairs (Langeard, 1981; Parasuraman et al., 1985; Grönroos, 2020). This dedication to customer service leads to service providers to measure customer satisfaction and also to use customer responses to guide service operations. Service in operations is an iterative service management process that determines the optimum level of customer satisfaction.

The Service Process Matrix (Schmenner 1986; Eyers et al; 2021) is a classification matrix of service industry firms based on the characteristics of the individual firm's service processes. The Service Process Matrix can be useful while investigating strategic changes in service operations. The classification characteristics include the degree of labour intensity and a jointly measured degree of customer interaction and customization. Customer interaction represents the degree to which the customer can intervene in the service process. Customization refers to the need and ability to alter service in order to satisfy the individual.
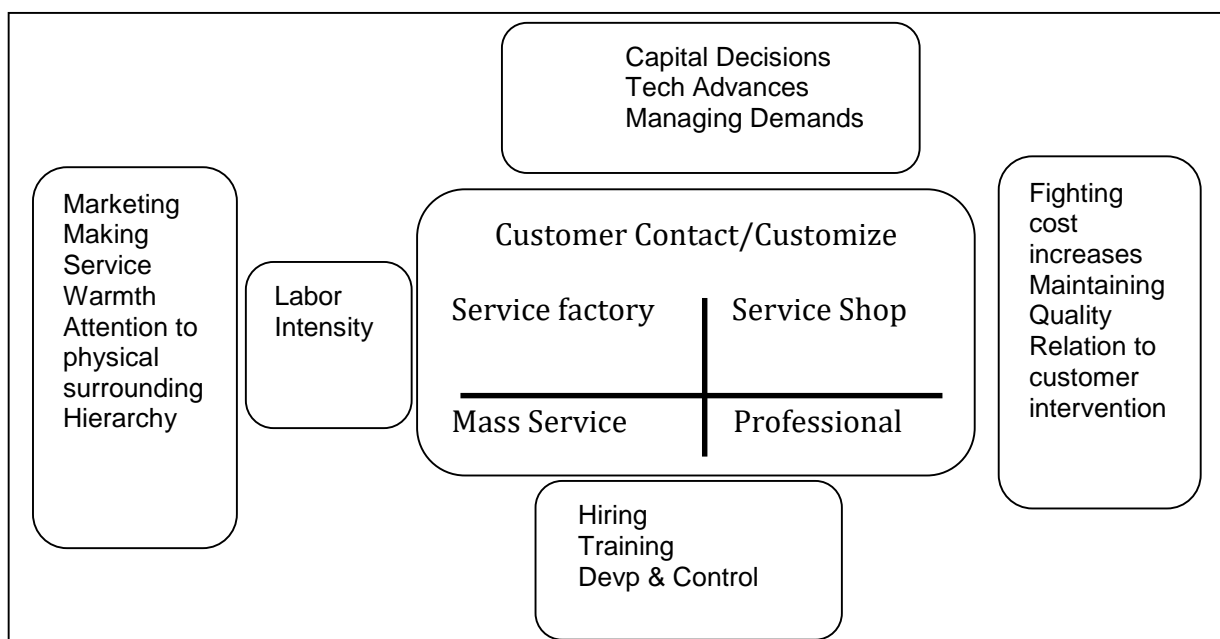
Figure 1.2 Service Process Matrix

The vertical axis on the matrix as shown is a continuum with high degree of labour intensity on one end (bottom) and low degree of labor intensity at the other end (top). The horizontal axis is a continuum with high degree of customer interaction and customizations on one end (right) and low degree of customer interaction and customization on the other end (left). This results in a matrix with four quadrants, each with a unique combination of degrees of labour intensity, customer interaction and customization. The upper left quadrant contains firms with a low degree of labour intensity and a low degree of interaction and customization. This quadrant is labelled as "Service Factory." The upper right quadrant contains firms with a low degree of labour intensity but a high degree of interaction and customization. The upper right quadrant is labelled "Service Shop." The passenger cars fall under this category including hospitals, auto repair shops and restaurant. The lower left quadrant contains firms with a high degree of labour intensity but a low degree of interaction and customization. This quadrant is labelled "Mass Service." Finally, the lower right quadrant contains firms with a high degree of labour intensity and a high degree of interaction and customization. The lower right quadrant is labelled "Professional Service."

The service positioning matrix shows how the desired nature of the customer's service encounter activity sequence translates into a recommended service system design. The matrix helps managers think about marketing and operations linkages, roles of the customer and service-provider in creating and delivering services, facility design and process choice, and the different types of management challenges at each position in the matrix.

1.10 Research Problem

Automobile and auxiliary industries can be considered as one of the most important industrial sectors in the world. The turn of the twentieth century is considered as the dawn of the automobile industry. Automobile maintenance has seen a comparative escalation during the recent years and has helped the automobile industries to stay at the top compared to the other industrial sectors (James et al., 2022). After-sales service, particularly in the automobile industry, has received little attention in the management literature. In case of the automobile industry, it is a part visible to the customers. After-sales service has considerable impact on customer satisfaction and further results in customer loyalty. It is important to identify factors and accurately measure SQ in after-sales service (Youchao Tan et al., 2017) in the Indian automobile industry. SERVQUAL is most popular and intensively used for SQ measurement scale (Izogo et al., 2017).The SERVQUAL scale depicts five SQ dimensions which has been extensively used for all types of services including tourism, hospitality, education, hospitals, retails, education,

car services (Bouman and Van der Weile 1992; Berndt and Herbst, 2006, & 2009), car rental (Zhang, 2013), health care, banking (Yi-Su Chen 2016), and so on.

Limited research has been conducted in Automobile after-sales service (Victor et al., 2017). There is a need to accurately measure SQ in Automobile after-sales service for Indian automobile sector. For almost 10-15 years since the development of SERVQUAL scale, no scale has been developed for Indian settings. There is a requirement to undertake research in measurement of SQ in Indian automobile after-sales service for automobile passenger car segment. This will enable to identify SQ dimensions in context to Indian market. After identification of the SQ dimensions, their impact on customer satisfaction and customer loyalty needs to be ascertained. Service failure and service recovery is a continuous phenomenon which is being undertaken during services. It is also important to determine the relationship in automobile sector as recording of both service failure and service recovery needs to be formalized and addressed at a specific management level. Formulation of service failure and service recovery strategies by OEMs and authorized service stations needs to be undertaken towards achieving customer satisfaction and further resulting in customer loyalty.

1.11   Objectives of the Research

The research focuses on the following research objectives:

- To develop a reliable SQ measurement scale for the Indian Automotive after-sales passenger car segment

- To analyze the impact of SQ dimensions on customer satisfaction and customer loyalty for Automotive after-sales

- To develop a Service Failure prediction model for automotive after-sales service

- To identify the factors influencing Service Recovery and its impact on after-sales service with advancement to green technology in automobile

1.12   Scope of the Research

The above-mentioned research objectives shall be studied as part of this research in the automobile industry in the Indian context. In view of the global linkages and the industry spanning across the entire country, the study shall endeavor to study customer relationship and their implications for customer satisfaction, perception, and loyalty with regards to the after-sales services. The focus of the present study is on the passenger car segment. It utilizes customer's point of views post purchase and covers back-up services in the car industry market. The automobile users were asked for their satisfaction on the after-sales services for their cars

provided to them by the manufacturers and the dealers and the customer-dealer relationship is interviewed keeping in mind the service provided to customers. There is a need to develop a SQ measurement scale for the automobile industry that is pertinent to Indian settings.

1.13   Outline of the Thesis

This section will describe the purpose of each chapter in this thesis.

Chapter 1: Introduction

This chapter covers the concept of SQ and its importance in automobile industry. The contribution and requirement of SQ in automobile industry is highlighted. A broad perspective on SQ, customer satisfaction and the after-sales market is given. A SQ measurement scale SERVQUAL along with dimensions is covered. Overview of SQ in automobile industry is deliberated. Research problem with existing gap in literature is given. Objectives of research and scope of research are stated. Lastly the chapter explains the outline of the thesis.

Chapter 2: Literature Review

An extensive review of the literature in the field of Services, SQ, Service Quality Dimensions, SQ Measurement Scale, SERVQUAL, SQ measurement, dimensions of SQ, service recovery, service failure and service operations is done. Customer satisfaction, After-sales Service and Customer loyalty is also covered. The research gaps in automotive sector after-sales segment for passenger car is identified and presented for proposing a research framework.

Chapter 3: Research Design and Methodology

In this chapter, the introduction and overview of research process is given. Definition of research problem and research objectives framework is presented. Outlined research design and methodology is given in detail, along with construct for data collection, survey instruments, in-depth interview with experts, target population and sample design, data collection including pilot study, questionnaire preparation, pilot study and main study for research are presented. Data analysis overview, structural equation modeling, service failure prediction, and service recovery details are given.

Chapter 4: Measuring Service Quality in Indian Automobile Aftersales: AutoIND Scale

This chapter covers the methodology undertaken towards development of SQ measurement scale for passenger car segment AUTOIND scale. First, the introduction to SQ is given along with available SQ measurement scale SERVQUAL. Literature review is presented followed by details of the existing scales in automobile industry. Gaps in literature, need and objective of study, scope of study and selection of hybrid scale are covered. Research methodology adopted includes sampling process and item deletion, sample size, demographic

distribution, item generation, reliability and validity analysis, factor analysis, communalities, factor loadings. The theoretical framework is presented, and the confirmatory factor analysis, structural equation modeling, exploratory factor analysis and mediating analysis is covered in detail. Lastly, conclusions, limitations, and future scope for research are given.

Chapter 5: Service Failure Prediction in Vehicle Servicing Using Bayesian Network (BN)

Service failure has been identified as new dimension in service quality measurement scale AutoIND for the automobile industry in Indian setting. In this chapter, the prediction of service failure for vehicles post scheduled servicing is presented. The effect of occurrence of these factors of service failure and magnitude of severity of factors affecting service failure has been presented. The types of service failure and possible reasons have been identified using BN, along with relationship with variables. Use of BayesiaLab software has been undertaken to carry out analysis against reliability, precision, and sensitivity.

Chapter 6: Identification and Modeling of Factors Influencing Service Recovery

Service recovery has been identified as a new dimension in SQ measurement scale AutoIND for automobile industry in Indian setting. In this chapter, various factors influencing service recovery process have been identified and classification of these factors into three categories of people, process, and technology-related has been undertaken. DEMETAL approach is used to establish the relationship amongst these identified factors quantitatively and further understanding their cause and effect relationships. Identification of independent factors and factors affecting service recovery are identified. Implication with graduation to green technology and electric vehicles in future is presented.

Chapter 7: Conclusions and Future Scope of Research

This chapter includes details on the main purpose of conducting this research, review of research objectives, and findings. It further outlines its contribution to Indian industry with an aim to enhance SQ, customer satisfaction, and customer loyalty. The limitation of research along with future scope is presented.

Chapter No. 2
Literature Review

2.1 Introduction

Organization often includes customer satisfaction and SQ strategy in their business plan for retaining a customer, profitability and increasing a market share. It is a linking of the customer's lifetime duration with projected profitability. Using a Markov switching matrix, a model can be developed for customer's lifetime value, which results from the frequency of category purchases, average quantity of purchase, and brand switching pattern, combined with the firm's contribution margin. There is a need to examine the profitability of long-lasting customers in a non-contractual setting. Customer retention has a major impact on market share but this is not the only factor which affects market growth rate, competitors in market, effective marketing all play important role for increasing market share. A business will not be successful in satisfying customer needs if it is not focused on the customer, or if it does not understand the value of building relationships with its customers. When poor service is experienced, both the firm and customer are negatively impacted. The customer receives poor service and the firm loses future potential sales. Satisfaction has a positive impact on post-purchase behavior (Oliver, 1980) and service quality directly and indirectly exerts influence on repurchase intention through its influence on satisfaction.

In recent decades the service industry has grown in importance (Schettkat & Yocarini, 2003), and manufacturing has declined (Jovane, Yoshikawa, Alting, Boër, Westkamper, Williams, Tseng, Seliger & Paci, 2008; Berry, Wall & Carbone, 2006). The service sector accounts for 70% of the employment, making most countries dependent on the service sector (Berry et al., 2006 and Gardner, 1985). More insights into innovative service processes are needed (Arvanitis, Kubli and Woerter, 2008). Companies continuously seek new and innovative ways to offer SQ, and try to differentiate their service offerings. This is used as a competitive advantage to attract and retain customers and also make a profit (Sandström, Edvardsson, Kristensson, and Magnusson, 2008; Khan & Fasih, 2014) through skill exchange and customer co-creation (Prahalad & Ramaswamy, 2004).

SQ is the difference between a consumer's perception and expectation of a service (Gronroos, 1982) and Rahman (2022). Seth, Deshmukh & Vrat (2005) defined SQ as the ability for service providers to match expected service with perceived service to achieve customer satisfaction. While Gronroos (1982), Lehtinen & Lehtinen (1982), and Parasuraman, Zeithaml &

Berry (1985) defined SQ as the comparison stemming from what customers feel a company is supposed to offer and the actual service performance of the company.

SQ can be accessed with the SERVQUAL scale (Magasi et al.,2022). SERVQUAL scale measures the quality of a service before and after the consumption of a service, with five dimensions: tangibility (visible elements of a service such as buildings, sites and tools); responsiveness (how fast service providers respond to customer queries/ the willingness for service providers to assist customers and provide prompt services); reliability (the ability for a service provider to assure customers of a reliable and proper service); assurance (the level of knowledge displayed by a service provider when delivering its services and their ability to inspire trust and confidence); and empathy (ability for a service provider to pay attention to individual customer demands/ individualization of service). Due to the increased competition faced by companies around the world, companies choose to expand their market size and increase customer expectations through advancement in technology and globalization (Lin, Lai, & Yeh, 2022). Hence necessitating businesses to be more customer centric (Naidoo, 2022 and Schneider, Ehrhart, Mayer, Saltz & Niles-Jolly, 2005).The quality of a service positively influences customer satisfaction (Kaura et al., 2012; R Agarwal et al., 2022) and SQ is of vital importance towards enhancing customer satisfaction.

2.2 Services

Kotler (1997) defines service as any act or performance that one party can offer to another that is essentially intangible and does not result in the ownership of anything. Its production may or may not be tied to a physical product. Mathe & Shapiro (1993) defines service as "all of the activities undertaken by the firm to provide value in use over time, measured by increased customer satisfaction with a tangible product or service of product." The studies are all related to the supplier's way of managing the after-sales services to the consumers in this environment. In the studies, particular emphasis is put on studying the appropriateness of the established dealer's concept and its impact on customer satisfaction and customer loyalty. The dealer and customer interaction are studied. The study also discusses the impact of services on customer satisfaction. With regards to service, the degree to which customers' needs change as a function of time related to the importance of the individual services to the customers is also studied. These relationships are related to individual services and customer satisfaction and loyalty and on the other hand, to the supplier's perception of the customer loyalty and satisfaction.

Services have been studied extensively since the 1980s. The idea of linking services value and customer satisfaction has existed from a long time. Customer satisfaction has been studied and recognized as an important factor in the management literature for the past few decades.

Studies indicate that there are links among customer satisfaction and customer perception. Many studies additionally attempt to establish connections between service qualities, customer satisfaction, customer loyalty and profitability. Services have gained importance over the past decades. Nobrega (1997) stated that service sector grew in importance and participation in the GDP, especially in more developed countries. Lovelock and Wirtz (2022) indicated that the increased automation of industry, besides political-governmental factors, social, and technological changes increased the demand for skilled labor in services worldwide. Gronroos (2009) and Atuo (2022) mentioned the service sector's participation in the global economy, ranging from 50% in developing countries, and approximately 70% in more developed countries. Growth in size and importance of participation makes the companies seek to improve their skills to improve their service level in order to create competitive advantage and improve their customer relationships.

No matter how good a company is in servicing, there are a number of factors, both in internal and external environment that can cause failures in service. Production consumption simultaneity, a feature present in most of the services, often demands customer participation, with the attendant possibility of failures. The search for differentiation, competitiveness, and growing the market share makes it necessary that the company adopt measures to minimize (or if possible, avoid) the effect of these failures on the perception of quality by the customer; the company should try not only to prevent, but also manage their effects and recuperate credibility with the customer, in case she has been affected. The share of services sector in economy together with the fact that the service sector is growing more and more competitive (Zemke and Bell, 2000; Lovelock and Wirtz, 2006; Gronroos, 2009) suggests that a company's relationship with customer depends on how he perceives the quality of service he receives. Nevertheless, failure to provide services is more difficult to reverse than when it occurs in the production of goods. In this context, it is important that companies should adopt practices in service recovery, in order to remain competitive and minimize damage to their relationships with customers.

In the literature, a series of service characteristics have been discussed (Grönroos, 1980; Gronroos, 1982; Parasuraman et al.,1985; Gronroos, 1988). The services have four basic characteristics (Grönroos, 1988 and 1998):

• Services are more or less intangible.

• Services are activities or a series of activities rather than a thing.

• Services are at least to some extent produced and consumed simultaneously.

• The customer participates, at least to some extent, in the production Process Services have four unique characteristics: intangible; more difficult to define and subject to alternative

expectations and perceptions, heterogeneity; subject to human variability and often the customer is involved, perish ability; once a service has been created, it has no value and inseparability of production and consumption; consumed as it is produced.

As the consumer and customer are frequently used as parallel terms, in the present study the terms are clarified (Parasuraman and Grewal, 2000) in that the customer is an individual or business entity that buys the product and pays for it. The consumer is a person who uses or consumes the product. Maister (1997 & 2022) discovered that service companies have in general the same mission statements. Every service company must be able to satisfy three goals: to deliver outstanding customer service, to fulfill employee satisfaction, and to achieve financial success. The important aspects of the service business process are as follows: the business process consists of a series of simultaneous and sequential activities that are performed by different actors; there are no clear boundaries between the different actors; and the input to, and outputs from, the process are time-wise inseparable. Customers can play several roles in which the customer supports the business process. There does not seem to be a misfit in developing customer-oriented market strategy and increasing productivity at the same time, but this frequently requires the manager to take a broader perspective on the company (Storbacka, 1992). Mathe and Shapiro (1993) & R Gupta (2022) has defined product in terms of three critical aspects: physical, tangible or technological, and intangible. In time, both the tangible or technological and the intangible may change as the way in which the product is used and the environment in which it is used changes. They also separate services into two main categories: encouraging or facilitating the sale of product and services that are intended to increase the benefit to the customer when using the product, and the customer's satisfaction while using the product. The later definition is more frequently used in the after-sales environment.

Services have been an integral part of companies' marketing mix (Wellemin, 1984; S Murali et al,' 2016). Quality service is frequently realized well when it is missing than when it is present. Wellemin (1984) argues that one of the most important aspects in influencing customer's perception is to try to convince customer that the supplier cares about him/her. It is important to keep the customer updated of the possible changes that take place. Services create an increasing proportion of company profits in many industries. Wellemin (1984) has identified (see Table 2.1) the benefits of service contracts, which in ideal conditions are made as the product is sold:

Table 2.1   Benefits of the service contracts to supplier and customer (Wellemin, 1984)

Benefits to Supplier	Benefits to Supplier
Simpler Planning	No need to place rush orders
Assured Revenue	Known Cost
Regular Customer Contacts	Reduction in administrative cost
Balancing of Work Load	Maintenance of assets due to regular
Simpler Administration	Preventive Maintenence

Service contracts can be viewed as a way to extend the relationship with the customer. They can be used to generate complaints, information, and new product ideas. In this approach, even a low-priced service contract can be justified (Heskett et al., 1997 & 2002). Service is one way of differentiating the product from that of the competitors and it can represent an effective competitive advantage, as it is difficult to convince customers that the company provides high-quality service (Davidow, 1986; Brown, 1992; Mathe and Shapiro, 1993; Wellemin, 1984 & 2022). Customers can be convinced of quality service only by constantly delivering excellent service. Generally, if services are priced into products, then services are seen as means, but if services are priced separately, then they are seen as business itself (Rothschild, 1984). Achieving sustainable competitive advantage through superior products and reasonable prices is difficult. Service can be used to distinguish the product and it is much more difficult for competitors to imitate (Rothschild, 1984; Parasuraman and Grewal, 2000). The cost of supplying high quality service is likely to continue rising. Therefore, service must utilize technical developments. Suppliers need to demonstrate to customers' added value, as there will be pressure on the margins. Parasuraman and Grewal (2000) predict that technology will be a major force in the future shaping of the buyer-seller relationships. In Figure 2.1, Parasuraman (1996) further develops Kotler's (1997) triangle model of services marketing by adding technology to it. The pyramid model emphasizes the need to manage company-technology, employee technology, and customer-technology linkages to maximize marketing effectiveness.

Triangle Model

(Kotler, 1994)

Triangle Model
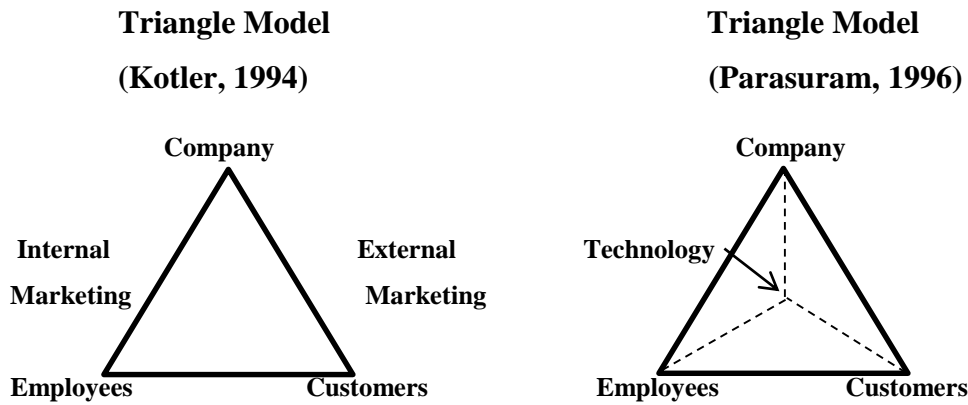
(Parasuram, 1996)

Figure 2.1 The Triangle and Pyramid Models (Parasuraman and Grewal., 2000)

Parasuraman (1998) and (Sands et al., 2022) argues that the importance of the customer service is growing as the suppliers' focus shifts from selling to customers to serving them effectively. The relative importance of customer service can vary depending on the type of buyer-seller relationship and the nature of the products. Service companies (Maister, 1997) can develop their practices in five areas namely broadcasting, courting, super pleasing, nurturing and listening. Broadcasting involves those activities that generate opportunities with new customers. Courting means that a specific customer has been recognized and the company is addressing the customer. Super pleasing involves doing outstanding work and servicing the customer so that the customer is more than satisfied. By means of nurturing paying attention to the customers the future businesses can be won. By listening to customers describe their needs, a company can improve the competitiveness of its existing services and identify opportunities for developing new services.

For most customers, super pleasing brings the highest return on investment (ROI). The most successful growth strategy is one whereby existing customer buy existing products. This is supported by research conducted at the Strategic Planning Institute at GE in the field of Profit Impact of Market Strategy database. Growth through penetration is appropriate for companies with a broad range of product lines. It creates both incremental sales and strengthens customer relationship. In the service industry, an important part of selling is to be able to convince customers and gain their trust. The next most successful strategy is to sell new products to existing customers. There is a constant need to give impetus to existing customers and have a relationship with the company so as to build future relationship and instill faith in them to achieve trust. The aim is to achieve customer satisfaction and customer loyalty.

2.3 Service Quality

According to Vavra (1995), quality is consistently delivering products and services that fully meet consumer needs and expectations. Quality is defined by Stonebraker and Leong (1994) as follows: "Product or service quality requires a total system, which identifies customer requirements, which designs the product/service to those requirements and which establishes a production or service delivery system to produce in conformance with the specifications." Woodruff (1997) defined customer value as a customer's perceived preference for and evaluation of those product attributes, attribute performances, and consequences arising from use that facilitate (or block) the achievement of the customer's goals and purposes in use situations. Vandermerwe (1996) makes three assumptions regarding customer value:

- Value is not what goes into a product, but what a customer gets out of it.
- A customer gets this value out over a period of time, rather than at a point in time.
- Value happens in the customer's space rather than in supplier's space, where only costs accumulate.

According to Naumann and Giel (1995), becoming market-driven means identifying market growth, market attractiveness, and target markets. Becoming customer-driven means using the customer to drive continuous improvement help in organizational reinvention, and radical redesign.

When a company is customer-driven, it means that the customer is the one to decide on the supplier's value-added processes (Stenberg, 1997). Quality work does not mean quality service (Maister, 1997). According to Brown (1992), customers prefer organizations that deliver quality service, and suppliers can charge a premium for quality services. Early research (Grönroos, 1982) suggests that customers assess SQ by comparing what they feel a seller should offer and compare it against the seller's actual service performance. Quality control and marketing must take place during service production and consumption. Gronroos (1988) had identified a list of six criteria of good perceived quality: professionalism and skills, attitudes and behavior, accessibility and flexibility, reliability and trustworthiness, recovery, and reputation and credibility. The first is outcome-related; reputation and credibility are image-related; and the rest are process-related. Storbacka et al. (1994) and Oliver (2014) mentioned that relationship quality can be seen as an antecedent to many other perception concepts, such as value, satisfaction, trust, and commitment. Customer retention and loyalty have become possible through the development of long-term, mutually beneficial relationships with customers.

The SQ model of Parasuraman et al. (1985) identified five key gaps that can cause problems in service delivery. These gaps are:

1. Research gap - between customer expectations and management's perception of those expectations.

2. Planning and design gap - between management's perception of what the customer wants and the designed capabilities of the system that management develops to provide the service.

3. Implementation gap - between what the service system is designed to provide and what it actually provides.

4. Communication gap - between what the service system provides and what the customer is told it provides.

5. Reality gap - between customers' service expectations and their perception of that service.

A company should always pay attention to the customer perceptions and expectations. If there is a difference between customer expectations and perceptions, there is a gap; in practice, it does not matter whether the gap is based on facts or feelings, but how the customer perceives service matters (Friday and Cotts, 1995). In studies of customers' expectations of SQ and their actual experiences, the following five elements are seen as the most important to a buyer (Gitomer, 1998, Heskett et al. 1990, Griffin, 1995, Parasuraman and Grewal, 2000):

• Reliability - ability to provide what was promised

• Assurance - knowledge and courtesy of employees

• Tangibles - physical facilities, equipment and the appearance of the personnel

• Empathy - caring and individual attention

• Responsiveness - willingness to help and provide prompt service.

Two critical dimensions are reliability and responsiveness. Generally, reliability is the most important for customers when they assess service (Parasuraman and Grewal, 2000). Responsiveness means anticipating problems before they occur, rather than fixing problems quickly. Companies must work at making sure that problems will not occur at all. Once the customer is sure about the quality of the product and responsiveness of the employees, the probability of a customer becoming a loyal customer increases. According to Friday & Cotts (1995), customers evaluate services based on the purpose of the service, necessity, importance, results, cost, and risk. In order to have appropriate expectations, a customer should have a full picture of the purpose of a job. Depending on the customer's perception, the necessity of a service can varies. If a service is necessary to help customers perform their jobs, they have high

expectations for the job. Individuals have their own views of the results of the service; the perception of costs is relative to each customer's perspective. If a customer sees a risk associated with dealing with the company, their perception of the added value can be minimal. According to Naumann (1994), the determinants of SQ are:

- Reliability - consistency of services.
- Responsiveness - willingness or readiness of employees to provide service.
- Competence - possession of required skills.
- Access - approachability and ease of contact.
- Courtesy - politeness, respect, consideration, and friendliness.
- Communication - keeping customers informed and listening.
- Credibility - honesty, trustworthiness.
- Security - freedom from danger, risk, or doubt.
- Understanding/knowing the customer - making the effort to understand a customer's needs.
- Tangibles - physical evidence of the service.

Products are made up of two elements: basic features such as components, ingredients and performance, and such added-value components as image, service, styling, and support. Every product additionally entails services. Customers do not always differentiate between product and SQ but regard these elements as a package. Research shows (Naumann, 1994) that improving tangible product quality is easier than improving SQ for most companies. Its implication is that SQ is more difficult to replicate, as SQ derives from corporate culture and therefore it can be a more permanent competitive advantage.

In the customer evaluation process (Heskett et al., 1990 and Evert 2021) it has been reported that customers perceive greater risk when purchasing services than products, rely more on information from personal sources, and use price and physical facilities as the major cues to SQ. Customers can be reluctant to try new services because of the risks involved (Cannie, 1994, Heridiansyah et al., 2021). For many non-professional services, the customer's set of alternatives includes self-provision of the service. Competing options for services are normally smaller than for products and consumers carry out greater post-purchase evaluation with services than with products.

Customers defines quality frequently through their subjective and preconceived values. The measures of quality in service organizations are generally more subjective than in the manufacturing environment. Therefore, the manufacturing view of quality does not apply in isolation but must be seen in the context of the customer service environment in which the

product is delivered (Stonebraker and Leong, 1994). SQ is one element of the service equation. Frequently, the results are more important to the customer than the process quality. In certain cases, price and other acquisition costs can be more important than the process quality incase of the customer value equation. Value is not equated with low prices; services and goods of high value can be at high or low prices. As customer needs are different, customers are willing to pay very different prices for a given service, depending on its importance. The resulting value to the customer over the costs creates potential profit. It has been estimated that a 5% improvement in customer loyalty would result in a 25-85% improvement in profit in service industries (Heskett et al., 1997). The customer value concept holds that customers buy what creates the most value for them. It has also been defined as an emotional bond created between a customer and a supplier. A precondition for this bond to be established is that the product be able to meet or exceed a customer's expectations. Customers can be delighted if the supplier is able to improve its performance continuously (Butz and Goodstein, 1996; Stenberg, 1997; Hong et al. 2021). SQ is a logical driver of perceived value (Parasuraman and Grewal, 2000). Even if the buyer-seller relationship involves a physical product, excellent presale or post sale can add to benefits received and reduce the buyer's non-monetary cost like time, effort, or mental stress.

There are differences in customers' abilities to evaluate the quality of tangible goods and services. In general, most goods are easier to evaluate compared to most services and it seems that most complex services are the most difficult to evaluate (Mathe and Shapiro, 1993). Heskett et al. (1990) and Zhongcao (2022) claims that quality of service equals delivered service quality minus service expected. Quality of service is seen to be similar to customer satisfaction. Heskett et al. (1990) and Bakhtiyari (2019) realized that the results from a service are frequently difficult to assess, and in some cases, it is so even after the purchase of service. The service value is a subjective matter and is defined by the customers. Stenberg (1997) calculates total added value for the customer as the difference between the customer's benefits and costs including both quantitative and qualitative aspects.

The customer value equation can be presented as follows (Heskett et al., 1997)

Value = (Results produced for the Customer + Process Quality) / (Price to the customer + Costs of acquiring the service)

The customer value equation is the customer perspective that influences purchasing decisions. The value and goods delivered to the customers equals the results created for them, as well as the quality of the processes used to deliver the results, all in relation to the price of a service to the customer and other costs incurred by the customer in acquiring the service. The value of the results varies with the size of the service tasks and their importance for the customer.

Frequently, the way a service is provided is as important as the results. For example, in a study of health care, more than half of the claims did not involve patient injury or unpleasant effects. This has the following effects on service providers (Friday and Cotts, 1995; Heskett et al., 1997):

• SQ is relative.

• SQ is defined by the customer.

• SQ varies from customer to customer.

• SQ can be enhanced by meeting customer expectations and controlling those expectations.

A company's most significant success factor is the ability to deliver better customer value than the competitors do. By analyzing (McDougall et al., 1997) the components of customer value, a company can estimate a customer's true profitability. Customer perception of expected benefits consists of product and service attributes. Fredericks and Salter's "customer value package" (1995) additionally includes company image relative to the competition. Good customer value consists of product value, service value, and value-based pricing (Naumann, 1994). Sacrifice consists of transaction cost, life cycle cost, and risk (Naumann, 1994). Many customers measure their costs only in terms of price, but in certain cases, the acquiring costs can be substantial and convenience costs can have a value for a customer (Heskett et al., 1997, Wayland and Cole, 1997). Customers' perceived risks (Heskett et al., 1990) should be reduced in ways that would increase their expectations and create competitive advantage. Service reliability reduces the costs of service delivery and builds value for the customers. For an organization that offers a service whose quality cannot be judged in advance, a service guarantee may represent an important marketing tool, and it can be significant for the potential customer to whom this service may cause a substantial risk. Service guarantees may further help the supplier to focus on its customers and can even lead to the re-design of the service process with breakthrough service (Hart, 1988, Cannie, 1994, Barsky, 1995, Griffin, 1995, Heskett et al., 1997).

Five basic customer value lessons (Naumann, 1994) are:

1. Customer defines the appropriate product quality, SQ and reasonable price.

2. Customer value expectations are formed relative to competitive offerings.

3. Customer expectations are dynamic, always demanding.

4. Product and SQ must extend throughout the channel.

5. Maximizing customer value requires total organizational involvement and commitment.

Walker (1998), Naumann (1994), Bhote (1996) and Xiao et al., 2021 claimed that the Japanese quality function deployment (QFD) technique provides statistically valid market research to determine the value customers place on different attributes. Vavra (1995) recognizes applications of quality function deployment in the marketing context as well. Rust et al. (1995) have described return on quality (ROQ) as a method to justify financially spending on quality initiatives. In return, quality improvement efforts are treated as investments.

2.4. Literature review

In today's business world, organizations have faced many challenges as a result of continuous change and development, especially in the light of globalization which has increased the competition between them. In order to withstand these challenges, organizations have to rely on quality to differentiate their offering, so that they can exploit resources effectively and achieve a competitive advantage at a local and global level. Goetsch & Davis (2003) postulated on the quality as a changing state associated with products, services, people, or processes that satisfy customers' needs. The ever-changing state of quality implies that there are no standards for it, and it is changing with time. The increased customer awareness of the quality of service in the service industry has led providers to focus more on quality management and approaching Total Quality Management (TQM) programmes to deliver high-quality service (Mosadeghrad, 2014). TQM enables service firms to maximize their competitiveness through continuous improvement of the quality of their services, therefore, increasing productivity and profitability, improving business performance in the marketplace, and keeping costs low (Goetsch and Davis, 2003; Parasuraman et al., 1985). The commitment to continuous improvement of the service has been realised by service firms as a significant strategy by which they can achieve a competitive edge over their competitors (Dale and Cooper, 1992).

2.4.1 SERVQUAL

There is a positive correlation between SQ and customer satisfaction (Khan & Fasih, 2014; Sureschchandar et al, 2002; Boulding et al., 1993; Tambi, Ghazali, & Rahim, 2008; Marković, & Raspor Janković, 2013). SQ is an antecedent to customer satisfaction (Markovic, & Raspor Jankovic, 2013). SERVQUAL scale is one of the most accepted SQ assessment scale, it was developed by Parasuraman et al. (2005). It uses a 44-item scale which is further grouped into five categories (tangibles, reliability, assurance, empathy, and responsiveness) to measure SQ before and after service consumption (Khan & Fasih, 2014).

The gap between a customer's expectation before and after service consumption affects the level of a customer's satisfaction or dissatisfaction (Clow & Vorhies, 1993). Clow & Vorhies (1993) also supported the view that customers who are exposed to

additional promotional material about a service could have their expectations of SQ influenced. Naidoo (2011) also suggests that service delivery firms with a developed customer relationship management can track complaints and give an indication of the SQ perception of customer. Fodness & Murray (2007) suggests the use of gap theory to analyze SQ. The gap theory addresses SQ through analysing the differences between customers' expected services quality and the actual SQ received.

2.4.2 Service Quality

Quality is the lifeblood of service delivery firms, bringing increased customer patronage, competitive advantage, and long-term profitability (Kenneth & Douglas, 1993). According to Grönroos (1982) services are non-stoppable interactions that involve both customer and service providers. These services may be considered as superior non-touchable services but do require tangible resources and any valuable instrument that will facilitate the process of solving problems for customers. Zeithaml (1988) defined SQ as the process where customers conduct a comparative analysis of the entire services being provided. Sureshchandar, Rajendran & Anantharaman (2002) stated that service delivery organizations can gain a successful competitive edge over competitors through good SQ. However, a good administration that focuses on well-trained staff, valuable program offering, and its influence on customers, are also components of quality dimensions (Naidoo, 2011). Top management deems it necessary to invest time, energy, training, and resources to keep their staff sensitive and customer-centric (Khan & Fash, 2014; Naidoo, 2011 and Schneider, et al., 2005).

Globalization and free trade agreements have resulted in the creation of highly competitive markets within service firms. Delivering superior service offers a firm a competitive advantage over its competitors; this stresses the importance of providing a high quality of service. There is difficulty in finding consensus on defining SQ because service is an abstract and elusive construct (Parasuraman et al., 1988). Some researchers have defined SQ as a form of consumers' attitudes toward a specific service and their overall evaluation of the service provided (Parasuraman et al. 1988, 1985; Iqbal et al., 2016; Dedeke, 2003). By this, they mean it is the consumers' judgments of the service provider's excellence through an evaluation of service they experienced, and this evaluation is related but not equivalent to consumers' satisfaction (Dedeke, 2003). Bitner et al., (1994) define SQ as delivering zero-defects service to consumers. They inspired their definition from the idea of providing "100% defect free" products in the manufacturing sector. This definition suggests that service firms should deliver flawless service to satisfy potential customers. The widely used definition of SQ is the difference between

consumers' perceptions of the services provided by a service firm and their expectations toward that service (Parasuraman et al., 1988; Grönroos, 1984; Quinn, 1997). This definition was the most cited definition by the other researchers for defining SQ (Cronin and Taylor, 1992; Mestrovic, 2017; Ismail and Yunan, 2016; Iqbal et al., 2016; Ojo, 2010; Kaushal, 2016). This definition implies that, when consumers' perceptions exceed their expectations, they are satisfied and the service firm delivers superior service, while when consumers' perceptions are less than their expectations, this indicates that consumers are dissatisfied with the service and the firm provides an inferior service. SQ is based on the notion that consumers always have an expectation of such service, and this expectation may vary from country to country, culture to culture and person to person; this makes measuring SQ a challenging task.

The challenges in defining SQ refer to the three features that distinguish services from products: intangibility, heterogeneity, and inseparability (Zeithaml, 1981; Parasuraman et al., 1985). First, services, unlike products, cannot be stored, touched, tested, verified, and counted (Parasuraman et al., 1985); they cannot be displayed and physically demonstrated, which makes it difficult to predict consumers evaluation of the service (Zeithaml, 1981). Therefore, we find that consumers engage in a cognitive process to collect information to obtain effective indicators of SQ. Second, quality of service could vary from day to day, producer to producer and employee to employee depending on their mood in producing the service; thus, it is challenging for service firms to standardize their behaviours to deliver consistent and homogeneous service (Zeithaml, 1981). Third, the consumption and production of service are inseparable because the service is sold, produced, and consumed, which entails the consumer attending the place where the service is provided. Because of this, consumers are usually involved in the production of the service, thereby affecting its quality (Zeithaml, 1981). In addition to these three abovementioned features, Mudie and Pirrie (2012) addressed another feature for services—perishability; a service cannot be stored for later use. For example, in the case of the demand for such a service exceeding the supply, it is difficult for service firms to meet the shortage. In the same way that the supply of the service exceeds demand the value of the service will be lost (Iqbal et al., 2016). SQ can differentiate service firms from one another through providing a long-lasting competitive advantage (Boshoff and Gray, 2004). For example, Amazon has the Prime service which offers customers with 2-hours, same-day, or two-day deliveries for over 50 million eligible products. In addition to the unlimited free shipping, Prime members get access to exclusive TV shows, music, books, and other services (Amazon, 2017). Amazon benefits from its widely spread warehouses to provide high quality and speedy delivery options for members; hence, Prime service gives Amazon a competitive advantage over its competitors in the online retail market.

Ojo (2010) argues that SQ has become a determinant of competitiveness for building strong relationships with customers. Also, to succeed in a competitive environment, service firms must focus on the standard of services they provide (Chen and Li, 2017). SQ is a perceived judgement resulting from the assessment of the expected service compared with the perceived service (Chawla and Sharma, 2017). Thus, it is determined by subjective evaluation of the perceived service rather than an objective assessment (Chen and Li, 2017). Gronoors (2007) identified two types of quality that consumers evaluate when they receive the service as a result of the consumer-company interaction: the technical quality, which refers to the type of service consumers receive from their interaction with the service company, and functional quality which refers to the performance of the service that consumers get. In other words, technical quality answers the question of what the consumer receives from his/her interaction with the service provider and can be measured objectively, while functional quality answers the question of how the consumer gets the service and can be measured subjectively (Grönroos, 1984). SQ is a multi-dimensional construct (Kouthouris and Alexandris, 2005; Kang and James, 2004). Thus, Parasuraman et al. (1985) suggest that consumers use similar criteria to evaluate the quality of service, regardless of its type. They argue that these criteria fall into 10 categories called SQ determinants: Reliability, Responsiveness, Competence, Access, Courtesy, Communication, Security, Credibility, Understanding, and Tangibles. Due to the overlap between some of these dimensions, the same authors (1988) condensed these 10 categories into five dimensions (Reliability, Tangibility, Responsiveness, Assurance, and Empathy) that make up SERVQUAL, which is the instrument they proposed to measure SQ. It is important to note that SERVQUAL only measure functional quality that is perceived by consumers to evaluate the service (Kaushal, 2016).

2.5. Dimensions of Service quality

2.5.1 Tangibles

According to Khan & Fasih (2014), tangibles are perceptible by touch or a visible existence. Information and Communication Technology tools, sites, company's employees and any visible facilities form the tangible dimension of SQ. However, these tangibles are applied in various ways by the service providers and are perceived and experienced at different levels by the end users. Tangibles are especially important to service delivery firms as they are crucial variables to developing strong, positive and inspiring customer association and experience, through its proprietary assets (Naidoo, 2014).

2.5.2 Reliability

The process in which service provider remains faithful in rendering services to its customers can be considered as the reliability dimension of SQ (Khan & Fasih, 2014; Blery et al., 2009). Reliability assures the customer of a service provider's ability to consistently provide a perceived quality of service. Reliability has an impact on trust and the overall impression left in the mind of a customer after service consumption (Abd-El-Salam et al., 2013). The reliability dimension of SQ is vital and perceived through the people aspect of SQ (Kaura, et al., 2012).

2.5.3 Assurance

Khan & Fasih (2014, after, Blery, et. al., 2009), stated that the process of acquired knowledge being showcased by staffs in executing their terms of references during service delivery can be highly assuring to customers. This gives customers the confidence that the service delivery representative will perform his/her duty professionally and ethically. Naidoo (2014) argues that not all customers have the expertise to understand the quality of service and values they received, and as such may require effective communication or personal explanations to understand the value they receive. This SQ dimension is performed through the people aspect of SQ (Kaura et al., 2012, Akasha (2021).

2.5.4 Empathy

Khan & Fasih (2014, after, Blery, et. al., 2009) state that empathy is the ability for service delivery firms to pay attention to individual customer problems and demands, then address these issues effectively. Khan & Fasih (2014) also argues that the way the company takes responsibility to address problems faced by their customers on an individual or group level is classified as empathy. This service quality dimension is perceived through the people aspect of SQ (Kaura et al., (2012); Akasha (2021).

2.5.5 Responsiveness

The process in which service providers react quickly to resolve customer problem positively within a given time is called responsiveness (Blery et al., 2009). This dimension of SQ is perceived through the people aspect of SQ. However, information technology advancement such as emails, webpage, and customer service interface improve the responsiveness of service delivery firm (Kaura et al., 2012).

2.6 Quality in Customer Services

Marketing activities strive to produce customer satisfaction with the "four P's," product, promotion, price, and place (Kotler, 1997). Many companies perform the "place" function of physical distribution separately from marketing. However, it is likely that physical distribution through the provision of customer service contributes to the success of a company and can enhance customer satisfaction. Industry has generally failed to recognize the importance of customer service to customer satisfaction (Innis and La Londe 1994). Hartley (1989) proposes that, in addition to the "four P's"," one should consider a fifth "P," public image. Public image is a composite of how an organization is viewed by its various stakeholders. According to Innis and La Londe (1994), customer service can influence demand in the market. It has been suggested that customer service is one of the most important considerations when a supplier is evaluated (Sheth, 1973; Perrault, and Russ, 1976; Jackson et al., 1985). A supplier's reputation for good service attracts potential customers and keeps existing customers loyal. Good service additionally provides protection from price competition (Hartley, 1989).

Quality service starts with customer service. Customer service is viewed as a process that takes place between a buyer, a seller, and third party (Innis and La Londe, 1994). The customer drives the service process and defines the quality (Friday and Cotts, 1995). Previous studies have shown that customer service is an integral and necessary part of the marketing mix, and it offers a significant opportunity for companies to gain advantage in the marketplace (Sterling and Lambert, 1987; Lambert and Harrington, 1989). Higher levels of customer service can create customer loyalty and improve long-term sales and profitability of a supplier. Companies that think about improving customer service should engage in it only if they can expect adequate returns for their attempts (Bowersox and Closs, 1996). Eckert & Goldsby (1997) propose that the constructs of involvement and visioning could be used as predictors of a company's propensity to consider service improvements. High involvement and high visioning customers can be identified as a potential group that would be more likely to respond to improved customer service with increased customer loyalty. If a supplier opts to improve customer service, it should be based on difficult-to-imitate competencies in order to avoid negation of the competitive advantage. The operative quality of a service organization is measured by its ability to handle service situations. To support customer service, the organization should have maximal freedom to make decisions and utilize resources. By decentralizing decision making, an organization can make decisions faster and more effectively, at least in theory. The thing that successful service organizations have in common is that they are built of independent profit centers and they know the importance of customer trust and quality of services for the company's success. Customers

that purchase services with high transaction values, high requirements for accuracy and high-perceived financial, legal, or personal risk prefer to deal with the same person. However, these dedicated servers are almost always a costly solution for the service provider. This is because this server does not have knowledge of all the areas and the person is not available all the time. Some organizations have, therefore, chosen to form teams of service providers (Heskett et al., 1997; Helmold et al., 2022).

2.7   Lifetime value of a Customer

The lifetime value of a customer can be seen as the sum of the value of the purchase stream and value of referrals. Satisfied or dissatisfied customers multiplied by the referral capture or loss rate can calculate the value as the number of referrals. Referral rate is influenced by the importance of referral rate to the potential customers and by the incentives to make, and to receive, referrals. Even estimates of the lifetime value of existing customers under various assumptions will help organizations to adjust their spending to retain customers (Cannie (1994); Helmold et al., 2022). Most service managers claim to be unaware of the value of their customers, although they know their sales margins (Heskett et al., 1997; Helmold et al., 2022).

Many companies spend money mainly on recruiting new customers. One reason for this behavior is that marketers assume that current customers are satisfied. Investing in existing customers is sensible, not only because the lifetime value of the customer is frequently much higher than the value of a single purchase, but also because many customers need after-purchase reassurance. Customer lifetime value can be calculated, for example, by using customer information files (Reichheld and Sasser, 1990; Sewell and Brown, 1990; Cannie, 1994; Glanz, 1994; Vavra, 1994 and 1995; Anderson and Mittal, 2000).

The level of support that a supplier provides to its customers should depend on their expected lifetime value to the company. A supplier must find ways to reduce service costs to customers with thin profit margins and enhance services to those customers whose retention is important for the supplier's profitability (McDougall et al., 1997).

2.8   Customer satisfaction and after-sales service

It was realized after the pre-study that the traditional definition of after-sales was too narrow to describe all the tasks of after-sales activities. In the literature, maintenance of preventive maintenances activities related to the delivered equipment. In case of the automobile industry, this definition covers the whole scope of the used after-sales activities. The basic needs related to automobiles are performance, reliability, and maintainability, which have to be met in order to provide availability. The objective of maintainability is to maximize the availability of after-sales services. Maintenance means performing duties to restore and to keep equipment in

operating condition after they are sold. Maintainability and maintenance refer to supporting operating capability that satisfies the users for the desired period of time. As the nature of automobile industry is dynamic, that is, constantly changing, finding optimal solution for customer appears to be difficult if not impossible. The dealers try to not only carry out different activities, but also enhance the current capabilities of the existing automobile industry.

The customer service manager has the business responsibility in the supplier organization to deliver the after-sales services to the customers. The success of the customer service manager is indirectly measured by the success of the delivery of the services. Success is interpreted in terms of the customer's perception of customer satisfaction and customer loyalty. The customer service manager concept was invented based on the customer feedback. In order to protect the long-term interest, service organizations are seeking ways to forge and to maintain an ongoing relationship with the customers. The changing focus of SQ is a mere competing instrument to that of the basic core of the service concept in meeting and exceeding customer expectation. Service loyalty precedes customer loyalty and how a firm's service employees develop the emotional connection with customers, which lead to exceptional service and the ability to exceed customer exceptions. It is proposed the offering loyal customer services give the organization an advantage, not only to be able to fulfill customers present needs but also the ability to anticipate their future needs. More and more companies are building service management programs to boost profits and provide competitive differentiation. In the automotive industry, after-sale services and parts account for nearly 80% of all revenue opportunities and more than 50% of the average automobile dealer's profits.

Across manufacturing companies, after-sale services and parts have been shown to contribute about 25% of all revenue and 40-50% of all profits. With nearly double the profit potential of first-time product sales, service management is the new frontier of competitive differentiation and profit enhancement. And once again, supply chain managers are at the forefront of a major business-improvement opportunity. Of course, capitalizing on the opportunity is not simple since comprehensive service management significantly complicates the typical company's supply chain. However, new strategies, infrastructures, and tools combined with informed oversight make it possible to create and deliver post-sale support more profitably than ever before.

Service management can be defined as the sum of all customer interactions that follow a product's sale, delivery, and installation. These interactions include customer support; training; warranties, maintenance, and repair; upgrades; product disposal; and sale of complementary goods. Superior service management can help heal the wounds cause by prior failures. Car

manufacturer has spent ten years and millions of dollars recovering from customer perceptions of poor product quality. To a large degree, the success the companies have attained in changing that perception towards extended warranties.

2.9   Customer Satisfaction

Abd-El-Salam et al. (2013 & 2021) and Chen (2010) suggested that customer satisfaction is the result of a customer's comparison of perceived quality and actual service performance. This comparison may lead to customer satisfaction or dissatisfaction. Kaura et al. (2012, after, Rust & Oliver, 1994) suggested that customer satisfaction reflects the degree to which a consumer believes that the use or possession of a specific service will evoke positive feelings. Hence, customer satisfaction is the physiological state of emotion associated with the conformity or nonconformity of a consumer's perceived quality of service during and after service experience (Kaura, et al., 2012, after, Oliver, Rust & Varki; Chen, 2010). Customer satisfaction has also been linked to an expectancy/disconfirmation paradigm; this paradigm is the background for most studies on customer satisfaction. It encompasses four constructs: expectations, performance, disconfirmation, and satisfaction.

The confirmation or disconfirmation that may arise owing to difference between the SQ expectations and the actual service performance during or after service consumption (Caruana, 2002; Chen, 2010; Barnes et al., 2019). Customer satisfaction has two different conceptualizations: transaction-specific satisfaction (satisfaction based on a specific purchase occasion) and cumulative satisfaction (satisfaction based on overall evaluation of multiple purchases and purchase experience of a service over an extended period). Customer satisfaction is based upon the common judgment of products or services that provide the maximum rate of satisfaction for the customers (Oliver et al., 1997 & Barnes et al., 2019). Customer satisfaction can either be considered as contentment, pleasure, or ambivalence based upon the kind of service being rendered to the customer at a specific purchase occasion (Zeithaml 1988 & Tanrikulu 2021). Customer satisfaction can also be impacted by price, service features, product perceptions, and SQ. However, customer perception has a direct impact on how customers evaluate the service (Liu & Jang, 2009).

Delivering a high quality of service only is not enough to ensure profitability and growth for service providers. Service firms might also emphasize customers' satisfaction to equip service providers with a competitive edge over their competitors. Customers' satisfaction has emerged as a basic construct for a firm's success and long-term competitiveness (Ojo, 2010). Oliver (1981) & Ratnasari et al., (2021) defined satisfaction as a psychological state that results when emotions surrounding consumers' expectations are paired with their feeling about the

consumption experience. Similarly, Bitner (1990) & Soderlund (2020) delineate satisfaction as the result of comparing product or service performance with the previous experience of how the service should be delivered. There is a debate in the literature whether customer satisfaction is an outcome or a process (Cronin and Taylor., 1994). According to the above-mentioned definitions of satisfaction, it can be found that satisfaction is a process as consumers engage in an evaluation of the service performance based on their previous experience of interaction with the service company. From the mentioned definitions, it is clear that satisfaction depends on consumers' judgements as to whether the service delivered is either pleasurable (service performance meets or exceeds their expectations), or disappointing (actual performance of the service falls below their expectations). As Oliver (1981) assumes that satisfaction is the result of emotions, coupled with consumers' feelings, it follows that satisfaction is different from service to service or from one person to another and that satisfaction is affected by psychological aspects like personal values, beliefs, attitudes, and evaluations.

More recent attention from literature has focused on the distinction between SQ and satisfaction. For example, Boulding et al. (1993) demonstrated that SQ and satisfaction are similar concepts in terms of matching consumers' expectations and experience of the service provided. In contrast, numerous studies have attempted to distinguish between the two constructs (Parasuraman et al., 1988; Bitner, 1990; Cronin and Taylor, 1992; Taylor and Baker, 1994). Parasuraman et al. (1988) differentiate between SQ and satisfaction in terms of measurement aspects; they suggest that SQ is measuring what consumers should expect, while, in contrast, satisfaction measures what consumers would expect. Cronin and Taylor (1994) also support the assertion that both SQ and customer satisfaction are distinct concepts, maintaining that the distinction between SQ and satisfaction is that satisfaction requires consumers to experience the service to make the satisfaction judgement, while SQ is an evaluation process that does not require prior experience of that service. The distinction between SQ and satisfaction is critical for service firms, allowing them to assess whether their goal is to satisfy customers with their performance or to provide a high level of perceived SQ (Cronin and Taylor, 1994). SQ and satisfaction are distinct concepts but they are interrelated (Parasuraman et al., 1988). For instance, the capacity of the service organization to deliver high-quality service usually leads to a pleasurable experience for its customers; thereby, SQ acts as a strong predictor of customer satisfaction (Ismail and Yunan, 2016). Service firms often pay more attention to SQ because it leads to customer satisfaction (Loke et al., 2011), so satisfied customers will repeat their purchase behaviours from the service provider and share their good experience with others. On the other hand, dissatisfied customers often switch to competitors if they found that SQ was inferior and

did not meet their expectations (Kotler and Armstrong, 2016). Bitner et al. (1994) suggested that the type of customers and employees are the major sources of satisfaction or dissatisfaction. They pointed out that customer dissatisfaction may result from inappropriate customer behaviours involving a misuse of the service and oppose the notion that consumers are always right. In support, Zeithaml (1981) concluded that the blame for delivering dissatisfied service might not completely be put on the service company but the consumers themselves, as they should consume the service appropriately. In summary, having a high level of customer satisfaction usually leads to improve a service provider's performance, and as a result, enhancing profitability and growth. Parasuraman et al. (1988) claimed that satisfaction is a transaction-specific measure. Five years later, Boulding et al. (1993) published a paper in which they provided two more general conceptualizations of satisfaction, transaction-specific satisfaction and cumulative satisfaction. Transaction-specific satisfaction refers to consumers' evaluations of their experience towards a specific service (Ojo, 2010), while cumulative satisfaction is consumers' overall evaluation of their previous experience when they start dealing with the service company (Loke et al., 2011).

2.10 Customer Loyalty

Many studies related to customer loyalty during the 1990s have been conducted in the area of consumer markets. Such studies have frequently concentrated on topics such as relationship marketing, but only a few studies have concentrated on business-to-business markets. Even though there are many studies in the area of services, after-sales services are after-sales activities generally and represent an overlooked area of the management literature. Only a few researchers have paid attention on it. Issues related to after-sales activities and after-sales services have been given only partial attention in those studies.

Nevertheless, the importance of after-sales service can be significant to customer satisfaction, particularly in the business-to-business environment, if the customer's capital expenditure on the equipment is significant, as in case of automobile industry, it is expected that the importance of well managed after-sales services is provided. Grönroos (1980) noted that academics and practitioners at the time were not paying much attention to the service marketing issues. Product support is a business opportunity for many companies. In the fast-growing world of globalization, talking about market is huge, and defining the market is people. When we talk of people the first thing that comes to our mind are their needs, wants, satisfaction and their perception for a specific product or service. Consumers are related to buyers, purchasers, customers and this entire set makes a consumer.

In the last few decades, there is a growing trend towards aggressive global competition,

expanded marketplace, demand and technological changes; these have led organizations to take a closer look at the service sector. Services, on the other hand, are talked about as a "performance" rather than a thing, and service performance, being intangible are experienced rather than owned. Unfortunately, customers are not always happy with the quality and value of services they receive. Consumers may compare what they received against what they expected, especially if it cost them money, time, and effort.

The Juran institution found that less than 30% of surveyed persons believed that their customer satisfaction "management" efforts added economic value and less than 2% were able to measure a bottom-line improvement as a result of increased customer satisfaction levels. Customer satisfaction survey questions are not designed to measure loyalty, that is, how the customer will behave. Companies that set goals for improving customer loyalty are more profitable and more likely to exceed growth plans than companies not having a good strategy. The positive correlation between customer satisfaction and customer buying behavior is unreliable; higher satisfaction levels do not necessarily result in more sales and higher margins. According to the Juran Institution, in more than 70% of businesses, price ranked among the most important factors that customers were not satisfied with. As regards customers who changed supplier's competitors, only 10% of those interviewed have changed suppliers because of the price. From the customers' point of view, the reason why a product is not as another is simple companies fail because they are unable to deliver total customer satisfaction. Companies should always satisfy the customers with new products and better services then what their competitors provide. Giving new product and services is not enough; the companies should be able to create good quality of product and services.

Customers are valuable resource for incremental product and service improvement. Customers need requirements and the environment must provide them understanding their correct requirements. Giving them different and better then what the competitors are giving will surely attract them to your product ultimately resulting to their satisfaction and a better profit margin. If dealers and buyers can develop a high loyalty and long-term relationship, it will be difficult for competitors to stand against as most customers fully rely on good after-sales services and are willing to pay for the same. Good after-sales services can be an entry barrier in the market entry. Effectiveness and efficiency are the key to profitability when managing a customer relationship. A company needs to have a relationship with its customers and the barriers blocking its competitors. Many companies interpret customer services as a reactive function, and this limits the use of services as a competitive advantage. If any company in the automobile industry stops the sales services, their sales will drop in no time. After-sales is the backbone of the auto

industry. The work force has to be trained and retained and monitored regularly. In this industry, the growth in business is totally dependent on service backup.

2.11 Service failure and Service Recovery

2.11.1 Service failure

The constant concern for customer satisfaction is an important factor in the pursuit of service excellence. The reduction of failure on service operations is one of the main guidelines of this movement, which emerged in the '90s (Santos, Fernandes and Mello, 2008). Although not so much explored in Brazil, the study of failure recovery also generated studies that investigated specific segments such as retail (Figueiredo, Arkader, Osorio, 2002 and Correa, Pereira and Almeida, 2007), restaurants (Oliveira, 2002), electrical (Xavier, 2004), telecommunications (Araujo, Primo and Araujo, 2006), airlines (Pedrosa, 2006), logistics (Flores, 2006) auto services (Kuyven and Silva, 2002; Drink and Ross, 2006), telephone operators (Correa, Pereira and Almeida, 2007), hospitals (Torres, 2003 and Campos, 2008;), banks (Santos, Fernandes and Mello, 2008)) and universities (Pereira, 2010). There are also studies on the reaction of customers in relation to the act of recovering service failures (Almeida & Toledo, 2003; Pedrosa and Cunha, 2006; Santos and Fernandes, 2007; Santos and Fernandes, 2008; Santos, Costa, and Sander, 2009; Battaglia and Borchardt, 2010).

The causes for the occurrence of failures in services may be different. Bitner et al. (1990) pointed to three different groups for the classification of service failures:

a) Failures owing to employee responses to problems in service delivery system;

b) Failures caused by employees' response to specific requests and needs of customer;

c) Failures caused by unpredictable and unwanted attitudes of contact personnel.

In all the three cases, the authors point to causes only caused by human actions in attendance, but a study by Hoffman & Bateson (2001) mentions that service failures causes are divided into two: the stage, visible to customers, and behind the scenes, invisible to them. Failures occurred on stage are usually execution failure. So, failures in "background" are process failures, which have not yet become visible to customers. Failures in the background, despite the internal damage, do not usually reach the customer and do not affect their satisfaction with the service. But when they become visible, and occur in contact with the client, this may result in dissatisfaction (Zeithalm and Bitner, 2003).

The effort to recover from a failure can be an opportunity for the service provider company to invest in customer relationship. It is possible that the recovery process causes a better impression than the first time, because it demonstrates the organization's interest in providing a good service (Lovelock and Wirtz 2006; Gronroos, 2009, 2010 Berry). Almeida and Toledo

(2003) argued that failure recovery can be an opportunity for companies to demonstrate a superior quality and special care to their customers, people would be more attentive in a disaster-recovery situation than in normal circumstances. Pedrosa and Cunha (2006) stated that companies should see that service recovery is a tool for the assessment of its processes and that these can be improved with their experiences.

2.11.2 Service Failure Recovery

Lovelock and Wright (2004) conceptualize recovery services as "the systematic efforts of a company after a service failure to correct a problem and retain the goodwill of a client." This effort to retain the customer also varies with the cost of change. Lower the cost of change for the customers, the greater the company's effort to retain them in its customer base (Lovelock and Wright, 2004; Gronroos, 2009).

' When a failure occurs in the performance of the service, the customer's confidence is affected. Even the most prepared organizations may not be able to prevent all failures. Therefore, in order to recover that trust, it is necessary to apply a series of measures, which is part of the process called service recovery. Slack, Chambers and Johnston (2002) conceptualize recovery service as a set of actions taken by an organization when failures occur in the service process. Hart, Heskett and Sasser Jr. (1990) and Zeithaml and Bitner (2003) conceptualize failure recovery as do the job right the second time, when the "do it right the first time" does not happen. Both the company and the client can initiate the process of service recovery. There are situations where the failure is apparent for both, but there are also situations in which the company becomes aware of the fact only by communication or customer complaint.

Therefore, it is necessary that there is a continuous stimulus for the client to lodge complaints where they find fault situations. Companies should also prepare a suitable structure for receiving and processing these complaints (Lovelock and Wirtz, 2006; Santos, Fernandes and Mello, 2008; Grönroos, 2009). There are cases where the handling of customer complaints is seen as the starting point of recovery services. Santos and Fernandes (2008) argue that customers use the answers to their claims to establish their attitudes to business and the inadequate management of the complaint may generate a double shift, which occurs when a company fails twice in meeting customer needs. Dealing with customer complaints and the way the company solves the problems, can often be decisive for losing or retaining customers. The act of protesting, complaining is "an expression through which a customer formalizes his dissatisfaction with some aspect of a service experience." (Santos, Costa, and Sander, 2009) Oliveira (2002), Xavier (2004), and Lovelock & Wirtz (2006) argue that customers who complain gives companies a chance to fix problems, restore relations with the complainant and improve the service. So, the

complaint can be seen as an opportunity for the implementation of improvements in services. Araujo, Primo, & Araújo (2006) also indicate that there is a direct correlation between the handling of complaints and a future intention to repurchase by customers. Berry & Parasuraman (1995) argue that the process of recovery services includes the following: (a) staff prepared for the recovery; (b) empower employees; (c) technical support and information to employees. According to this statement, it is assumed that employees should be trained, have autonomy, and support the organization in order to quickly solve the problem caused by the failure. Figueiredo, Ozorio, & Raeder (2002) conceptualize that an apology from the company is generally well received by the client but is not sufficient to remedy the problems caused by a fault detected by her. Santos, Costa, & Sander (2009) further advocate that companies that are striving to regain its customers in the event of failure, are more likely to have them back, and the opposite may also be true.

Hart, Heskett and Sasser Jr. (1990) argue that managers should avoid simple solutions like simply not solving the problem work or not to satisfy the customer because companies must prevent the loss of the same; this is because of the fact the cost to replace it would be much greater than to keep it. When "do it right the first time" does not work, it becomes necessary posture of a recovery by the company, because when you have attention to the prevention of defects, there is usually no preparation of the company to deal with these when they occur (Heskett, Sasser Jr., and Hart, 1994). The authors argue that "while generally there is nothing better than running a service in a manner satisfactory to the customer at the outset, there is nothing worse than fail to meet an unsatisfied customer." A refund for any injury caused by a failure is not always sufficient to reverse a negative situation caused by itself. Correa, Pereira and Almeida (2007) found that, although customers have considerable satisfaction with refund, there is, for these, a high rate of advertisement "word-of-mouth" negative, as well as changes in purchasing habits.

Service recovery is also an opportunity to delight the customer since she can perceive this action as a company's commitment to customer satisfaction. Hart, Heskett, and Sasser Jr. (1990) and Zemke and Bell (2000) argue that customers who experienced successful failure recovery, are generally more satisfied and more willing to hire the company again than those who did not go through an experience of failure. To this phenomenon, Zeithaml and Bitner (2003) give the name of the recovery paradox. This thought suggests that customers can experience greater satisfaction due to the recovery than in the absence of failures.

2.12 Research Gaps in Service Recovery

Service Recovery began to be exploited in 1990 and beyond. Tax and Brown (1998) stated that the theme began to receive greater attention at the end of this decade and at that time there only were few studies on service recovery. Zhu and Sivakumar (2001) commented that there was a significant increase in work related to disaster recovery services. The present study evaluates the practice of services recovery in automobile assistance through surveys with customers and managers. International literature on service recovery was accessed, and then a reference model was adopted by integrating elements. Service recovery, then, becomes an object of study with potential to contribute not only to service companies, but also for anyone who intends to use service as a differential factor in the relationship with customers. Thus, besides the generation of knowledge management services, this work is justified by the contribution that can be generated for business management.

(a)   There are very limited studies being undertaken in service recovery for automobile sector.

(b)   There is no streamlined strategy existing in the service stations to address the service failure through designated service recovery strategy.

(c)   There is formal recording of the complaints and failures, and corresponding recovery strategy undertaken for service recovery in automobile authorised stations.

In order to address the gaps, the service recovery objectives have to be undertaken in the research and are deliberated in further chapters.

Chapter 3
Research Design and Methodology

3.1 Introduction

In this chapter, the blueprint of the research design and methodology adopted to conduct this research has been given. This chapter gives an overview of the research process, outline of the research problem, besides defining the research problem and listing the research objectives. It identifies the method used to reliably ascertain the data points, method, and instruments used for data collection, instruments design, data analysis, and the validation of the same. In-depth analysis and utmost care have been undertaken to determine these methods and revalidate the same in order to draw clear inferences to address the research problem. This chapter will encompass an overview of the research framework adopted for this study and the relevant details including implementation, data analysis, and inferences that have been covered in subsequent chapters.

This chapter is divided into three sections. The first Section (Section 3.2) has an overview of the research process while defining the research problem, research objectives, research design, and the research methodology adopted that is aligned to meet the research objectives. The second section (Section 3.3) covers the constructs for data collection, instruments used for data collection, and execution of the field work. The third section (Section 3.4) covers the statistical tools and techniques used for analysis, as well as their correctness in meeting the research objectives.

3.2 Overview of the Research Process

Research is an academic activity that comprises defining and redefining problems; formulating hypotheses; collecting, organizing and evaluating data; making deductions and reaching conclusions, and at last, carefully testing the conclusions to determine whether they fit the formulating hypotheses. They have defined research as a manipulation of things, concepts, or symbols for the purpose of generalizing to extend, correct or verify knowledge (Slesinger & Stephenson, (1930); Balwan et al., 2022). Research is a systematic process which consists of formulating the research problem, collecting relevant facts and data, logically analyzing the facts, and deriving information, inferences and conclusions from it (Rwegoshora, 2016). Research is a scientific process which needs to be undertaken in a structured manner (Sekaran & Bougie, 2016; Bell et al., 2022). The research process entails a series of logically ordered directional choices, running from problem formulation, design and execution of study, analysis and interpretation

(Ghauri & Gronhaug, 2005). This research has been conducted by using a systematic process and approach.

The overall research process includes extensive literature review, identifying the research gaps in literature, defining the research problem, and developing research objectives to address the research problem. Identification and formulation of approach and studies required to address research objectives, assessment of the data and information requirements involving the extent of data required, working out the methods for data collection, analyzing the data and arriving at relevant conclusion, revalidating the analysis, and drawing the correct inferences from the data. In order to reach and identify the Research Problem, a systematic top-down approach has been followed for narrowing down the scope of research and objectives therein so that the research is specific and not open-ended. The research pertains to the Indian automobile industry and the research problem relates to the four-wheeler passenger car segment. This is to remain focused and have in-depth study of the sector to strongly arrive at solutions and framework which can be easily emulated. Figure 3.1 below highlights the details of the approach followed to arrive at the Research Problem and Research Objectives.
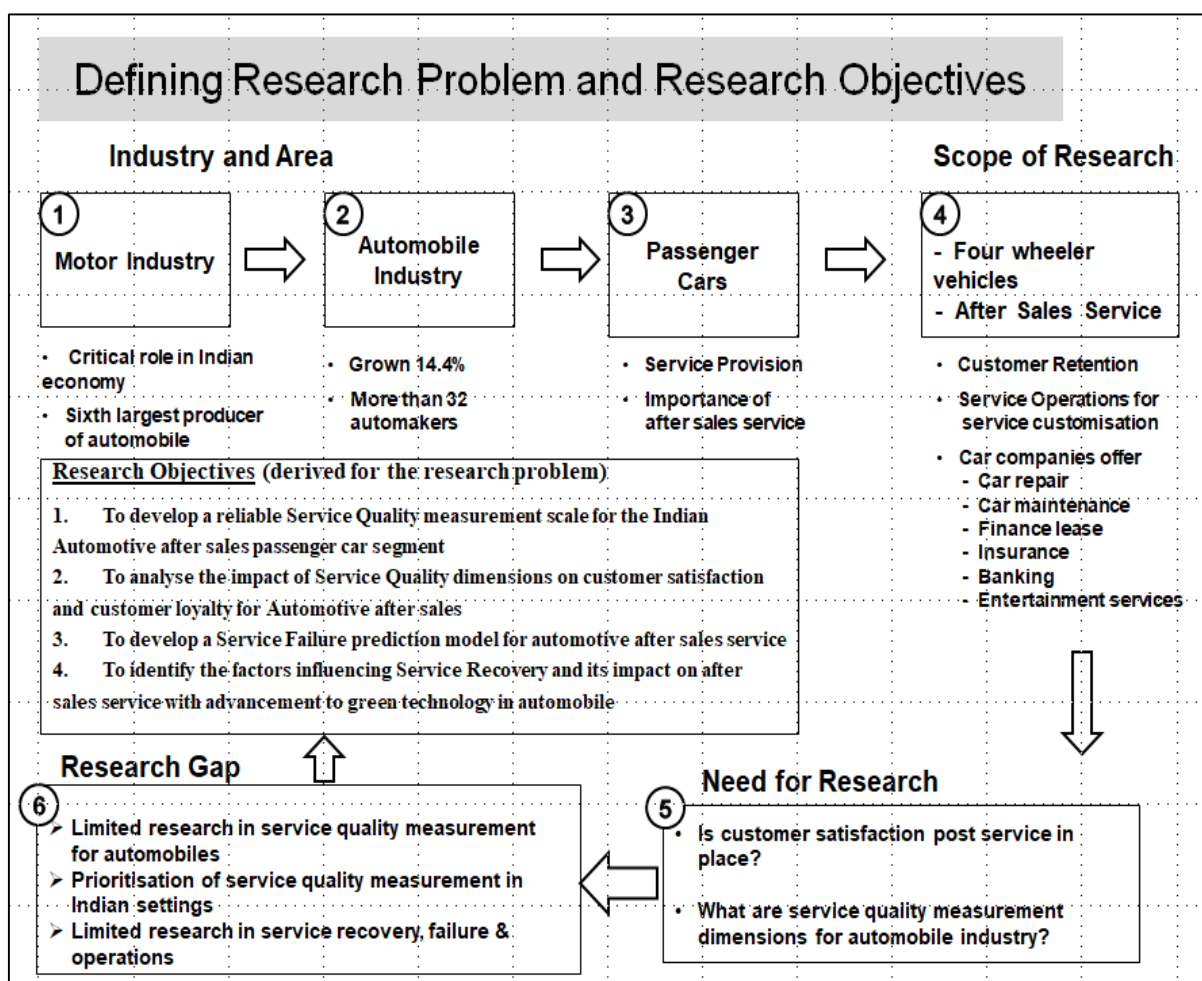
Figure 3.1   Defining Research Problem and Research Objectives (by Author)

The Research work progresses with providing broad idea about the automobile industry and more specifically from an India perspective while taking global references into consideration. It entails opportunities lying ahead in automobile sector and contribution of the automobile after-sales market in sustenance of the vehicle. This research study has been carried out keeping in view the practicality of adoption of the framework in practice and from ease of implementation point of view while considering all the fundamentals with regards to SQ. Research has been undertaken in ascertaining SQ for retail, generic services, logistics, hospitality, education, travel agency, banking, online retail, Asian culture, health care, hotel, higher education, airport services, internet banking, healthcare, hybrid, retail stores, events, online financial services, transport, ecommerce, banking, health care laboratory etc. There are a very few research studies in the field of SQ measurement for automobile industry passenger car segment.

According to AT Kearney study (2016) and Lempp and Siegfried (2022) on the contribution of the automobile industry to technology and value creation, the automobile industry is a pillar for the global economy, a main driver of macroeconomic growth and stability, and a source of technological advancement in both developed and developing countries, besides supporting many auxiliary industries. For developing countries such as India, understanding the auto industry's evolution in other countries offers a road map forward. India's automobile industry is the sixth-largest producer of automobiles in terms of volume and value. According to the Society of Indian Automobile Manufacturers, the Indian automobile industry has grown 14.4% over the past decade. With more than 35 automakers, the industry contributes 7% to India's gross domestic product and is responsible for 8% of India's total employed population. Two wheelers comprising of motorcycles, scooters, mopeds, and electric two wheelers account for 80% of the sales followed by passenger vehicles contributing 1 % of the total value. The commercial vehicles and the three wheelers account for 3% each. Automobile is a unique product in that it has components of both product quality and service that account for overall experience of the customer.

The automobile provides an entire spectrum of earnings to the OEM during the lifetime use by customer. The customer experiences the ownership of the product with periodic maintenance service. Customer avails service almost three times a year for regular maintenance as well as intermittent repairs. In span of 4-5 years, the after-sales service is experienced almost 12-15 times. Therefore, the service satisfaction has a significant effect on the loyalty of the customer. It is important to focus on service experience to attain satisfaction of the customer. The satisfaction of the customer will help to recommend, revisit, and re-purchase the product.

Disruptive technology-driven developments have greatly changed the nature of customer interaction and the design of the customer experience with new digital touchpoints. Targeted leveraging of data is critical in shaping the shift from a product-centric to a service-centric business model.

The National Electric Mobility Mission Plan 2020 and Make in India are also major initiatives in the automobile sector by the government. With all these developments in the automobile sector, service research has to be taken up more efficiently while meeting criteria of time, cost and quality. Keeping in view this background, Research has been designed in such a way that it effectively responds to the Research Problem. The entire Research work has been arranged into systematic process steps starting from the defining the Research Problem, Research objectives and then suggesting the framework which emerges during course of research with the aim to benefit automobile industry. The framework should assist both service and technical managers to enhance SQ resulting in customer satisfaction and, in turn, customer loyalty.

The Research design and methodology outline by author is given in Figure 3.2. It specifies the objective of the study in field of automobile industry, with measurement of SQ in the automobile industry. It encompasses data collection comprising of extensive literature review, interaction with industry experts in automobile industry, visits to various automobile industry locations pan-India, face to face interviews with customers visiting these authorized service stations, service managers, technical managers and staff. It specifies the data analysis, statistical tools to be used during research, various techniques employed, and analysis of outcome. These outlines and processes are the detailed activities undertaken over the course of research and the final outcome of the research with development of SQ measurement scale in Indian setting and identification of the two new dimensions relevant to the Indian context. The design illustrates the various steps that are undertaken during the conduct of research. This methodology will not only focus on SQ but will also undertake more exhaustive research on the major SQ measurement dimensions.

The authorized service stations comprise both the service and the technical managers. The service managers are the front-end staff and experts who provide the customers the detailed history of the vehicle, with periodic maintenance undertaken based on the number of visits and interaction. This manager oversees the detailed checkup of the vehicle by the staff and empowers customers with information about the vehicle's health. It empowers the customer to make decision regarding process of service and a broad idea of the work to be done. The manager ensures comfort and hospitality to the customers and ensures timely feedback about progress of the vehicle is given by electronic and other means of communication. The technical managers

are the back-end managers who undertake the work scheduling, monitors the shop floors, undertake pre- and post-service check of the vehicles. They ensure quality in processes and that all technical tasks are undertaken as per documentation of the OEM. During the course of research, the interaction with service experts both at authorized stations and head offices at various locations was done.

Research Design and Methodology Outline

Objective	Automobile Industry	→	Service Quality	→	Service Failure & Service Recovery	→	Service Operations
Data	• Literature Review • Automobile Experts • Authorised Service Stations • Face to face interview with Owners, Service Managers, Technical Managers and staff		• Literature Review • Existing Scales • Existing Dimensions		• Literature Review • Automobile Experts • Service Stations • Face to face interview with customers • Forms for lodging complaints		• Literature Review • Automobile Experts • Service Stations
Tools & Techniques	• Focus Group interviews • Questionnaire Survey • Post Service Feedback		• Focus Group interviews • Item generation process • Reliability & Validity Analysis • Factor Analysis • Principal Component Factor Analysis • Structural Equation Modelling with PLS		• Bayesian Network • DEMETAL Approach • Cause and Effect Relationship		• Focus Group interviews • Item generation process • Reliability Analysis
Outcome	• Service Quality Measurement Scale • Identification of Service Failure		• Service Quality Measurement Scale for Indian Settings • Identification of Service Failure		• Service Failure Identification • Service Recovery Framework		• Service Operation Enabling Factors

Figure 3.2   Research Design and Methodology Outline (by Author)

The research objective demands identification and assessment of the dimensions of SQ in the context of the automobile passenger car segment. Thus, the focus was on service quality dimensions, SQ measurement scale, identification of SQ dimensions for Indian automobile industry, classification of these dimensions, prioritization of the dimensions, understand interdependencies, relation to customer satisfaction and customer loyalty. Extensive literature review has been undertaken for identifying the academic developments and approaches undertaken in the field, followed by data collection through experts. As the research is specific to the automobile industry, subject matter experts who have been involved in the automotive sectors, working in authorized service stations as service managers and service experts, technical managers, and customers visiting the service stations were interviewed through structured interview questions designed to cater to the requirements of the research problem and research

objectives. This was followed by Research Survey in the form of questionnaires filled in by the experts and customers visiting the authorized service stations. While the research problem entails different aspects of SQ, the research process was designed in such a manner that all the inputs required to arrive at a comprehensive framework are obtained. Accordingly, survey questionnaire set was designed and inputs were taken from experts, as well as customers owning the various brands of passenger cars, in both online and offline owing to the pandemic-related constraints. Care has been taken to fill the data gaps of secondary data.

The data was collected for different steps and stages of research work which is detailed out in subsequent sections; multiple tools and techniques were used to process and analyze the data obtained. An exercise was carried out to assess the tools and techniques available which will be relevant to analyze the data for the research problem and appropriate techniques were used during research. This involved evaluating tools and techniques used by other researchers and what the benefits and challenges of using them.

The research is undertaken towards SQ measurement for passenger car segment automobile industry of India. Research problem and set of objectives required for undertaking both Qualitative and Quantitative assessment of SQ, service recovery and service failure with detailed analysis have been pursued. A combination of both quantitative and qualitative methods and tools has been used. Quantitative methods including surveys with SMEs, project sponsors, project managers, and so on have been used to measure, rank, identify and categorize risks and to draw out inferences.

The research uses various research designs used by various researchers which are divided into three categories, according to Niglas (2009) and Kigozi (2020); these are: exploratory, descriptive, and experimental. There are different Research designs concepts laid down by different researchers. The Research Design developed for this study considers aspects, such as research design for exploratory research or descriptive research, at the same time as it considered that the Research Outcome and the linkages to the Research Objectives are well established. The fact remains that the SQ measurement in automobile segment especially in passenger car segment has not been dealt much in the past and the research projects have been very limited.

This research has been based on research objectives identified and has led to the development of a conceptual framework and resultant model towards measurement of SQ in the after-sales phase. The study includes overall research methodology, research design, sampling strategy, measurement of constructs and design, research instrument and the statistical tools employed, that is, the significant issue about the methodology of data analysis.

In order to prepare a comprehensive SQ measurement framework for the Indian automobile industry, a detailed study of the SQ dimensions, service failure, service recovery and service operations has been undertaken. The data has been collected through both primary (technicians and experts working in authorized service stations and experts by means of detailed interactions/in-depth interviews, surveys etc.) and through secondary sources (including online databases, annual reports, third-party data providers, etc.).

Both qualitative and quantitative tools and statistical techniques have been used. The outcome of these analysis/models is the formulation of the "Service Quality Measurement Scale AutoIND Scale," service failure factors including prioritization of these factors, service recovery factors identification and prioritization and also service operations affecting SQ. The architecture of this research design and research methodology of this study has been aligned with the research objectives. The following section covers the description of the data collection and data analysis techniques used in the Research.

3.3   Constructs for Data Collection

Data collection is the process of collecting information from all relevant sources to find solutions to the research problems test the hypothesis and evaluate the outcomes. It is gathering and measuring information on variables of interest, in an established systematic fashion, that enables one to answer stated research questions, test hypotheses, and evaluate outcomes. The goal for all data collection is to capture quality evidence that translates into rich data analysis and allows the building of a convincing and credible answer to questions that have been posed. It also ensures that information-rich and reliable data is collected for statistical analysis so that data-driven decisions can be made for research purposes.

Extensive exercise has been undertaken to source the data for the research. This include both Secondary and Primary data collection techniques. This includes detailed Literature review which formed the basis to carry out further data search and sourcing.

Both Qualitative and Quantitative data has been collected keeping in view the requirements of the Research Objectives defined through primary and secondary sources. In-depth surveys with the experts, face to face interviews with experts, automobile professionals, service engineers, and technical engineers have been conducted. Primary data sources included Surveys using Questionnaire, and in-depth Interviews with industry and sector experts. Three focus groups comprising seven to eight people were formed. The first group had people waiting in customer lounge for their car to be repaired and the age of these after-sales customers was between 20 and 60 years old. They were mostly males, with one or two female owners. The

second group was the employees working in sales advisor, service advisor, and technical advisor roles in authorized service stations, attending to these customers, and being well aware of the procedure and processes. The third group was manager-level officers across various authorized automobile service stations in India who monitored the processes of their service dealers all across India. Focus group interviews were undertaken to generate meaningful discussion by employing multiple perspectives and moderator recording and controlling the discussion. It was ensured that no biasing of responses was done and freedom of opinion prevailed. Extensive Literature Review was conducted for all the aspects related to Research problem and objectives. Qualitative research design was chosen for the study and exploratory research used to calibrate the survey instrument.

3.3.1 Survey Instruments

Exhaustive literature review has been undertaken for the SQ pertaining to automobile industries. Interactions with the automobile industries reveal that the response from the passenger car companies during the initial interaction was forthcoming. The access to secondary data and response from the customer and service stations was positive. Selection of the passenger car companies in automobile industry was undertaken owing to limited research, access to data, and relevance of SQ in the companies. Focus group interaction was carried out with persons during visit to the authorized service station. 22-point SQ factors SERVQUAL scale questionnaire was taken for the initial survey. The customers were asked to rate on a 7-point Likert scale. The questionnaire was answered by the population and out of five SQ dimensions the mean was calculated and not much difference in mean among the dimensions was noticed. Reliability and assurance dimensions emerged as key among the five dimensions and application of SERVQUAL scale emerged as reliable. Service mapping was also undertaken of one of the authorized service stations during the visit. Service operation mapping was undertaken of one of the passenger car service stations. The initial service operation mapping was confined to authorized service station only and the mapping from service operation from OEM was also undertaken. Service operation blueprinting was prepared based on the interaction with one of the original equipment manufacturer and a framework for improvement of SQ operation formulated to enhance customer satisfaction.

The research is descriptive in nature in that it includes in-depth surveys, fact-finding enquiries of different kinds and state of affair as it exists. The purpose of research design is to present the master plan that will specify the method and procedures for collecting and analysing the information. In-depth Literature Review involving review of data available in the public

domain, exhaustive review of Research Papers in the area, and discussion with experts/executives of both automobile industry and academia. Selection and reliability of the SQ instrument was undertaken with use of multi-criteria decision-making technique. Identification of the SQ dimensions and assessment of the relative importance of each SQ factor for the customer was undertaken. Prioritization of SQ Dimensions and recognition of Operation Variables affecting SQ was carried out. Analyzing relationship of Service Operations with SQ and Mapping of existing service operation process was undertaken to assess impact of customer satisfaction and further customer loyalty in restricted service settings. Service operation blueprinting from the original equipment manufacturer to the authorized service station of passenger car segment was done. Preparation of a framework for improving SQ and Service Operations to enhance customer satisfaction has been proposed.

3.3.2 In-depth Interviews with experts

In-depth interviews have been carried out to seek inputs and knowledge of the automobile sector. To have a complete sample representation, experts from all the relevant fields pertaining to respective fields were taken from technical group, services group, commercial group, marketing, operations, and quality assurance have been included. The interview questionnaire has been systematically designed to conduct face-to-face conversation and discussion with the respondents. Care has been taken to ensure all the relevant data points, views are recorded in the right manner, as has been told.

3.3.3 Target Population and Sampling design

The target population for the data sourcing was people visiting and waiting in customer lounges for their car to be serviced and repaired as per the requirement. Also, the group was the employees who were working in sales advisor, service advisor and technical advisor roles in authorized service stations, including ground level workers. Also, manager-level officers across various authorized automobile service stations in India who monitored the processes of their service dealers all over India experts and ensured that the philosophy of repairs were met. Owing to the present pandemic, the online platform for response for questionnaire was also undertaken. The sampling design was done accordingly. The purpose was to include consultants to gain insights from their experiences in the field while working to arrive at a solution for projects on time or to develop strategies to enhance quality. The sample was designed to include age groups from young to senior customers who had different perspective towards owning the car and service requirements. Online platform was used to target all regions across India and their

peculiar experience during visit to authorized service stations at remote areas and metropolitan cities across India.

3.4   Data Collection Field Work

There are three categories of service stations in context to Indian passenger car segment. Firstly, customers visiting authorized service station that offers both sales and after-sales services on behalf of the original equipment manufacturers (automobile companies). These authorized service stations facilitated and rendered sales and after-sales services to particular brand/ manufacturers, such as Maruti Suzuki, Hyundai, Tata Motors, and Toyota etc. Second, customers visited privately owned stations, but not confined to a particular brand or make. This facility aims to provide complete solutions for almost all brands of cars; these include quick servicing, mechanical repairs, body repairs, accessories, insurance, car exchange, and doorstep service akin to that provided by authorized service stations, such as Carnation, Car24, and so on. The third category is the customers visiting local service station/workshop present in large numbers in a particular region and privately owned. Our research has been confined to first category of authorized service stations that adhered to procedure and quality standards for service station laid down by the OEM.

The administration of the survey instrument was done in two stages. The first stage involved transmission through online platform with generation of Google forms for the questionnaire. Secondly, through interaction with the customers physically visiting the service stations, as well as technical and service engineers working in the service stations. The respondents in the same city and approachable were handed over the survey questionnaire by hand as well. The mail survey, both by e-mail and surface mail, has been complemented by a number of randomly selected interviews where it has been felt that respondents may require intervention to facilitate the process of completing research instruments. The possibility of self-selection bias and false representation (Zikmund and Babin, 2007; Dawes, 2022) was addressed by ensuring that each respondent fills in their business details. The details of responses received have also been covered at appropriate places in the subsequent chapters. The in-depth interview was undertaken in an environment where there is least disturbance so that the respondents feel comfortable and are not disturbed by external factors. The relevant details about the number of professionals approached and their relevant details are covered in the subsequent chapters, that is, Chapters 4-7.

3.5   Data Analysis

The conceptual research framework focused on SQ research framework for the passenger car segment of the Indian automobile industry. The Indian automobile industry can be segmented into two-wheelers, passenger vehicles, commercial vehicles, and three wheelers. The passenger vehicles segment has been selected for the SQ measurement scale development process. The SQ concept is primarily limited to the passenger cars segment of the automobile industry. Second, this particular segment of the Indian automobile industry is grappling with intense competition, discerning customers, and rising environmental pressures; the challenges face by this this segment acted as stimulus to pursue research in the field. Presently, the guidelines towards adopting green technology and meeting strict emission norms make it imperative for original equipment manufacturers to smoothly adapt to the changes in terms of transfer of technology and providing unstinting customer service support. Development and validating the SQ measurement scale to enhance SQ and customer satisfaction. Two new dimensions have been identified—service failure and service recovery. Item generation process followed by factor analysis, reliability, and validity analysis has been undertaken. Further principal component factor analysis with varimax rotation followed by structural equation modeling and Partial least square method has been done. Last, hypothesis testing has been done.

Exploratory Factor Analysis (EFA) Normalization has been undertaken using the principal component analysis with Kaiser Normalization (eigenvalues greater than 1) and varimax rotation method for each of the constructs to establish the reliability and validity of measures (Hair et al., 2006). The objective of carrying out analysis was to summarize the information elicited into a smaller set of new attributes that would attempt to bring out the constructs for measurement of SQ offered to the customers by authorized service stations. This process resulted in the extraction of seven factors towards AutoIND scale that explain 73.57% of the variance.

The subjective opinion of the researchers, besides consultation with experts from automobile industry, lead to the identification of seven factors: Tangible, Reliability, Responsiveness, Empathy, Assurance, Service failure, and Service recovery. All items have significant communalities that are not less than 0.50 and significant factor loadings that are not less than 0.55. The reliability score for each factor is more than 84.7%. The final pilot AutoIND scale, after rewording and deletions based on the interactions, is given below. Based on the empirical results, the dimensions of SQ and service failure have been included in the factors.

3.5.1 Service Failure Prediction in Vehicle Servicing Using Bayesian Network

Service failure in literature is defined from expectation perception gap perspective. This concept is applicable in all manufacturing and service. Based on this concept the service failure occurs when the consumers are dissatisfied with the service delivery system or in other words when performance/quality of product falls below their expectations (Lewis and Spyrakopoulas, 2001; Gye-Soo Kim, 2007). Duffy et al. (2006) have described service failure as real or perceived breakdown of the service in terms of either outcome or process. Miller et al. (2000) contemplate that high level of human involvement between providers and consumers, in conjunction with continuously varying consumer's perception, make service failure inevitable in delivering services, which subsequently makes the service delivery process more complex Hardeep et al. (2013). The interconnection between these variables and their relationship with our target node: Service failure will make up the structure of BN

3.5.2 Identification and Modeling of Factors Influencing Service Recovery

Identification of various factors that influence service recovery process and classification of these factors into three categories of people, process and technology by undertaking exhaustive literature review. Further analysis and review of these factors will be conducted through survey and establishment of relationship amongst all factors. DEMETAL approach is used to establish the relationship amongst these identified factors quantitatively and further understanding their cause-and-effect relationships. During the process, the requirement to address the prevailing need for addressing the six pillars of sustenance for electric cars has been studied with a need to address six pillars of sustenance to address service failure and service recovery process owing to transition.

3.6 Outcome

The first research objective has been achieved post extensive literature survey, followed by formulating research design and detailed interactions with the industry professional, authorized service station customers and professionals. Development of SQ measurement scale AutoIND has been undertaken by factoring in Indian settings. The scale developed considers five dimensions of SERVQUAL and two additional dimensions —service failure and service recovery—identified in context of Indian customers. The AutoIND scale comprises of 37 items and the following seven dimensions: Tangibility, Reliability, Responsiveness, Empathy, Assurance, Service failure, and Service recovery. This scale fills the gap that exists in measurement of SQ in Indian settings for passenger car segment and brings out seven

determinants towards measurement of SQ. Further, the impact of SQ dimensions on customer satisfaction and customer loyalty in undertaken.

Second, Service Failure Prediction in context of four-wheeler segment using BN has been done. It provides reliability and precision that can be used for real-time prediction of possible service failures in automobile sector. The survey data model provides exceptional insights towards identification of gaps and proposes changes in the servicing system for automobile to enable less failure rate and enhancement of customer satisfaction. The information derived by this research can be used to tackle the service failure issues and further reduce the probability of failure. This results in checking of failure rates without spending time and resources by undertaking planned additional quality checks on each and every vehicle. The Bayesian model developed is useful and provides methodology for attaching machine learning (ML) and artificial intelligence (AI) for predictive and prescriptive analytics. The authorized service stations can use this model in real-time with realistic time data streaming of vehicle coming in and can get valuable insights about how to change their business ways with changing factors and situations. This model can also be used for getting realistic insights into service operations of an authorized service station and to make further improvements.

Third, identification and modeling of factors influencing service recovery was undertaken. The occurrences of disruptions in supply chain and analyzing several factors responsible in the process of service recovery in supply chains was undertaken. The study points out relative importance of each factor and its relationship with other factors using a mathematical approach with help of DEMETAL technique. The study identifies that out of the 17 factors identified, Proactive recovery capability, Communication from suppliers in form of early warnings, and focus on service outcome failures are the major enablers of service recovery. Customer commitment level, transparent communication with end customers, and Automation are the factors on which the others have the highest impact. Moment of truth, modularization, and contingent rerouting factors have a weaker relationship with others and act independently.

Chapter No. 4

Measuring Service Quality in Indian Automobile Aftersales: AutoIND Scale

4.1   Introduction

An automobile is an exceptional product that not only serves numerous practical needs, but also intersects intimately with the owner's family life and reflects her socioeconomic status. The services offered are constantly changing in response to the introduction of new automobile technologies; this, in turn, affects the service systems used in the automobile industry. New theories and technologies are also key factors affecting the design and development trend of the service model and solutions offered. The automobile industry is becoming more customer-oriented and needs faster response time to deal with automobile incidents (Meiling et al., 2016; Choudhury et al., 2020). Major automobile manufacturers aspire to provide customers with unique services and experiences. Thus, ways of improving SQ, enhancing customer satisfaction, creating a competitive edge, and reducing customer attrition are key aspects of service that must be addressed in today's dynamic environment (Gogoi et al., 2020). The Indian auto industry has become the fourth largest in the world on the back of annual sales growth of 9.5%. India is also a prominent automobile exporter and has strong export growth expectations in the near term. In response to the present focus on meeting emission norms, the automobile industry is undergoing transformation in technology, operations, and services.

SQ refers to a consumer's subjective impressions regarding the efficiency and effectiveness of the service delivery process provided by a service provider. Empirical studies claim that SQ is generally the key to improving operational performance and competitive advantage, as well as generating profit and market share. SQ is a way of thinking about how to satisfy customers so that they develop a positive attitude toward the service they receive. Delivering quality service is considered to be an essential strategy to succeed in a competitive business environment. Firms that offer superior services achieve higher growth in the market and increase their profits (Gandhi et al., 2018; Kivijarvi et al., 2021).

Surveys by global automakers have revealed that consumers' relationships with their cars mimic their relationship with people; of course, they feel much attached or somewhat attached to their metal and steel possession. This also means that customer satisfaction is intrinsically linked to the quality of service from an automaker after it has been sold. In a cost-conscious market like India, passenger vehicle buyers demand value for every rupee they spend and when they get what they paid for, their word-of-mouth leads to greater sales of the passenger car they

praise. With fast-changing customer preferences, low interest rates, high disposal incomes, and advancement of technology in vehicles, ownership has dropped from an average of over seven years to around four years. To ensure that customers are happy, service stations are focusing on after-sales service and success in the onerous job of customer satisfaction, which, in turn, ensures that customers exhibit customer loyalty. So, for the sale of their vehicles, OEMs have retail outlets equipped with modern facilities and authorized service station for after-sales service. Authorized service stations serve as a link between original equipment manufacturer and the customer to ensure serviceability and high performance of vehicle. An understanding of the OEM and authorized service station helps to build loyalty and customer retention over the long term. Therefore, a customer-oriented organization has to offer additional services even if it is a manufacturing firm; the services include post-purchase customer service, and customer care service.

So, it is important to measure SQ in automobile after-sales service. There are many SQ measurement scales adapted for specific sectors, but there are not too many scales on automobile after-sales in the extant literature (Gencer et al., 2017; Patel et al. 2022). Among the few SQ measurement scales available, SERVQUAL (Parasuraman, Zeithmal, & Berry, 1988, 1994) is extensively used in various domains. The SERVQUAL scale comprises 22 items and has been used by researchers to measure SQ in logistics, banking, fitness health clubs, public hospitals, higher education, e-commerce, and many other research areas in both online and offline contexts. SERVQUAL has been used alongside other important service measurement surveys, such as SERVPERF (Cronin et al., 1994), Bouman and Van Der Wiele (1992), and the Adele Berndt study (2009) model for automobiles.

Measuring customer satisfaction for passenger car entails the development of a measurement scale by administering a detailed questionnaire to elicit responses that would help in scale construction. In this paper, the pilot SQ-measuring AutoIND scale for the passenger car segment of the Indian car industry has been developed on the basis of various interactions with respondents at the automobile authorized service stations; the recommendations are a result of these interactions. Two additional dimensions of SQ and service failure emerged during focus group discussions and have been included in the scale. In the subsequent sections, we present the literature review, and explain the process of focus group interviews, item generation process, factor analysis, along with content and reliability analysis undertaken during the course of this research.

4.2 Literature Review

The SQ concept defines it as the outcome of the comparison between the service expectations of the consumer from a service provider and the perception of the service actually received Uzir et al. (2021). Thus, it can be seen as the outcome of the process of evaluating the expectations and the actual performance. The SERVQUAL model was made of ten dimensions of SQ when created: tangibles, reliability, responsiveness, communication, credibility, security, competence, courtesy, understanding the customer, and access (Parasuraman et al., 1985). However, later on these dimensions were reduced to five because some dimensions were overlapping (communication, credibility, security, competence, courtesy, understanding customers and access) and they included the following: Tangibles- physical facilities, equipment and staff appearance; Reliability- ability to perform the promised service dependably and accurately; Responsiveness- willingness to help customers and provide prompt service. SERVQUAL had 22 questions covering these five dimensions. The major focus in the SQ literature is on developing SQ scales to determine the relationship of SQ with other constructs, such as customer satisfaction, brand orientation, and financial performance, as is evident from the major works (Cronin & Taylor, 1992).

Researchers differ in their views toward SQ and it has been linked with long-term customer evaluations of service. Therefore, providing a sufficient level of SQ in different environments, such as automobile maintenance services, involves a certain level of complexity. Further, there is unfair customer judgment owing to the technical nature of automobiles and customers not being regularly involved in evaluating and monitoring the repair process of their cars as it requires having the detailed technical knowledge that service providers possess. The service from automobile service providers concerning the mechanical repair of an automobile is completely different from guest services provided by hotels, where customers can evaluate the cost based on the human attention and care provided.

4.3 Service Quality Measurement in Automobile

Literature has many versions of SERVQUAL that have been explicitly used for development of scales in various domains. However, the automobile industry has witnessed limited development of SQ development scales. SERVQUAL remains the most widely used scale in studies undertaken on the automobile industry. Table 4.1 present the major scales that have been developed for automobile industry and associated services measured.

Table 4.1 Key Service Quality Scales developed in Automobile Industry and Associated Services

S.No	Author(s) & Year	Focus Area & Select Contributions
1.	Shalender et al. (2015)	- AUTOFLEX Scale with six dimensions and 26 items - Price, Customer orientation, Product, Place, Promotion, and Structural Hierarchy - Conceptualization, development and validation
2.	Zhen He et al. (2017)	- TeleServQ Scale with six dimensions for remote service - Efficiency, System Reliability, Information Quality, Security, Customization and Call Centre Service - Conceptualization, development and validation
3.	Yasin & Ulas (2017)	- AutoSERVQUAL scale with five dimensions and 28 items - Tangible, Assurance, Responsiveness, Reliability and Empathy - After-sales car services SQ measurement in Turkey - Conceptualization, development and validation

Stafford and Wells (1998) and Pooya et al. (2020) conducted an empirical research to study the determinants of SQ and customer satisfaction in the automobile industry. This study's result underscored the importance of the reliability component of SQ in improving customer satisfaction. Bouman & Van der Weile (1992) found customer kindness, tangibles, and faith to be important factors in measuring SQ after empirical and confirmatory testing. Andronikidis and Bellou (2010) examined alternative measures of the SQ construct in Greek automobile service centres. This study indicated that the improvement activities can be implemented after measuring SQ on a regular basis and comparing the actual service delivered with customer expectations. Asadollahi et al. (2011) studied SQ and customer satisfaction in automobile after-sales services in three Indian companies. These results revealed a positive relationship between SQ and market share. Shuqin and Gang (2012) conducted an empirical study on the relationship between after-sales service qualities in China Automobile sector and found that empathy, reliability, and convenience have a significant positive impact on customer satisfaction. Jajaee et al. (2012) studied the perceived SQ in the Australian automobile insurance industry and highlighted the importance of measuring SQ in improving performance. Yasin (2017) developed the AutoSERVQUAL scale and introduced additional determinants to measure the SQ through a scale made for the Turkish automobile industry.

Another SQ measurement is obtained through the Customer Service Index (Farooq et al., 2020). The study is conducted amongst customers who have owned a vehicle for more than 12–24 months and focuses on the dealer service experience. It is based on what matters most to customers when they bring their vehicles in for servicing to an authorized service centre. This study also examines customer satisfaction with maintenance and repair service at new-vehicle dealerships and independent service facilities. Owners are surveyed regarding their most recent

dealership service experience for both in-warranty and customer-pay work and provide feedback on key areas, such as service facility, service initiation, service advisor performance, SQ, and delivery. The study analyses the processes that define the dealer service experience. There are various brands in the automobile industry; each and every automotive brand is evaluated in the customer service index. The measures of SQ obtained through consumer surveys have become a widely used business performance measurement tool.

Also, strong policy support by the Government of India has been crucial in developing the automobile industry. In 2002, the government introduced Auto Policy 2002 that provided automatic approval for foreign equity investment up to 100 per cent with no minimum investment criteria and encouraged Research and Developed by offering rebates on expenditure. The "Make in India" programme of the government is a key driver for the growth of the automobile industry. The government unveiled a plan to implement Faster Adoption & Manufacturing of Electric Hybrid Vehicles (FAME) till 2020 that covered all vehicle segments including all forms of hybrid and pure electric vehicles. The Passenger Vehicle Industry has backward and forward linkages with the following sectors: backward linkages with steel, aluminium, copper, plastics, Paints, Glass, Electronics, Capital Equipment, Trucking and Warehousing and forward linkages with Dealership retails, Credit and Financing, Logistics, Advertising, Repair and Maintenance, Service parts, Petroleum products, Gas stations and Insurance.

4.4   Gaps in the literature

In the extant literature on SQ measurement for the automobile industry's passenger car segment, limited research has been undertaken and the subject is still underdeveloped in the Indian context. Parasuraman et al. (1985, 1988), in their pioneering work, identified five components of SQ, that is, reliability, assurance, tangibles, empathy, and responsiveness. These five dimensions used to evaluate SQ are called SERVQUAL dimensions. Further, interactions with authorized service centres provide opportunities to enhance SQ. Researchers have developed SQ measurement scale for various domains but not for automobiles. Research undertaken for automobile after-sales has used SERVQUAL as the base scale for SQ enhancement. Shuqin and Gang (2012) conducted an empirical study on the relationship between after-sales service qualities in China Automobile sector, Jajaee et al. (2012) studied the perceived SQ in the Australian automobile insurance industry and Yasin (2017) developed the AutoSERVQUAL scale for the Turkish automobile industry. The AutoSERVQUAL scale has also been considered for this study, since its outcome parameters seek to enhance SQ. The preliminary pilot questionnaire is a combination of the dimensions of SERVQUAL, AutoSERVQUAL scale, Adele Berndt study, Bouman &Vander Weile study and the interview

schedule with 506 information-rich and willing respondents comprising: (i) customers approaching authorized service stations; (ii) employees working as sales advisor, service advisor, and technical advisors in authorized service stations; and (iii) manager-level officers at various authorized automobile service stations across India. Taking cues from these available scales and the interaction with various groups, we were able to identify the gaps in having a scale towards measurement of SQ in automobile in the context of four wheelers. No dedicated studies for Indian automobile and particularly on passenger car segment have been done wherein dedicated service centres exist pan-India for almost major brands. The data being recorded post customer encounter is not fully structured and generic in nature.

From the literature review, following gaps were identified:

• Gap 1: to date, there are very few studies that have been dedicated to the measurement of SQ in respect of automobile industry, specifically in the context of Indian automobile industry passenger car segment, which has received very limited attention.

• Gap 2: a need is felt towards identification of a distinct set of dimensions for evaluation of SQ in respect of automobile industry's passenger car after-sales segment.

• Gap 3: the literature requires an empirical framework to develop a SQ measurement scale for the automobile industry in an Indian setting.

4.5   Need and objectives of the study

There is a need to develop a reliable measurement scale to assess the SQ measurement in the Indian automobile industry's passenger car after-sales segment. This scale will enable the identification of various dimensions of SQ in the Indian settings. This is important for enhancing customer satisfaction and customer loyalty. Looking at the gaps, the following objectives were identified:

• Importance of SQ in automobile industry passenger car after-sales;

• Identification of SQ dimensions for Indian automobile passenger car segment; and

• Development of reliable SQ measurement scale for Indian setting

Sector-specific SQ scales have been developed. There is limited literature on scale generation for automobile after-sales service. Limited SQ scale generation has been observed. Thus, most researchers have resorted to the use of SERVQUAL for measuring the SQ in automobile after-sales service. In addition, a few scales have been developed using SERVQUAL as the base measurement scale for measuring SQ in automobile after-sales service. There are few studies on the automobile passenger car segment. There are a number of OEMs in the passenger car segment of the Indian automobile market and they are committed to providing customer

satisfaction. With the presence of various brand and models of passenger cars it is imperative to develop a measurement scale to analyze and enhance SQ. The gaps identified in the literature will be addressed in this research.

4.6   Scope of the Study

The area under study is the passenger car after-sales segment of the Indian automobile industry. The Indian automobile industry can be segmented into two-wheelers, passenger vehicles, commercial vehicles, and three wheelers. First, the passenger vehicles segment has been selected for the SQ measurement scale development process and is limited to the passenger cars segment of the automobile industry. Second, this particular segment of the Indian automobile industry is grappling with intense competition, discerning customers and rising environmental pressures; the challenges faced by this this segment acted as a stimulus to pursue research in the field. Presently, the guidelines towards adopting green technology and meeting strict emission norms make it imperative for original equipment manufacturers to smoothly adapt to the changes in terms of transfer of technology and providing unstinting customer service support.

4.7   Research methodology

The outlined research methodology is depicted in Figure 4.1, used in this study. This methodology represents the detailed process undertaken towards the conduct of research. The conceptual research framework is represented in Figure 4.2. The initiation of service is offered by an authorized service station of original equipment manufacturer by establishing contact with the customer. The process of SQ is initiated by establishing contact and further delivered by the service station to the customer by attending to the vehicle and undertaking designated assigned tasks. The whole process involves the customer, front desk executive, sales advisor, service advisor, technical advisor, and service station during various stages till the completion of service. Feedback is taken from customer after completion of task by the service station. Another, independent feedback is taken after some period about SQ on the performance of vehicle by another department. In case of service failure, service recovery process is undertaken by service station to address the shortcomings and instill confidence about the service among customers. The feedback generated is monitored at each level of the hierarchy to review customer feedback and address shortcomings, if any.
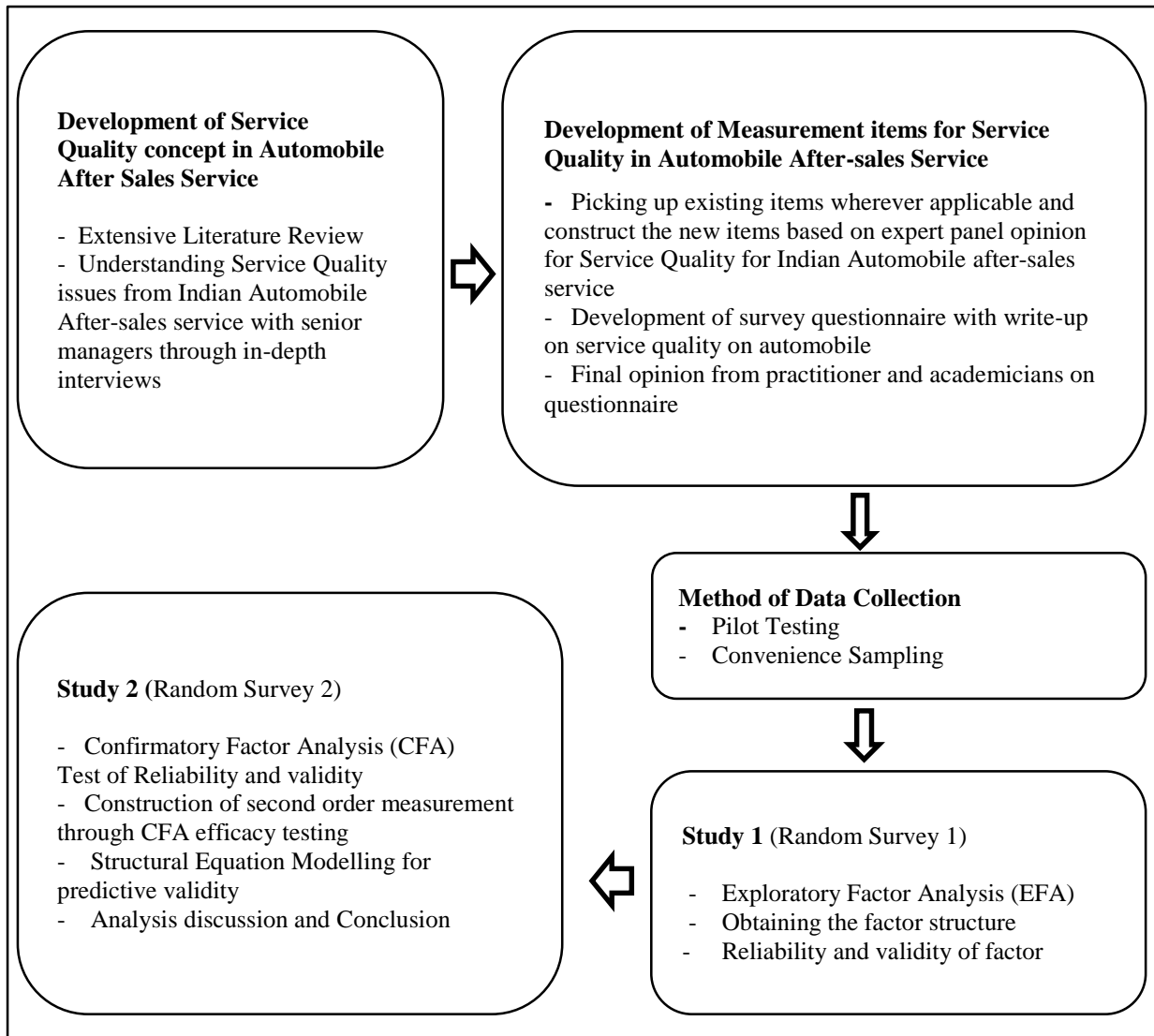
Figure 4.1   Chart of research methodology adopted for formulation of measurement scale
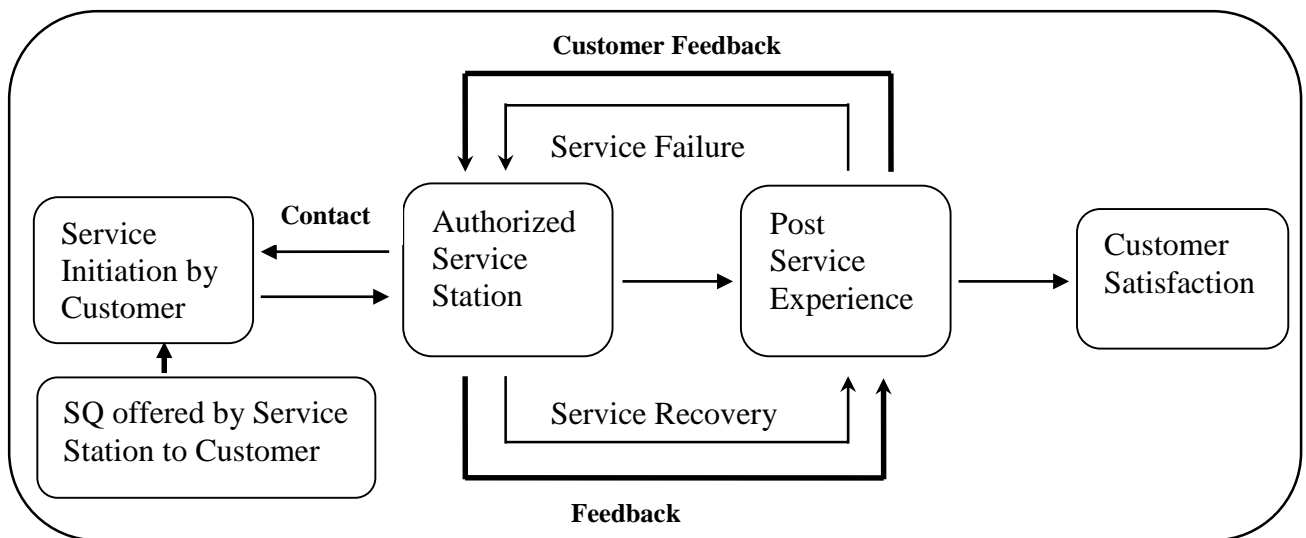
Figure 4.2   The service initiation and feedback process

A survey instrument was developed by undertaking an exhaustive literature review of the literature on various aspects of SQ. Research papers were selected from online databases by using keywords, such as "Service quality dimensions," "Service quality scales," and "Service quality in automobile." The papers were further filtered based on relevance to the current research. For the development of a survey instrument to measure the after-sales SQ of passenger car segment, SERVQUAL and the AutoSERVQUAL scale were considered as the starting point for survey generation. It shows the level of SQ and also implies the service station is critical to trace the customer perceptions and expectations over time. A survey instrument was developed based on an extensive review of the literature on automobile SQ and combination of dimensions of SERVQUAL, AutoSERVQUAL scale, Bouman &Vander Weile study, Adele Berndt study, and the interview schedule for 206 information-rich and willing respondents.

There are three prominent categories of service stations in the Indian passenger car segment. First, the authorized service station that offers both sales and after-sales services on behalf of the original equipment manufacturers (automobile companies). These authorized service station dealerships are present in almost all cities and larger cities have more than one. These authorized service stations facilitated and rendered sales and after-sales services to particular brand/ manufacturers, such as Maruti Suzuki, Hyundai, Tata Motors, and Toyota. The second category of service stations is privately owned, but not confined to a particular brand or make. This facility aims to provide complete solutions for almost all brands of cars; these include quick servicing, mechanical repairs, body repairs, accessories, insurance, car exchange, and doorstep service akin to that provided by authorized service stations, such as Carnation. The third category is the local service station/ workshop present in large numbers in a particular region and privately owned. The scope of service and other facilities varies across service stations/workshops. So, our research was confined to first category of authorized service stations that adhered to procedure and quality standards for service station laid by original equipment manufacturer (automobile companies) and were also involved in the sale of new passenger cars.

Qualitative research design was chosen for the study, and exploratory research used to calibrate the survey instrument. Focus group interviews were the starting point to understand the various processes adopted for SQ. Focus group, group interaction, and synergy make the sum of knowledge greater than separate individual opinions. The characteristic feature of focus groups is the explicit use of group interaction to produce data and insight that would be less accessible without the interaction found in a group. Three focus groups were formed to generate inputs for the construct. Carson et al. (2001) affirms that the contemporary view about the appropriate number of respondents in each group settles on 5-8. Saturation is a criterion in determining the

number of groups. Saturation is the point at which additional data collection no longer generates new understanding.

Three focus groups comprising 7-8 people were formed. The first group had people waiting in customer lounge for their car to be repaired and the age of these after-sales customers was between 20 and 60 years old. They were mostly males, with one or two female owners. The second group was the employees working in sales advisor, service advisor, and technical advisor roles in authorized service stations, attending to these customers, and being well-aware of the procedures and processes; these were mostly men. The third group was manager-level officers across various authorized automobile service stations in India who monitored the processes of their service dealers all over India; these, again, were mostly men. Focus group interviews were undertaken to generate meaningful discussion by employing multiple perspectives. A moderator recorded and controlled the discussion. It was ensured that no biasing of responses was done and freedom of opinion prevailed. The minutes of the discussion was used for content analysis and scale development. The open-ended questions that were discussed during focus group discussion were:

Question: What are your expectations of the car service that you associate with your car?

Question: What do you expect the service station to look like where you bring your car?

Question: Think about car service station and conditions that fail to meet your expectations? and

Question: Share any other after-sales service related issue that is important for service station? (Any problems you faced or suggestion you want to offer)

Two important aspects emerged from the discussions; these were service failure and service recovery. During the discussion of the first focus group, it emerged that some customers had experienced problems after the servicing to their vehicles. These failures were formally brought to the notice of authorized service stations. Almost all authorized service stations had monitoring system in place for recording the service failure and service recovery occurrences and resolving these failures on a day-to-day basis; they had also formed a charter at the managerial level. These two aspects were identified and suitable opinions were recorded during discussion. Keeping and developing relations with current customers is a key business strategy. However, problems and complaints are bound to occur over the lifetime of customer relationships. Handling these effectively is vital to maintaining customer satisfaction and loyalty.

A service failure, simply defined, is service performance that fails to meet a customer's expectations. Typically, when a service failure occurs, a customer will expect to be compensated for the inconvenience in the form of any combination of refunds, credits, discounts, or apologies. Service failure is the opposite of customer satisfaction. Service failure can range from bad quality to rude behavior to late delivery. These examples result in the customer not receiving performance that they were promised.

Service recovery refers to the "actions taken by an organization in response to a service failure." Failures occur for all kinds of reasons; for example, the service may be unavailable when promised; it may be delivered late or too slowly; the outcome may be incorrect or poorly executed; or the employees may be rude or uncaring. All these types of failures bring about negative feelings and responses from customers. The goal of service recovery is to identify customers with issues and then to address those issues to the customers' satisfaction to promote customer retention. However, service recovery does not happen on its own. It is a systematic business process that must be designed properly and implemented in an organization. Perhaps, more importantly, the organizational culture must be supportive of the idea that customers are important and their voice has value. In service recovery management, practitioners have devoted their efforts to discovering solutions aimed at recovering service failures and retaining customers. Previous research in service recovery has covered various issues, such as: identifying effective recovery initiatives, investigating antecedents of consumer responses to service recoveries from a perspective of justice/fairness theory, examining the effect of service recovery efforts on service recovery satisfaction (SRS), as well as trust and commitment. So, the decision on retaining the two dimensions of service failure and recovery that emerged during focus group discussion will be taken if they are found to fit empirically with the framework.

(a)   The scale construction and evaluation is based on Robinson, Shaver, and Wrightsman (1991). The writing and locating of items to include in the scale as a service dimension was carefully done.

(b)   Proper Sampling of Content: Sampling of items is an important process and needs deliberation about how detailed it should be. Help of senior managers of OEMs in automobile after-sales business was taken, along with consultation with two other experienced researchers.

(c)   Simplicity of Item Wording: Wording of the items was another important area that   determined the success of the scale generated. This principle was followed.

(d)   Item Analysis: This last process was a very broad one that required an understanding of the researcher by the respondents. Talking in the same language in terms of the researched subject was very important.

The data emerging from Focus Groups' discussion were collected by recording answers and decoded by writing each opinion on a piece of paper. The variables that were produced by group members were used to develop a questionnaire about the components of SQ in automobile after-sales services. Proper sampling of content was an important process and needed to be performed carefully. The presence of two other researchers with adequate experience and senior management executives from the services department working with authorized service station helped in the item generation process. Simplicity in understanding of the dimensions helped in scale construction and item analysis. Discussions emerging from focus groups were collected and recorded. Ideas coming from focus groups were analyzed and the results were interpreted in light of the research. The variables identified were used to develop questionnaire and generate scale for after-sales customers of passenger car segment called AutoIND scale. Data reduction, data display, and the drawing and verifying of conclusion were done jointly. Reliability and validity analysis was done after the grouping of items exhibiting similar patterns.

4.8   Sampling process and item deletion

The three aspects of population, sample, and subject contributed towards the sampling frame in survey research. Authorized service stations of various original equipment manufacturers for passenger cars were chosen for total population of the survey. Three focus groups comprising of seven to eight people were formed to reach the right respondents and collecting the data for various authorized service stations justified the sampling for collection of data and subject for conducting the survey. Collection of data was done by visiting the authorized service stations of various passenger car makes and brands. The respondents were asked to respond to the questionnaire based on a seven-point Likert scale. The researchers approached around 300 respondents and were able to elicit data from 206 respondents, providing a response rate of 68.6%. Service stations cooperated for the research and prior visit to these station and interactions helped a lot during the course of research.

4.9   Appropriateness of sample size

For conduct of EFA on the collected data, the number of observations must not be less than 50 and samples of more than 100 are preferred. The present research had 206 observations and this was found to be suitable for data analysis.

4.10   Demographic distribution of respondents

The demographic distribution of the respondents is given in Table 4.2. The categorization is based on the age of respondents and people visiting authorized service stations as customers, executives working as front desk executives, sales advisors, service advisors, technical advisors, and manager-level officers.

Table 4.2   Demographic distribution n = 306 Respondents

Age of respondents	N	%	Designation and functional area of work
20-30 years	94	30.58	Customers, front desk executives
30-40 years	111	36.40	Customers, front desk executive, sales advisors, service advisors, and technical advisors
40-50 years	64	20.88	Customers, sales advisor, service advisor, technical advisors, and manager-level officers
50-60 years	33	10.68	Customers, service advisors, technical advisors, and manager-level officers
Above 60 years	4	1.45	Customers

4.11   Item generation

Item generation was done jointly by taking expert opinion of a group comprising three researchers, one academician and three business professionals from four different automobile companies. The draft scale that emerged comprised seven dimensions including 55 questions, as given in Table 3. To understand the Indian passenger car segment's after-sales, customers' personal interview method was adopted. The items that emerged in the AutoIND draft scale reflected the feedback from various geographic regions across the country. Face-to-face interviews led to high response rates and were more convenient. Interactions with authorized service stations staff and managers across northern, western, southern, and eastern parts of the country were undertaken to answer the questionnaire. The draft initial questionnaire is given in Table 4.3.

Table 4.3   Item pool of 55 questions and 7 dimensions proposed for the AutoIND survey

1) **Tangibles** (8 Items) *Service Station has modern outlook with up-to-date equipment (TAN1)* ***Service Station features are visually appealing (TAN2)*** *Service Station employees are neat, professional-looking and well-dressed (TAN3)* ***Service Station material and equipment associated with service are visually appealing (TAN4)*** *Entry and Exit parking convenience (TAN5)* ***Takes advantage of technology and knowhow (TAN6)*** *Possess Quality Standard Certificate and adherence to procedure (TAN7)* ***Visually appealing and comfortable customer waiting lounges (TAN8)***	2) **Reliability** (11 Items) *When Service Station promises to do something by certain time, it adheres to it (REL1)* ***When you have a problem, Service Station shows a genuine interest in resolving it (REL2)*** *Service Station performs the service right the first time (REL3)* ***Service Station provided its services at the time it promised to do so (REL4)*** *Service Station maintains error-free records of your vehicle (REL5)* ***Sincerity of staff (Sympathetic and reassuring) (REL6)*** *Personal Information security (REL7)* ***Reliable repairing (REL8)*** *Adherence to laid down procedures (REL9)* ***Use of Original Product and spare parts (REL10)*** *No ambiguity in prices (REL11)*
3) **Assurance** (8 Items) *The behavior of service employees instills confidence in you (AS1)* ***You feel safe in your transactions with the service station (AS2)*** *Service Station employees are consistently courteous and polite with you (AS3)* ***Service Station employees have the knowledge to answer to your questions (AS4)*** *Trained staff (AS5)* ***Informative explanations to queries (AS6)*** *Guaranteed Maintenance (AS7)* ***Reasonable price (AS8)***	4) **Responsiveness** (10 Items) *Service station employees intimates you exactly when services will be performed (RES1)* ***Gives prompt service to its customers (RES2)*** *Service Station employees are always willing to help you and accommodate you (RES3)* ***Service station employees are never too busy to respond to your request (RES4)*** *Compatible staff (RES5)* ***Adequate alternate transport facilities (RES6)*** *Qualified labour force (RES7)* ***Replacement vehicle during repairs (RES8)*** *Equal treatment to all (RES9)* ***Attentive service (RES10)***
5) **Empathy** (8 Items) Individual attention (EM1) **Service Station has operating hour convenient to all its customers (EM2)** Service Station employees give personal attention to its customers (EM3) **Service Station has best interest at heart (EM4)** Service Station employees understand the need of customers (EM5) **Various payment options (EM6)** Offering gift and promotions (EM7) **Delivering Quality (EM8)**	6) **Service Failure** (8 Items) *Acknowledges failure w.r.t Service Hygiene and Physical Evidence or Service Operation or Employee Related (SF1)* ***Identifies reason for failure w.r.t Service Hygiene and Physical Evidence or Service Operation or Employee Related (SF2)*** *Understands problem from customer point of view (SF3)* ***Takes ownership as a customer (SF4)*** *Addresses the service failure promptly (SF5)* ***Maintains the record of service failures (SF6)*** *Top priority to resolve service failure (SF7)* ***Service Station apologizes for Failure (SF8)***
7) **Service Recovery** (2 Items) Gives adequate compensation, refund, replacement (SR1) **Speed of recovery, follow up, fair policies and procedures (SR2)**	

4.12   Reliability and Validity Analysis

The reliability of AutoIND scale was analyzed using Cronbach's alpha (α). α is defined as the proportion of a scale's total variance that is attributed to a common source (Cronbach, 1951). Cronbach's alpha was calculated for each of the 55 items in the survey instrument. The reliability

analysis was done and the value of α for the 55 items was 0.910 (Cronbach,1951); the findings were quite good as depicted in Table 4.4.

Table 4.4 Reliability Analysis of items in AutoIND scale

Cronbach's alpha (α)	Cronbach's alpha based on standardized items	No of Items (n)	Findings
0.910	0.914	55	Very Good

4.13   Factor analysis

The items' mean and variance were calculated and the corrected item total correlation was carried out for the 55 items. Berthon, Ewing and Hah (2005) described the elimination of all items in the study whose corrected item-to-total correlation is less than 0.40; however, this study proposes the elimination of items with values less than 0.30 and this resulted in the identification of 18 items for deletion and retention of the remaining 37 items. The deletion of the 18 items does not influence the value of Cronbach's alpha; further, items having value more than 0.30 have an impact on the value of Cronbach's alpha if they are deleted, as is evident from Table 4.5. It was decided that the final elimination of items will be undertaken by considering the results of factor analysis of the 55 items based on principal component analysis and rotation method with varimax and Kaiser normalization.

Table 4.5 Corrected Item-Total Correlation analysis

Item Total Statistics	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's alpha if Item Deleted
T1	291.87	990.916	.226	.910
T2	291.87	986.049	.293	.910
T3	291.45	970.389	.538	.908
T4	291.61	987.845	.386	.909
T5	291.29	1000.013	.195	.910
T6	291.26	978.198	.421	.909
T7	291.06	1004.129	.091	.911
T8	291.16	989.006	.310	.909
R1	291.19	977.428	.390	.909
R2	291.06	969.329	.522	.908
R3	290.90	981.224	.477	.908
R4	290.71	974.480	.602	.908
R5	291.84	944.740	.629	.906
R6	291.81	950.961	.564	.907
R7	291.77	963.514	.537	.907
R8	291.32	971.559	.532	.908
R9	291.03	978.766	.511	.908
R10	290.84	987.140	.418	.909

R11	291.16	972.406	.560	.908
RE1	291.87	975.249	.501	.908
RE2	292.26	964.531	.471	.908
RE3	292.16	981.473	.266	.910
RE4	292.26	963.798	.400	.909
RE5	292.10	951.357	.535	.907
RE6	292.13	943.116	.652	.906
RE7	291.71	938.746	.692	.905
RE8	291.81	956.495	.664	.906
RE9	292.19	988.028	.200	.911
RE10	292.74	1016.398	-.072	.916
A1	291.10	965.290	.495	.908
A2	291.19	969.028	.434	.908
A3	291.65	986.837	.287	.910
A4	291.87	989.049	.275	.910
A5	292.00	990.467	.274	.910
A6	292.03	1001.366	.104	.911
A7	291.06	975.329	.398	.909
A8	291.16	971.606	.448	.908
E1	291.81	990.495	.245	.910
E2	291.45	989.589	.241	.910
E3	292.00	979.333	.350	.909
E4	291.81	986.095	.276	.910
E5	292.10	979.957	.321	.909
E6	291.48	929.858	.752	.904
E7	292.94	966.929	.349	.909
E8	291.68	934.359	.660	.905
SF1	291.77	979.181	.314	.910
SF2	291.94	976.396	.276	.910
SF3	292.00	972.667	.266	.911
SF4	292.29	981.146	.281	.910
SF5	292.29	984.746	.330	.909
SF6	292.00	971.067	.458	.908
SF7	291.35	973.370	.437	.908
SF8	291.03	996.899	.180	.910
SR1	291.35	980.103	.312	.909
SR2	291.68	969.028	.433	.908

Exploratory Factor Normalization (EFA) was carried out by using the principal component analysis with Kaiser Normalization (eigenvalues greater than 1) and varimax rotation method for each of the constructs to establish the reliability and validity of measures (Hair et al., 2006). The objective of carrying out the analysis was to summarize the information elicited into a smaller

set of new attributes that would attempt to establish the constructs required for measurement of the SQ offered to the customers by authorized service stations. This process resulted in the extraction of seven factors for the AutoIND scale that explain 73.57% of the variance, as shown in Table 4. 6.

Table 4.6   Total Variance Explained Extraction Method: Principal Component Analysis.

Compone nt	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Varian ce	Cumulat ive %	Total	% of Varian ce	Cumulat ive %	Total	% of Varian ce	Cumul ative %
1	11.957	21.740	21.740	11.957	21.740	21.740	7.547	13.723	13.723
2	8.109	14.743	36.483	8.109	14.743	36.483	7.167	13.030	26.753
3	6.427	11.686	48.170	6.427	11.686	48.170	6.146	11.175	37.928
4	4.215	7.663	55.833	4.215	7.663	55.833	5.881	10.692	48.620
5	3.659	6.653	62.486	3.659	6.653	62.486	5.440	9.892	58.512
6	3.275	5.955	68.440	3.275	5.955	68.440	5.088	9.251	67.763
7	2.822	5.132	73.572	2.822	5.132	73.572	3.195	5.809	73.572

The result of the extraction method using Principal Component Analysis based on Rotation Method Varimax with Kaiser Normalization is presented in Table 4.7. These factor loadings are consistent with the suggested factor structure of the scale. The subjective opinion of the researchers, besides consultation with experts from automobile industry, leads to the identification of seven factors: Tangible, Reliability, Responsiveness, Empathy, Assurance, Service failure, and Service recovery. All items have significant communalities that are not less than 0.50 and significant factor loadings that are not less than 0.55. The reliability score for each factor is more than 84.7%. The final pilot AutoIND scale, after rewording and deletions based on the interactions, is given below. Based on the empirical results, the dimensions of SQ and service failure have been included among the factors.

Table 4.7   Communalities, Factor structure, and loadings

S. No.	Factors and associated Items	Communalities	Factor structure and loadings						
			Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Tangible (F1)									
1	Service Station has modern outlook with up-to-date equipment	.683	.736						
2	Service Station features are visually appealing	.591	.561						
3	Service Station employees are neat, professional-looking and well-dressed	.662	.718						
4	Service Station material associated with service are visually appealing	.696	.732						
5	Entry and Exit parking convenience	.837	.769						
6	Visually appealing and comfortable waiting lounges	.576	.680						
Reliability (F2)									
7	Takes advantage of technology and knowhow	.804		.765					
8	Possess Quality Standard certificate and adherence to procedures	.790		.699					
9	When Service Station promises to do something by certain time it adheres to it	.898		.846					
10	When you have problem Service Station shows a sincere interest in resolving	.918		.823					
11	Personal Information security and error free records	.779		.636					
Responsiveness (F3)									
12	Gives prompt service to its customers	.855			.843				
13	Service Station employees are always willing to help and accommodate you	.856			.891				
14	Service station employees are never too busy to respond to your request	.783			.841				
15	Compatible staff	.884			.899				
16	Service Station apologizes for failure	.554			.688				
Empathy (F4)									
17	Service Station employees give personal attention to its customers	.894				.861			
18	Service Station has best interest at heart	.768				.783			
19	Service Station employees understand the need of customers	.761				.808			
20	Service Station has operating hour convenient to all its customers	.662				.719			
21	Adequate alternate replacement transport facilities	.793				.796			
22	Delivering Quality	.843				.752			
Service Failure (F5)									
23	Acknowledges failure w.r.t Service Hygiene and Physical	.889					.927		

No	Item								
	Evidence or Service Operation or Employee Related								
24	Identifies reason for failure w.r.t Service Hygiene and Physical Evidence or Service Operation or Employee Related	.816					.802		
25	Understands problem from customer's point of view	.878					.708		
26	Takes ownership as a customer	.852					.765		
27	Addresses the service failure promptly	.831					.826		
28	Maintains the record of the service failure	.898					.867		
29	Top priority to resolve service failure	.898					.805		
Assurance (F6)									
30	Service Station employees have the knowledge to answer to your questions	.799						.859	
31	Trained technical staff	.663						.768	
32	Informative explanations to queries	.701						.772	
33	Service Station performs the service right the first time	.660						.559	
34	Attentive guaranteed service	.769						.753	
35	Reasonable price	.758						.827	
Service Recovery (F7)									
36	Adequate compensation, refund or replacement against service failure	.857							.639
37	Speed of recovery, follow up, fair policies and procedures	.704							.727
Reliability of identified factors			.877	.879	.889	.861	.891	.847	.809

After formulation of the AutoIND scale for the measurement of SQ for the automobile industry, a study of the further relationship between individual dimensions contributing to SQ was undertaken. The impact of SQ on customer satisfaction and customer loyalty has been mentioned below. This study contributes to the literature in a significant manner by addressing the individual level dimensions, such as Reliability, Assurance, Tangibles, Empathy, Responsiveness, Service Failure and Service Recovery, that affects SQ and further result in customer satisfaction and customer loyalty. It addresses the following important empirical and theoretical questions in SQ literature:

(i) Do the individual dimensions of Reliability, Assurance, Tangibles, Empathy, Responsiveness, Service Failure, and Service Recovery affect SQ?; (ii) Do SQ impacts customer satisfaction and further leads to customer loyalty?; (iii) Does SQ directly result in customer loyalty?; and (iv) Is there any mediating effect between SQ, customer satisfaction and customer loyalty. Assessing these questions will provide various empirical evidence for both academician and practitioners to achieve a deeper understanding of the relationship between these factors.

Total of 55 items were identified initially for the different variables and, of these, 37 items were identified for the final analysis. Exploratory factor analysis (EFA) using principal component factor analysis (PFA) with varimax rotation is used for each of the constructs to establish the reliability and validity of measures (Hair et al., 2010). Next, the robustness of the factors extracted is tested using CFA and, further, using the partial least square (PLS) estimates. Structural Equation modeling (SEM) by PLS is used to test the proposed model (Hair et al., 2012; Henseler et al., 2014).
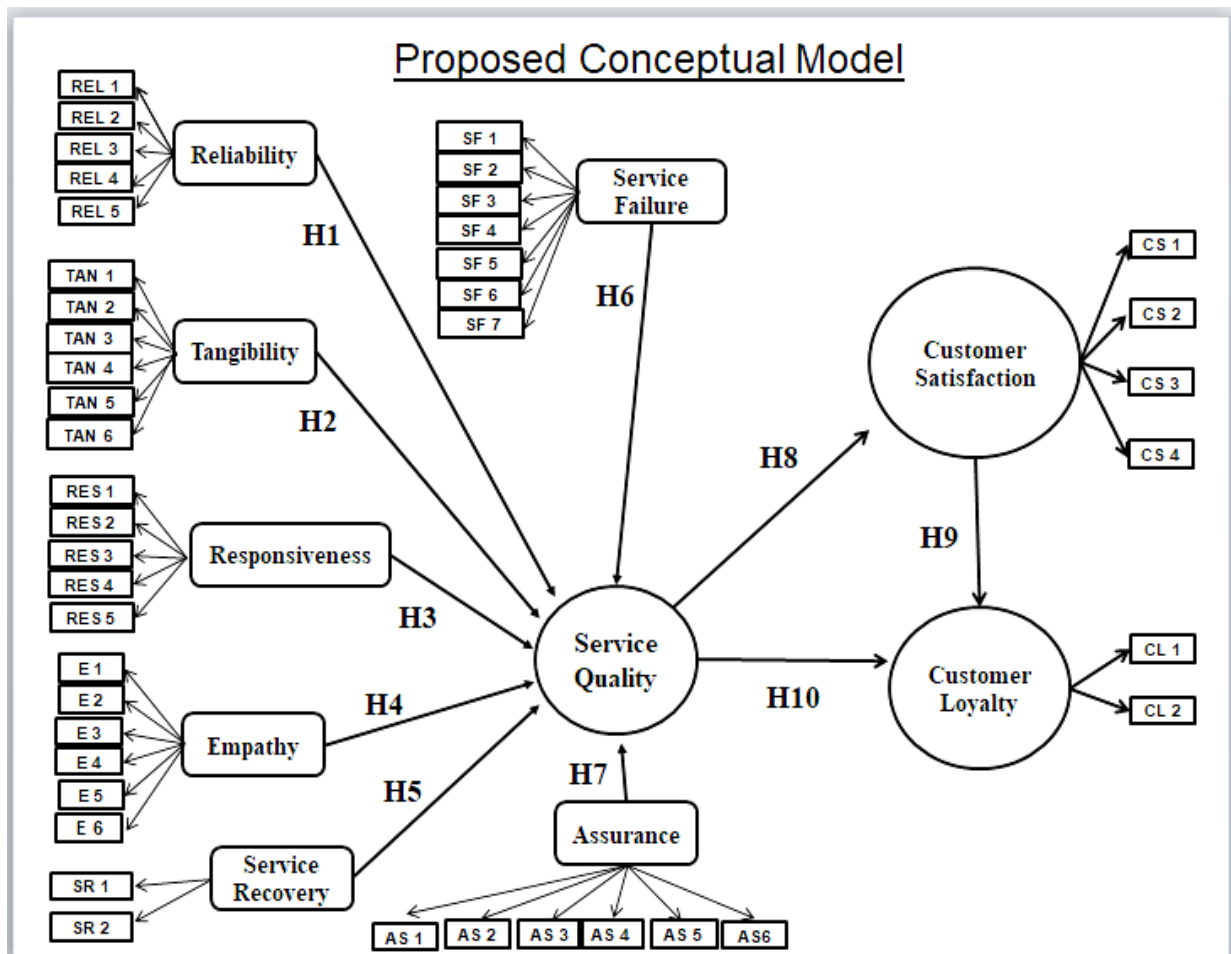
Figure 4.3   Theoretical Framework

Figure 4.3 represents the theoretical framework showing a customer's perception on SQ in terms of the seven dimensions that have been identified. These dimensions are: tangibles, reliability, responsiveness, assurance, empathy, service failure, and service recovery. SERVQUAL questionnaire was used to determine their relationship with customer satisfaction and customer loyalty for consumers in India.

4.14. Confirmatory Factor Analysis

To examine the reliability and robustness of the seven dimensions obtained from the sub sample, and after including customer satisfaction and customer loyalty, CFA is performed, and presence of non-normality checked. The constructs were tested by using the PLS estimation approach. Similarly, covariance-based structural equation modelling (CB-SEM), reliability, convergent validity and discriminant validity of the scale were examined using CFA. Convergent validity was checked through indicator reliability and average variance extracted (AVE). SEM was used to derive the relationships between SERVQUAL dimensions, customer satisfaction, and loyalty. It is an advanced statistical approach designed to describe causal relationships between the latent variables construct. The results were obtained using SMART PLS software. Figure 4.4 Represents the SEM framework with results t-values, p-values & path coefficients
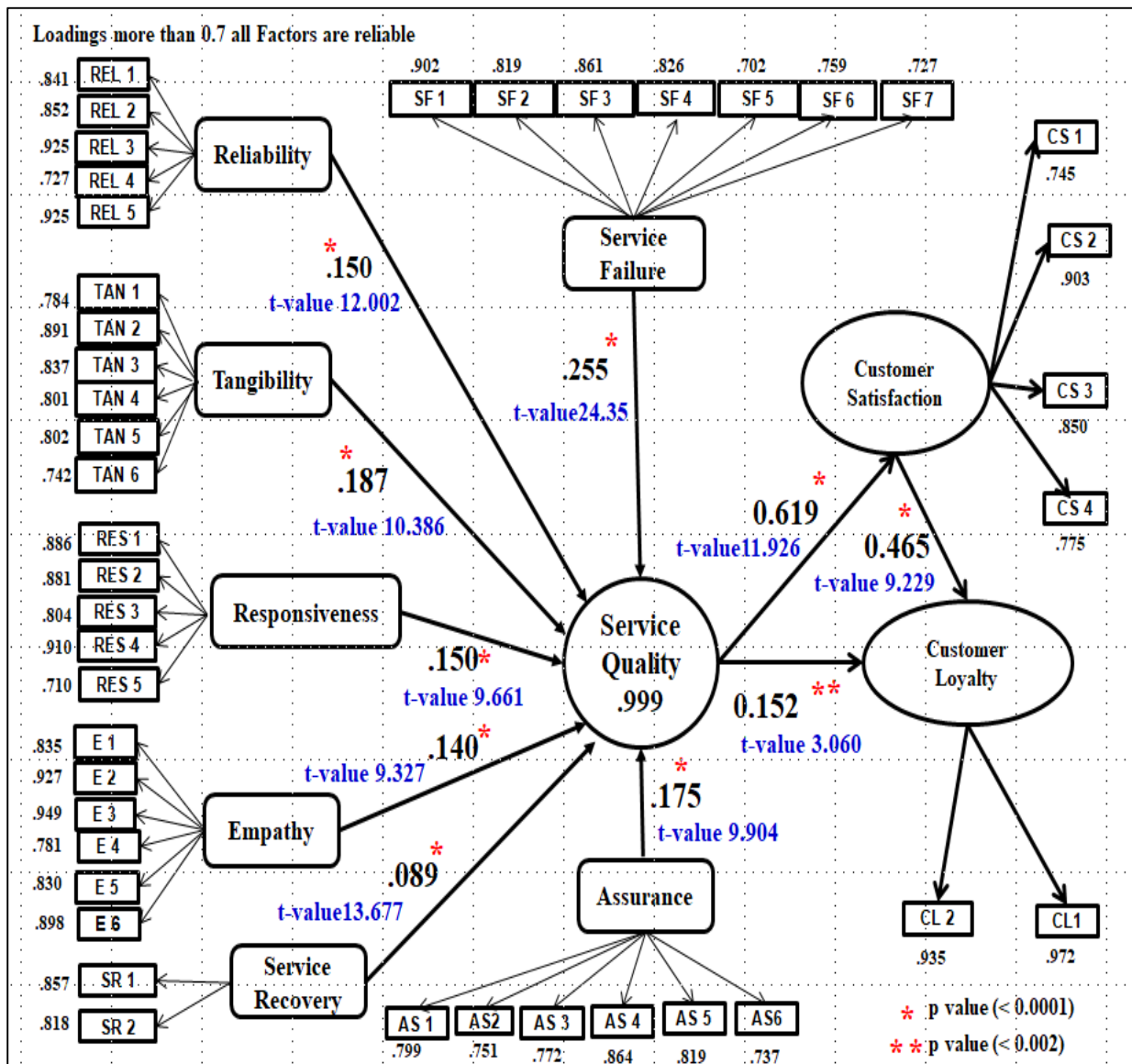
Figure 4.4   SEM Results

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Evaluation of internal consistency reliability Rho_A, composite reliability and Cronbach's alpha has been undertaken. The convergent validity is verified though the indicators; further, the values of reliability and average variance extracted are calculated using SMART PLS.

Table 4.8 EFA Results

Factor	Cronbach Alpha	Rho_A	Composite Reliability	Average Variance Extracted
Assurance	0.835	0.838	0.881	0.555
Empathy	0.936	0.946	0.950	0.760
Reliability	0.871	0.881	0.909	0.668
Responsiveness	0.821	0.870	0.881	0.611
Service Failure	0.888	0.907	0.913	0.606
Service Quality	0.969	0.973	0.972	0.689
Service Recovery	0.777	0.802	0.825	0.702
Tangibility	0.838	0.858	0.887	0.579
Customer Loyalty	0.904	0.816	0.952	0.909
Customer Satisfaction	0.841	0.866	0.891	0.674

The results of Table 4.9 suggest that most of the path coefficient values are positive and highly significant. The dimensions of reliability, empathy, responsiveness, and service failure are highly significant to SQ. t-value measures size of difference relative to variation in sample data. The t-value is higher, greater the evidence against null hypothesis. P-value is statistical number to conclude if there is relationship between two dimensions. As the true value of coefficient is equal to zero there is no relationship establisehed.

Table 4.9 EFA Results, VIF Values, t- value, p-value, f sq and Path Coefficients in the structural model

Hypothesis	Path		VIF	Path Coefficient	t-value	p-value	f Sq
H 1	REL ⟶	SQ	12.607	0.150	12.002	<0.0001	2.196
H 2	TAN ⟶	SQ	1.917	0.187	10.386	<0.0001	22.407
H 3	RES ⟶	SQ	9.157	0.150	9.661	<0.0001	3.018
H 4	E ⟶	SQ	10.436	0.140	9.327	<0.0001	2.327
H 5	SR ⟶	SQ	2.740	0.089	13.677	<0.0001	3.546
H 6	SF ⟶	SQ	8.190	0.255	24.325	<0.0001	9.827
H 7	AS ⟶	SQ	4.883	0.175	9.904	<0.0001	7.811
H 8	SQ ⟶	CS	1.000	0.619	11.926	<0.0001	0.623
H 9	CS ⟶	CL	1.623	0.465	9.229	<0.0001	0.198
H 10	SQ ⟶	CL	1.623	0.152	3.060	<0.002	0.021

4.15 Mediating Analysis

PLS models assume that exogenous constructs directly affect the endogenous constructs without any systematic influence of other variables. However, sometimes this assumption does not hold owing to the presence of mediation among the variables. Mediation occurs when a third variable, referred to as a mediator variable, intervenes between two other related constructs. Hair et al. (2017) suggested that the first step in the mediation analysis is to evaluate the significance of the direct effect of the exogenous variable on the endogenous variable in absence of the mediator variable. If the path is significant, then the significance of the indirect effect should be assessed by including the mediator variable in the PLS path model. Finally, the variance accounted for (VAF) is calculated by using the following formula:

VAF = Indirect effect / Total effect

Based on the value of VAF, Hair et al. (2013) made the following suggestions to check the mediation effect:

(i) if $0 < VAF < 0.20$, then there is no mediation

(ii) if $0.20 < VAF < 0.80$, then there is partial mediation

(iii) if $VAF > 0.80$, then there is full mediation

In this paper, mediation analysis was carried out to estimate the magnitude of the indirect effect of mediating variable SQ on customer loyalty in the relationship between exogenous variable and endogenous variable.

Table 4.10   Mediation tests using PLS

	Indirect Effect	95% confidence interval for the indirect effect	t- value	p<0.05	Total Effect	95% confidence interval for the indirect effect	t- value	p<0.05
SQ➔CL	0.2821	(0.217 to 0.371)	7.135	p<= 0.000	0.440	(0.369 to 0.514)	11.432	p<= 0.000

VAF = 0.2821 / 0.440 = 0.641

Final VAF = 0.641

There is partial mediation between SQ to customer loyalty and SQ to customer satisfaction and further customer loyalty. So, there is bootstrapping in the results for the relationship among the

three constructs. Thus, we can conclude that customer loaylty partially mediates the relationship between SQ and customer satisfaction.

4.16 Conclusion

This research sought to examine the literature on SQ measurement scales for after-sales service of the passenger car segment in India. The AutoIND SQ measurement pilot scale that has been developed for Indian passenger after-sales car segment has 37 items and seven dimensions. The dimensions are: Tangible, Reliability, Responsiveness, Empathy, Assurance, Service failure, and Service recovery. It is hoped that the scale will enhance SQ and customer satisfaction. The data was collected through an interview schedule and questionnaire survey comprising 306 information-rich and willing respondents. The feedback was taken from customers approaching authorized service stations, employees working at these stations as sales advisors, service advisors, and technical advisors, and manager-level officers all over India. Some of the distinctive benefits of the scale are as follows:

(1) The proposed measurement scale fills in the gap that exists in measurement of SQ in Indian settings for passenger car segment. This study brings out useful seven determinants to measure SQ and includes aspects of service failure and service recovery.

(2) The conceptual research framework highlights the importance of feedback taken from the customer after the completion of her interaction with the service station that can be for a scheduled maintenance task, corrective task, or service recovery. This feedback helps in: instilling confidence in customer; identification of gaps in existing procedures; and a revision of processes to avoid service failure. This scale can be enlarged to take care of other segments of the automobile industry.

4.17 Limitations and scope for future studies

The research's findings are based on lesser geographical area and sample size on which pilot scale has been developed. This can be extended to all parts of country to get more realistic results. As a next step, 42 companies in the passenger car segment in India need to be covered, besides visiting authorized stations across various parts of the country. The scale of this exercise will involve adapting the research tools to various companies and gaining insights to improve SQ. This research has been carried out for the passenger car segment of India's automobile industry. The framework and findings of this research present a platform for future researchers to study the commercial vehicle and two wheeler segments of the Indian automobile industry. New variables and dimensions, apart from those identified in the research, can be used to gather more insightful findings. In the future, a similar study that gauges the changes in perceptions of the owners of passenger cars owners over time can also be conducted.

Chapter No. 5
Service Failure Prediction in Vehicle Servicing Using Bayesian Network

5.1 Introduction

Predicting the future has fascinated people since ages. Millions of people in the roles of astrologer, meteorologist, politician, pollster, stock analyst, doctor, computer scientist, and engineers work on prediction on a daily basis since the future obviously matters to all of us. We need some degree of foresight if we are to make effective plans for managing our affair and services. With the advent of industrial revolution 4.0 manufacturing and service industry are focusing on interconnectivity, automation, machine learning and real-time data. These requirements can be met by radical advances based on integration of both the business and manufacturing processes, as well as integration of all actors in the company's value chain including suppliers and customers. Service sector includes IT, financial services, hospitality, logistics, maintenance services, and so on. The service sector contributes 50% of Gross Value Added (GVA) growth in Indian economy (Economic Survey 2021-2022). The mammoth size of the service sector's contribution is because of the interface it has with the consumers; its significance in the Indian economy has continued to increase and this has led to increased interest for research by academic community.

Product, process, and service design can be largely improved using modern modeling, simulation and optimization techniques. In practical applications performance of process and product design is often measured with respect to multiple objectives. These objectives are sometimes conflicting, that is, achieving the optimal value for one objective requires some compromise on one or more than one of other objectives. Every process is undertaken with an aim of multiple optimization of system that differs in scope and planning parameters. Despite advanced planning and execution systems, service providers tend to provide service levels that are below their targets. Hence, it is desired to predict mismatch in service design in advance to avoid service failure. These service failures can cost customer satisfaction and further impact loyalty (Okeiyi, 2022). Studies by Mostert et al. (2009) and Mathew (2021) on airlines showed that people who experienced service failure and were not compensated in some way either travelled less with the airline (42.1%) or had never flown with the same airline operator again (14.1%). Therefore, it becomes extremely important to identify the parameters that can predict service failure occurrence in advance. Service failure arises when the company fails to meet customer expectations and service recovery strategies are described as actions the companies undertaken to overcome these incident (Dong, Evans, & Zou, 2008; Hazee, Vaerenbergh, & Armirotto, 2017; Baliga et al., 2021). Most services marketing literature aims to close the gap

between the two, suggesting that a successful failure recovery strategy determines consumer satisfaction and the marketer success (Gu & Ye, 2014; Roy et al., 2022). This gives the management insight of what strategies require change and relook.

According to Society of Indian Automobile Manufacturers, approximately 2,773,575 passengers and 717,688 commercial vehicles were sold in India in 2019-2020. These large numbers of vehicles on road highlight the importance of service industry towards vehicle maintenance and servicing. These service stations can be authorized company franchised stations or other non-authorized private owned service stations. The latter are usually in an informal space and exhibit non-adherence to company procedures; hence, they are a bit difficult to analyze. Our study focuses on the prediction of service failure for vehicle servicing done by authorized company four-wheeler service station.

In this chapter, network learning is used for building predictive Bayesian model. The BN is a machine learning method which predicts and describes classification based on the Bayes theorem (Friedman, et al 1997, Asadayoobi et. al 2022). The BN provides interpretable classification by logic inherent in a decision support. The parameter and their dependences with conditional probabilities of the BN can be provided either by expert's knowledge or by automatic learning from data. In this chapter we present a system that uses Bayesian learning to identify the process conditions which are combinations of events, deviations, or insufficient systems configurations which may lead to service level failures. To increase confidence in the results achieved, the study also aims to explain results by identifying their underlying causes and providing the context of potential fixes. Failure prediction is frequently confused with root cause analysis. Having observed some misbehavior in a running system, root causes analysis tries to identify the fault that caused it, while failure prediction tries to assess the risk that the misbehavior will result in future failure, as depicted in Figure 5.1. This chapter focuses primarily on failure prediction.
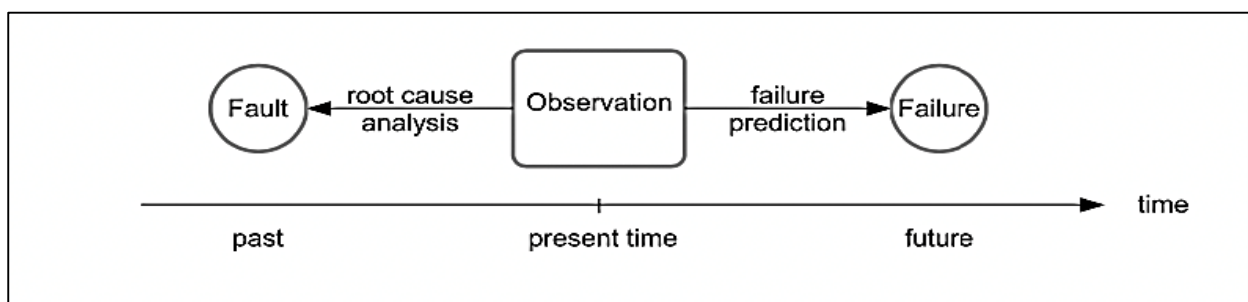

Fig 5.1 : Difference in Root Cause Analysis and Failure Prediction

In this chapter two research questions will be answered and explored:

R1.   What factors affect the occurrence of service failure in vehicle servicing?

R2.   By what magnitude do these factors affect service failure?

Further sections of the chapter are outlined, with the second section pertaining to extant research in the field and identification of the models developed for both business processes and service failures. The third section provides details on the research methodology employed. The fourth section provides details on model development. The fifth section outlines the analysis part and discussion on the model findings. The sixth section outlays the findings and then last seventh section exhibits the research findings with future scope of research.

5.2   Literature Review

A service failure (Chaung, 2007; Wang et al. 2022) occurs when customers' expectations are not met or service performance falls below a customer's expectation. It includes situations when the service fails to live up to the customer's expectations. Similar to SQ and satisfaction, customer perception is a major factor that determines whether a service failure occurred even if the company has the best strategic plans and the tightest quality control procedures. Service failure is essentially a flawed outcome that reflects a breakdown in reliability. It generally encompasses any problematic situation during service while service is delivered to a customer, causing significant damage to customer satisfaction.

Service failure is also defined from expectation perception gap perspective and this concept is applicable to manufacturing and service units. Based on this concept, the service failure occurs when the consumers are dissatisfied with the service delivery system or in other words when performance and quality of product falls below their expectations (Lewis and Spyrakopoulas (2001) and Moorhouse et al. (2016) have described service failure as real or perceived breakdown of the service in terms of either outcome or process. Miller et al. (2000) and Peinkofer (2022) contemplated that the high level of human involvement between providers and consumers in conjunction with continuously varying consumer's perception makes service failure inevitable while delivering services; this, subsequently, makes the service delivery process more complex. In today's hyper-competitive business environment, repeat customers are vital for success. Service failures have the potential to destroy customer loyalty.

5.2.1   Service Delivery

Murray & Frenk (2000) and Bahadori et.al (2018) defined service delivery as "the combination of inputs into a production process that takes place in a particular organizational setting and that leads to the delivery of a series of interventions." Service delivery is the platform where customers encounter services, interact with employees, and evaluate quality of services.

Any deficiency in service delivery results in service failure situations. Successful service organization should be synonymous with delivering excellent service. Designing service delivery system should mainly focus on what creates value to the core organization and how it engages frontline employees to deliver the ultimate customer experience.

5.2.2   Service Failure

Service failure is defined as service performance that falls below the expectations of customer (Hoffman & Bateson, 1997; Sands et al. 2020). Services are likely to have errors. These failures are due to labour intensive nature of services which leads to heterogeneous outcomes than the outcomes from manufacturing (Berry, 1980; Sands et al., 2020). The cost of Service Failures is directly proportional to customer dissatisfaction, switching to competitor, negative word-of-mouth, and negative image (Johnston et al., 1997; Jones, 2022).

5.2.3   Faults, Errors and Failures

Several attempts were made towards definition of faults, errors, and failures. Avizienis et al. (2004) and Amin et al. (2022) seemed to have been broadly accepted the definitions which have been used here, with some additional extensions and interpretations. Failure is an event that occurs when the service delivered deviates from the correct one. The focus point here is that a failure refers to misbehavior that can be observed by the user. Things may go wrong inside the system, but till the point it does not result in wrong output or no further output, there is no failure. The situation when "things go wrong" in the system can be considered as one wherein the system's state deviates from the correct state, which is called an error. Hence, "an error is the part of the total state of the system that may lead to its subsequent service failure." Finally, faults are the adjudged or hypothesized cause of an error or the root cause of an error. In most cases, faults remain inactive for some time and after becoming active, they cause an incorrect system state which results in an error.

The definition of an error means that the activation of a fault leads to an incorrect state. However, this does not mean that the system knows about it. In addition to the definitions given by Avizienis et al. 2004, we determine that there exist both undetected and detected errors. An error remains undetected until an error detector identifies the incorrect state. Besides causing a failure, undetected or detected errors can cause out-of-norm behavior of system parameters as a side effect. This out-of-norm behavior is called symptom. So, in other words, a fault is the adjudged or hypothesized reason for an error. An error is the deviation of the system from its desired state. Finally, failure happens when the system is not able to deliver its output as it is supposed to, leading to an outcome which is not desirable.
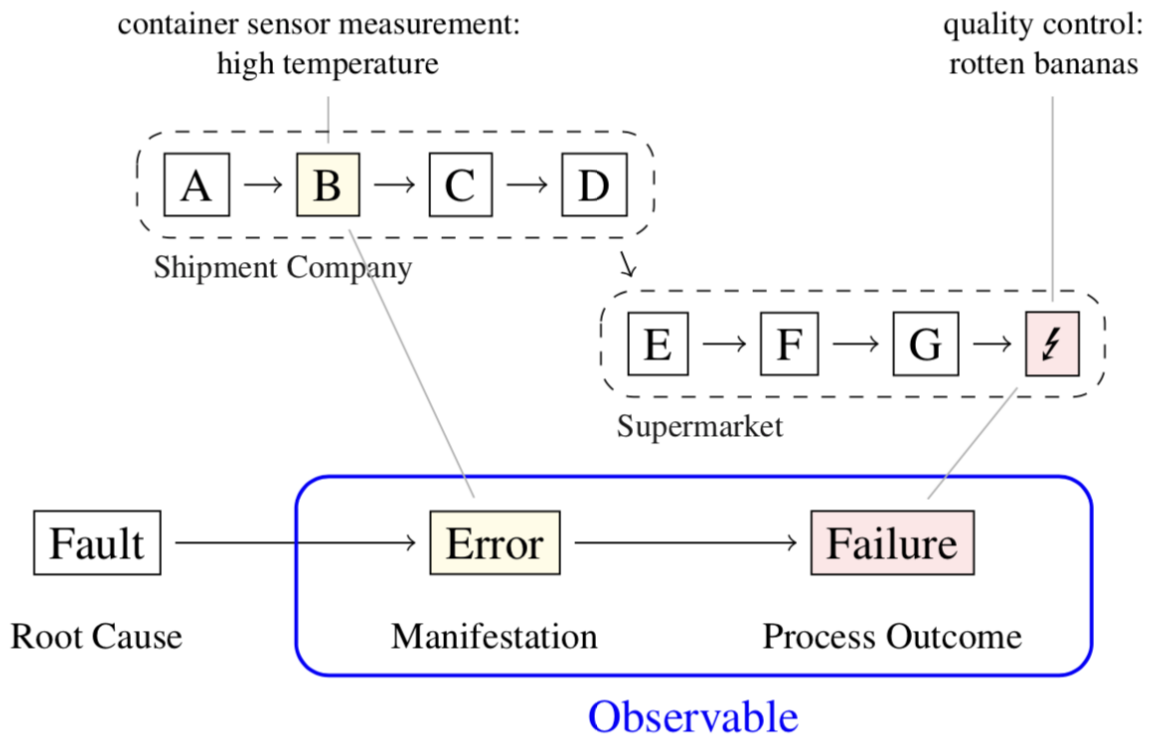
Figure 5.2   Example of Faults, Errors and Failures as Part of a Process.

In the above figure, the difference between fault, error and failure in a process is clearly depicted with an analogy of shipment of bananas to a supermarket store in a temperature-controlled container (Borkowski et al., 2017). The high temperature in container will lead to the rotting of bananas. Here, high temperature is an error which can be observed by the operator. So, the reason for this error is a fault, which is outside of the observable system. Further, this fault leads to an error which will eventually lead to rotten bananas, resulting in a failure. Machine learning (ML) techniques can predict failures by using errors as inputs, but faults will have to be determined by logic and investigation.

5.3   Recent Studies

Recent advances in ML and availability of data from various platforms have inaugurated a stream of research combining both ML and supply chains. Many papers have explored the domain of supply chain failure prediction. Melcancon et al. (2021) did a failure prediction on service level failures in Michelin Europe. The study used an ML technique to establish relationship between features and failures; further, it proposed the importance of reducing the silos in supply chain management. Similarly, Sharma et al. (2018) did a service failure prediction on a supply chain network and showcased the importance of time window size, slack, and

geographical location of the customer to prevent service failures. Prakash et al. (2018) studied the supply chain risks caused by the growing exposure to disruptions in supply chains to manage risks proactively in the automobile industry. Some papers explore disruptions' impact on the supply chain and how risk propagates (Simchi-Levi et al.; 2015, Garvey et al., 2015), while other papers are more focused on how to react and mitigate its impact, as in the case of improving last-mile public service delivery for beneficiaries such as farmers owing to the COVID pandemic (Murlidharan et al., 2022).

Abu Samah et al. (2015) used the BN learning for predicting failure to prevent failure occurrences and maintenance cost of equipment in semiconductor manufacturing. It identified predictors and applied different supervised learning algorithms to find the structure of network equipment degradation physical models and ML methods. The algorithm which gave a structure with lowest Maximum Descriptive Length (MDL) was used and, then, the maximum likelihood of Conditional Probability Table (CPT) for different fails was calculated. A similar process was adopted by Park et al. (2018) and Kyrimi et al. (2021) for predicting post-stroke outcomes with available risk factors. Improving last-mile public service delivery with beneficiaries for farmer owing to COVID pandemic (Murlidharan et al., 2022). The BN classifiers were trained with a hill climbing search for the qualified network structure and parameters were measured by MDL for parameter estimation in prediction.

No study has been undertaken in the field of failure prediction after vehicle servicing for the after-sales industry. This is attributable to challenges in obtaining of realistic data, given the complexity of vehicle service processes and nature of post-service level failures. The authorized dealers are not properly maintaining the database for service failure; the failure events are not formally recorded by service stations.

5.4 Research Methodology

Below is the brief of the methodology followed in this research paper. Firstly, Bayesian methodology is described in brief and a further subsection explains the structural learning and parametric modelling towards model development. Below is the brief flowchart of the stages involved in this study.
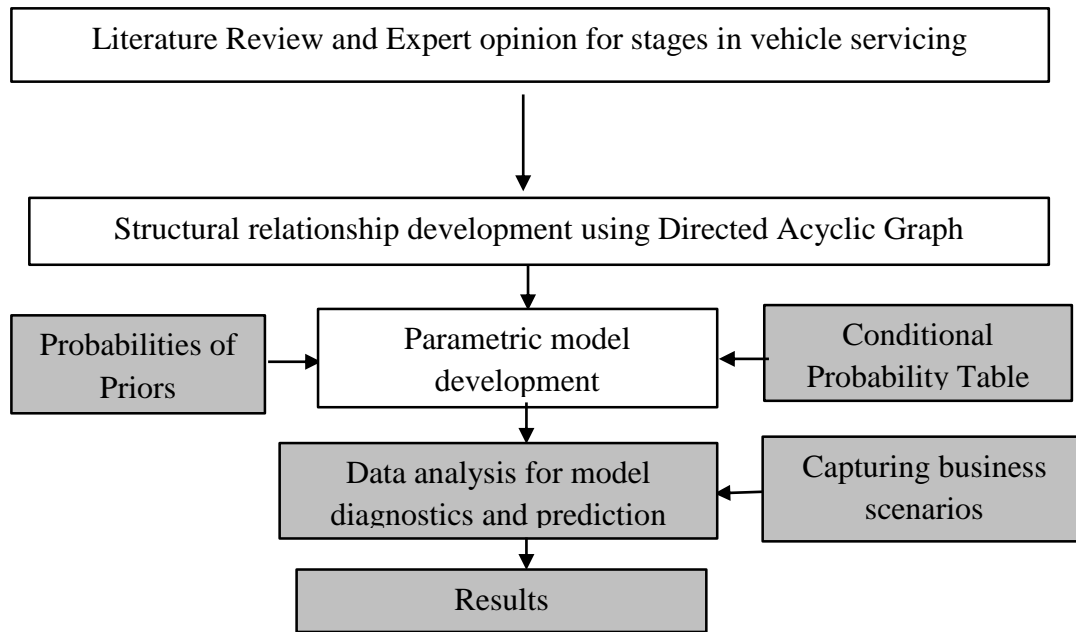
Figure 5.3 Process Map for study

5.5 Bayesian Network

A BN is a directed acyclic graph which represents uncertain knowledge by describing relationships and influences among variables (Pearl, 1988; Stallman et al., 2021). Bayesian networks are based on Bayes Theorem which states that:

$$P(A_i|B) = \frac{P(B|A_i)P(A_i)}{\sum_{j=1}^{n}P(B|A_j)P(A_j)}$$

where **P(Ai / B)** represents the posterior probability, that is, the probability of a hypothesis Ai after considering the effects of evidence **B**. It represents the general idea that a person's belief in an event **Ai** will depend on the body of knowledge **B** or its belief measure. **P(Ai)** represents probability of **A**, the probability of a hypothesis before evidence is seen.

Moreover, because of graphical representation consisting of nodes and edges, a BN can be understood much more easily than many other techniques. So, a BN is mostly used for solving system modelling problems in a variety of fields owing to its advantages. BN modelling process usually has two parts: first, learning the BN structure which is represented with nodes and edges, and second, estimating the BN parameters which specify the Conditional Probability Distributions of the BN.

5.5.1 Structural Learning

Structural learning involves the learning of BN. This can be done by taking opinions form experts and forming a manual network or through various supervised and unsupervised learning algorithms. In the case of failure prediction, supervised learning algorithms can be used as target node. Various BNs obtained through these algorithms can be compared against their quality using score-based methods, namely Bayesian information criterion (Schwarz G, 1978;) Bayesian Dirichlet equivalence score (Heckerman et al., 1995), Akaike information criterion (AIC) (Vrieze, 2012) and MDL scores (Drugan et al., 2010).

5.5.2 Parameter estimation

In a BN, parameter learning is used to find the P to maximize objective likelihood function $(P \mid X, A, D)$ when the best network structure (X, A) is learned from the dataset D. The calculation of P is a parameter estimation problem in statistics and is usually solved by the maximum likelihood estimation (MLE) method.

In the MLE-based BN parameter learning method, the conditional probability distributions of nodes is given by counting the state distributions of each node under every state combination of all its father nodes from the dataset; the MLE method can find the best probability distributions $P*$ for all nodes.

5.6 Data Collection

Data for vehicular servicing failure prediction for passenger's cars was not available in a standard database and had to be obtained through survey of customer and service stations. Owing to the lockdown induced by the COVID-19 pandemic, the data collection was done with eight experts of dedicated original equipment manufacturer authorized service stations and also random simulation was undertaken to obtain workable database. A questionnaire was made to get data on all possible factors that influenced service delivery and the questions are listed in Appendix A. These questionnaires were sent to around eight experts of particular original equipment manufacturer service stations as our source data.

5.7 Proposed Model

"Data is the new oil," this is the famous saying that signifies how important the data is in the new era of data analysis. By using appropriate data, we can calculate the conditional probabilities and fit a model that can give us insights about the possibility of failures arising from these factors. Berry et al. (1990 & 2000) finds that whenever a customer experiences a problem his confidence, trust and risk taking with respect to the provider reduces. The response of provider after the failure decides whether the customer could be physically, as well as mentally retained or not. It is possible that unsatisfied customer may be still giving the business but owing

to the grudge holding, may switch off whenever she gets a chance. The service failure in vehicle repairing results in dissatisfaction of customers. These dissatisfactions can be classified into four categories.

Table 5.1 Type of service failures considered

Type of Failure	Description
Repeat of Vehicle Breakdown	The servicing done was not up to the technical standard as the problem persisted or reappeared within a week
Cost Overrun	The cost estimate given while dropping the car was very different from the actual cost. Whenever the actual cost is higher by 10% than the estimated one, it is registered as a service failure
Not returned on time	The car was not available at the time promised to the customer. Any delay felt by customer is registered as a cost failure
Behaviour Issue	Any kind of rudeness or insensitivity faced by costumer is mentioned as a service failure

The different reasons that can cause the various types of failures identified are listed below in table 5.2. These are drawn from logical deduction and through industry experts.

Table 5.2   Possible Reasons for Service Failure

Type of Service Failure	Possible Reasons
Repeat Breakdown	• Insufficient mechanics allotted • Faulty car model • Inexpertise of station in a particular type of job • Mileage of car
Cost Overrun	• Wrong estimates given for a particular range of costs • Wrong estimate for a particular type of job being given
Not returned on time	• Number of bookings on that day • Number of mechanics allotted

Type of Service Failure	Possible Reasons
Behaviour Issue	• Cost estimates • Number of bookings • Individual mechanic involved

The variables which can be derived from these failure and reasons are listed in Table 5.3 below. The study did not consider factors, such as the dynamics of a particular mechanic's effect on job quality and behavior issues because that would make our model more person/individual specific.

Table 5.3 Factors derived out of reasons discussed and their units

Factor	Unit
Number of mechanics allotted	Numerical Value
Car Model	Car A/B/C/D
Cost Estimate	In Rupees
Number of Bookings	Numerical value
Mileage of Car	In Km
Type of Job (Difficulty)	• Cleaning and Polishing • Battery maintenance and charging • Minor electrical faults with replacement of bulbs • Denting and Painting / Regular Maintenance • Light repairs to sub-assemblies, minor lighting defects, upholstery work, seat repair • Medium repair: e.g., clutch repair, brake change • Heavy repair: e.g., gearbox change, engine repairing, differential repair, • Accidented vehicles that requires extensive repairs with refurbishment of the vehicle

5.8   Relationship

The interconnection between these variables and their relationship with our target node, service failure, will make up the structure of the BN. Table 5.4 below explains the relationship of each variable to service failure:

Table 5.4 Relationships of the variables with each other

Variable	Relationship
Car Model	Autonomous
Type of Job (Difficulty)	Autonomous
Number of Bookings	Autonomous
Mileage of Car	Autonomous
Number of mechanics allotted	Depends upon the type of job (e.g,. cleaning of car would require fewer number of people)
Cost Estimate	Would depend on the type of serving required and also on the model of car e.g., a high-end car would cost more to be serviced owing to expensive spare parts and a gear box change would be more expensive than cleaning for a given car

Autonomous variables are the one which are independent of any other variable. These are controlled by factors that are out of our model. While variables like cost estimates and number of mechanics allowed are affected by other variables of the model itself. A cyclic graph made out of these factors is our BN, which is shown below (Fig 5.4).

Figure 5.4 Relationship of variables with each other
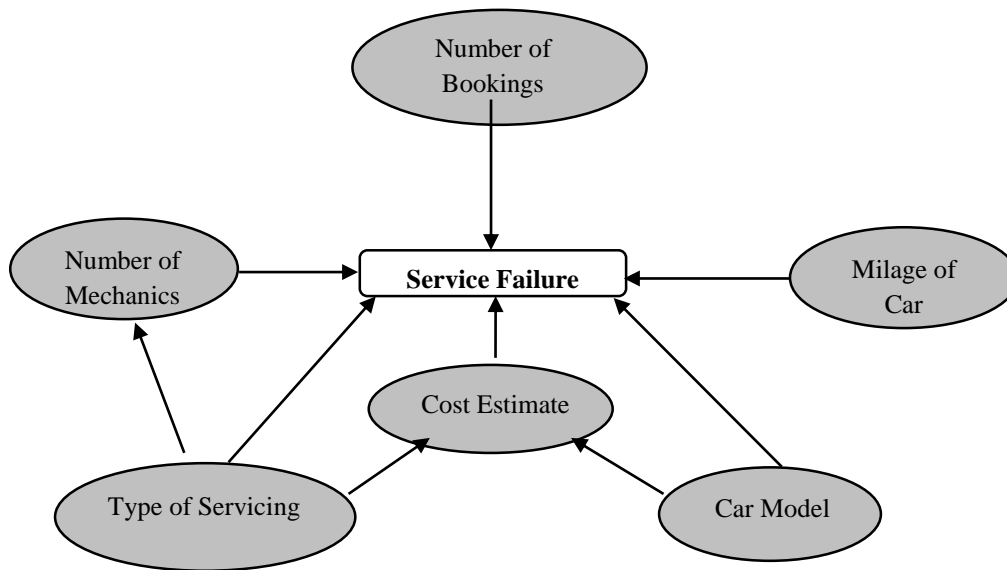
5.9   Data Analysis

The B **Figure 5.4 Relationship of variables with each other** Various structural relationships can be tried out and ranked according to the score-based approach. The continuous variables are discretized for getting different states. Parameter estimation is done once the structured is finalized. Parameter estimations give us the posterior probabilities for each of the variables. Hence, we can learn how different states of each variable affect the target node of service failure. Below is an image of how the overall analysis of target state looks in BayesiaLab like once parameter estimation is performed Fig 5.5

Figure 5.5   Screenshot of BayesiaLab for Overall Target analysis

Overall Precision: 95.8944%   Mean Precision: 90.9727%
Overall Reliability: 96.2709%   Mean Reliability: 85.6933%
Gini Index: 8.5952%   Relative Gini Index: 97.6983%
Lift Index: 1.0909   Relative Lift Index: 99.8980%
ROC Index: 98.8505%
Calibration Index: 78.1530%
Binary Log-Loss: 0.0664
R: 0.8425   RMSE: 0.1526
R2: 0.7097   NRMSE: 15.2608%
Acceptance Threshold: Maximum Likelihood
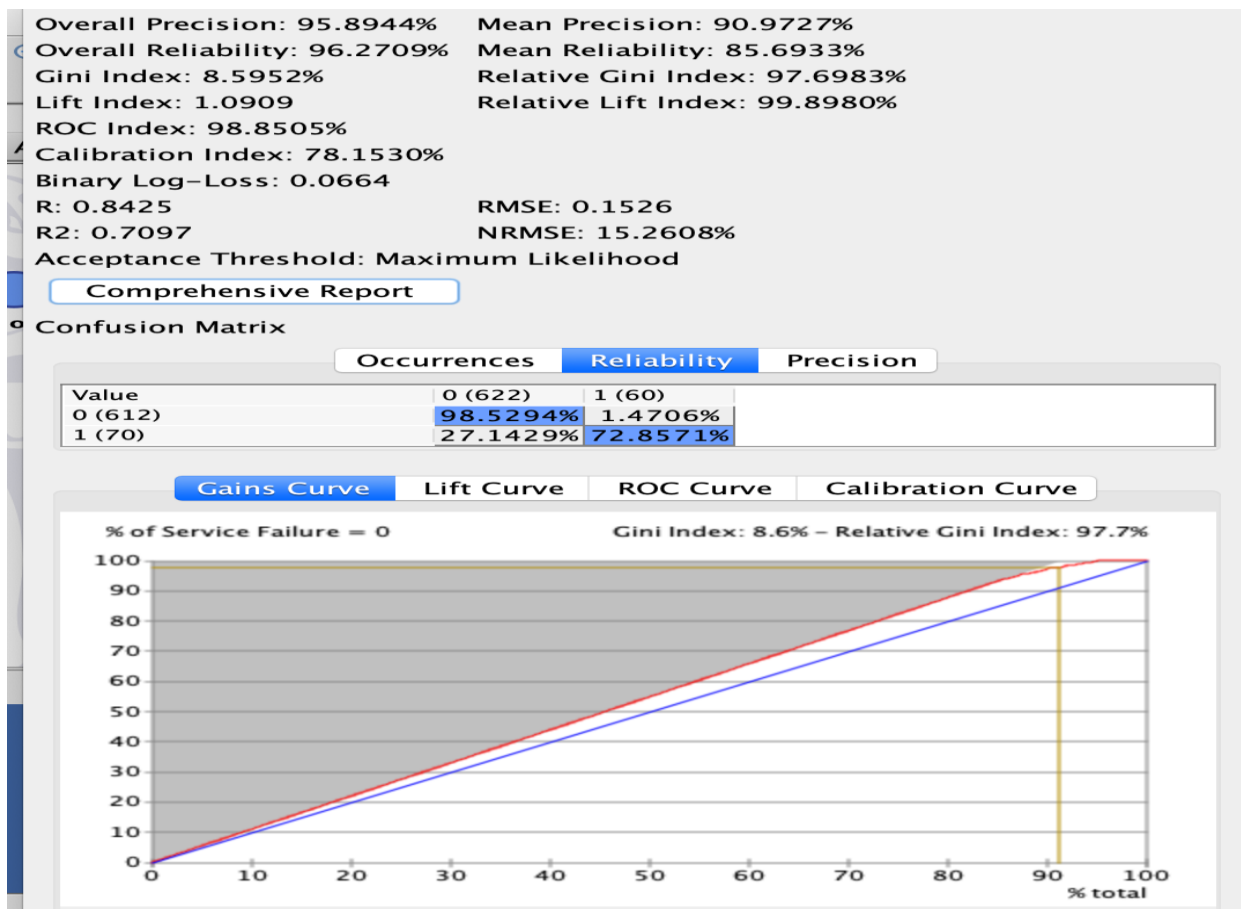
Table 5.5 Overall analysis of Bayesian Network

Target: Service Failure	
ValueÂ	0
Gini Index	8.5952%
Relative Gini Index	97.6983%
Lift Index	1.0909
Relative Lift Index	99.8980%
ROC Index	98.8505%
Calibration Index	78.1530%
Binary Log-Loss	0.0664

The measure undertaken into account for measuring the fit of a model is the Relative Gini index, which appears to be quite appropriate here, with a value above 97%. However, the actual

quality of the model is determined by the precession and reliability of the target state prediction table 5.7

Table 5.7 Additional Overall analysis of Bayesian Network

Statistics	
R	0.8425
R2	0.7097
RMSE	0.1526
NRMSE	15.2608%

Statistics for Acceptance Threshold: Maximum Likelihood	
Overall Precision	95.8944%
Mean Precision	90.9727%
Overall Reliability	96.2709%
Mean Reliability	85.6933%

Occurrences		
Value	0 (622)	1 (60)
0 (612)	603	9
1 (70)	19	51

Reliability		
Value	0 (622)	1 (60)
0 (612)	98.5294%	1.4706%
1 (70)	27.1429%	72.8571%

Precision		
Value	0 (622)	1 (60)
0 (612)	96.9453%	15.0000%
1 (70)	3.0547%	85.0000%

Reliability: The number of correct predictions divided by the total number of predictions for that state. Our model predicted a total of 70 service failures and out of these 51 turned out to be actual service failures, whereas 19 were false alarms.

Precision: The number of correct predictions divided by actual occurrence of that state. There were a total of 60 service failure cases in our dataset and our model was able to predict 51 of them, that is, it had a precision rate of 85%.

Sensitivity: It gives a measure of how the change in different factors affects the target state probability. Tornado diagrams are an effective way of measuring this. Below is a tornado diagram which shows that the top three factors affecting service failure are Car model, Number of Mechanics and Number of bookings
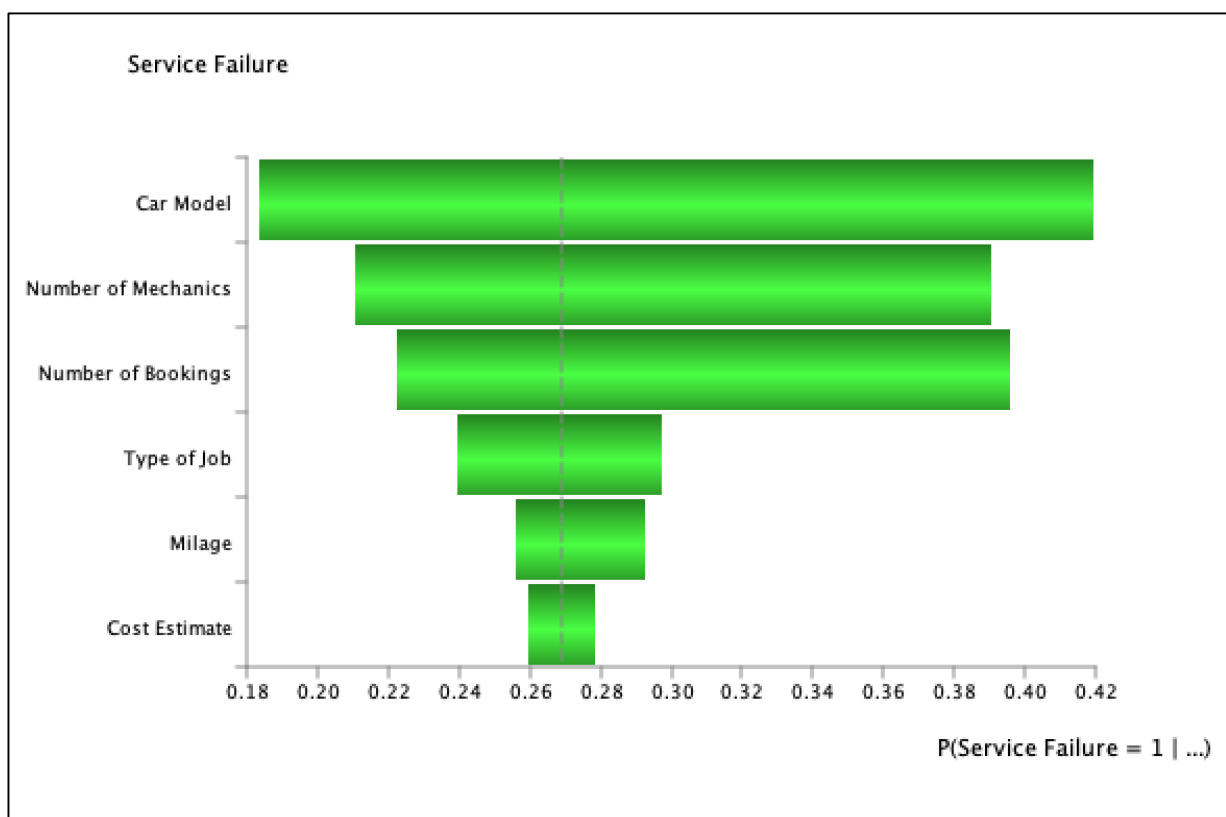
Figure 5.6   Tornado Diagram

To find out how the exact states of various variables affect our target state, we check the histogram of the target node's posterior probabilities.
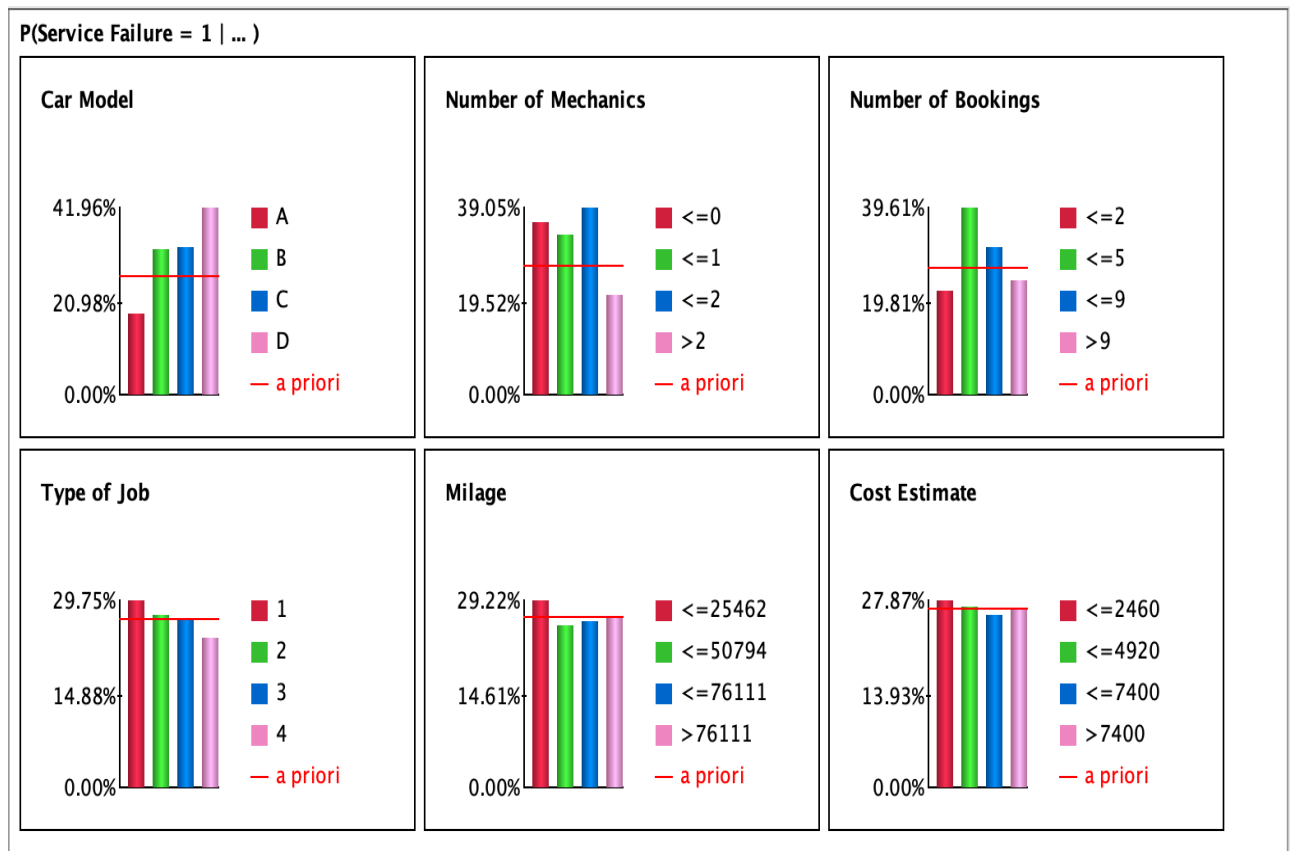
Figure 5.7 Posterior Probability Histogram

From the histogram chart, it is clear that failure rates are exceptionally high for car model D while being lower than average for car model A. Similarly, employing less than 3 mechanics increases the risk of service failure.

5.10 Conclusions and Managerial Inferences

Given the proposed model's fair reliability and precision, it can be used for real time prediction of possible service failures. With real survey data, this model might give exceptional insights into how to make changes in the servicing system for a lower failure rate and, hence, more satisfaction. For example, here we found out that the model D car has high susceptibility to failures. This information can be used to tackle the failure issue; for example, we might allot more mechanics to reduce the probability of failure and opt for extra quality checks for this particular model. This way, the failure rate can be checked without spending excess time and resources by doing extra quality checks on each and every car. This same principle can be applied for analyzing each and every factor if we had real survey data.

The Bayesian model developed is practical and provides an approach for harnessing ML and AI for predictive and prescriptive analytics. The management of the service-providing company can deploy this model in real time, with the real-time data stream coming in, and can get valuable insights about how to change their business ways with change in factors and situations.

5.11 Limitation and future scope of research

The study is done with simulated data because of the difficulty of conducting a survey during pandemic restrictions; so, as soon as the COVID-19 situation normalized, data collection was done with eight experts of dedicated original equipment manufacturers, to give a physical meaning to this study. With the real-life data, a more sophisticated supervised learning algorithm was explored and using constraint and score-based ways we could decide on the structural learning method to be used.

In the study, all the factors taken are technical factors, we have not explored the angle of human interface. Service failure is a customer perception and, hence, the customer reviewing the service also becomes a variable that influences the possibility of service failure. A few customers might have higher quality criteria than others. Similarly, the provision of service delivery is not dealt with. A service failure is ideally followed by an attempt at recovery, in which the service provider tries to provide some sort of compensation. But how, and to what extent, does it work for this industry is an option that has to be explored by another empirical study.

Appendix A

Questionnaire for Customers

1.   What was the issue you went for at the service centres?

2.   Which car do you own?

3.   What is the mileage of your car (in km)?

4.   Which day did you give your car for servicing?

5.   Was the vehicle returned to you within the stipulated time?

6.   Was the actual cost incurred you was similar to the cost estimate given to you?

7.   What was the cost of service done?

8.   Was the issue fully resolved/ Did you face another breakdown after the vehicle was returned to you?

9.   Was the staff behavior up to your expectations?

Questionnaire for Service centres

10.   How many mechanics were present at the service centres on that given day?

11.   How many bookings did you have on the given day?

Chapter No. 6

Identification and Modeling of Factors Influencing Service Recovery

6.1. Introduction

Service recovery is defined as actions that service providers take in response to service defections or failures in service delivery to return aggrieved customers to a state of satisfaction by addressing customers' problems (Grönroos, 1988; Jones, 2022). Service recovery embraces a much broader set of activities than complaint management, which focuses on customer complaints triggered by service failures (Smith et al., 1999; Mafael, 2022).

The supply chain is a web of interconnected organizations, operations, capital, resources, people, and data that transform natural resources and raw materials into a finished product for distribution to the end user. The main function of supply chain management is to improve the products or service's competitiveness (Parkhi et al., 2015; Rahmanzadeh, 2022). It is important to note that anorganization could also be involved in several supply chains; for example, Walmart is a multinational retail corporation that operates various chains of supercenters that are part of the supply chain for departmental, grocery, clothes, hardware and variety of other items and products. The multiple supply chain phenomenon explains the network nature of several instances of supply chain value integration (McCarthy et al.,2011; Fernández et al., 2019).

The decision-making area in supply chain design includes facility location preparation, customer allocation, and supplier selection. It is important to take into account various associated risks and uncertainties while providing sound decision-based solutions. There are mainly two types of risks that exist in every supply chain; first, operational risk, and second, disruptive risk (Cao et al., 2019). Supply chain networks are established to address the effects of the growing global competition, demanding customers and staff, shrinking product lifecycles, and fair response times. As the dependence of these organizations on networks increases, they expose themselves to the operational risk of their suppliers (Speckman and Davis, 2004; Chhimwal, 2022). This also contributes to the operational risks associated with the supply chain of organizations. Disruptive risks refer to structural disruptions that take place in a supply chain in the form of a ripple effect. This risk has a significant negative effect on both supply chain participants' financial and operational success, as well as the supply chain as a whole. For the abovementioned risks and disruptions, it is observed that organizations go with one of the two methods: either consideration of disruption in the absence of a recovery strategy based on its awareness, or else in conjunction with a recovery strategy. While formulating service recovery measures, organizations should consider various factors and design their supply chains

accordingly. They should also build contingency plans to aid in the service recovery process (Chen et al., 2019). An established service recovery setup helps in increasing customer satisfaction by ensuring that all goods arrive on time at their respective drop-off locations. The other advantages of setting up such processes are reducing losses, avoiding loss of potential customers, enhancing loyalty, and maintaining brand image.

The aim of this study is to identify the various factors that influence service recovery process and classification of these factors into the three categories of people, process, and technology by undertaking exhaustive literature review. Further analysis and review of these factors will be conducted through a survey and establishment of relationship amongst all factors. The DEMETAL approach is used to establish quantitatively the relationship amongst these identified factors and further understanding their cause and effect relationships.

6.2. Factors Influencing Service Recovery

Service recovery has attracted increasing consideration in recent years as a corollary of the premise that service failures are unavoidable but discontented customers are not. Service recovery is the response of a service provider to service failure. Service recovery is a well thought out and planned method of restoring unhappy customer's satisfaction aligned with company service by considering customer satisfaction as the main target (OK et al., 2007; Bae et al., 2021). Service recovery, as opposed to complaint management, focuses on service problems and a company's immediate action. The goal of every service recovery setup is to resolve the pain points of dissatisfied customers even before they face a problem and defect from the service. The frontline employees must operate in a non-conventional and innovative way to resolve customers' issues; further, they should show commitment along with truthfulness to provide excellent services that delight customers (Agnihotri et al., 2021). In their efforts to lay the foundation for a reliable service recovery process, organizations are working on the creation of a resilient supply chain for the future. This involves scaling capabilities, recognizing the resources required, and putting in place the relevant technologies (Kamalahmadi et al., 2022).

The service recovery process consists of a wide range of factors that influence the overall supply chain design and impact the service recovery of a supply chain. The degree of impact of each factor is different, but their consideration is necessary to make the performance of the entire supply chain robust. The factors that have been considered for this study canbe broadly classified into three categories: People related; Process related; and Technology related.
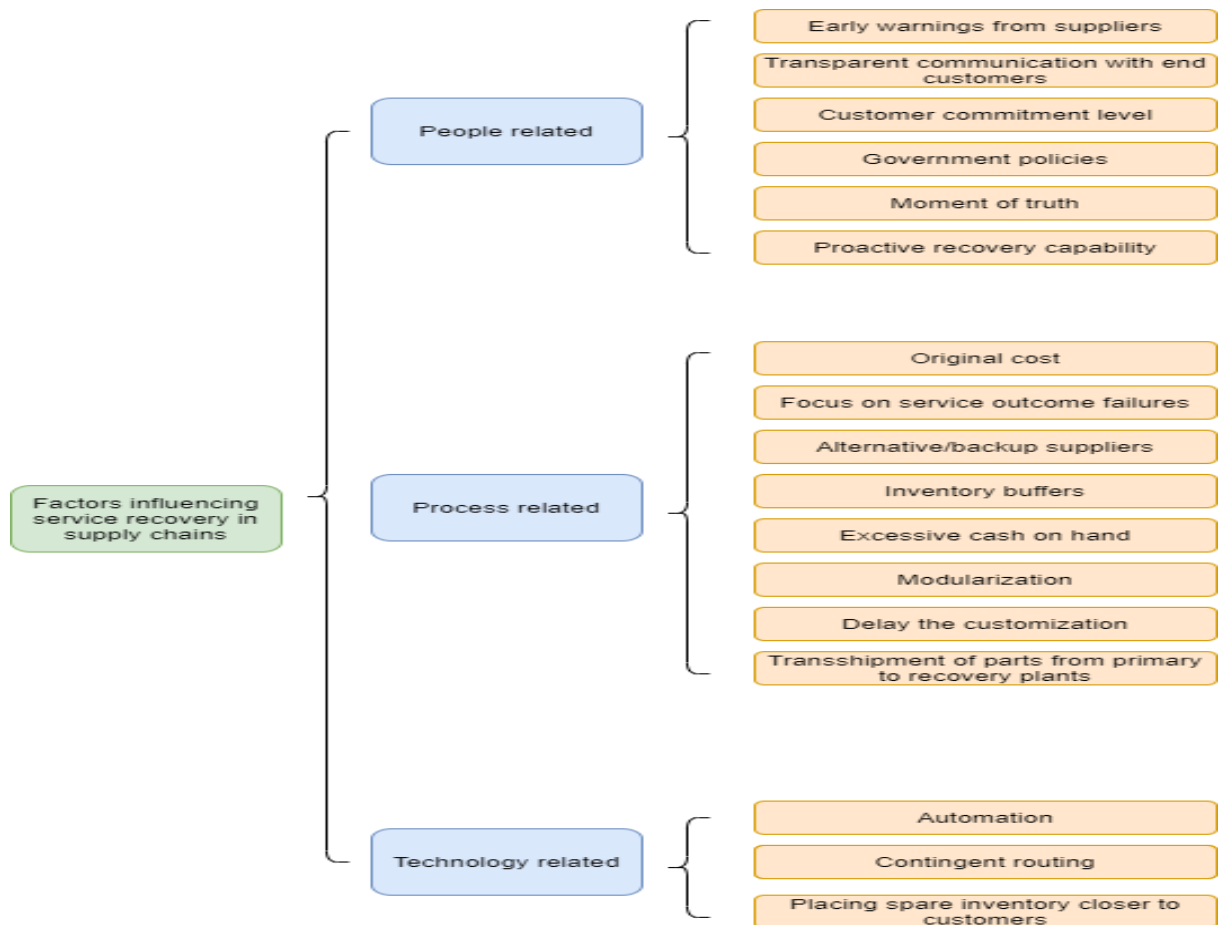
Fig 6.1 Factors Influencing Service Recovery Process

6.3   People Related Factors

People form the backbone of every supply chain. The stakeholder involved at each stage of this supply chain contributes towards the end goal of creating a frictionless supply process to satisfy customers, and thereby, retain them. There are multiple factors driving the service recovery process that depend on the stakeholders, both internal and external. It is necessary for all stakeholders to collectively add value in the recovery process at each step to ensure that the organization's recovery goals and objectives are fulfilled with a successful resolution of customer service dissatisfaction.

6.3.1   Early Warnings from Suppliers

Supplier partnerships are a prominent subject of supply chain analysis and practice right now. The success of a company's supply chain has been correlated with its relationship with suppliers (Shin et al., 2000; Munir et al. 2020). In order to maintain a strong relationship, suppliers should send early warnings to their customers in cases of disruption to prepare them well in advance to setup the recovery process. Early-warning communication at the supplier

stage prepares stakeholders down the chain to come up with effective alternatives/solutions to recover from the emergent disruption (Oloruntoba et al., 2018). When suppliers are able to determine the root cause of a problem and prevent it from happening again, they are deemed effective. When suppliers begin the recovery process before asking who is to be blamed for the loss, their clients are pleased to intimate the cause for failure (Primo et al., 2007; Baliga et al., 2021).

6.3.2 Transparent Communication with End Customers

During both service failure and service recovery, it is always necessary to establish an open and transparent communication system between the company and its customers. The goal of every service recovery setup is to satisfy customer needs and retain them. Hence, all processes should bedesigned keeping customers in mind (Primo et al., 2007; Van Vaerenbergh et al., 2019). It is crucial to set up communication modes with fast information travel speed, keeping in mind the end customers' preferences. Effective and transparent communication channels have a direct impact on key variables, such as customer fulfillment, loyalty and behavior (Shapiro et al., 2006 ; Vaerenbergh et al., 2019).

6.3.3 Customer Commitment Level

When a loss occurs, customers who have positive view of SQ increase their recovery goals, thus reducing the probability of a full recovery. In order to counteract the negative effects of these expectations, organizations need to develop a very high level of customer commitment, showing their dedication for customers' success and empathy towards their problems (Fullerton, 2014; Jang, 2021). Customer service recovery preferences are directly influenced bySQ and organization commitment levels, while customer satisfaction has an indirect influence.

6.3.4 Government Policies

Governments plays a key role in strategizing recovery options in times of severe disaster. A critical role is played by them in organizing and mainstreaming risk mitigation policies in order to achieve long-term supply chain disaster resilience. A government should always be driven to create policy instruments that focus on enhancing recovery before disasters occur, rather than promoting recovery after disasters (Linghe and Abe, 2012; Davis and Alexander, 2019).

6.3.5 Moment of Truth

Customers evaluate company services at two stages—first, during the first interaction, and second, after using the service. A single well-defined interaction between a customer and a service provider is the subject of the "moment of reality." At the frontline level of service delivery, customer evaluations of service performance in relation to service expectations are referred to as encountersatisfaction. The value of creating service recovery is extremely high in

encounter satisfaction cases where service failures have occurred (Brown et al., 1996; Vaerenbergh et al., 2019). To increase customer loyalty, companies can also offer a compensation policy to them for waiting periods during disruptions.

6.3.6 Proactive Recovery Capability

Mitigation/recovery capabilities reduce the severity of impact of disruptions. Recovery capability is characterized as the capacity to bring back a supply chain to its normal state and expected product flow through various interactions between entities and corresponding coordination of the resources in a supply chain (Santos Vijande et al., 2013; 2021). Recovery capability of any organization should always be proactive in nature rather than reactive. They should always act towards disruptions before their occurrence and not after they have occurred (Braunscheidel et al., 2009; Baz et al., 2021).

6.4 Process Related Factors

A supply chain consists of multiple processes that contribute towards achieving the end goal of goods reaching their respective destinations in the required time. Disruption at any one of the stages may cause problems in the goods reaching their destinations on time. Optimization of various processes and stages in a supply chain are essential to set up service recovery. These factors occur at any one stage in the chain process and have a great influence on the overall customer satisfaction and other organizational goals.

6.4.1 Original Cost

In cases of disruption, service recovery is the only way for companies to minimize the costs of customer desertion and negative publicity. The cost of losing customers is very high owing to the high customer acquisition cost paid by companies to increase their base. The cost of recruiting new customers can be five times the cost of retaining old ones. Hence, companies need to concentrate all their efforts on the service recovery process to retain their customers at the original cost instead of spending money to attract new ones.

6.4.2 Focus on Service Outcome Failures

In order to recover from disruption, the concentration of suppliers and distributors should always be on service outcome failures rather the process failures (Zhu & Zolkiewski, 2015; Baliga et al, 2021). It is always important for stakeholders to recognize the root cause of the problem and assure the customers that itwould never occur again, instead of just apologizing in order to aid retention as easily as possible. (Primo et al., 2007; Baliga et.al; 2021)

6.4.3 Alternative/Backup Suppliers

Considering transportation and natural disruptions, it becomes necessary for companies to have multiple suppliers in contract as a backup option to keep the inflow of goods. During

supply disruptions, companies can choose to create a buy back contract with their backup suppliers (Hou et al., 2010; Jhang et al., 2021). An assembly order system with multiple backup suppliers can also be created to offer on-time delivery when disruptions occur.

6.4.4 Inventory Buffers

Stocking up inventory in warehouse provides a lot of assistance during a disruption. Owing to trouble at the supplier's end, the delivery of material becomes impossible, thus putting a halt to the production process. Backup inventory is always kept as a reserve for such situations, to fulfill customer demands during low/negligible production cycles (Li et al., 2017; Islam et al., 2020). Inventory can be used in fulfilling demand while figuring out the disruption's root causes in parallel, thus running two simultaneous processes to satisfy all the stakeholders of the company.

6.4.5 Excessive Cash in Hand

It is not always easy to plan for disruptions way ahead of time. Not all factors can contribute towards the end goal of products reaching the customers. Having excess cash in hand can help organizations tackle cash flow problems during periods of disruptions (Lamzaouek et al., 2021). They can also roll out many policy instruments during such events, allowing themselves and their partners to be sustainable and empower them to look for alternate solutions. This excess cash can also be used to purchase products from other company's buffer inventory, if recovery for disruptions was not planned well before (Linghe & Abe, 2012).

6.4.6 Modularization

During times of disruption, the priority of organizations is to decrease the time involved in the entire supply chain process in order to satisfy the needs of their customers. To optimize for time reduction, manufacturers can start working with their suppliers to create modularized parts, thus reducing the complexity and speed of manufacturing (Fadeyi et al., 2017; 2022). These modularized parts can be used in multiple products, saving time and money in the process, which, in turn, creates a positive impact on customer satisfaction and retention (Chen et al., 2020).

6.4.7 Delay the Customization

Focusing on customizable approach during product creation may not work for companies during disruptions owing to the huge weight of customer expectations they need to fulfill. The theoretical increase in lead time needs to be reduced back to the normal lead time. In order to achieve this, they need to compromise on the customization aspect of their products, delaying it for a period of time rather than focus on a modularized approach (Krishna et al., 2011; Shams et.al; 2020).

6.4.8 Trans-shipment of Parts from Primary to Recovery Plants

While considering the actions a company needs to take into account its supply chain after the occurrence of disruptions, recovery supply and the trans-shipment method can serve as solutions. In case a primary production facility is disrupted, a fair distribution management approach is to shift the production to alternative facilities in order to keep operations rolling and commence the recovery process (Sawik, 2020). For example, Intel has duplicated its manufacturing process at several plants in order to be ready for a rapid shift in production in case one of its facilities is destroyed. This phase can commence well before a disturbance occurs or it can begin immediately after one occurs (Sawik, 2020).

6.5 Technology-Related Factors

Technology can be leveraged in the design of supply chain and recovery planning to create an overall robust process. With the implementation of technology, the flow of information through all stages occurs, thereby allowing all stakeholders to keep a track of their goods and products. It can alsobe used for: creating in-house systems; aiding in the re-routing; and locating the right facilities to perform the required activities.

6.5.1 Automation

Data is one of core pillars of any organization in the modern world. It facilitates automation, identification, and controlling the routes of service failures. It ensures that correct steps are taken into consideration while implementing the recovery process, further allowing for a smooth recovery process. It is easy to analyze all the complaints and bottlenecks by having an automated in-house process. (Rejeb et al., 2019)

6.5.2 Contingent Routing

This is a strategy that can be put in place if reliable suppliers can increase theirprocessing capacity and significantly reduce the firm costs in the process. It can only take place when suppliers have huge flexibility at their end. It increases their supplies for a short period of time. During disruptions, in case some suppliers are unable to meetdemand, this can be implemented to ensure that the given number of materials required are received. Having right information systems in place can help in achieving this strategy with accurate and seamless flow of data into a central system to track everything (Tang & Tomlin, 2008; Katsaliaki, 2021).

6.5.3 Placing spare inventory close to customers

Disruptions occur very suddenly and firms need to plan well in advance to mitigate the risks associated with them. Apart from holding excess inventory as buffer and working with multiple suppliers, organizations also choose to place their spare inventory closer to their

customers' location (Kouki & Larsen, 2020). Based on customer data and insights, organizations can develop their own models to understand better the location of their customers and accordingly select a few locations where they wish to place this spare inventory. The model can also be in real time to enable them to be more accurate with their placement strategies.

6.6   Research Methodology

The above section defines the various factors that influence the process of service recovery through supply chains. Out of a total of the 17 factors listed, it is very difficult to rank them in a given order based on their qualitative importance. Also, no quantitative sources were available on theonline platform to rank them. The DEMATEL approach is used in this study to conduct a structured quantitative analysis of the factors affecting supply chain service recovery. These factors were sent across as part of a detailed discussion by researchers with three Original Equipment manufacturers comprising of four expert advisors and managers each from company for survey. The aim of the survey was to understand the influence of one factor on the others listed on an individual basis togather the required data. After receiving the responses, the data was processed through the DEMATEL method to understand the relationship between the most important factors of the service recovery process. The results of this study can be used to prioritize recovery methods in the recovery process.

6.6.1   Data Collection and Calculation

As part of the survey creation process, all the factors listed below have been assigned codes andarranged in the form of a matrix for experts to fill. The factor codes are as in Table 6.1 below.

Table 6.1   Factor Codes

F 1	Communication from suppliers in form of early warnings
F 2	Transparent communication with end customers
F 3	Customer commitment level
F 4	Government policies facilitating business rehabilitation and maintenance
F 5	Moment of Truth
F 6	Proactive recovery capability
F 7	Original cost
F 8	Focus on service outcome failures
F 9	Alternative/Backup suppliers
F 10	Inventory buffers
F 11	Excessive cash on hand in the entire chain
F 12	Modularization

F 13	Delay the customization	
F 14	Trans-shipment of parts from primary to recovery plants	
F 15	Automation	
F 16	Contingent Rerouting	
F 17	Placing spare inventory closer to customers	

In order to make the survey-filling process frictionless, the process was designed to make it similar to the Likert Scale. Experts were given qualitative options to choose from and a quantitative number was assigned to each option for the purpose of analysis. The options given to experts to choose from are shown in Table 6.2 below.

Table 6.2   Linguistic Score

Linguistic Assessment	**Score**
No Influence	0
Extremely Low Influence	1
Low Influence	2
High Influence	3
Extremely High Influence	4

After the data collection process, it was arranged in the form of a 17 x 17 matrix to perform further calculations. The data in the Table 6.3 below is an example of one of the original data sample collected as part of the survey.

Table 6.3 Original Data Example from Survey

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17
F1	0	3	4	1	3	4	3	4	4	4	1	4	3	4	1	1	2
F2	1	0	4	1	4	4	2	3	1	2	1	2	3	2	3	1	1
F3	3	3	0	1	3	3	1	2	3	3	0	1	2	1	3	2	3
F4	1	1	0	0	1	0	3	2	1	0	2	0	0	2	2	0	2
F5	4	3	4	1	0	3	3	4	1	1	2	3	3	1	3	1	3
F6	3	4	4	0	3	0	2	3	3	3	2	3	3	4	3	2	3
F7	1	2	2	2	1	0	0	1	3	3	0	1	1	0	3	2	2
F8	3	4	4	1	4	4	1	0	3	3	1	2	3	3	3	1	3
F9	2	2	3	0	2	3	1	3	0	4	0	3	2	2	1	0	3
F10	3	3	3	2	3	4	3	2	3	0	3	3	3	2	0	0	2
F11	1	0	1	0	0	1	1	1	2	2	0	1	0	1	3	0	2
F12	2	2	3	0	2	3	3	2	1	2	3	0	4	3	3	3	1
F13	2	3	3	0	3	4	2	3	1	2	1	4	0	3	3	3	2
F14	3	2	1	1	2	3	2	2	1	2	1	3	3	0	2	2	2
F15	3	3	3	1	3	4	2	3	2	1	2	2	2	1	0	1	1
F16	2	1	2	0	2	2	1	2	1	1	0	1	1	1	1	0	2
F17	3	2	2	2	2	2	1	2	2	1	0	2	2	1	2	3	0

For each row in the above example, its sum was calculated and then the maximum value out of the given range of sums was noted (original$_{max}$). Using this maximum value, a normalized matrix (Y) was constructed, where a_{ij} (normalized) = a_{ij} (original) / original max. Table 6.4 is the constructed normalized matrix (Y)

Table 6.4   Normalized matrix (Y)

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17
F1	0.0000	0.0652	0.0870	0.0217	0.0652	0.0870	0.0652	0.0870	0.0870	0.0870	0.0217	0.0870	0.0652	0.0870	0.0217	0.0217	0.0435
F2	0.0217	0.0000	0.0870	0.0217	0.0870	0.0870	0.0435	0.0652	0.0217	0.0435	0.0217	0.0435	0.0652	0.0435	0.0652	0.0217	0.0217
F3	0.0652	0.0652	0.0000	0.0217	0.0652	0.0652	0.0217	0.0435	0.0652	0.0652	0.0000	0.0217	0.0435	0.0217	0.0652	0.0435	0.0652
F4	0.0217	0.0217	0.0000	0.0000	0.0217	0.0000	0.0652	0.0435	0.0217	0.0000	0.0435	0.0000	0.0000	0.0435	0.0435	0.0000	0.0435
F5	0.0870	0.0652	0.0870	0.0217	0.0000	0.0652	0.0652	0.0870	0.0217	0.0217	0.0435	0.0652	0.0652	0.0217	0.0652	0.0217	0.0652
F6	0.0652	0.0870	0.0870	0.0000	0.0652	0.0000	0.0435	0.0652	0.0652	0.0652	0.0435	0.0652	0.0652	0.0870	0.0652	0.0435	0.0652
F7	0.0217	0.0435	0.0435	0.0435	0.0217	0.0000	0.0000	0.0217	0.0652	0.0652	0.0000	0.0217	0.0217	0.0000	0.0652	0.0435	0.0435
F8	0.0652	0.0870	0.0870	0.0217	0.0870	0.0870	0.0217	0.0000	0.0652	0.0652	0.0217	0.0435	0.0652	0.0652	0.0652	0.0217	0.0652
F9	0.0435	0.0435	0.0652	0.0000	0.0435	0.0652	0.0217	0.0652	0.0000	0.0870	0.0000	0.0652	0.0435	0.0435	0.0217	0.0000	0.0652
F10	0.0652	0.0652	0.0652	0.0435	0.0652	0.0870	0.0652	0.0435	0.0652	0.0000	0.0652	0.0652	0.0652	0.0435	0.0000	0.0000	0.0435
F11	0.0217	0.0000	0.0217	0.0000	0.0000	0.0217	0.0217	0.0217	0.0435	0.0435	0.0000	0.0217	0.0000	0.0217	0.0652	0.0000	0.0435
F12	0.0435	0.0435	0.0652	0.0000	0.0435	0.0652	0.0652	0.0435	0.0217	0.0435	0.0652	0.0000	0.0870	0.0652	0.0652	0.0652	0.0217
F13	0.0435	0.0652	0.0652	0.0000	0.0652	0.0870	0.0435	0.0652	0.0217	0.0435	0.0217	0.0870	0.0000	0.0652	0.0652	0.0652	0.0435
F14	0.0652	0.0435	0.0217	0.0217	0.0435	0.0652	0.0435	0.0435	0.0217	0.0435	0.0217	0.0652	0.0652	0.0000	0.0435	0.0435	0.0435
F15	0.0652	0.0652	0.0652	0.0217	0.0652	0.0870	0.0435	0.0652	0.0435	0.0217	0.0435	0.0435	0.0435	0.0217	0.0000	0.0217	0.0217
F16	0.0435	0.0217	0.0435	0.0000	0.0435	0.0435	0.0217	0.0435	0.0217	0.0217	0.0000	0.0217	0.0217	0.0217	0.0217	0.0000	0.0435
F17	0.0652	0.0435	0.0435	0.0435	0.0435	0.0435	0.0217	0.0435	0.0435	0.0217	0.0000	0.0435	0.0435	0.0217	0.0435	0.0652	0.0000

The normalized matrix (Y) is subtracted from an identity matrix of size 17 x 17 to create a new matrix P = I – Y. Its inverse is taken, as shown in Table 6.5 below.

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Table 6.5   Inverse of P

In the DEMATEL process, a matrix named Total Relation Matrix (T) and presented in table 6.6

1.2094	0.2839	0.3298	0.0947	0.2813	0.3341	0.2298	0.2973	0.2613	0.2779	0.1275	0.2838	0.2701	0.2587	0.2196	0.1510	0.2291
0.1856	1.1739	0.2748	0.0776	0.2524	0.2770	0.1717	0.2302	0.1603	0.1902	0.1043	0.1967	0.2213	0.1769	0.2178	0.1221	0.1668
0.2204	0.2299	1.1898	0.0773	0.2291	0.2539	0.1485	0.2081	0.1975	0.2070	0.0803	0.1750	0.1976	0.1546	0.2078	0.1372	0.2020
0.0907	0.0938	0.0820	1.0273	0.0925	0.0826	0.1181	0.1132	0.0830	0.0659	0.0757	0.0665	0.0673	0.0974	0.1098	0.0429	0.1044
0.2618	0.2547	0.2981	0.0854	1.1915	0.2804	0.2066	0.2698	0.1801	0.1911	0.1319	0.2347	0.2397	0.1748	0.2362	0.1353	0.2226
0.2641	0.2946	0.3214	0.0721	0.2745	1.2466	0.2030	0.2714	0.2344	0.2493	0.1425	0.2570	0.2619	0.2503	0.2524	0.1669	0.2406
0.1248	0.1505	0.1641	0.0802	0.1309	0.1270	1.0838	0.1297	0.1513	0.1566	0.0528	0.1192	0.1216	0.0856	0.1569	0.1030	0.1338
0.2609	0.2922	0.3178	0.0907	0.2908	0.3226	0.1809	1.2078	0.2308	0.2444	0.1215	0.2340	0.2581	0.2285	0.2484	0.1433	0.2378
0.1928	0.2022	0.2406	0.0543	0.2004	0.2444	0.1417	0.2162	1.1294	0.2210	0.0778	0.2073	0.1925	0.1691	0.1614	0.0945	0.1946
0.2327	0.2438	0.2667	0.1019	0.2410	0.2873	0.2021	0.2214	0.2115	1.1633	0.1498	0.2287	0.2315	0.1891	0.1684	0.1081	0.1974
0.0952	0.0782	0.1072	0.0273	0.0769	0.1099	0.0792	0.0963	0.1066	0.1101	1.0373	0.0916	0.0724	0.0814	0.1288	0.0444	0.1062
0.2038	0.2128	0.2536	0.0567	0.2113	0.2575	0.1915	0.2095	0.1613	0.1925	0.1434	1.1565	0.2398	0.1971	0.2173	0.1640	0.1662
0.2208	0.2506	0.2742	0.0622	0.2494	0.2971	0.1845	0.2462	0.1732	0.2053	0.1122	0.2522	1.1775	0.2114	0.2314	0.1743	0.1989
0.2070	0.1962	0.1959	0.0719	0.1948	0.2379	0.1606	0.1939	0.1467	0.1764	0.0965	0.2036	0.2063	1.1249	0.1800	0.1337	0.1705
0.2176	0.2285	0.2499	0.0750	0.2266	0.2702	0.1672	0.2255	0.1776	0.1687	0.1206	0.1921	0.1958	0.1547	1.1505	0.1170	0.1620
0.1392	0.1246	0.1572	0.0347	0.1435	0.1581	0.0977	0.1422	0.1049	0.1108	0.0478	0.1144	0.1170	0.1024	0.1118	1.0602	0.1280
0.1923	0.1801	0.1977	0.0869	0.1800	0.1999	0.1273	0.1796	0.1536	0.1420	0.0662	0.1672	0.1701	0.1329	0.1645	0.1429	1.1166

is defined. T = Y*inv (I-Y).For the given matrix, we define the average of all its values as the threshold value/alpha. The total relation matrix for the given set of data is shown below, where the values highlighted in bold are greater than the threshold value.

Table 6.6 Total Relation Matrix (T)

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17
F1	0.2094	0.2839	0.3298	0.0946	0.2813	0.334	0.2298	0.2973	0.2613	0.2779	0.1275	0.2838	0.2701	0.2587	0.2196	0.151	0.2291
F2	0.1856	0.1739	0.2747	0.0776	0.2524	0.277	0.1717	0.2302	0.1603	0.1902	0.1043	0.1967	0.2213	0.1769	0.2178	0.1221	0.1668
F3	0.2204	0.2299	0.1898	0.0773	0.2291	0.254	0.1485	0.2081	0.1975	0.207	0.0803	0.175	0.1976	0.1545	0.2078	0.1372	0.202
F4	0.0907	0.0938	0.082	0.0273	0.0925	0.083	0.1181	0.1132	0.0829	0.0659	0.0757	0.0665	0.0673	0.0974	0.1098	0.0429	0.1044
F5	0.2618	0.2547	0.2981	0.0854	0.1914	0.28	0.2066	0.2698	0.1801	0.1911	0.1318	0.2347	0.2397	0.1748	0.2362	0.1353	0.2226
F6	0.2641	0.2946	0.3214	0.0721	0.2745	0.247	0.203	0.2714	0.2344	0.2493	0.1424	0.257	0.2619	0.2503	0.2524	0.1669	0.2406
F7	0.1248	0.1505	0.1641	0.0802	0.1309	0.127	0.0838	0.1297	0.1513	0.1566	0.0528	0.1192	0.1215	0.0856	0.1569	0.103	0.1338
F8	0.2609	0.2922	0.3178	0.0907	0.2908	0.323	0.1809	0.2078	0.2308	0.2444	0.1215	0.234	0.2581	0.2285	0.2484	0.1432	0.2378
F9	0.1928	0.2022	0.2406	0.0543	0.2004	0.244	0.1417	0.2162	0.1294	0.221	0.0778	0.2073	0.1925	0.1691	0.1614	0.0945	0.1946
F10	0.2327	0.2438	0.2667	0.1019	0.241	0.287	0.2021	0.2214	0.2115	0.1633	0.1498	0.2287	0.2315	0.1891	0.1684	0.1081	0.1974
F11	0.0952	0.0782	0.1072	0.0273	0.0769	0.11	0.0792	0.0963	0.1066	0.1101	0.0373	0.0916	0.0724	0.0814	0.1288	0.0444	0.1062
F12	0.2038	0.2128	0.2536	0.0566	0.2113	0.258	0.1915	0.2095	0.1613	0.1925	0.1434	0.1565	0.2398	0.1971	0.2173	0.1639	0.1662
F13	0.2208	0.2506	0.2742	0.0622	0.2494	0.297	0.1845	0.2462	0.1732	0.2053	0.1122	0.2522	0.1775	0.2114	0.2314	0.1743	0.1989
F14	0.207	0.1962	0.1959	0.0719	0.1948	0.238	0.1606	0.1939	0.1467	0.1764	0.0965	0.2035	0.2063	0.1249	0.18	0.1337	0.1705
F15	0.2176	0.2285	0.2499	0.075	0.2266	0.27	0.1672	0.2255	0.1776	0.1687	0.1206	0.1921	0.1958	0.1547	0.1505	0.117	0.162
F16	0.1392	0.1245	0.1572	0.0346	0.1435	0.158	0.0977	0.1422	0.1049	0.1108	0.0478	0.1143	0.117	0.1024	0.1118	0.0602	0.128
F17	0.1923	0.1801	0.1977	0.0869	0.18	0.2	0.1273	0.1796	0.1536	0.142	0.0662	0.1672	0.1701	0.1329	0.1645	0.1429	0.1166

6.7   **Results and Analysis**

From the total relation matrix, two new fields are constructed: Sum of rows (Ri) and Sum of columns (Ci). Also, fields are created for their sums (Ri + Ci) and differences (Ri – Ci). Based on the sign for each value against its factor, we can assign the factor as a cause or effect. If the value of Ri – Ci > 0, which is positive the given factor is considered as a cause. And when it is < 0, it is considered as an effect. Table 6.7 shows the cause and effect factors. Table 6.7   The influencing, affecting, centrality, and cause degree for each factor

Cause effect relationship
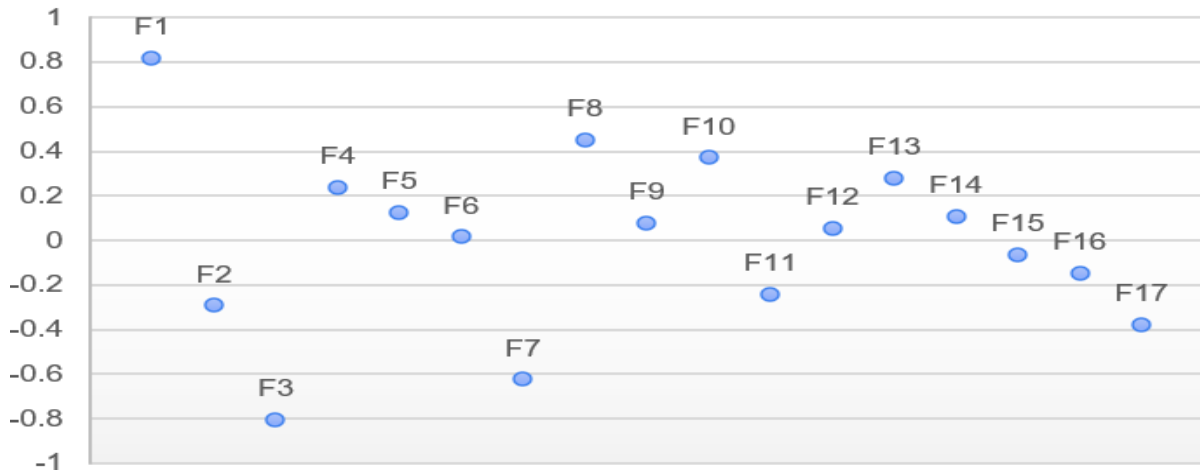
		Ri	Ci	Ri + Ci	Ri - Ci	Category
F1	Communication from suppliers in form of early warnings	4.1392	3.319	7.4582	0.8202	Cause
F2	Transparent communication with end customers	3.1996	3.4903	6.6899	-0.2907	Effect
F3	Customer commitment level	3.1159	3.9206	7.0365	-0.8047	Effect
F4	Government policies facilitating business rehabilitation and maintenance	1.413	1.176	2.5891	0.237	Cause
F5	Moment of Truth	3.5944	3.4669	7.0613	0.1275	Cause
F6	Proactive recovery capability	4.0029	3.9862	7.9891	0.0167	Cause
F7	Original cost	2.0717	2.6942	4.766	-0.6225	Effect
F8	Focus on service outcome failures	3.9104	3.4581	7.3685	0.4522	Cause
F9	Alternative / Backup suppliers	2.9401	2.8634	5.8035	0.0768	Cause
F10	Inventory buffers	3.4446	3.0725	6.5172	0.3721	Cause
F11	Excessive cash on hand in the entire chain	1.4487	1.6879	3.1366	-0.2392	Effect
F12	Modularization	3.2347	3.1804	6.4151	0.0543	Cause
F13	Delay the customization	3.5214	3.2404	6.7618	0.2811	Cause
F14	Transshipment of parts from primary to recovery plants	2.8966	2.7896	5.6862	0.107	Cause
F15	Automation	3.0995	3.1628	6.2623	-0.0633	Effect
F16	Contingent rerouting	1.8942	2.0408	3.935	-0.1465	Effect
F17	Placing spare inventory closer to customers	2.5996	2.9775	5.5771	-0.3779	Effect

Based on the values of Ri + Ci, the factors can be prioritized as: F6> F1 > F8 > F5 > F3 > F13 > F2 > F10 > F12 > F15 > F9 > F14 > F17 > F7 > F16 > F11 > F4. According to this ranking, Proactive recovery capability (F6) is the enabler most crucial for service recovery in supply chains, followed by Communication from suppliers in form of early warnings (F1) and Focus on service outcome failures (F8). The rest follow these in the order mentioned above.

Based on the column Ri – Ci, we assign the net cause/effect for the given factor. From the diagram below, it is clear that that customer commitment level (F3) and Original cost (F7) are the factors influencing service recovery in supply chains most directly.

6.8   Research Implications

From the above study, based on the bolded values from Table 6.7, it can be understood that Moment of Truth (F5), Modularization (F12), and Contingent Routing (F16) do not have a significant relationship with any of the factors. They act independently and do have a major cause effect relationship with the others.

The study provides executive and managerial level employees a deep insight into factors that needs to be considered while designing their supply chains, further helping them keep a track of activitiesduring disruptions and the methods to keep the chain moving during periods of disruption. As per Table 6.7, we understand that Proactive recovery capability (F6), Communication from suppliers in form of early warnings (F1), and Focus on service outcome failures (F8) are the major enablersof service recovery, and need to be focused upon in detail to set up the foundational process of service recovery in any organization. Organizations need to prepare themselves for disruptions instead of reacting to them at the time of occurrence. Further studies can focus on a structured methodology to implement this practice across supply chains, and aid techniques to measure the success after the implementation. Factors analyzing the relationship with suppliers should be understood in depth in order to understand the strength of a relationship and its implications on communication between the two parties. Organizations should focus on having a mutual relationship with suppliers and reward them during times of success, only to build a strong foundationto help each other in times of need and disruption. Techniques such as root-cause analysis can be implemented not only across production processes, but also in cases of major disruptions to find out the root causes and convey them to customers in order to maintain a sense of transparency.

Customer commitment level (F3) and Original cost (F7) are factors that have a high influence on the entire recovery process and need to be carefully observed to ensure that the supply chain is working as intended. Psychological studies into behavior of organizations towards their customers will help in understanding their commitment level during times of disruptions and alsothe state of their service recovery process. Also, since the cost of enabling service recovery is very high, companies should start concentrating their efforts on reducing acquisition costs, in order to ensure their capability of easily acquiring new ones after the end of disruptions.

This study can also be performed across various industries in order to specifically understand thenuances of their supply chain processes and recovery strategies that need to be implemented in their cases.

6.9 Implications with Graduation towards Green Technology and Introduction of Electric Vehicles

The service recovery has also got implications with the total engineering support plan of the organization to carryout scheduled and preventive maintenance including service tasks. With the shifting of the focus of India automobile industry to green technology and alternate fuels there is requirement to address the engineering support imperatives which will enable to gear the organization to meet the service requirement of electric/alternate fuel requirements. The infrastructure will need to be revamped to meet the requirement of availability of all test jigs and testing equipment to undertake successful repairs to electric vehicles in the future. This includes plant and facilities that will be required by authorized service stations to undertake scheduled and corrective maintenance. Requirement of adequate number of battery charging stations will also be required. This envisages the requirement of technically trained technicians having adequate knowledge of electric background to undertake repairs. Owing to this transition electric and electronic background service and technical advisors will replace the existing mechanical background service and technical advisors. The fuel-driven technology will have an electric source. The companies have presently changed the policy of hiring the technicians from mechanical stream to electric stream. Three out of four technicians/service and technical managers that are being employed have a mechanical background. The availability of mechanical test jigs and tools needs to be changed to electric and electronic technology tools, jigs, and fixtures. The requirement of specialist tools and equipment of electric and electronic technology will also have to be met for undertaking successful repairs. The availability of the technical documentation for new generation vehicles and electric vehicles will also have to be made available for by the OEMs to ensure that the processes are aligned as per the specified quality standards and documents. Requirement of mandatory engineering and process documents to undertake disassembly, flaw detection, assembly, and testing needs to be met for educating the technical trained manpower and successfully undertaking repairs. Stocking of spares mostly in the technology of electrical and electronics needs to be undertaken against the prevailing mechanical spares stocking. The existing diesel/petrol technology vehicles will continue to be exploited as these forms the maximum chunk in the fleet of vehicles. These are based on replenishment policy stocking of both electric/electronic and mechanical spares. Provisioning and stocking of batteries and charging system will be required. The quality check

document after servicing or undertaking technical work will also be required to meet laid down quality standards and adherence to specifications.

Presently, there are very few vehicles exploiting dual technology/alternate fuel like LPG/CNG cars running on the road. There are not adequate number of service stations available towards ensuring the requisite engineering support. Presently, the customers are facing lots of challenges owing to limited charging stations at various states. So, there is a requirement to have proactive engineering support plan to presently address the service failures arising due to transition in technology. To accelerate the adoption of electric vehicles and for its management in India, issues such as charging infrastructure, research & development, financing of electric vehicles, battery and cell manufacturing, proper regulatory framework, fiscal and non-fiscal incentives, availability of power and its infrastructure, consumer awareness needs to be addressed immediately (Juyal, 2022). The service failure presently is due to technology being naïve and it will stabilize in times to come. The factors impacting the technology transition to alternate fuel and electric vehicle is as in Fig 6.3 and addresses the pillars of sustenance.
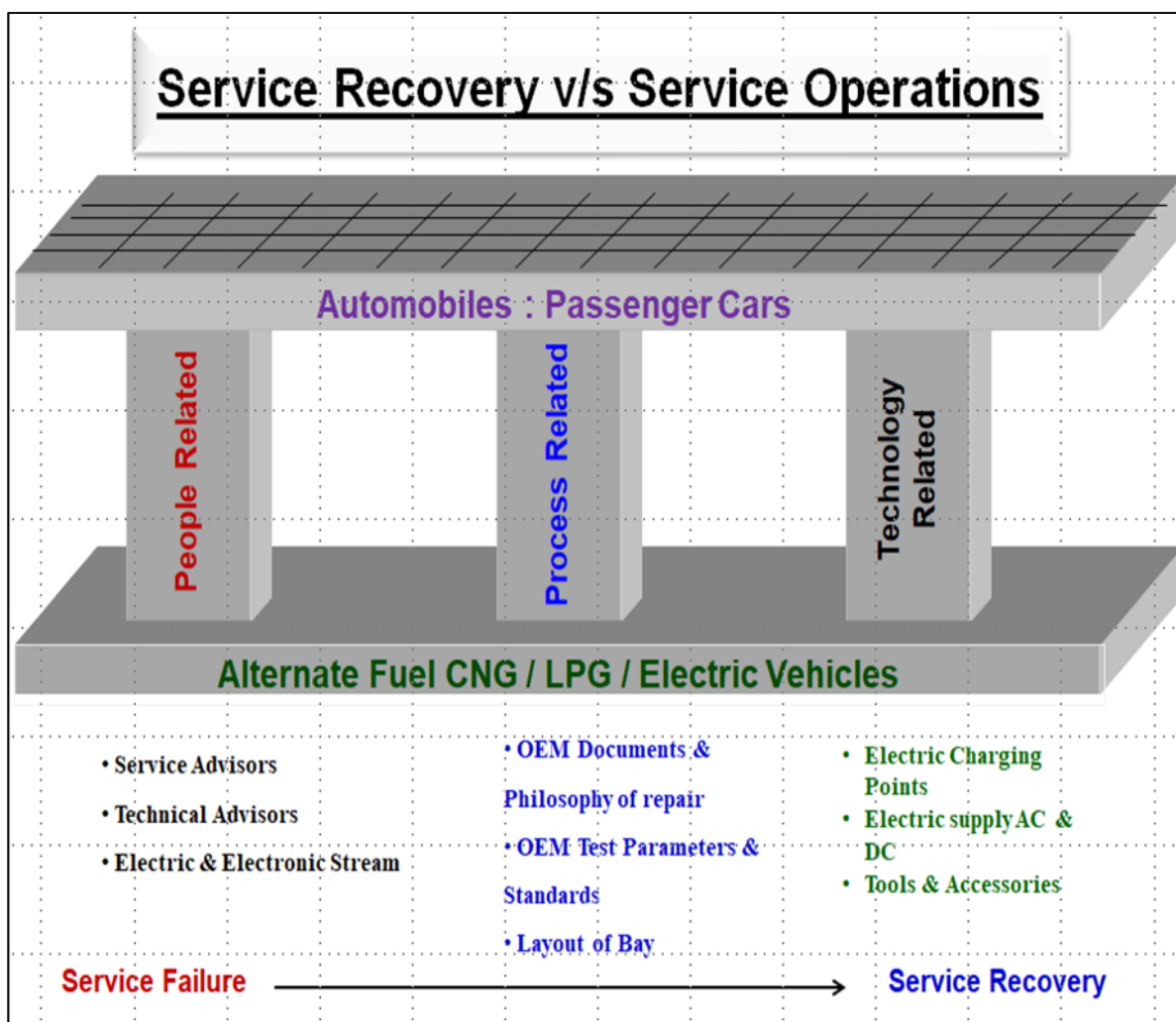
Figure 6.3 Service recovery versus Service operations

6.10   Conclusions

This study defines the occurrences of disruptions in supply chain and analyses several factors that are responsible in the process of service recovery in supply chains and the role played by each factor independently. To qualitatively point out the relative importance of each factor and its relationship with others, a mathematical approach was followed with the help of the DEMETAL technique. This study concludes that out of the 17 factors identified at the start, Proactive recovery capability (F6), Communication from suppliers in form of early warnings (F1), and focus on service outcome failures (F8) are the major enablers of service recovery,while Customer Commitment Level (F3), Transparent communication with end customers (F2), and Automation (F15) are the factors on which the other factors have the highest impact. Also, Moment of Truth (F4), Modularization (F11), and Contingent rerouting (F16) are factors that do not have a strong relationship with the others and, hence, act independently.

Chapter No. 7

Conclusion and Future Scope of Research

7.1   Overview

The main objective of this research was to study the impact of SQ in the Indian automobile industry and develop a SQ measurement scale for the automobile industry. As a sequel to the preceding chapter wherein DEMATEL approach is used to conduct a structured quantitative analysis of the factors affecting supply chain service recovery, this chapter enumerates the summary of findings of the research; they are presented as theoretical and managerial implications for industry, limitations, and future scope of research.

This chapter is divided into five sections. In section 7.1, an overview of the chapter has been given. The second section, 7.2, presents the review of research objectives and findings. The third section 7.3 covers the contribution and findings of the study in form of theoretical and managerial implications for industry. The fourth and fifth sections, 7.4 and 7.5, encompass the limitations and future scope of research, respectively, followed by the conclusions in the last section, 7.6.

7.2   Review of Research Objectives and Findings

The four research objectives, as enumerated in Chapter 1, are presented here first and the answers and findings to these questions are presented thereafter.

- To develop a reliable SQ measurement scale for the Indian Automotive after-sales passenger car segment

- To analyze the impact of SQ dimensions on customer satisfaction and customer loyalty for automobile after-sales passenger car segment

- To develop a Service Failure prediction model for automotive after-sales service

- To identify the factors influencing Service Recovery and its impact on after-sales service with advancement to green technology in automobiles

The first research objective has been achieved after extensive literature survey, followed by a formulation of research design and detailed interactions with the industry professionals, authorized service station customers, and professionals. Development of SQ measurement scale AutoIND has been undertaken in Indian settings. The scale developed takes into account the five dimensions of SERVQUAL and two additional dimensions identified in the context of Indian customers—service failure and service recovery. The AutoIND scale comprises 37 items and seven dimensions, that is, Tangibility, Reliability, Responsiveness, Empathy, Assurance, Service failure, and Service recovery. This scale fills the gap that exists in the measurement of SQ in

Indian settings for passenger car segment and proposes seven determinants towards measurement of service quality. Further, an analysis of the impact of SQ dimensions on customer satisfaction and customer loyalty is undertaken.

Second, service failure prediction in context of four-wheeler segment using BN has been done. It provides reliability and precision that can be used for real-time prediction of possible service failures in the automobile sector. The survey data model provides exceptional insights towards identification of gaps and proposes changes in the servicing system for automobiles to lower the failure rate and enhance customer satisfaction. The information derived by this research can be used to tackle the service failure issues and further reduce the probability of failure. This results in checking of failure rates without spending the time and resources involved in undertaking planned additional quality checks on each and every vehicle. The Bayesian model developed is useful and provides a methodology for attaching machine learning and AI for predictive and prescriptive analytics. The authorized service stations can use this model in real-time with realistic time data streaming of vehicle coming in and can get valuable insights about how to change their business ways with changing factors and situations. This model can also be used for getting realistic insights into service operations of an authorized service station and to improve further.

Third, identification and modeling of factors influencing service recovery was undertaken. The occurrences of disruptions in supply chain and analyzing several factors responsible in the process of service recovery in supply chains was undertaken. The study points out the relative importance of each factor and its relationship with other factors using a mathematical approach with the help of the DEMETAL technique. The study identifies that out of the 17 factors identified, the following are the major enablers of service recovery: Proactive recovery capability; Communication from suppliers in form of early warnings; and focus on service outcome failures. Customer commitment level, transparent communication with end customers and Automation are the factors on which the others have the highest impact. Moment of truth, modularization, and contingent rerouting factors have less of a relationship with others and act independently.

Subsequently, service operations framework has been depicted, owing to the graduation to green technology, by addressing the requirements of infrastructure and other aggregates. It helps in enhancing customer satisfaction through service operation efficiency and accounts for the entire spectrum of earnings during the lifetime of customer. Service operation is an open transformation process of converting inputs—in this case, customers—to desired outputs, that

is, satisfied customer through appropriate application of resources. The categorization of SQ operations is undertaken and its relationship to various SQ dimensions is ascertained.

7.3 Theoretical and Managerial Implications for Industry

SQ is an essential aspect for any service provider and automobile service industry is no exception (Katarne et al., 2010; Vigneshwaran et al., 2021). Here, customers are much concerned about after-sales service. The focus is shifting to enhanced customer satisfaction through superior SQ for higher customer retention, loyalty, and profitability. The concept of SQ bridges scientific and humanistic management philosophies by focusing on areas, such as coordination, collaboration, commitment, communication, trust, flexibility, dependence, joint engineering, integration, and the training and development of employees (Gandhi et al., 2018; Sharma et al., 2021). SQ is a way of thinking about how to satisfy customers so that they hold a positive attitude towards the service they are receiving. Delivering quality service is considered to be an essential strategy to not only succeed through superior services, but also achieve higher growth in the market and increase profits (Jain et al., 2013; Gandhi et al., 2018)

Although the SQ structure has a rich set of empirical studies on different service sectors, SQ modeling in automobile sector has not been adequately investigated in the Indian context. This research will be of importance to the automobile industry of India as it seeks to enhance customer satisfaction by laying more emphasis on each dimension of SQ. Automobile is a unique product in that it has components of both product quality and service that account for the overall experience of the customer. The automobile provides an entire spectrum of earnings for the manufacturer during the lifetime of a customer. The customer experiences the ownership of the product with periodic maintenance service. A customer avails service almost three times a year for regular maintenance, besides intermittent repairs. In a span of 4-5 years, the after-sales service is experienced many times. Therefore, the service satisfaction has a significant effect on the loyalty of the customer. It is important to focus on service experience to provide satisfaction to the customer. The satisfaction of the customer will help her to recommend, revisit, and re-purchase the product (Xu et al., 2017; Simbolon et al. 2020).

For developing countries, such as India, an understanding of the auto industry's evolution in other countries offers a road map towards technological development. India's automobile industry is the sixth-largest producer of automobiles in terms of volume and value. With more than 35 automakers, the industry contributes 7% to India's GDP and is responsible for providing employment to 8% of India's total population. The study conducted an investigation into SQ and service operations that lead to the development of a SQ measurement scale for the Indian automobile industry. The AutoInd measurement scale has been developed with seven dimensions

comprising of five dimensions of SQ and two additional dimensions—service failure and service recovery. The AutoInd measurement scale fills the gap that exists in the measurement of SQ in the for the passenger car segment Indian setting. This will result in a measurement of SQ post interaction with customer and address issues pertaining to service failure. It will enhance customer satisfaction and, further, lead to customer loyalty. The feedback from customers will help in instilling confidence in customer, identification of gaps in existing procedures, and the revision of processes to avoid service failure.

The Bayesian model developed for service failure prediction is practical and provides an approach for harnessing ML and AI for predictive and prescriptive analytics. The management of the company offering the service can deploy this model in real time with the real-time data stream coming in and can get valuable insights about how to change their business ways with changing factors and situations. It can be used for real time prediction of possible service failures. With real survey data, this model might give exceptional insights into how to make changes in the servicing system for a lower failure rate and, hence, more customer satisfaction.

The study provides executives and manager-level employees a deep insight into factors that need to be considered while designing their supply chains, helping them keep track of activitiesduring times of disruptions, and offers methods to keep the chain moving during disruptions. Organizations need to prepare themselves for disruptions instead of reacting to them at the time of occurrence. Further studies can focus on a structured methodology to implement this practice across supply chains and provide techniques to measure the success after the implementation. Factors analyzing the relationship with suppliers should be understood in depth to understand the strength of a relationship and its implications on the communication between the two parties. Organizations should focus on having a mutual relationship with suppliers and reward them during periods of success, in order to build a strong foundationto help each other in times of needs and disruption. Techniques such as root-cause analysis can be implemented not only across production processes, but also in cases of major disruptions to find out the root causes and convey them to customers to maintain a sense of transparency.

7.4   **Limitations**

The research has been undertaken for passenger car segment only with service operations at the naive stage. The same can be extended to other segments of the automobile industry. In the failure prediction, all the factors taken into account are technical and pertaining to breakdown, cost overrun, and vehicle not returned on time. The human interface and intervention can be explored. In the failure prediction model, all the factors considered deal with technical attributes and have not explored any human interface which might impact the results. The

provision of service delivery has not been dealt in the study. A service failure is ideally followed by an attempt of recovery, in which service provider tries to provide for some sort of compensation. But how and to what extent does it work for this industry is an option which has to be explored by another empirical study.

7.5   Future Direction of Research

This AutoInd scale can be expanded to take care of other segments of the automobile industry as this research has been carried out for the passenger car segment of India's automobile industry. The framework and findings of this research present a platform for future researchers to study the commercial vehicle and two-wheeler segments of the Indian automobile industry. New variables and dimensions, apart from those identified in the research, can be used to gather more insightful findings. Also, with more stringent emission norms being put in place, it is also envisaged that research will be undertaken for service operations after graduation to alternate fuels and electric-driven vehicles to cope with challenges caused by existing government policies.

The service failure prediction has been done in a pandemic situation; additional data collection can be done to gain actual database for further study. With the real-life data, a more sophisticated supervised learning algorithm can also be explored; using constraint- and score-based ways, one could decide on the structural leaning method to be used.

The study on identification and modeling of factors using service recovery can also be performed across various industries to specifically understand thenuances of their supply chain processes and the recovery strategies that need to be implemented in their domain.

7.6   Conclusions

This research focused on the accomplishment of research objectives identified during course of research. Development of SQ measurement scale AutoInd, comprising of seven dimensions suiting the Indian context, has been undertaken. Analysis and impact of the seven SQ dimensions on customer satisfaction and customer loyalty for Automobile after-sales has been done. Development of Service Failure prediction model for automotive after-sales service has been achieved. Identification of the factors influencing Service Recovery and its impact on after-sales service with advancement to green technology in automobile has been done. With the graduation of automobile sector from the existing non-renewable technology to renewable electric technology, the application of the research can be applied and tested under these conditions.

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Questionnaire for a PhD Research Study

Your filling up this Questionnaire is greatly appreciated. Your response will be treated as confidential

Study Conducted by

Munish Pal Singh

PHD Scholar

A return envelope has been enclosed.

On completion of the questionnaire, kindly return it in the postage paid envelope.

In case of the loss of return envelope, please send the survey to:

Munish Pal Singh, Department of Management, BITS Pilani-333031, Rajasthan

Due to prevailing COVID 19 Pandemic you can also fill in the questionnaire in the link given below

https://forms.gle/L3hz73hVYhtstY4N8

In case of any queries regarding this Questionnaire or the study please free to contact: munish_pal@yahoo.com

SERVICE QUALITY QUESTIONNAIRE

(Please tick only one option in the box as per your opinion is best suited)

Ser	Details / Factor	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree Nor Agree	Somewhat Agree	Agree	Strongly Agree
Tangible								
1	Service Station has modern outlook with up-to-date equipment							
2	Service Station features are visual appealing							
3	Service Station employees are neatly professional appearing and dressed							
4	Service Station material associated with services are visually appealing							
5	Entry and Exit parking convenience at service station							
6	Visually appealing and comfortable waiting lounges							
Reliability								
7	Takes advantage of technology and know how							
8	Possess Quality Standard certificate and adherence to procedures							
9	When Service Station promises to do something by certain time it adheres to it							
10	When you have problem Service Station shows a sincere interest in resolving it							
11	Service Station maintains personal information security and error free records							
Responsiveness								
12	Gives prompt service to its customers							
13	Service Station employees are always willing to help you and accommodate you							
14	Service station employees are never too busy to respond to your request							
15	Service station has compatible staff							
16	Service Station apologises for failure							

Ser	Details / Factor	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree Nor Agree	Somewhat Agree	Agree	Strongly Agree
Empathy								
17	Service Station employees give personal attention to its customers							
18	Service Station has best interest at heart							
19	Service Station employees understand the need of its customers							
20	Service Station has operating hour convenient to all its customers							
21	Adequate alternate replacement transport facility is provided							
22	Delivering Quality							
Service Failure								
23	Service Station acknowledges failure w.r.t Service Hygiene and Physical Evidence or Service Operation or Employee Related							
24	Service Station Identifies reason for failure w.r.t Service Hygiene and Physical Evidence or Service Operation or Employee Related							
25	Service Station understands problem from customer point of view							
26	Service Station takes ownership as a customer							
27	Service Station addresses service failure promptly							
28	Service Station maintains record of service failure							
29	Service Station gives top priority to resolve service failure							
Assurance								
30	Service Station employees have the knowledge to answer to your questions							
31	Service Station has trained technical staff							
32	Service Station gives informative explanations to queries							

33	Service Station performs the service right the first time							
34	Attentive guaranteed service							
35	Service station offers reasonable price							
Service Recovery								
36	Service station gives adequate compensation, refund, or replacement against service failure							
37	Service station ensures Speed of recovery, follow up, fair policies and procedures							
Customer Satisfaction								
1	Willing to recommend dealer to others							
2	Maintain long term relationship with dealer							
3	Repurchasing intention want to return to same dealer							
4	No complaints in product and services offered by dealer							
Customer Loyalty								
1	Strongly feel chosen dealer is the best and have never visited another dealer							
2	Will not change the dealer in future							

Personal details

Education Level: Graduation / Post Graduation / Doctorate

Details of Service Station: _____

Make & Model of Vehicle: _____

Age: Yrs:

Place of Service Station :

https://forms.gle/L3hz73hVYhtstY4N8

Appendix 2
Questionnaire for a PhD Research Study

Your filling up this Questionnaire is greatly appreciated. Your response will be treated
as confidential
Study Conducted by
Munish Pal Singh
PHD Scholar

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In case of any queries regarding this Questionnaire or the study please free
to contact : munish_pal@yahoo.com

Questionnaire for Customers

1.   **What was the issue you went for at the service centres?**

2.   **Which car do you own?**

3.   **What is the mileage of your car (in km)?**

4.   **Which day did you give your car for servicing?**

5.   **Was the vehicle returned to you within the stipulated time?**

6.   **Was the actual cost incurred you was similar to the cost estimate given to you?**

7.   **What was the cost of service done?**

8.   **Was the issue fully resolved/ Did you face another breakdown after the vehicle was returned to you?**

9.   **Was the staff behavior up to your expectations?**

Questionnaire for Service centres

1.   **How many mechanics were present at the service centres on that given day?**

2.   **How many bookings did you have on the given day?**

Questionnaire for Customers

3.   **What was the issue you went for at the service centres?**

4.   **Which car do you own?**

5.   **What is the mileage of your car (in km)?**

6.   **Which day did you give your car for servicing?**

7.   **Was the vehicle returned to you within the stipulated time?**

8.   **Was the actual cost incurred you was similar to the cost estimate given to you?**

9.   **What was the cost of service done?**

10.   **Was the issue fully resolved/ Did you face another breakdown after the vehicle was returned to you?**

11.   **Was the staff behavior up to your expectations?**

LIST OF PUBLICATIONS/PARTICIPATION IN CONFERENCES

Publications : International

Singh M.P., Sharma S.K. and Chanda U. (2021) **"**Measuring service quality in Indian Automobile aftersales: AutoIND scale*" Int. J. Process Management and Benchmarking*, Accepted Forthcoming, Scopus and article is available online

Singh M.P., Sharma S.K. and Chanda U. (2022) "Identification and Modelling of Factors Influencing Service Recovery" *Int. J. of Services and Operations Management,* Accepted Forthcoming, Scopus and entering publication schedule

Papers Presented in Conferences

Singh M.P., Sharma S.K. and Chanda U. (2017) "Service Quality measurement of Indian After-sales Service Passenger Car segment" Joint International Conference on Interdisciplinary Research and 8th International Conference on Quality, Reliability, Infocom Technology and Business Operations" Amity University , Noida 08-10 Feb, 2017

Singh M.P., Sharma S.K. and Chanda U. (2017) "A changing scenario of Service Quality in passenger car segment" in the proceedings of second International Conference on Evidence Based Management 2017 (ICEBM 2017) at BITS Pilani on17-18 Mar 2017 pp.132-136

Singh M.P., Sharma S.K. and Chanda U. (2020) "Service Quality measurement of passenger car segment with effect of Service Recovery and failure" Online International Conference on Marketing 5.0'Relationships, Personalization and Data Herald' held at Chitkara Business School, Chitkara University, Punjab,India on 06-07 June 2020

Singh M.P., Sharma S.K. and Chanda U. (2021) "Influence of Service Quality on Customer Satisfaction and Customer Loyalty for Passenger Car Segment of India" POMS India International Conference- Doctoral Colloquium at SPJIMR, Mumbai on 21-22 December 2021

VITA

Candidate:

Munish Pal Singh is a practicing techno-managerial professional working with the Indian Army since last 20 years. He has done his technical education B.Tech (Industrial Engineering) from NIT, Jalandhar, Punjab, M Tech (Automobile Engineering) from JNU and MBA in Marketing from IGNOU. He has experience in both industry and academics. Before joining the elite Indian Army, he worked with M/s MINDA at Pune as Manufacturing Engineer. He specialises in Tanks and has undergone training at Russia.

Currently, he is pursuing his PhD from BITS, Pilani. His research areas are service quality, service failure and service recovery. He has written six papers that have been published in international and national journals or presented in conferences. He has been a regular recipient of awards for standing in merit in academic courses and has been awarded Army Commander Commendation Card for his distinguished service in the Indian Army. He has worked in J&K and the North-East as part of his posting profile.

Supervisor:

Dr. Satyendra Kumar Sharma is BE, MBA from MNIT Jaipur and PhD from BITS Pilani. Dr. Sharma carried out his Phd research on Supply chain risk management. He has more than 2 years of experience in industry and 14 years in academics. Currently he is working as a Associate Professor in Department of Management. He has served as Nucleus member of planning cell in Practice school division, BITS Pilani. Currently he is also heading Center for Innovation, Incubation and Entrepreneurship (CIIE). His research interest areas are Supply Chain Risk Management, Project Risk Management and Multicriteria Modelling. He has successfully completed two sponsored R & D Projects. He has published more than 50 papers in international journals of repute, and more than 22 papers in international conferences and four Case studies. He has guest edited tow special issues of Emerald Publishing. He has conducted several MDP's. He is a member of professional bodies like Society of operations and production management and AIMS international.

Co-Supervisor:

Udayan Chanda is currently working as Associate Professor in Department of Management, Birla Institute of Technology & Science (BITS), Pilani. Earlier he was associated with Industrial Statistics Labortary, Department of Information & Industrial Engineering, Yonsei University as Post Doctoral Fellow and Department of Operational Research, University of Delhi as Assistant Professor (Ad-hoc). He received his Ph.D. degree in Marketing Models and Optimization (Operational Research) from University of Delhi, Delhi. He has published numerous papers in the area of Marketing Models, Optimization, Software Reliability and Inventory Management in international journals and conference proceedings. His current research interests include marketing models, inventory modeling, software reliability growth modeling and dynamic optimisation techniques. He has guided two PhD students and completed one sponsored R&D project.