EVALUATION OF SERVICE QUALITY AND PASSENGER SATISFACTION IN INDIAN RAILWAYS BY DEVELOPING RAILQUAL

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By

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DECLARATION

I, **MARUVADA DEVI PRASAD**, hereby declare that the thesis work entitled, **“Evaluation of Service Quality and Passenger Satisfaction in Indian Railways by developing RAILQUAL”**, submitted by me under the guidance and research supervision of **Prof. B. RAJA SHEKHAR** is an original and independent research work. I also declare that, it has not been submitted previously in part or full to this University or any other University or Institution for the award of any degree or diploma.

Place: Hyderabad
Date: 30th December, 2011

Maruvada Devi Prasad
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CERTIFICATE

This is to certify that this thesis entitled, **“Evaluation of Service Quality and Passenger Satisfaction in Indian Railways by developing RAILQUAL”**, submitted by **Maruvada Devi Prasad**, Research Scholar (Regd No.07MBPH04) enrolled for Ph.D programme at the School of Management Studies, University of Hyderabad, is a bonafide work done under my guidance and supervision as prescribed under the Ph.D ordinances of the University.

The thesis has not been submitted previously in part or full to this University or any other University or Institution for the award of any degree or diploma.

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ABBREVIATIONS

ADB	-------	Asian Development Bank
AMOS	-------	Analysis of Moment Structures
CRB	-------	Chairman Railway Board
IR	-------	Indian Railways
SCR	-------	South Central Railway
PKM	-------	Passenger Kilo Metres
NTKM	------	Net Tonne Kilo Metres
GTKM	-------	Gross Tonne Kilo Metres
SEM	-------	Structural Equation Modelling
GOF	-------	Goodness of Fit Index
CFA	-------	Confirmatory Factor Analysis
EFA	------	Exploratory Factor Analysis
GFI	------	Goodness of Fit Index
AGFI	------	Adjusted Goodness of Fit Index
RMR	------	Route Mean Square Residual
RMSEA	------	Route Mean Square Error of Approximation
NFI	------	Normed Fit Index
TLI	------	Trucker Lewis Index
CFI	------	Comparative Fit Index
RNI	------	Relative No centrality Index
PNFI	------	Parsimony Normed Fit Index
PR	------	Parsimony Ratio
SPMR	------	Standardized Root Mean Residual
RFI	------	Relative Fit Index
NNFI	------	Non Normed Fit Index
LISERAL	------	Linear Structural Equations
CAGR	------	Compounded Annual Growth Rate
RPSQ	------	Railway Passenger Service Quality

Abstract

Service organizations are continually confronting challenges to remain competitive and successful, which compels them to regularly revaluate their strategies to improve services. Customer satisfaction, from the service quality perspective, has emerged as a new modus operandi for assessing customers' perceptions and/or expectations of services in order to reorient and regulate existing services. Services are becoming increasingly ubiquitous and this growth is accompanied by increased business interest in measuring and managing service quality. This interest is also reflected in a large number of academic studies. Despite this there is very little consensus about the dimensions and antecedents of Railway Passenger Service Quality (RPSQ).There are two possible reasons for this: first the phenomenon of railway passenger service quality is changing as affordability is increasing among customers. Second, the theoretical approach and the assumptions on which the public transport service quality is usually founded, is flawed in the Indian context.

The research issues are: 1) What is the structure of Railway Passenger Service Quality? 2) What are the antecedents of the Railway Passenger Service Quality? 3) What are the most appropriate modelling and measurement methods for measuring Railway Passenger Service Quality quantitatively? 4) What is the relationship between Railway Passenger Service Quality and passenger satisfaction and behaviour loyalty of passengers?

It was found that leading models and instruments tend to be based on exploratory factor analysis and have not been informed by advances in measurement theory, particularly co-variance-based structural equation models. The diverse nature of requirements of stake holders makes it extremely difficult to decide upon what constitutes quality in Railway passenger services. Hence, identification of common minimum quality items suitable for all passengers will help design the system and there by improve passenger satisfaction. To address this issue, recent advances in measurement theory to dataset were applied and compared two different modelling methods namely exploratory factor analysis and confirmatory factor analysis. Based on psychometric scale development approaches, this research conceptualized, constructed, refined, and tested a multi-item scale 'RAILQUAL', that examined key factors influencing railway passenger service quality. Through qualitative and quantitative studies in three phases a 18 item six dimensions 'RAILQUAL' model was developed, which is a measuring instrument for service quality and passenger satisfaction in Indian Railways. The resultant dimensions showed good psychometric properties based on findings from various reliability and validity tests as well. Nine hypotheses were proposed in the thesis and examined using structural equation modelling. Although one hypothesis was rejected the resultant structural model showed strong relationships between the dimensions included.

The research identified that service quality is a strong contributor to behaviour loyalty. The strong pathway from service quality to behaviour loyalty was through passenger satisfaction. Both passenger satisfaction and service quality had significant effect on profitability. The research provides an empirical evaluation of relationship between identified attributes towards dimensions of service quality and also the importance of each dimension towards the overall service quality of passenger services in Indian Railways. A number of recommendations for further research were made. These included the replication of this study in all the zones of Indian Railways so that the instrument 'RAILQUAL' can be standardized across Indian Railway.

1

CHAPTER 1: INTRODUCTION

1.1 Introduction

Managing services effectively is a main challenge in the service management domain because of intangibility, heterogeneity, perishability, inseparability of services and massive human involvement in service delivery. Delivering superior service and ensuring higher customer satisfaction have become strategic necessities for organizations to survive and prosper.

The Indian Railways (IR) is the principal mode of transportation for the long haul freight movement in bulk, long distance passenger traffic and mass rapid transit in suburban areas and it networks the nation providing economic and reliable transport to Indians. While the freight traffic generates bulk of the revenue for railways, passenger transport is the more visible face of the railways as it touches directly the lives of millions who avail the passenger transport services. Accordingly, Indian Railways have been making efforts over the past few years to enhance the services being provided to their passengers.

However Indian Railways market share in passenger segment has come down from 68% in 1951 to a mere 13% now in total passenger transportation sector in India. Indian Railways has to learn quintessentially that market share has to be fought and won in the market place. For winning this battle consistently, the customer should be offered superior and compelling value on a continuing basis. The ultimate measure of value for Railways' services is customer satisfaction. To create this value, the Indian Railways has to transform itself from an introspective organisation where the emphasis was on process and procedure, to one that is externally oriented with emphasis on the market and the customer.

1.2 Background of the Study

Gauging passenger satisfaction through service quality studies has become one of the most popular marketing strategies, and it is an approach that infiltrates many academic disciplines, such as psychology, mechanical engineering, business and management science. As a result, many commercial service studies have been commissioned by numerous service providers (Azhar 2007; Badri, Abdulla & Al-Madani 2005; Mazzeo 2004; Prewitt-Baker2000), as it is critical for such service providers to prove their strength in business performance in a competitive environment (Chowdhary & Prakash 2007:238, Mehta, Lalwani & Soon 2000:62; Park 2007:238; Shemwell, Yavas & Bilgin 1998:155). Service quality as multi – dimensional concept with multi-attributes, might mean different things to different people (Brady & Cronin 2001; Dabholkar 1996:30; Gronross 1984: 38-40).

Moreover, defining quality is also a difficult task due to its generic nature. Significant body of research has focussed on measurement of service quality in conventional services (Bolton and Drew, 1991; Parasuraman et al., 1985; Parasuraman et al., 1988). SERVQUAL (Parasuraman et al., 1988) and SERVPERF (Cronin and Taylor, 1992) are the examples of scales which have been developed to measure service quality in such contexts. However, further research has identified additional dimensions of service quality besides those extracted in SERVQUAL and SERVPERF (Brady and Cronin, 2001; Levseque and McDoughall, 1996). With the rise of technology enabled services, research has also captured the technology related dimensions of service quality (Collier and Bienstock, 2006; Parasuraman et al., 2005).

Although Railways is large and economically important for most countries, there has been surprisingly little research in the industry on service quality. As an example a search on Google scholar (20, November, 2009) revealed that only fifteen of the nearly eighteen hundred articles in scholarly journals on topic of service quality relate to Railways service quality. A closer examination shows that out of these fifteen, only nine related to service quality in passenger services in Railways (e.g. Disney,1998,1999; Hanna and Drea,1998; Dria and Hanna,2000; Tripp and Drea,2002). There is very little published literature that reports the use of SERVQUAL in assessment of railway passenger service quality.

As such, it remains the least researched subject area open to intensive research. As little is known about the service quality dimensions of railway passenger services and appropriate measures of such dimensions, there is a need to empirically identify these dimensions.

Hence this study addresses this need by developing a comprehensive instrument RAILQUAL by using the Structural Equation Modelling approach.

1.3. Brief Overview of Indian Railways

The Indian Railways is a state-owned unique enterprise due to its size, ownership structure, and one-hundred-and-fifty-year-old history. These attributes, among others, make it a complex, intriguing and thus fascinating subject to do research. The Indian Railways is one of the world's largest state-owned enterprises, a utility under a single management, second only to China's .With around 1.4 million employees and 1.1 million pensioners, one of the world's largest railway networks – over 63,000 Kilometres of routes – running approximately 13,000 trains each day, including 9000 passenger trains, the railways is a Ministry within the Government of India. Indian Railways carry over two million tons of freight and some 17 million passengers between 7000 railway stations each day. A fleet of 2, 00,000 wagons, 40,000 coaches, and 8000 locomotives achieves this. To fathom the scale, we need to consider the fact that each day Indian trains travel four times the distance to moon and back.

Indian Railways (IR) is state owned and operated under the Ministry of Railways (MOR), Government of India (GOI). The MOR functions under the guidelines of Minister of Railways assisted by Minister of State for Railways. The policy formation and management of Indian Railway board comprises of Chairman and six functional members (Exhibit 1.). Wide powers are vested in the board to effectively supervise the running of 17 Zonal railways each headed by a General Manger. Zonal Railways are further divided into smaller operating units called Divisions. There are 68 Operating Divisions in Indian Railways at present, each under a Divisional Railway Manager. In addition, there are a number of production units, training establishments, construction organization and other railway establishments. These are generally headed by General Managers. 12 subsidiary organizations under the MOR are also doing specialised jobs contributing to IR's growth and progress.

IR is a departmental enterprise, wholly owned by the Government. It is the largest single organization in India, with a capital investment of about Rs. 876 billion ($18 billion) and it supports a workforce of about 1.4 million constituting 5 % of the 27 million people employed in the organized sector. Another 0.7 million employees are supported indirectly thorough establishments servicing IR. IR is a vertically integrated organization controlling its own facilities, performing all operating and administrative functions and unilaterally determining what service to provide. In addition to carrying out the core business of rail transport, IR also owns and manages activities such as design and manufacture of rolling stock, overhaul and remanufacture of rolling stock, construction projects, schools, technical institutes, housing, hospitals, hotels etc.

1.3.1 Brief Overview of South Central Railway:

South Central Railway was formed on 2nd October, 1966 as the 9th zone of the Indian Railways. In its forty plus years of committed service and path breaking progress, South Central Railway has grown to a modern system of mass transportation fulfilling the aspirations of the passengers/customers and carved a niche for itself in Indian Railways system.

Strategically positioned in the southern peninsula, this dynamic organization with its headquarters at Secunderabad serves the economically vibrant state of Andhra Pradesh, parts of Maharashtra, Madhya Pradesh and Tamil Nadu. South Central Railway has six Divisions viz., Secunderabad, Hyderabad, Vijayawada, Guntur, Guntakal and Nanded with 5752 Route KMs of which 1604 RKMs are electrified.

Its passenger and freight performance has met with stupendous leaps forward. The freight loading which was only 9.00 million tons in the year of its inception, i.e., 1966 has seen a quantum jump and touched 44.79 Million tons in the financial year 2003-2004. Passenger transport too has met with tremendous growth touching 195.65 million in the year 2003-2004 as against 50 million in the year of inception and the gross earnings from Rs. 58.00 cr. to 3683.00 cr in the year 2003-2004.

1.3.2. Railway Sector Performance

Railway freight is measured in ton-km (tkm) and passenger traffic measured in passenger km (pkm), each increased at an annual rate of around 4 % over the past 50 years. Growth in railway traffic has been much lower than growth in total transport demand. During FY 1980-2010 the total freight traffic grew at an average annual rate of 6.8% and passenger traffic at 8.5%. Over this period the traffic carried by road increased at an average annual rate of 10.2 % for freight and 9.6% for passengers. Indian Railways' total share of freight and passenger traffic has steadily declined. Fifty years ago IR carried more than two thirds of both freight and passenger traffic. Twenty years ago it still accounted for two thirds of freight, but its passengers share had fallen to one third. By FY 2007, IR's share of freight traffic had fallen to less than one third and its passenger traffic share was only 13%. (ADB report IND 36317, Nov 2002). Trends in road and rail traffic shares are in Table 1.1.

Table 1.1 Operational performance of different modes of transport

Historical Overview of Operational Performance of different modes of Transport Mode-wise Traffic in Million Tonnes and percentage Share in Total Traffic							
Year	Total originating Inter regional traffic	Railways	Highways	Coastal Shipping	Airlines	Pipe lines	Inland Water transport
1950-51	82.3	73.2 (89%)	9.0 (11%)	NA	NA	NA	NA
1978-79	283.4	184.7 (65%)	95.6 (34%)	3.1 (1%)	NA	NA	NA
1986-87	484.9	255.4 (53%)	224.0 (46%)	5.5(1%)	NA	NA	NA
2007-08	2555.35	768.7 (30.08%)	1558.9 (61%)	59.1 (2.31%)	0.28 (0.01%)	113.5 (4.4%)	54.9 (2.15%)

Source: RITES Draft final report 2009: "Total Transport System Study on Traffic Flows and Modal Costs"

It is seen that the market share of rail transport has reduced drastically from 89 % in 1950-51 to 30 % in 2007-08. The road sector has been the biggest gainer and pipelines also have gained share by 4.5 %.

Along with People's Republic of China (PRC) and United States (US), India is one of the few countries in the world with annual railway traffic in excess of 500 billion converted ton-km (ctkm). The passenger share of railway traffic in India is high compared with other countries with large railway operations. In FY 2010 passenger-km represented 60% of IR's total ctkm, compared with 24% in PRC and 1 % in the US.

1.3.3 Global Benchmarks

A comparison of the essential features of important world railways including those which carry more passenger and freight traffic than IR, is given in the two tables below. The figures of efficiency parameters in the second table are derived figures.

Table 1.2 Comparison with World Railways

Country	Network Lengths (kms)	Number Of Employees	Passenger Carried (millions)	Passenger (kms) (millions)	No of Locos	No of coaches
France	29488	166000	1087	83299	4289	33238
Germany	33897	231000	1835	74740	4128	95595
Russia	84158	1128000	1280	173411	12063	566802
USA**	226706	187000	26	9059	23990	475416
Canada	57042	34000	4	1451	2947	97836
South Africa	24487	36000	533	14856	3301	112417
Australia	9639	13000	54	1309	509	10889
India	63327	1406000	6219	694764	8110	207719
China	63637	2067000	1287	689618	17222	571078
Japan	20050	132000	8907	252579	1190	9067

*Source: UIC 2007 ** AAR Class I and Amtrack

In terms of route length, IR is the fourth largest in the world after US railroads and Russian and Chinese Railways. As regards freight traffic, again it is fourth but substantially behind these three railway systems. In passenger traffic, even though Japan carries more passengers, Indian Railways is the highest in terms of passenger kilometres.

The efficiency and productivity figures reveal that passenger leads are much higher on Russian Railways, US Railroads and Chinese Railways. The PKMs/route kilometre of IR compares well with other railways like Chinese and Japan Railways. IR's productivity figures of PKM/employee are second only to Japan which, however, has very less number of employees. Compared to Railways like Chinese Railway and Russian Railways, IR's figures are much higher. An analysis of the comparative figures reveals that in respect of passenger traffic, IR's figures are not strictly comparable since it does not have high speed passenger services in Japan, China and the European railways.

Table 1.3 World Railway Efficiency Parameters

Country	Passenger Lead (km)	PKM/Employee (millions)	PKM/Route Length (millions)
France	76	0.5	2.82
Germany	41	0.32	2.20
Russia	135	0.15	2.06
USA**	348	0.05	0.04
Canada	363	0.04	0.03
South Africa	28	0.41	0.61
Australia	24	0.10	0.14
India	112	0.49	10.97
China	536	0.33	10.84
Japan	28	1.91	12.60

*Derived from UIC 2007 data

1.3.4 Losses in Passenger Operations

Passenger segment is one of the two major streams of business and significant efforts of Railways are devoted to the satisfactory delivery of passenger services. Despite the outlined strategy and initiatives taken, revenues from passenger services were insufficient to meet the cost of operations and the Railways suffered heavy losses (Table 1.4). It is through cross-subsidy from freight traffic that the losses in the passenger segment are compensated.

Table 1.4 Loss on Coaching Operations (Rs in Crore)

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Earnings	15045.62	15896.26	17420.34	20419.14	22722.01	26088.09
Expenditure	20826.46	23829.47	23986.47	26711.34	30244.46	40045,88
Profit/loss	-5780.84	-7933,21	-6566.13	-6292,2	-7522.45	-13957.79

Source: Indian Railways vision 2020 report

While passenger services consume nearly 60% of the network capacity, their share in the traffic earnings amounts to only 33 %. Competition from different modes, low cost air carriers in particular in respect of long distance and luxury buses in short to medium distance segments, is beginning to threaten Railway's hold on upper-class passenger segment. As a result, Railways are under pressure not to increase premium class fares. On the other hand, second class fare, especially suburban fares, have been spared from any hike for several years as these are considered critical for the underprivileged sections of the society. The net result is that passenger business of Railways has been a losing proposition. Table 1.5 illustrates the point.

Table 1.5 Economics of Passenger Services

Year	Earnings per train Passenger kilometre(Rs)	Cost of hauling a passenger train kilometre (Rs)	Net earnings on working a passenger train one kilometre
2005-06	322.02	454.50	(-) 132.48
2006-07	368.07	509.06	(-)140.99
2007-08	412.22	550.97	(-)138.75

Source: White paper on Indian Railways 2009-10

1.4. Quality and Services

Numerous researchers and scientific associations have tried and are trying to define the concept of quality based on different aspects. It is safe to say, however, that as of this day there is no uniform definition. The main reasons of it are found in the below characteristics of quality (Veres, 2005. p 68).

Quality is objective and subjective at the same time. It can be generalized to a limited degree. Among its factors there are specifications, which can be measured and others that can only be apprised. Quality can mean a technical-efficiency level and on any departure therefrom (condition), it will have perceivable use effects and effects that the purchaser does not consciously perceive.

1.4.1 Development of Definition of Quality

Parasuraman (2002, 2005) describes the change of the concept of quality in the light of historic development. Quality originally was connected to tangible products and as supported by Juran's "fitness for use" (Juran, 1988) and Crosby's "Zero defect" theory (Crosby, 1979). Later this interpretation expanded linearly as well and experts started to apply the concept of quality (and its criteria) to all elements of the production chain, creating products or services, rather than to one product. In other words, they addressed the quality of the entire production or consumption process. For example, in assessing the quality of a product, the production, sale, and customer service procedures are taken into consideration as "the total composite product and service characteristics of marketing, engineering, manufacture, and maintenance through which the product and service is use will meet the expectations of the customer" (Feigenbaum,1991, p.7).

The subsequent development was characterized by a shift towards the service quality of intangible products (such as research and development and engineering). As the significance of services in the economy skyrocketed, quality too started to have an ever-expanding importance in the sector. One constant component of the quality definition is meeting customer expectations or demands. Be it a product or a service, suitability to meet customer demands is a significant, if not the most important element of the concept of quality.

Fitzsimmons put it as: "*the characteristics of a product or service that bear on its ability to satisfy stated or implied needs"* (Fitzsimmons 2004) Pursuant to Deming`s interpretation, quality "exceeds" the expectations of the buyer during the lifetime of product (or service). In his opinion the concept of quality has no meaning, unless it composes (frames) the expectations of buyers (Deming, 1986).

According to the traditional interpretation, quality meant compliance with internal prescriptions and standard. Later it was identified with suitability for use and in the most current interpretation of the word, quality means not simply meeting or exceeding the buyer needs, rather meeting or exceeding *environmental and social expectations.*

Today quality is construed in a more comprehensive manner; it refers to the entire organization (company, instrument), its environment, infrastructure and the society as well. Organizational, social culture as well as the category of life-quality gain true quality content (Parasuraman, 2000).

1.4.2 Definition of Services

A uniform definition of a service has not been developed till this day. Besides theoretical constructions, several classification structures are accepted in the professional literature.

The most accepted definition approaches the concept from the activity side of the service. Pursuant to this approach to service, is the result of such activities, which facilitate that the condition of a person, object, information – maybe process – is maintained (repaired), forwarded, stored, supplemented, improved or transformed, without changing its basic character. The result of the service usually cannot be stocked up and no new product in a physical-objective form is produced. Rather the conduct directly satisfies the common personal or communal needs of persons and the society, as well as the demands of the production process (Parasuraman, 1994b).

Pursuant to the Classification of Services (2003): “service is the result of the activity which satisfies needs typically by establishing a direct connection with the customer.It usually does not take a physical-material form, rather is manifested by improving or maintaining the condition of economic units, objects or persons”. Pursuant to Kotler, service is an act or performance provided by one party to the other which fundamentally is not materialized and does not result in creating ownership over things. Its production is either connected to the physical product or not (Kotler, 1998).

***Service** means the process aimed at meeting customer expectations, which is fundamentally based on the direct or indirect interaction of the customer and the supplier. The result of the service typically manifests itself in an intangible form.*

1.4.3 Service Characteristics and Service Quality

Due to the specific nature of the services, evaluating their quality is extremely difficult. Service quality is *harder to evaluate* for the customers than the quality of products, because the person evaluating the service typically does not have the necessary expertise to do it or there are no objective measures. Customer judgment is rather subjective and it is affected by psychological factors, prior experiences and word-of-mouth. Considering the above we can conclude that in case of services the popular service quality definition, stating that "quality is good if it is deemed to be good by the customer" is especially true (parasuraman, 1994a).

Suppliers face more difficulty if they want to explore the expectations they have to comply to. In case of some services - such as immaterial service-results like educational or development services - the customer can only circumscribe his/herexpectations. "Compliance standards and success of the performance depend on the professionalism of the supplier and on the preparedness and attitude of the customer" (parasuraman, 2005).

Service quality is a field of many *ambiguities*. It is hard to define what we understand under bad and under good service. What makes it more complicated is that different customers find different features important in the same service. Let us look at a trade company, serving both retail and wholesale partners. Retail customers are likely to appreciate if the service is rendered in an esthetical store, by employees having a decent appearance, proper skills and capable of providing adequate information on the products. Similarly, the customer will value if there is a chance to try the products or use other complementary services (e.g. home delivery). The wholesale partners of the same company will appreciate the service for other features like: proper phone availability, professional information and personalized offers while physical appearance will have less importance. The generally held "trust elements" and the "experience factors" after the service was delivered have an impact on service assessment (Hentschel, 1995).

The research results of Zeithaml (1981) also support that in evaluating service quality customers rely on *experience* and *trust* to a greater degree. The service is evaluated - not only upon its outcome (e.g. the bank transaction was completed) - the process of the service provision will be taken into consideration as well (whether the bank employee was polite, professional, how long the procedure lasted etc.). As opposed to product quality, service quality can only be measure during the process itself. This procedural approach requires that tangible and intangible quality components are interpreted simultaneously. Grönroos (1982) describes this feature of service quality in the *technical - functional model* of service quality.

1.4.4 Approaching Service Quality Concepts

Although the service sector makes up a substantial part of the economy, publications choose to address service quality a lot less, than the quality of products or manufacturing processes (Ghobadian, Speller, and Jones, 1994). This is so, because the characteristics of the physical products and the services are different and there are many ways to interpret the concept of service quality. While during industrial production the quality (the totality of the products' characteristics) and fitness (features deemed material or the prescribed, determinable and measurable features) may be clearly separated, in case of services differentiation is more complicated.

Accordingly, in determining service quality, personal subjective judgments play a more substantial role. Relevant to the above quality-fitness duality, the set of characteristics expected by the individual corresponds to the quality side and the actual subjective judgment on the material service qualities, to the fitness side. Zeithaml defined perceived quality as: *"the consumers' judgment about an entity's overall excellence or superiority"* (Zeithaml, 1988, p. 3). This is rather a judgment or a subjective attitude, than an objective concept. Service quality is determined by comparing the expectations with the perceived performance, that is, by disconfirmation. This correlation was the starting point of many researchers (Parasuraman et al., 1985, 1988, 1991a, 1991b, 1994a, 1994b) and one of most accepted service quality models, SERVQUAL, is based on this premise too. The real challenge of defining service quality originates from the difficulty of determining which characteristics or dimensions should be evaluated by the customer and by the problems of deciding how to interpret the degree of the given characteristic, that is, the expectations formulated relevant to them. According to the Gap-model the perceived service quality is "*the degree and direction of the discrepancy between consumers' perceptions and expectations*" (Parasuraman et al.,1988, p. 17). In other words, expectations are clearly determined by the individual customer as to whether the expectations have to be interpreted in an explicit manner, or simply measuring the individual characteristics (promises in connection with fitness) would suffice. The latter theory is supported by research results from Cronin and Taylor (1992, 1994), Teas (1993, 1994), Liljander and Strandvik (1994), and Dabholkar (2000), concluding that service quality is the quality perceived by the customer. Academicians and practitioners in service operations, while accepting the meanings of the words 'products' and 'services', have conceded that quality – as it pertains to services – could be defined differently from the definition of quality of products. Service quality has been recognised as an abstract construct that is difficult to define and measure (Parasuraman, Zeithaml and Berry 1985; 1988: 13), and thus, it remains management field's one of the most important problems (Cravens 1988, cited in Cronin & Taylor 1992:55). Gronroos (2000:7) and parasuraman, Zeithaml and Berry (1985: 41:1997:66) propose that high quality service may allow an organisation to gain competitive advantage simply by achieving customer satisfaction.

1.4.5 Customer Satisfaction

The concept of Customer Satisfaction (CS) has drawn the interest of academics and practitioners for more than three decades in the light of the fact that customers are the primary source of revenue. Churchill and Surprenanat (1982) define customer satisfaction as an outcome of purchase and use resulting from the buyers' comparison of the rewards and costs of the purchase in relation to the anticipated consequences. It has also been viewed as an emotional state that occurs in response to the evaluation of service (Westbrook, 1981).

The former conceptualization recognizes that satisfaction is determined by cognitive process comparing what customers receive (rewards) against what they give up to acquire the service (costs) whereas the latter views satisfaction as an emotional feeling resulting from an evaluative process. Currently, the most widely adopted description of CS is a process: an evaluation between what was received and what was expected (Oliver, 1977, 1981; Olson and Dover, 1979; Tse and Wilton, 1988). By looking at satisfaction as a process, these definitions concentrate on the antecedents to satisfaction rather than satisfaction itself.

The most “well-known” descendent of the discrepancy theories is the expectation disconfirmation paradigm (Oliver, 1977, 1981). According to this paradigm consumers’ satisfaction judgement is the result of consumers’ perceptions of the difference between their perceptions of performance and their predictions (or expectations) of performance. Positive disconfirmation leads to increased satisfaction, with negative disconfirmation having the opposite effect. Many studies support the disconfirmation paradigm but others do not; for example, Churchill and Suprenant (1982) found that neither disconfirmation nor expectations have had any effect on CS with durable products.

In their review, Poisz and Van Grumbrkow (1988) view satisfaction as a discrepancy between the observed and the desired. This is consistent with value-percept disparity theory (Westbrook and Reilly, 1983) which was developed in response to the problem that consumers could be satisfied by aspects for which expectations never existed (Yi,1990). The value-percept theory views satisfaction as an emotional response triggered by a cognitive-evaluative process (which is the comparison of the “object” to one’s values rather than expectation). Consumers want consonance (or no disparity) between their values (needs, wants and desires) and object of their evaluations. Recent developments of this study include the concept of desire congruency (Spreng et al., 1996).

Equity theory has also been applied to customer satisfaction (Fisk and Young, 1985; Swan and Oliver (1985).In this theory, individuals compare their input/output ratios with those of others (Yi, 1990). In a transaction relationship, therefore, a consumer could compare their net gain to the marketer’s or any other reference group (Merton and Lazarsfeld, 1950). If this was perceived to be fair then the consumer would be satisfied. Thus, in these cases, satisfaction is an outcome of inter-personal rather than intrapersonal comparisons.

1.4.6 Customer Satisfaction Measurement:

Satisfaction is defined as a customer's perception of a single experience, whereas quality is the accumulation of the satisfaction for many customers over many service experiences. Such post-evaluative experiences perhaps lead over time to a more general attitude. Moreover, service is equal to the perception of a "single" service as perceived and measured against the expected service received. The difference in the degree, direction, and discrepancy between the "perceptions" and "expectations" of a customer results in a level of satisfaction or dissatisfaction (Hill, 1992; 44).

The connection of 'quality' to 'service' is now anchored, unreservedly by association – to heterogeneity and diversity. No longer does service quality imply achievements of the highest possible standards of execution with in the service sector.

1.5 Statement of the Problem

Organisations are making concerted efforts to improve the quality of their services to meet customer expectations, satisfaction and reactions. Although passenger satisfaction can be predicted by service quality attributes, very few empirical research studies have been carried out in field of transportation services (Robert Y Cavana and Lawrence M.Corbett 2005). As a result, many questions still remain unanswered. Questions like: "Do railway passengers vary in their preferences for and perceptions of various aspects of passenger services?" "Can the service quality model developed for railway passenger services lead to improved passenger satisfaction in railway passenger services?" need to be more thoroughly investigated to improve the quality of services in Indian Railways.

1.5.1 Significance of the Study

This study aims to develop a model RAILQUAL for assessing the extent to which service quality indicators and other explanatory attributes can be used to predict passenger satisfaction from the perceptive of passengers of Indian Railways. In order to address the purpose of the study, the research questions and research objectives are outlined as indicated below.

1.5.2 Research Questions

The gap identified in the review of conceptual and contextual literature and management practices of passenger transportation service sector in Indian Railways have led to the formulation of five research questions that motivated the present study.

(i) What is the structure of Railway Passenger Service Quality?

(ii) What are the antecedents of the Railway Passenger Service Quality?

(iii) What are the most appropriate modelling and measurement methods for measuring Railway Passenger Service Quality quantitatively?

(iv) What is the relationship between Railway Passenger Service Quality and passenger satisfaction and behaviour loyalty of passengers?

1.5.3 Research Objectives

Based on the research questions the broad objective has been framed to evaluate service quality and passenger satisfaction in Indian Railways by developing RAILQUAL. The broad objective was further divided into the following sub-objectives. They are

(i) to identify railway passenger service quality attributes and dimensions and to construct RAILQUAL instrument for measuring railway passenger service quality;

(ii) to develop RAILQUAL theoretical model to find service quality dimensions which are significant predictors of overall service quality in railway passenger services and to identify individual service quality attributes which are significant predictors of their respective service quality dimensions ;

(iii) to confirm the identified railway passenger service quality attributes and railway passenger service quality dimensions by developing RAILQUAL measurement model and

(iv) to test the relationship between attributes and dimensions of railway passenger service quality through RAILQUAL Structural Model and to determine the role of each attribute and dimension in predicting service quality and passenger satisfaction.

1.5.4 Research Hypothesis

Based on the objectives, the following nine hypotheses are framed to be tested for the study and correlate significant variables as follows.

H_1 Reservation and Ticketing have a significant effect on Railway passenger service quality

H_2 Platform services have a significant effect on Railway passenger service quality

H_3 In-Train services have a significant effect on Railway passenger service quality

H_4 Punctuality has a positive effect on Railway passenger service quality

H_5 Employee services have a significant effect on Railway passenger service quality

H_6 Safety and Security have a significant effect on Railway passenger service quality

H_7 Railway passenger service quality has a significant effect on passenger satisfaction

H_8 Railway passenger satisfaction has a significant effect on passenger behaviour intention

H_9 Railway passenger service quality has a significant effect on passenger behaviour intentions

Figure 1.1 shows the hypothesised RAILQUAL research model.

1.6 Statement of originality of the Research

Within the last three decades, research in the field of service quality has significantly matured and moved towards conceptually and contextually better research studies. This has helped to make research in service quality discipline more cumulative in nature, allowing for broader conceptual progress from one study to another. However, the researcher was motivated to carry out the study due to paucity of prevailing research studies in the transportation sector and the researcher was also encouraged to select railway passenger services in transportation sector due to the importance and weightage it got in our nation building.

To resolve the deficiencies in the emerging contemporary research studies, this research aims for a greater degree of reliability and validity through a robust and comprehensive framework of research methods, in order to approach the problem area while maintaining a rigorous conceptual framework appropriate for the study.

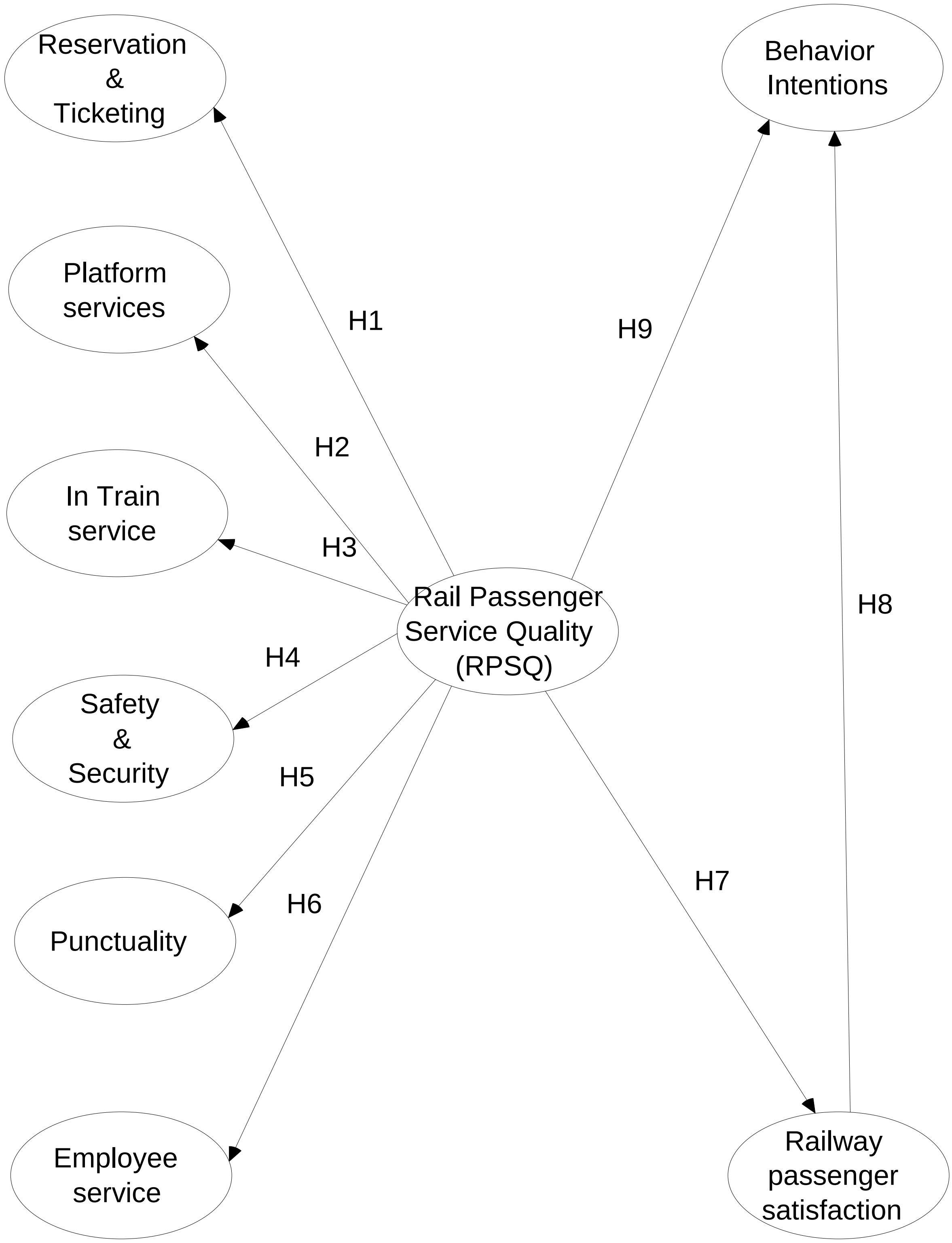

Figure 1.1: Hypothesised RAILQUAL Research Model

In examining the literature for the studies relating to the field of railway passenger services, it was found that employment of a methodological approach suggested by this research has not been done in other similar studies, which indicates the methodological novelty of this research work.

As the services operations concept continues to evolve, a tendency is expected to grow to establish rigorous methodological approaches to undertake thorough investigation of the different phenomena and to incorporate context-specific issues into the global body of knowledge for possible generalisation. Most of the previous research studies relevant to this research have been carried out in America, UK, Canada, New Zealand and a few in China. It was therefore considered important and pertinent to investigate the Indian scenario, thus contributing to and enriching the existing body of knowledge for world wide application and empirical generalisation, which would in turn be another original contribution to the body of knowledge in the said field. Furthermore, the unique contextual distinctiveness of Indian Railways being a government department with mandatory social obligations on one hand and the expectation to function as a commercial organisation on the other makes this study more relevant. Its passenger services, long distance as well as urban transport, continue to heavily subsidized. Populism rather than business objectives continue to guide and determine the key investment decisions. The new services of Indian Railways have provided new dimension and insight into the said field of study to predict passenger satisfaction in relation to service quality.

Further, Walker (1997:150-152) charts a number of routes to demonstrate the originality of research, such as the development of new methodologies, tool and /or techniques, new area of research, new interpretations of existing material, new application of existing theories to new areas, or new blends of ideas. Drawing upon this background, the contribution to knowledge of this research could be principally viewed as a theoretical contribution, since the identification and development of appropriate measures – based on the best-suited theory for predicting passenger satisfaction of railways, especially with in the issues surrounded on the passenger services in the context of Indian Railways – were yet to be explored. Thus the expected key outcome of this study was to develop a model ‘RAILQUAL’ for predicting passenger satisfaction in relation to service quality in passenger services for the purpose of helping Indian Railway Management and policy makers in the Government of India to make managerial decisions related to improvement in service quality.

There are two major underlying reasons for the development of a new model. One is that the prevailing literature explicates that the existing models of service quality do not account for quality attributes particularly specific to railway passenger services. The second reason is that in reviewing the literature, it was discovered that none of the research studies had been carried out by using Structural Equation Modelling approach. The results of the analysis therefore demonstrates a divergent view of emerging passenger satisfaction based on these two paradigms, and as a result, a better parsimonious model for the prediction of satisfaction can be derived by selecting the optimal paradigm; this demonstrates another aspect of novelty in this study.

Overall, service quality attributes in the proposed model are proven useful as components for examining the predictive power, which has not been extensively investigated in the previous research in service quality in transportation services in general and railway passenger services in particular.

1.7 Research Design and Methodology

The pedagogical debate that exists over the relative merits of quantitative and qualitative research can be, and was in this research, ameliorated through the inclusion of both qualitative and quantitative research approaches. This is known as triangulation approach, where a combined approach is taken within a particular study (Leedy, 1993). In this study a methodological triangulation or mixed method approach was adopted, whilst other approaches to triangulation include measurement, theoretical and observational triangulation (Neuman, 2003). The inclusion of a mixed approach enables some of the benefits of both qualitative and quantitative research approaches to be contained with one study.

In this research the initial approach was qualitative and enabled the researcher to gain a deep understanding of the perceived rail travel experience. Focus groups of railway officers and passengers with experience of rail travel were held with the resultant data providing valuable insights into aspects of the train travel experience that created satisfaction and dissatisfaction in passengers in upper class as well as in lower class travel. This was followed by a quantitative approach with data collected through a self - completed survey instrument. The instrument was partially constructed through an analysis of the data collected in the qualitative stage of research. The quantitative stage enabled the researcher to gain a volume of response that would not have been possible within an exclusively qualitative approach.

1.7.1 Research Design

The selection of an appropriate research methodology is crucial to the effectiveness of the research work. Methodology in social science falls within the three categories of positivist, interpretive and critical social science with majority of research being contained in the first two categories (Neuman, 2003). Often the methodology is more simply defined as quantitative or qualitative, but of most importance is that the methodology selected must complement the research questions being examined (De Vaus, 2002). In this research work qualitative research work followed by quantitative approach is used.

1.7.2 Qualitative Research Approach

In this research, focus groups were used to explore perceptions of railway passenger services with the resultant data being analysed and used for the development of scales to be used in the quantitative stage of the research. Each of focus groups lasted from one to one and a half hours. The researcher acted as moderator for the focus group discussion and recorded extensive notes of the proceedings. The key themes and words were identified and used to develop a range of attributes in relation to the rail passenger quality. In addition the focus groups discussed aspects of the service quality relationship that affected passenger satisfaction and the aspects of the passenger satisfaction that influence loyalty. As a result of the focus group discussion and the review of transport quality literature, a scale was developed.

1.7.3 Sample Plan and Data Collection for the Main Study

The main data were collected dynamically across South Central Railway. The researcher travelled along with the passengers in the trains and collected data from the passengers. A purposive sampling approach was used. Judgement sampling is an approach whereby the researcher selects a non-probability sample they believe is representative of the population as a whole (Zikmund, 1997). In this research the selected trains were considered to be approximately representative of the whole South Central Railway. In total 1215 completed survey responses were collected out of 1620 distributed (i.e., with a response rate of 75%).

1.7.3A Sampling Frame

For this study South Central Railway is purposively selected. The Sampling frame is as follows as shown in Table 1.6.

1.7.4 Sampling justification

The sample size selected for the study was justified with the following sampling justifications as shown below.

1.7.4. A First justification

The method of “Five subjects for one attribute” was used for the determination of total number of subjects for the sample of the exploratory survey (Hair, Anderson & Black 1995, cited in Okoroafo 1997). The method of five subjects for one attribute denotes that the sample size should be five times as large as the number of total attributes identified, following the attribute refinement process of the study. Since there were 45 attributes identified/ refined by the panel of experts in compliance with above requirement, the sample size should be 225. However, with a contingency rate to compensate for the potential non-responses, 236 subjects can be used as a sample. In this study 1215 is the sample size proportionately split into strata of male and female, upper class and lower class passengers, frequent travellers and occasional travellers. Each stratum sample is also around 225 which indicates that it is a proportional representation of the population.

Table 1.6 Sampling Frame

Total Population (Indian Railways)					**Fig in millions**
Trains	Trains	Yrly Passen	Pass/Day	Revenue	Revenue(%)
Passenger	2999			34590	17
Mail/Express	2077	3120	8.5	14755	75
Suburban	4648	3800	10.4	1569	8
Total	9724	6920	18.9	19783	100
Working Population (South Central Railways)					**Fig in millions**
Trains	Trains	Yrly Passen	Pass/Day	Revenue	Revenue(%)
Passenger	254			3050	17
Mail/Express	170			13470	75
Suburban	47			1440	8
Total	471	290	0.795	17960	100
Sampling Frame					
Trains	Trains	Pass/Train		Total Sample	
Passenger	8	26		208	
Mail/Express	35	26		911	
Suburban	4	24		96	
Total	47			1215	(ie 0 .15% or one out of 650
Detailed Sampling Frame					
Trains	Trains	Pass/Train		Total Sample	
Passenger	8	26		208	
Mail/Express(UC)	35	9		315	
Mail/Express(LC)	35	17		596	
Suburban	4	24		96	

1.7.4. B Second justification

While using the Structural Equation Modelling approach the sample size should follow the following norms based on model complexity and basic measurement model characteristics (Hair, Anderson & Black 2007).

- Minimum sample size – 150: Models with seven constructs or less, modest communalities (.5) and no under identified constructs.

- Minimum sample size - 300: Model with seven or fewer constructs, lower communalities (below .45), and/or multiple under identified (fewer than three) constructs.

- Minimum sample size – 500: Models with larger number of constructs, some with lower communalities, and/or having fewer than three measured items.

In addition, group analysis requires each group to meet the sample size requirements. In this study the sample taken is 1215 which is adequate to represent the population of interest.

1.7.4. C Third justification

With random samples, it is possible to set the size of sample according to how accurately we want to estimate the actual population parameters, or how much sampling error we are willing to accept. The basic formula for computing the sampling error for a sample estimate of population parameter is as follows. The proposed sample size for the research is based upon the formula suggested by Krejcie and Morgan (1970).

$$\mathbf{S = \chi^2\ NP\ (1\text{-}P)/d^2(N\text{-}1) + \chi^2\ (P(1\text{-}P))}$$

Where, S = required sample size; χ^2 = the table value of Chi-square for one degree of freedom at the desired confidence level (3.84); N = the population size; P = the population proportion (assumed to be 0.50 since this would provide the maximum sample size); and d = the degree of accuracy expressed as a proportion (0.05). As per this formula the sample size comes to 374 and the sample taken for this study is well above that level.

1.7.4. D Fourth justification: **The Confidence Interval Approach**

First specify the lever of precision. This is the maximum permissible difference (D) between the sample mean and population means. It is + or - 5. Then specify the level of confidence. For a 95% confidence level, the probability that the population mean will fall outside one end of the interval is 0.025 (0.5/2). The associated Z value is 1.96. After that determine the standard deviation of the population either through secondary data or through pilot study or through researchers judgement .The researcher can estimate the standard deviation by dividing the range by 6 and the range can be estimated on the basis of knowledge phenomenon. Then sample size can be determined using the following formula for the standard error of mean. After the pilot test the biggest standard variation of factors was selected that belonged to item means standard deviation for in train service dimension which is 0.755. Following is the formula.

$$\text{Sampling error} = \frac{\text{Variability of the measurement (Values among the sampling units)}}{\sqrt{\text{(Size of the sample)}}}$$

$$0.05 = \frac{0.755}{\sqrt{\text{(Size of the sample)}}} \Rightarrow \text{Size of sample} = 230$$

1.7.5 Non Response Bias

Although the data collection process in research is intended to collect data from a sample of the population that is fully reflective of the population as a whole it is unlikely that all the possible respondents will participate in the survey (De Vaus, 2002; Dillman, 1978; Fink, 2003; Fowler, 2002) and therefore the respondents may not form a true subset of the population (Armstrong & Overton, 1977; Leedy, 1993; Neuman, 2003). The response rate to surveys have declined over recent years due to increase in the number of surveys and growth in the number of people refusing to participate in surveys (Chen1996; Neuman, 2003).Even if the sample selected is fully representative of the whole population, the pattern of actual respondents is unlikely to reflect the whole population, as those who do not respond may exhibit different characteristics in respect of demographics and lifestyle than those who choose to respond (Chen, 1996; Leedy, 1993). Chen (1996) identifies that previous research has found that gender, age, educational level, income, travel class, travel frequency, travel purpose affects the response rate. Unless a survey achieves hundred per cent response rate, some elements of non-response bias will be implicit in the data set (Chen, 1996). There are many approaches to minimise non-response bias.

Armstrong and Overton (1977) identify three approaches to minimise the impact of non – response bias. The strategies are to minimise the number of non-respondents, to sample non-respondents and thirdly to estimate the effects of non-response (Armstrong & Overton, 1977). In this research as the first two approaches are not possible, the third strategy is adopted.

The third strategy is the estimation of non-response bias and there are three approaches namely comparison with known values, subjective estimates and extrapolation (Armstrong & Overton, 1977). The second and third approaches are not feasible in this research. Hence the first approach, comparison with known values, entails comparing the dataset with known values in the population. In this research the demographic characteristics of the respondents from each train was checked with the railway staff (i.e., Travelling Ticket Examiner (TTE) and Enquiry Commercial and Reservation Clerks (ECRC) including age, gender and travel class and the railway staff agreed that the respondent profile is representative of the general passenger population. As train passengers vary considerably over time this only reflects the railways perception that the respondents were reflective of the general population. Although this indicates the response set is a reasonable subset of the population it is not valid to conclude that there is no non-response bias contained in the sample. On the basis of the railway staff confirmation that the respondents were representative of the passenger profile is being accepted as reasonably representative of the whole population.

1.7.6 Data Cleaning and Missing Value Analysis

After data collection was completed and the data entered into SPSS, the data were subject to examination for errors, including those resulting from data entry. The data were examined using SPSS descriptive statistics to ensure all data entries fell within the accepted range for that item.

The data were also examined for item non-response, with item non-response for any individual item ranging from 0.3 per cent to 8.2 per cent. There were no generalised patterns of non response. The range of item non-response fell within the parameters suggested by Craig and McCann (1998), who suggest between 3 per cent and 8 per cent of items on questionnaire are left blank by respondents with age, gender, education and income affecting levels of non-response. The data were examined for patterns of non-response using the pattern and descriptive functions within Missing Values Analysis in SPSS, and the missing values were a random distribution. The overall average of missing items was 1.62 per cent.

Where there are missing values within a dataset there are two approaches to remedy the situation. The first option is that the missing values are deleted from the dataset either by removal of the case or variable. The use of case wise deletion, where each case that has a missing value is deleted can lead to the loss of substantial amount of data. The alternative approach involves the deletion of a variable if there is evidence that the variable is responsible for a high missing value and can be deleted without impinging on the research program (De Vaus, 2002; Hair et al., 1998; Tabachnick & Fidell, 2001). The second option involves the missing values being replaced by imputation from the rest of the available data. There are a number of approaches to the imputation of the missing values including mean substitution of regression (Tabachnick & Fidell, 2001).

In this research the option of the case wise deletion was evaluated but rejected, as it would result in the deletion of too large a number of cases. It was therefore decided to use an imputation approach with the regression approach being adopted to replace the missing values in the dataset. This approach was selected as it is a more sophisticated approach to missing value imputation than mean substitution as it includes other variables in the development of the regression equation (Hair et al., 1998; Tabachnick & Fidell, 2001).

1.7.7 Data Triangulation

Data triangulation refers to the use of more than one form of data in order to enhance confidence in the findings. In social and behaviour sciences research, it is used as a source of reducing bias. Thus it is important to retrieve more than one data that can strengthen the object to process the facts for appropriate results. Flick (2002) reveals that validation of data can be done by triangulation tools because it is collected by more than one source.

There are five types of triangulation. They are Data triangulation, Investigator triangulation, Theory triangulation, Methodological triangulation and Interdisciplinary triangulation.

In this research to make more reliable and validated findings, data triangulation was applied. The researcher applied different sources of data like theory triangulation which refers to the same set from multiple perspectives. Thus, the survey questionnaire applied in this research is contained in different sections which were correlated with desired objects. The questionnaire comprises seven sections which are interpreted with multiple perspectives like reservation and ticketing, platform services, in train service, punctuality and reliability, employee service, safety and security and demographic variables to the railway passenger service quality. By employing these sources the researcher could increase the reliability and validity of findings.

1.7.8 Reliability and Validity Assessment

The final stage of the model development process is the assessment of the reliability and validity of the proposed model. This stage of the model development process is included in the next chapter of this thesis as an outcome of the Confirmatory Factor Analysis on the dimensions. The Cronbach alpha value for the scale was 0.922.

1.7.9. Demographic Characteristics and Relationships

This study was undertaken from October 2010 to March 2011 across South Central Railway. The survey questionnaire were distributed and collected on 47 trains overs South Central Railway in which 35 are express trains, 8 passenger trains and 4 suburban trains. To capture exact perceptions of the passengers on railway passenger service quality the researcher travelled along with the passengers and the questionnaires were distributed to passengers when they have travelled half of the journey and then the filled in questionnaire were collected back when the respondents were about to alight at the destination station. The characteristics of the respondents such as age, gender, education, profession, income, travel class, travel frequency, travel purpose and travel reason were asked in the questionnaire. Demographic details of the participants (Table 1.7) showed that 59.6 %

Table 1.7 Demographic Characteristics of Respondents

Demographic	Category	Frequency	Per cent
Gender	Male	724	59.6
	Female	491	40.4
Travel Class	Lower Class	881	72.5
	Upper Class	334	27.5
Age	Up to 20	104	8.6
	21-30	277	22.8
	31-40	231	19
	41-50	164	13.5
	51-60	236	19.4
	61-70	115	9.5
	71-80	59	4.9
	81 and above	29	2.4
Education	Illiterate	119	9.8
	Primary	358	29.5
	Up to inter	380	31.3
	Graduate/Post Grad	302	24.9
	Professional/Doctoral	56	4.6
Annual Income	Less than 1,50,000	40	3.3
	1,50,000 – 3 Lakhs	172	14.2
	3 Lakhs – 5 Lakhs	392	32.3
	5 Lakhs – 10 Lakhs	333	27.4
	Above 10 Lakhs	278	22.9
Travel frequency	less often (once in a year)	70	5.8
	twice in a year	239	19.7
	frequently (i.e., four to 5 times a year	641	52.8
	very frequently (i.e., monthly once)	242	19.9
	Daily	23	1.9
Travel Purpose	On official/business work	49	3.9
	On personnel work	201	16.5
	pilgrimage/holidaying	639	52.6
	to visit friends and relatives	242	24.2
	other reasons	34	2.8

(n=724) of participants were male and 22.8% (n=277) were between 21 to 30 years of age. A majority 72.5% (881) of the participants were lower class passengers and most of them 52.8% (641) were frequent travellers. The respondents were educated up to intermediate in 31.3% (380) of the cases and Graduates/Post Graduates comprised 24.9 % (302). About 32.3 % (392) were in the income group of 3 to 5 lakhs per annum and most of the respondents of around 52.6 % (n=639) were on pilgrimage/holiday .

1.7.10 Data Analysis

Following the data cleaning and missing value replacement, the data set was subject to a range of analytical techniques to test the hypothesis. The statistical analysis was mainly conducted using SPSS Version 17.0. A range of the analysis techniques provided in SPSS were used. It included descriptive, frequencies, factor analysis and reliability tests. In addition to analytical techniques available within SPSS, an additional computer software package, AMOS version 16.0 was used. AMOS is a Structural Equation Modelling software package and was used to undertake Confirmatory Factor Analysis and to test the Structural Equation Model that links railway passenger quality with its antecedents.

The standardised regression weights produced in the Structural Equation Model were used to evaluate hypotheses 1 to 9 inclusive. Each of the techniques used in the research is discussed here. First the data was split into two equal parts using half split algorithm in SPSS. The first part of data (n=607) was used for exploratory factor analysis to develop the theoretical model ‘RAILQUAL’ to measure the railway passenger service quality. The second part of the data (n=608) was used for Confirmatory Factor Analysis to test the theoretical ‘RAILQUAL’ model and to confirm the dimensions and attributes developed in this research. Then using AMOS a structural model of ‘RAILQUAL’ was developed to test the hypotheses proposed in the research.

1.7.10. A Exploratory Factor analysis (EFA)

In essence, Exploratory Factor Analysis is a data reduction technique that aims to explain the scores on observed variables (survey items). An exploratory component analysis of the railway performance in relation to scales developed was undertaken to identify the attributes that loaded adequately. As the sample size exceeded 1200, a factor loading of 0.60 was deemed acceptable (Hair et.al., 1998). Each scale was analysed and items that were complex (i.e., loaded onto more than component, or showed factor loading below 0.60) were removed.

The Cronbach alpha for the resultant scales was calculated to ensure scale reliability. Cronbach alpha is a measure of the internal consistency of a scale and is widely used as a means of assessing the reliability of a scale (Churchill, 1979; DeVellis, 2003; Hair et al., 1998; Tabachnic & Fidell, 2001). A Cronbach alpha value of 0.70 or above is generally accepted to demonstrate a high level of homogeneity within the scale and to determine that the items do reflect a single dimension (Churchill, 1979; Hair et al., 1998; Hinkin et al., 1997).

1.7.9. B Confirmatory Factor analysis (CFA)

A Confirmatory Factor Analysis, using AMOS, was then undertaken to ensure that the dimensions identified above were robust. The use of a fully disaggregated first order model allows individual item to load only onto its specified dimension, whilst also allowing inter-correlation between dimensions (Shemwell & Yavas, 1999).

A number of fit indices were obtained including the Chi-square (χ^2), the normed Chi-square statistic, the Goodness of Fit Index (GFI), Adjusted Goodness of Fit (AGFI), Root Mean Square Residual (RMR) and the Root Mean Square Error of Approximation (RMSEA), the Normed Fit Index (NFI) and Comparative Fit Index (CFI). In addition the Standardised Root Mean Square Residual (SRMR) is reported and it reflects the difference between the samples observed and hypothesised correlation matrices and therefore indicates the average error to which the hypothesised model explains the correlations (Byrne, 2001).

This approach allowed confirmation of the factor structure associated with the measurement of perceived railway passenger service quality.

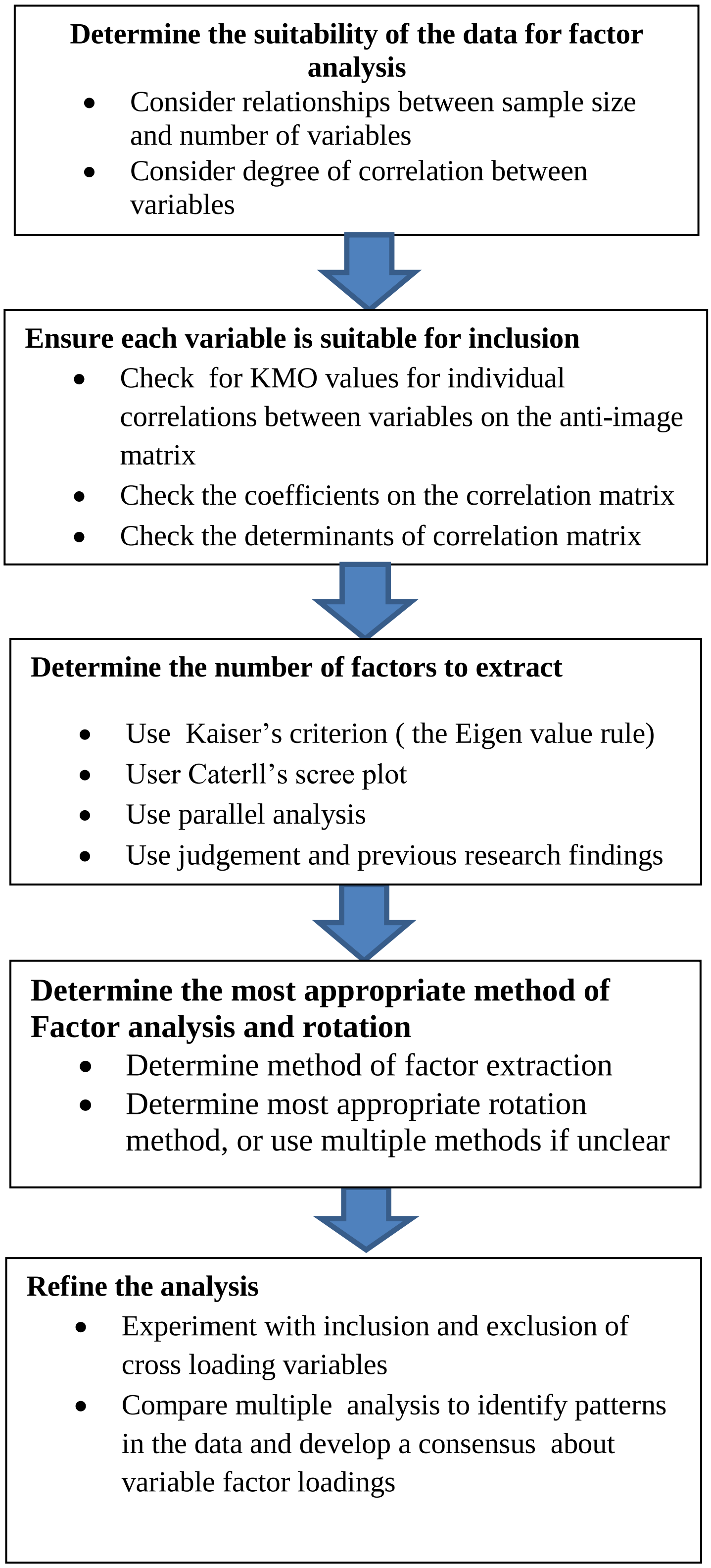

Figure 1-2: Research Approaches Adopted for Exploratory Factor Analysis

1.7.10. C Structural Equation Modelling

Structural Equation Modelling (SEM), also known as latent variable analysis (Baumgartner & Homburg, 1996; Hair et al., 1998), is a development from multiple regression analysis to combine a series of multiple equations with in one structural model (Hair et al., 1998). The approach simultaneously runs several multiple regression equations and has been used in this research to combine the relationships investigated into one broad model that integrates the relationships in the pathway from service performance to behaviour loyalty.

SEM is a confirmatory approach and is used to test theory rather than to develop theory (Byrne, 2001; Tabachnick & Fidell, 2001). SEM has a number of benefits over multiple regression in that it recognises interdependence and allows a dependent variable in one multiple regression in that it recognises interdependence and allows a dependent variable in one multiple regression to become an independent variable in a subsequent equation (Hair et al., 1998). It also allows for independent variables to act simultaneously on more than one dependent variable, thus identifying both direct and indirect effects on a dependent variable (Hair et al., 1998). In addition the approach enables the inclusion of latent variables with in the model. Latent variables are hypothesised but unobserved variables (Byrne, 2001; Hair et al., 1998; Tabachnick & Fidell, 2001). Finally an additional strength of Structural Equation Modelling is the treatment of error variance. In most data it is likely that there will be elements of error incorporated into the data and SEM incudes estimates of error variance in contrast to other multivariate approaches that ignore error (Byrne,2001; Hair et al., 1998).

Although SEM provides a number of advantages over other statistical approaches there are also limitations associated with its use. These limitations include the need for a larger sample than may be the case for other statistical tests and sensitivity to non-normality. Although with large sample sizes, sensitivity to non-normal distributions is reduced (Hu & Bentler, 1998; Lei& Lomax, 2005). Also there is a need to ensure absence of multicollinearity (Tabachinck & Fidell, 2001). It is important, when using SEM, to ensure the model is correctly specified as SEM is vulnerable to specification error whereby a predictor variable is omitted from the model thus distorting the results for the included variables (Hair et al., 1998).

There are a number of indicators that are used to assess the validity of a hypothesised model i.e., the fit between the sample and the estimated population covariance matrices (Hair et al., 1998; Tabachnick & Fidell, 2001). Although the Chi-square (χ^2) is accepted as the conventional overall test of fit, a number of alternative fit indices have been developed to overcome concerns with the Chi-square statistic in relation to issues of sample size (Hu & Bentler,1995). Whilst the model fit is important the issue of over fitting the model is also of consequence with it being necessary to balance the model fit with parsimony (Hair et al., 1998). The fit indicators can be grouped into the categories of absolute fit indices, incremental or comparative fit indices and parsimonious fit indices (Byrne, 2001; Hair et. al, 1998).

The absolute fit indices include Chi-square (χ^2), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Root Mean Square Residual (RMR) and Root Mean Square Error of Approximation (RMSEA). The incremental fit measures include the Normed Fit Index (NFI) and the Comparative Fit Index (CFI). The parsimonious fit indices include the Akaike Information Criteria (AIC) and normed chi-square statistic. In addition the Standardised Root Mean Square Residual (SPMR) can be reported and reflects the difference between the sample and hypothesised correlation matrices and therefore indicates the average error to which the hypothesised model explains the correlations (Byrne, 2001). The SRMR has been found to be more effective in distinguishing between models and is not affected by non-normality (Hu-Bentler, 1995).

The Chi-square (χ^2) statistic is recognised as the conventional overall test of fit (Hu & Bentler, 1995). However research has shown that the Chi-square statistic is not entirely reliable as an indicator of good model fit and can reject an acceptable hypothesised model (Byrne, 2001; Hu & Bentler, 1995). In particular the Chi-square statistic is sensitive to sample size with large samples often resulting in high values of Chi-square indicating a poor fit whereas alternative measures suggest an acceptable fit. In this research the Chi-square statistic is reported as it is accepted as a fundamental measure of fit (Hu & Bentler, 1995).

Absolute fit indices, such as Goodness of Fit Index (GFI) effectively compare the hypothesised model with null model and measure the relative level of variance and covariance (Byrne, 2001). Detailed research by Hu and Bentler (1995), Marsh et. al., (1988) suggest that GFI performs better than the other absolute fit indices. Although theoretically a negative result is possible if the hypothesized model is worse fit than the null model, the results for the GFI are normally in the range of zero to one with higher values indicating a better fit (Byrne, 2001). A GFI of above 0.90 is generally accepted as indicative of a good fit (Hair et al., 1998; Hu& Bentler, 1995).

The Adjusted Goodness of Fit Index (AGFI) is similar to the GFI but addresses the issue of parsimony by adjusting for the degrees of freedom. As with the GFI the result will normally range between zero and one with higher values indicating a better fit (Byrne, 2001). As with the GFI, values above 0.90 are seen as acceptable (Hair et al., 1998).

The Root Mean square Residual (RMR) represents the average residual value resulting from a comparison of the variance – covariance matrix of the hypothesised model with that of the data (Byrne, 2001). The range of values, for the RMR, range from zero to one with lower values reflecting a better fit. Values below 0.08 are indicative of a good fit (Hair et al., 1998).

In contrast to the absolute fit indices, the incremental fit indices or comparative indices of fit compare the hypothesised model with a baseline model, normally the null model (Byrne, 2001; Hair et al., 1998). The Normed Fit Index (NFI) is recognised as the principal incremental fit index but has been criticised for underestimating fit with small sample sizes. The results for the NFI range from zero to one with larger results indicating a better fit. A result of above 0.90 is indicative of a good fit (Byrne, 2001; Hari et al., 1998). In this research, Structural Equation Modelling applications were used as a confirmatory technique to validate the component structures identified using exploratory approaches and to test the full research model.

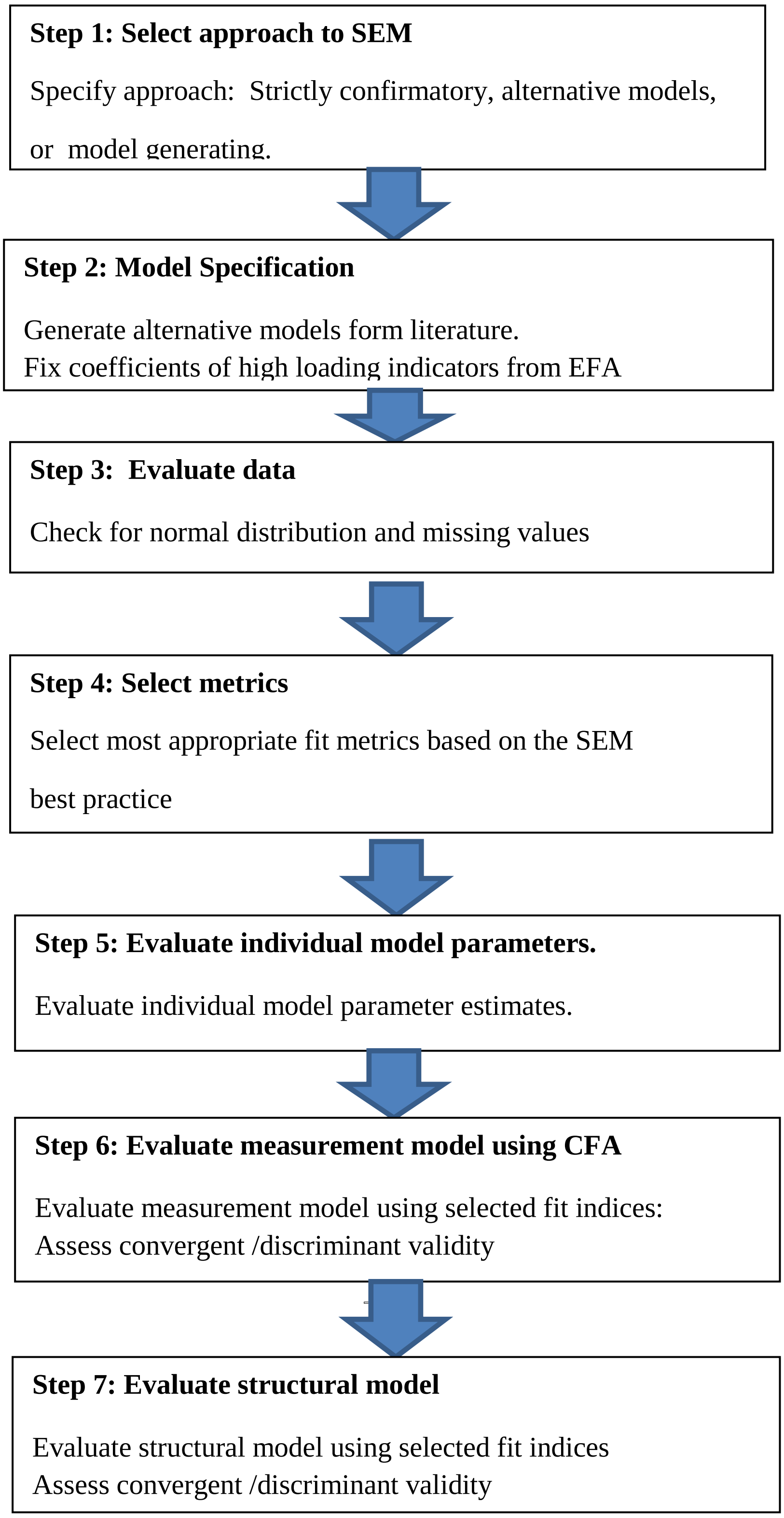

Fig 1-3: Research Approach adapted to Confirmatory Factor Analysis using SEM

1.8 Summary of Research Methodology adopted

The research design and methodology applied in the research are described in this section. The design of the research study involved several steps, syndicated in two main stages.

Stage One: Exploratory study

Attributes and domain identification completed (see Table 1.8)

Stage two: Main study

Provisional model building and testing were completed.

Given the research problem outlined in section 1.5, the basic philosophy underlying this study is positivism. For the generation of service quality attributes specific to the Indian Railways passenger services environment, focus group discussions were employed (see Table 1.8) to ascertain the dynamism of the context. Thus, stage one follows the phenomenological approach, too. The first stage of the study used a combination of inductive and deductive approaches. The inductive approach was mainly used to understand the underpinning theories and to generate attributes pertaining to service quality, primarily through a number of focus group discussions, as indicated in table 1.8 (see steps 1 and 2) . Next, it used deductive approach to refine the quality attributes for possible identification of pertinent quality dimensions particularly applicable to Indian railways passenger services as indicated in steps 3 and 4 of Table 1.8. However, the second stage of research was purely based on the deductive approach, as it adopts positivist inquiry to achieve predictive values, as illustrated in Table 1. 9.

The research was mainly exploratory in nature and demonstrates its casual research characteristics in relation to the attributes and constructs of passenger service quality and satisfaction. The survey research method was used in this study because the intention of this research was to gather data regarding passenger attitudes about service quality and passenger satisfaction of Indian Railway services. Two surveys – a pilot survey and main survey – were conducted in the study and administered purposive sampling method as depicted in Tables 1.8 and 1.9.

TABLE 1.8: METHODOLOGICAL DESIGN FOR THE ATTRIBUTES AND DOMAIN IDENTIFICATION

STEPS IN RESEARCH STAGE ONE: EXPLORATORY STUDY ATTRIBUTES AND DOMAIN IDENTIFICATION
Step 1: Specifying the area of service quality and passenger satisfaction Step 2: Generating a list of service attributes that can be utilised for the prediction of passenger satisfaction (literature survey, focus groups and experts opinions) Step 3: Developing a questionnaire to identify degree of importance of attributes Step4: Refining the service quality attributes and service quality domains through an exploratory study **PILOT SURVEY** ➢ **Sample and sampling technique:** • The method of "five subjects per attribute" was used for the determination of sample size and 185 subjects were selected through the purposive sampling technique from Secunderabad station of South Central Railway, India. The stratum was a mix of upper class passengers and lower class passengers. ➢ **Data gathering technique:** • A structured questionnaire was used based on multidimensional scaling, in combination of Likert, numerical and categorical scales (Cooper & Schindler 2006: 373; Kotler 2000:110). ➢ **Data analysis:** • Refinement of attributes and domain identification were done through exploratory factor analysis (EFA), the Kaiser-Meyer-Olking measure of sample adequacy and Bartletl's Measure of Sphericity. • Cronbach's alpha was used for reliability testing.

The problem area of the study was initially investigated through a comprehensive literature survey of a variety of areas, including transportation engineering and service quality and customer satisfaction in the service operations area. The selection of quality of attributes for the study was initially based on literature survey. The identified attributes were then discussed at focus group meetings to select more appropriate attributes in the context of the Indian Railway passengers. Subsequently, a questionnaire was designed, based upon the attributes identified by the focus groups, to gather data for refining the attributes and to identify pertinent quality domains for the main study described in stage two (See Table 1.9)

The methodological design of second stage of the study for provisional model building and testing is illustrated in Table 1.9

TABLE 1.9: METHODOLOGICAL DESIGN FOR RAILQUAL MODEL BUILDING AND TESTING

STEPS IN RESEARCH STAGE TWO: MAIN STUDY RAIL QUAL MODEL BUILDING AND TESTING
Step 5: Developing provisional models based on the identified attributes, quality domains and the conceptual model.
Step 6: Conducting a survey to gather data on passenger satisfaction and service quality
Step 7: Data analysis proceeds in two steps. First the exploratory factor analysis is used to identify the underlying dimensions of service quality for railway passenger services. For this the sample was split into two approximately equal sub-samples: sample 1 (n=607) and sample2 (n=608) .This was done by randomly selecting ~ 50 per cent of the cases using a filtering algorithm in SPSS16. Next an exploratory factor analysis was performed on the 36 attributes of the measurement scale by principal component analysis using Varimax rotation
Step 8: Next Confirmatory Factor Analysis was done on sample two to confirm the factor structure of the railway service quality factor dimensions.
Step 9: The framed hypothesis were tested using structured model
MAIN STUDY
➢ **Sample and sampling technique:** Sample size was determined through selection of sample size method developed by Krejcie & Morgan (1970: 608) and 1215 subjects were chosen by means of purposive sampling dynamically across 47

express and passenger trains of the South Central Railway

- **Data gathering technique:**
    - A structured questionnaire was used based upon multidimensional scaling, which is a combination of Likert, numerical, categorical and dichotomous scales (Cooper & Schindler 2006: 373; Kotler 2000 :110)
- **Data analysis:**
    - Structural Equation Modelling was employed for identification of relationships between service quality domains and service quality at attributes

1.9. Future Scope and Limitation of the Study:

This study was conducted on only one of the zones of the Indian Railways i.e., the South Central Railway. This research needs to be taken up on all the other zones of Indian Railways (i.e., 16 nos.) so that the model can be tested thoroughly. Recent mathematical modelling techniques like Fuzzy Logic, Data Envelopment Analysis (DEA), Quality Function Deployment (QFD) and Neural Networks may be applied to this research to make it more robust and innovative.

1.10. Justification of the Research:

This research study is important in many ways. While having the potential to improve the quality of railway passenger services to improve the passenger satisfaction and thereby to economically contribute to higher benefits, this study also works as a useful instrument to predict passenger satisfaction through service quality in railway passenger services principally in India.

These quality indicators may also serve as tools of reference to railway administration and particularly to policy makers in the government, giving them basis to gauge levels of overall passenger satisfaction and to measure the specific elements that determine levels of passenger satisfaction in different service quality domains.

1.11 Structure of the Thesis

The thesis is divided into eight chapters:

Chapter 1 – Introduction

This chapter provides a brief outline of the overall study. It initially presents the conceptual and contextual background to the study, before proceeding onto the problem statement. The problem statement explains specifically why an evaluation of service quality and passenger satisfaction is needed in Indian Railway passenger services. The motivation for and the brief overview of the conceptual and contextual backgrounds to the research study are discussed in this chapter. The research objectives, research questions, potential contribution, research methodology, demarcation and outline of the thesis are discussed.

Chapter 2 – Review of Literature

This chapter reviews the existing theories in relation to customer satisfaction on the outlook of service quality and the theoretical frameworks, which comprise underpinning relationships to be addressed in this study. The chapter concludes with the theories needed to be empirically tested in accordance with the research problems and objectives.

Chapter 3 – Contextual Review

This chapter reviews the prevailing research in the context of Railway passenger service quality. This specifically addresses the contextual applicability of the conceptual framework identified in Chapter 2 to substantiate its viability within the contextual environments put forth by vast array of existing literature. It principally provides the scholarly research information required to build the emerging frame of reference for the study.

Chapter 4 – Developing and Validating RAILQUAL Instrument

The identification of pre-acclaimed service quality attributes were carried out for possible RAILQUAL instrument development through focus group discussions and validating the attributes through expert opinions and pilot study.

Chapter 5 – Developing RAILQUAL theoretical model

Chapter 5 details the RAILQUAL theory building approach through exploratory factory analysis. The broad aim of the exploratory study is to identify service quality attributes and aggregate them into quality domains by means of exploratory factor analysis. This section also presents the statistical justification of the scales and analytical methods used in the study. The procedure for validity and reliability checks are also discussed in detail.

Chapter 6 – Developing RAILQUAL measurement model

This chapter contains the RAILQUAL theory testing approach through Confirmatory Factor Analysis. Before going for CFA the Normality and Linearity of the data has been tested through Kolmogorov-smirnov, Shapro-Wilk test and Pearson’s correlations. The Homoscedasticity of the variables was tested through Levene’s test of homogeneity. The broad aim of this study is to confirm the service quality attributes and dimensions developed through exploratory factor analysis. A higher order model also proposed and confirmed through findings. RAILQUAL first order model, second order model and final third order model were also validated through convergent validity and discriminant validity. Then different models across demographic bifurcation also tested and results of model fit across all the groups discussed. The Exploratory Factor Analysis and Confirmatory Factor Analysis factor loadings were compared.

Chapter 7 – Evaluating RAILQUAL Structural model

In this chapter RAILQUAL structural model has been tested and the structural relationships along with validity and reliability were established through findings. The face validity, convergent validity, discriminant validity and nomological validity were tested through appropriate tests. All the proposed hypotheses of the study were tested and results discussed. The results of the hypothesis across all the demographic variables also tested. Finally Multi Analysis of Variance (MANOVA) was used to analyse the relationship between demographic variables and study variables. In the end the importance of service quality attributes were ranked by using Kendall’s W test.

Chapter 8 - Summary, Conclusion and Recommendations

First, a summary of the thesis is presented. Then, the chapter introduces the contribution of this research to academic theory and to practice then to Industry theory and practice and discusses the findings of the study in particular and general. Afterwards, the managerial, methodological and theoretical implications of the findings are discussed comprehensively. Then the research limitations of both theoretical and practical nature were discussed. Then the chapter concludes with suggestions for future research.

1.12 Referencing Style and References

The most commonly accepted way of acknowledging the work of other authors is to use a referencing style. Thus, this study correctly references all paraphrasing and direct quotations of other authors. The list of references is sorted by name.

45 % of references in the thesis are older than ten years, while only 23 % is less than five years old. Conversely, 55 % of references are less than ten years old. However, the generally accepted procedure regarding the use of references for a thesis is that two thirds of the references should have been published with in the last five year period from the submission of the final thesis. However, the researcher had to be exempted from this rule because of some distinctive reasons specific to this study as indicated below.

1. This study is mainly based on established theories related to service quality and /or customer satisfaction in the sphere of consumer behaviour and the thesis principally tested the theories to select the best for developing a model to predict customer satisfaction (i.e., passenger satisfaction). The research mainly used performance and expectancy disconfirmation theories, which were developed in the 1980s. Thus, a large number of research studies on these theories were conducted during the 1980s and therefore, the study used original articles of these research studies when referring to particular theories in the thesis. Thus by reviewing the literature that emerged between 1980 and 2000, it is apparent that a large number of good research studies on service quality and/or customer satisfaction have been carried out within this period of time.

2. There is a dearth of contemporary research studies to be found in the contextual area, where the research problem at hand resides. The quality of some of the studies based on service quality and /or customer satisfaction in railway passenger services is also questionable because most of them did not use the established theories correctly. However it was extremely difficult to find current research articles that are relevant to the construct of "customer satisfaction in relation to service quality in railway passenger services", compared to the studies carried out in other disciplines during the 1980s and 1990s.

3. Since the latest research has been linked to studies conducted in 1980s and 1990s, the researcher believes that it is very important to see the original article before citing them in the text, rather than citing them as "cited in", which may lessen the overall quality of the thesis.

Given the above circumstances, a number of dated sources were used for this research study, as there were no options to integrate the latest research and particularly to maintain the high quality of the thesis. The references are quoted chapter wise and if the same reference is repeated in the subsequent chapters it was not repeated again in that chapter.

1.13 Chapter Review

Chapter 1 provided an overview of the study. This is the culmination of the study, which belongs to the general area of transportation sector in Service Operations Management. This study aims to examine different indicators of service quality in Indian Railway passenger services and to determine the most effective means of predicting passenger service quality and passenger satisfaction. The research is therefore concerned with modelling passenger satisfaction with passenger service quality by developing a robust model RAILQUAL for possible predictions concerning the specific phenomenon. The next chapter reviews the conceptual and fundamental paradigms to formulate the conceptual underpinning, which supports a study of how organisations oriented towards customer satisfaction relating to service quality. The review summarises the pertinent conceptual base and gives a suitable framework for the study to address the research problem.

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CHAPTER 2: REVIEW OF LITERATURE

2.1 Introduction

In this chapter, the literature on service quality in general will be reviewed. Three main areas of interest are to be explored. To start with, the construct service quality is addressed in terms of its various definitions and unique characteristics as compared to product quality. Since the proliferation of service quality research in the early 1980s, different models of service quality have been proposed and empirically tested by different researchers. An overview of these service quality models is indispensable at the outset of this study.

Next, a review on the relationship between service quality and customer satisfaction is presented. Such a review becomes critical as there is a growing tendency for researchers and practitioners to equate service quality with customer satisfaction. Although the constructs are interrelated, they are not synonymous. A need to distinguish these two constructs in terms of their theoretical foundations, use of comparison standards and direction of relationship is envisaged before attempting to measure service quality.

Finally, empirical issues of measuring service quality will be examined. This part of the review will focus on how the construct of service quality will be operationalized and measured. In view of the fact that there are more quantitative studies than qualitative studies in researching service quality, more emphasis will be placed on discussing dimensions/attributes of service quality and prevailing methods of measuring service quality.

2.2 Service quality

Most of the published works about service quality prior to the early 1980s have come form practitioner sources rather than academic research Early pioneers in service quality study such as Christian Gronroos of Sweden, A.Parasuraman, Valarie Zeithaml and Leonard Berry of United States have laid down building blocks through their rigorous academic research. Their studies were based on synthesis of services marketing literature, customer satisfaction research and the limited writing on services. The following sections will discuss most of the earlier theoretical works on service quality, in particular, the characteristics of service quality, its definitions and components.

A close perusal of business industries in the 1990s revealed that the concept of service quality has received a great deal of interest as a key strategic factor for product differentiation and for increases in market share and profits (Bolton, Lemon and Verhoef 2004: 278; Luo and Homburg 2007: 113; Newmand and Cowling 1996, cited in Maddern et. al. 2007). It also revealed that the concept of service quality is primarily based on the quality of services as perceived by customers. When service providers understand how services are assessed by their customers, it becomes possible to identify how to manage these assessments and how to influence them in a positive direction (Gaster & Squires 2003:57; Seth, Deshmukh and Virat 2005). Although it is difficult to define the authenticity of service quality (Brown & Swartz 1989: 93; Schneider and White 200:9), some researchers have reached a consensus on the fact that service quality should be defined and measured from the customers' perspective. Thus, service quality appears to be predominantly defined from the perspectives of customers in a given service organisation. Many definitions of service quality maintain that this is the result of an assessment process, whereby customers compare their perception of the service to be received (Haywood-Farmer 1988:19). Zeithaml and Bitner (1996: 117) also define service quality as the "delivery of excellent or superior service relative to customer expectations."

However, the most widely accepted definition of perceived service quality is that it represents the discrepancy between customers' expectations and their perceptions of the service performance, which is basically founded on the expectancy disconfirmation theory (Churchill & Suprenant 1982; Oliver 1993; Parasuraman, Zeithaml and Berry 1994; Tse and Wilton 1998).

2.2.3 Definitions of Service Quality

Although very much studied, Service Quality is a difficult concept to define. Some definitions have been proposed by leading theorists and numerous studies have been done to explore the dimensions of the construct and to distinguish it from other closely related constructs such as customer satisfaction.

Some examples of definitions include:

“Service quality is a comparison between expectations and performance”
(Parsuraman, Zeithaml and Berry, 1985, p42);

“An evaluative, affective, or emotional response” (Oliver & Swan, 1989, p.1)

Perception of service quality is determined by “Prior expectations of what will and what should transpire … and the actual delivered service”
(Parasuraman, Zeithaml, &Berry, 1994, p.111);

“Perhaps [Service] quality factors are those primarily under the control of management … in contrast, perhaps the [customer] satisfaction factors are those that impact the experiential aspects of the service purchase from the customer’s point of view”
(Iacobucci and Ostrom,1995, pp.295-296).

It can be seen that there has been some consensus at the highest and most abstract level that the customer perceived service quality is a customer judgement based on a comparison between prior expectations and performance. However, even this has been called into question, with Cronin and Taylor finding little support for the expectations construct, at least as an explicit construct that customers could readily quantify (Cronin and Taylor, 1994). This does not necessarily invalidate the conceptual definition, as the customer might be making implicit comparisons when arriving at their assessment of the service they have received.

Despite some loose consensus, a clear, usable definition of service quality that can be applied to railway passenger services does not exist in literature. Service quality is a many-faceted concept and many studies have illuminated different aspects of service quality, without providing the definitive definition, if such a thing can exist. It is also unclear how existing definitions will transfer to railway passenger services environment, where aspects of the tangible actions are directed towards customers’ bodies. If a passenger reaches the destination late (e.g. due to train delays), will they perceive the service quality as poor? This is a case of delay in service delivery.

Most studies have attempted to define the service quality in terms of its component parts, or constructs. Accordingly, this discussion takes a “bottom-up” approach to building a definition of railway passengers’ service quality.

2.3. The Characteristics of service quality models

Parallel to changing the definition of quality and service quality, we need to remember that the measurement models elaborated by researchers have changed as well. This transformation is traceable in *time*, *place* and in terms of *research areas* as well. It can be looked at as the models of the 80s, the 90s as well as the models of the millennium, or that of the Nordic or the American schools. In addition, the models can be distinguished on the basis of further characteristics.

Framework of definition: defining the concept of service quality;

Dimensions: the dimensions determining service quality emphasized by the model;

Field of applicability: which service field the model can be applied to;

Measurement methodology: whether the model uses the disconfirmation paradigm or the performance paradigm as the method of measurement;

Service improvement: how can the model assist in making decisions aimed at improving service quality?

The above characteristics offer an opportunity to carry out a comprehensive analysis of the individual models.

2.4 Introductions of the most significant models

The following are the 18 service quality models which are found to be the most significant in relation to this research work. In case of each model a short introduction is followed by the major conclusions and findings of the given model.

2.4.1. Technical and functional quality model (Grönroos, 1984)

This model is the starting point of the so-called Nordic school. The model is based on the premise that, in order to achieve customer satisfaction, the quality expected and actually perceived by the customers should be identical. The supplier can only succeed on the market if he/she knows how quality is perceived by the customers as well as characteristics that influence the service quality. According to Bopp (1990), the technical level of the services is most often hidden from the customers, thus he/she has very few information in this respect. Donabedian (1982) maintained that in perceiving service quality, customers primarily focus on the functional factor.

Grönroos defines service quality as *the outcome of an evaluation process, where the customers compare their expectations with the service they have received"* (Grönroos, 1984, p.37). In his model he differentiated between the three components of service quality

technical quality: determines *what* the buyer receives as the result of buying the actual service (result dimension).

functional quality: determines *how* the service is provided, according to subjective perception of the customer and the customer evaluates the service procedure (process dimension).

image: shows how the characteristics, originated by and connected to the technical and functional service quality, such as traditions, policies, social connections, service standards and goodwill are mingled.

Customers mostly evaluate service quality based on the dimensions of the result and the procedure; however image, functioning as a screen, influences the quality perception in a positive or a negative manner depending on how the buyer judges the supplier and its image.

2.4.2. Three-dimension model (U. Lehtinen, J.R. Lehtinen, 1991)

In the authors' interpretation, service quality may be determined on the basis of three qualities: *physical quality*, *interactive quality* and *corporate quality*. Physical quality means the quality of the supplier's circumstances, tools, equipments; interactive quality means the nature of the buyer's and the supplier's relationship; corporate quality means the image of the cooperation as perceived by the buyer.

The dimensions may be compared with the technical and functional dimensions, that is result and procedural dimensions of the Grönroos model. The researchers took the opinion that the physical quality has a result - and the procedure-nature as well; interactive quality may clearly be connected to the procedure dimension, while corporate quality is judged by the buyer even before service delivery.

2.4.3. Three-component model (Rust and Oliver, 1994)

Similarly to the model of Lehtinen et al., the model of Rust and Oliver model originates from the Nordic model of Grönroos, but they assigned to the two original dimensions technical dimension (in this model: *service - product*) and functional quality (in this model: *service delivery)* – the dimension of *service environment.* The model was later tested by J.C.B. Llusar and C.C. Zornoza (2002) and they proved that the model is adequate. They named it the Perceived Business Quality – PBC.

2.4. 4.Gap-model (SERVQUAL) (Parasuraman et al., 1985)

Parasuraman et al. maintained – in line with Grönroos – that service quality is: *"a form of attitude, related but not equivalent to satisfaction, that results from comparison of expectations with perceptions of performance"* (Parasuraman et al.,1988, p. 15).

Pursuant to the GAP-model, the organization and the customer may differ as to how they perceive service performance and this is caused by the "gaps" in providing the service.

GAP 1: The customer's expectations are not known: the buyer's expectations and the ideas, the management has regarding that may differ.

GAP 2: Wrong service quality standards: the difference between management's ideas regarding customer expectations and the customers' expectation as to its manifestation in the specifications.

GAP 3: Service performance gap: the difference between the specifications regarding service quality and the actual implementation of the service.

GAP 4: When promises do not match delivery: the difference between the qualities of the service and the qualities of the service as communicated to customers.

GAP 5: When the customer does not receive the expected service: the difference of the quality that the customer expects and the actually perceived service quality.

Combining the customer's and the supplier's side, shows how the individual components of the model are related and connected to one another. GAP 5 is the central component of the model, because it may be minimized by reducing the other four gaps. "*the* *conceptual model conveys a clear message to managers wishing to improve quality of service: the key to closing Gap 5 is to close Gaps 1 through 4 and keep them closed"* (Zeithaml, Parasuraman, Berry, 1990, pp. 45-46). How customers experience service deficiencies, will depend on the size of the gaps. To explore the existence and the degree of the 5 gaps the SERVQUAL model is applied most often.

2.4. 5. Zone of tolerance model (Parasuraman et al., 1993, 1994)

The model is based on the premises of the SERVQUAL model, at the same time it contains its criticism as well. Its most significant difference from the original model is that it reconsiders the concept of expectation. The model presumes that consumer expectations manifest themselves at two different levels: desired and adequate service level. The zone of tolerance is between the two levels, where the customer perceives the service as acceptable.

The model, instead of the original two scales (expectation – performance) applies three scales (desired service, adequate service, performance). ZOT offers a more extensive and complete picture on service quality then SERVQUAL. It promulgates data potentially facilitating further analysis, by introducing the "Measure of Service Superiority – MSS", which is the difference between the perceived and the desired service and the concept of "Measure of Service Adequacy – MSA", which is the difference between the perceived and the adequate service level.

2.4 6. Attribute service quality model (Haywood-Farmer, 1988)

The model premises that the supplier provides high quality service, if it is capable to continuously satisfy customer expectations and always is familiar with the customers' preferences. The characteristics of the service are divided into three major groups: *physical facilities and processes*; *behavioural aspects*; *professional judgment*. The authors argue that in order to achieve high quality services, an optimal balance of the different factors should be reached. If the resources are concentrated on a single area, it would cause quality standards to drop.

2.4. 7. The synthesised model of service quality (Brogowitz et al., 1990)

The authors have included the traditional management methods into their service quality model, which is built on the difference between expectation and perception. The model approaches service quality from a comprehensive aspect. It takes into consideration – besides the already existing buyers – the quality perception of the prospective customers as well. Customers in some way (e.g. did not receive the service yet, but already received an offer on that) know and thus are able to judge the service quality.

The purpose of the model is to encompass the traditional planning- implementation-evaluation/feedback structure in measuring service quality. Utilizing the Gap-model, the authors identified several gaps connected to service quality, such as information, feedback, planning, implementation, communication, as well as the problems related to customer expectations and perceptions. The model also extends the concept of expectations. The authors argued that *company image*, *external influences* and the factor of the *traditional marketing activities* likewise influence the technical and functional quality expectations of the customers.

2.4. 8.SERVPERF model (Cronin and Taylor, 1992)

Cronin and Taylor started out by presuming that the conceptual premises of the SERVQUAL model and the methodology of measuring service quality developed from it are inadequate. They argued that the service quality measurement method, originated from the gap model (perceived performance – minus expectation formula) is not supported by theoretical or empirical research. They pointed out that the marketing literature rather supports its measurements made relative to performance.

To support their hypothesis they compared their *SERVPERF model, based on the perception paradigm* with (3) three alternative models on the different service areas (banking, cleaning service, fast-food restaurant, pest control): The original disconfirmation based SERVQUAL: $SQ = P - E$ (performance– expectations),Weighted SERVQUAL: $SQ = w \times (P\text{-}E)$ (importance × (performance– expectations)),SERVPERF: $SQ = P$ (performance),Weighted

SERVPERF: $SQ = w \times P$ (importance × performance).

They completed reliance and validity tests by applying the 22 statements of the SERVQUAL scale and the seven point Likert-scale. They examined reliability by the Cronbach alpha numbers. The SERVQUAL model's (1) indicator was between 0,849 and 0,901, and SERVPERF's indicator (3) between 0,884 and 0,964. They measured the standard deviation, explained by the models and by adjusted determination coefficient (adjusted R^2). The explicative potential of the SERVPERF always exceeded that of the alternative models and the un weighted models showed a higher R^2 value in all cases than the weighted counterparts (Cronin and Taylor, 1992).

They held that the SERVQUAL model confuses satisfaction and attitude. Their research results proved the hypothesis: service quality needs to be interpreted both theoretically and practically as the attitude of the customer. Their empirical conclusions also showed that using and administering SERVPERF is simpler (the 22 questions need to be asked only once) and the *SERVPERF scale exceeds the reliability and validity of the SERVQUAL.* They also pointed out that weighing the results do not improve the model`s capacity to project. They also showed that the five service quality dimensions determined by Parasuraman et al. (1988) cannot be proved in the studied service areas; rather service quality is a uni dimensional concept (Cronin and Taylor, 1992, pp. 61-65.).

Parasuraman et al. (1994a) in their response to the critical comments of Cronin and Taylor admitted that SERVPERF has better projection potentials, but maintained that SERVQUAL diagnostic adequacy is higher and that their method provides a lot more information for managerial analysis. While Cronin and Taylor opined that by illustrating service quality determined by the SERVPERF method in relation to time and other indicators and by observing the trends, the managers may receive useful information in support of their decisions (Cronin and Taylor, 1994, p. 130).

2.4. 9. Evaluated performance and normed quality model (Teas, 1993)

The model, similarly to the SERVPERF model, was originated by critical remarks made relevant to the SERVQUAL model and the disconfirmation paradigm it is based on. The author identified the following problems and deficiencies of the SERVQUAL model: the ambiguity of the definitions, the theoretical justification of the role of the expectation in measuring service quality, interpreting the connection between service quality and customer satisfaction. The author based on his researches proposed that (instead of the performance-expectation difference identified in the SERVQUAL model, the values determined by two separate models (EP and NQ) (actual-ideal (EP), actual-excellent (NQ)) are used. The SERVQUAL model approached expectations as the excellence level of the given service field and compared the actual performance with this level. In his model Teas introduces the concept of ideal value and uses this as a point of reference. Any deviation from this point of reference in a positive or negative direction will effect how the individual perceives quality:

Normed Quality model:

While the EP model compares the perceived quality with the ideal, the NQ model compares the actually perceived value to the excellent level, that is, practically norms the quality value. Pursuant to the premise of the model, if we define the *i* unit as excellent level (norm), then the equation of the EP model determines the quality of the excellent (perceived) level Q_e. Accordingly, the quality of another *i* unit (Q_i) if compared with the quality of the excellent level (Q_e) will indicate the normal quality (NQ):

$$NQ = [Q_i - Q_e]$$

2.4.10 PCP attribute model (Philip and Hazlett, 1997)

The model created by the authors is a hierarchical construction, which is composed of three attribute-groups. All the characters and dimensions describing the service can be assigned to one of the groups. The groups are overlapping and they have a hierarchical connection.

The *pivotal attributes* are connected to the essence or the result of the service, and the customer chooses the supplier based on these attributes (e.g. capable to provide the service demanded by the customers). These attributes have the greatest impact on customer satisfaction.

The so-called *core attributes* surround the pivotal attributes and may be interpreted as a compound of the human factor, procedure and the organizational structure. The customer attains the essence of the service via interacting with these “core attributes” (staff, procedures etc.). The third level of the model contains the "*peripheral attributes*", that is ancillary characters, with which the service forms one unit.

When the customer buys the service for the first time he/she will be satisfied if the pivotal attributes are properly performed, but during later interactions the core and the peripheral attributes will play a greater role in evaluating the level of satisfaction.

2.4.11. Retail service quality and perceived value model (Sweeney et al., 1997)

Sweeney et al. developed their model by studying retail services and described the impact of service quality on value and purchase propensity, as well as their correlations. In their model value means monetary value or "*value for money*" and in determining service quality, they have relied on the findings of Grönroos.

Pursuant to their model value is impacted by the quality of the product and its price, as well as the functional and technical service quality. Their further research proved that the correlation is more complex; perceived functional service quality affects the value and the perception of service quality through the technical service quality. At the same time the perceived functional service quality has direct effect on customers' willingness to buy, as opposed to technical service quality and product quality, which only impact customers' willingness to buy indirectly via the perceived value.

2.4.12. CVW –Customer value workshop (L. Bennington, J. Cummane, 1998)

Bennington and Cummane (1998) developed techniques that differ from the major research directions of the service quality models. Their objective was to develop a method, integrating qualitative and quantitative techniques, thereby offering a deeper analysis of the questions of what exactly creates value for the customers. The method applies the technical version of the model of focus group and a modified version of the Gap-model developed by Parasuraman et al. (1985, 1988).

In the procedure of the CVW the participants (generally a group of 12-15 buyers) are requested to determine such mutually exclusive categories or qualifying groups, which represent the value in an ideal product or service and then to set forth their degree of importance. In the course of the evaluation the supplier's current performance is compared to the predetermined characteristics.

The CVW method is rather time-consuming since the multi-phase, moderator introduced procedure contains the following steps: filling-out questionnaires, describing the ideal product/service, applying brainstorming techniques, preparing affinity diagrams, determining the importance of a certain value and multi-step control and feedback procedure. Its major advantage compared to traditional models, is that it is more suitable to support management decisions, because it presents a more accurate and reliable picture of service quality and the potential directions of change and opportunity.

2.4.13. The hierarchical retail service quality model (Dabholkar et al., 1996)

The critical studies on the SERVQUAL model's factor structure made Dabholkar et al. (1996) conclude that service quality should be interpreted on multiple levels: *overall*, *dimensional* and *sub dimensional*. They have supported their presumption by studying service quality in retail trade businesses, by determining a factor structure different from the SERVQUAL model: physical aspects, reliability, personal interactions, problem solving and policy.

In addition to evaluating the individual characteristics of the dimensions, customers form a general picture on the whole service, which is independent from the total value assigned to the factors. This represents the overall service quality level. Furthermore the authors proved that individual dimensions are a lot more complex, thus they cannot evaluated separately. Further they indicated that we can break down certain dimensions to sub-dimensions (e.g. sub-dimensions of the dimension of reliability are: promise and doing-it-right). Consequently, service quality should be judged on the three levels simultaneously.

2.4.14. Hierarchical model (Brady and Cronin, 2001)

The model developed by Brady and Cronin is also based on the Grönroos dimensions. Besides technical (result) quality and functional (procedure) quality, they introduced the dimension of service environment quality. They construed these three dimensions as factors, which primarily determine service quality, and which all are determined by further three-three subdivisions. Perceived service quality is the result of a multi-level evaluation, where the customers evaluate first the primary dimensions, on the basis of the sub-dimensions and then by aggregating those, the perceived service quality of the entire organization.

2.4.15. Antecedents mediator model (Dabholkar et al., 2000)

In order to come up with a more thorough interpretation of service quality, the authors developed a theoretical model which includes analysing the antecedents, consequences and mediators of service quality, as well as the results produced by the hierarchical (multi-dimensional) retail service quality model developed by the authors (Dabholkar et al., 1996).The different quality-factors are not components of the service quality, rather their antecedents. Accordingly, customers - although they evaluate the individual dimensions as well – form a general picture on service quality which is not related to the aggregated evaluation of the factors. They identified factors determining service quality or serving as antecedent to thereof (reliability, personal attention, comfort, features) or determine the relationbetween customer satisfaction and behavioural intentions.

2.4.16. Fundamental factors of service quality (G.S. Sureshchandar, C.Rajendran, T.J. Kamalanabhan, 2001)

One of the latest service quality models also uses the dimensions of the SERVQUAL model. The authors, contrary to the many criticism against SERVQUAL, concluded that in the SERVQUAL list “the 22 items are reasonably good predictors of service quality in its entirety” (Sureshchandar et al., 2001, p.112.). At the same time, however, these statements are organized around two major character groups: the material characteristics of the service and the subjective/personal connections of the service procedure. They argued that the SERQUAL model only concentrates on one part of the service quality. It neglects areas, such as the characteristics of the service, particularly the core service elements, systematization/standardization of service delivery as well as the supplier`s image, goodwill, and social responsibility.

2.4.17. Internal service quality, DEA model (Soteriou and Stavrinides, 2000)

The internal service quality model, based on the DEA (Data Envelopment Analysis) method is applicable, if we would like to evaluate the service quality of the units of an organization consisting of multiple decision making units (DMU) (such as bank network; corporations having multiple branch offices, franchises, etc.), or if the decision makers would like to optimally distribute the available resources among the units. The model does not propose a new service quality measurement method, but assists in applying the already available quality-related data (based on a prior service quality measurement method) in the course of making decisions on service quality improvement.

The DEA model by processing the service quality indicators of the units (input) and the performance/consuming resources indicator, determines an optimal target value and relevant to that, evaluates the individual units. The model offers an opportunity for the units, performing under the target value to establish new directions for service quality improvement and for the units over performing thereof, to save resources.

2.4. 18. SERVPEX model (M. A. Robledo, 2001)

Robledo's (2001) model was developed during a comparative analysis of the SERVQUAL and the SERVPERF models. The most important difference is that SERVPEX does not evaluate the perception-expectation disconfirmation on two separate scales – as done by the SERVQUAL – but on a single one, the disconfirmation scale. By properly setting the end points of the seven point Likert scale, applied to evaluate the statements of the questionnaire composed of 26 items, expectations and perceived performance are practically evaluated in parallel. One of the endpoints is described as "a lot worse than I expected" the other as "a lot better than expected". In the study the 26 statements form three dimensions: tangibles, reliability and customer contacts. The study proved that the SERVPEX model as a projection scale exceeds the performance of the SERVPERF and the SERVQUAL models.

2.5 Summary of all the important service quality models

The continuous evolution of the service quality models is well represented by the professional publications. The scientists always relied on the previous models in developing new ones; they modified the older models to a smaller or larger degree or supplemented those by new elements.

The models based on the disconfirmation paradigm (e.g. Grönroos , SERVQUAL , Zone of Tolerance, character-based methods (PCP), character- based service quality model, alternative models focusing on measuring performance SERVPERF, EP/NQ, intermediate (SERVPEX), model searching for the connection between satisfaction, value and purchasing attitude hierarchical retail service quality model and model applying service quality as input.

Reviewing the professional publications proved that the late service quality models and the measurement models mostly originated from the so-called Nordic model developed by Grönroos and the SERVQUAL model established by Parasuraman et al. from the GAP-model. The comprehensive model of Borgowitz et al. (1990) mixes the above two models. The three dimensional model of Lehtinen and Lehtinen ,and the model of Rust and Oliver may be considered as a further development of the Nordic model, while the SERVQUAL model and its wider interpretation are presented by the Zone of Tolerance model . From the aspect of the continuing development of the models the criticism triggered by SERVQUAL was of fundamental importance. Cronin and Taylor's SERVPERF, Teas' (1993) EP (Evaluated performance)/NQ (Normed Quality) model and Robledo's SERVPEX model just like the attribute models (Hayword-Farmer; Philip and Hazlett).

The subsequent studies focused on the relation between service quality and customer satisfaction, as well as that of service quality and purchasing attitude, from which newer models were developed. Cronin and Taylor's (1992) results indicated that customer satisfaction is originated by service quality, while purchasing intent is impacted by satisfaction. The antecedent and mediator model of Dabholkar et al. (2000) model continued to examine this connection.

Cronin and Taylor (1992) also pointed out that customers do not always buy the best-quality product, but their purchasing decision is determined by how they judge the value of the given service. Introducing concept of value in turn resulted further models (e.g. Sweeney et al., 1997), and hybrid techniques also appeared in this respect CVW model.

The more thorough testing, on how the customer evaluates service quality, drew attention to the fact that service quality is not evaluated by customers on single level, but on multiple, parallel levels. The latest results used hierarchical, multi-level evaluations, for example the models developed by Dabholkar et al. (1996), and Brady and Cronin (2001).

It can be seen that there was a continuous development in identifying the dimensions constituting (or determining) service quality. Researchers always extend the concept of service quality. Beside the dimensions referring to the quality of the service results and the service procedure, new dimensions –interpreting service quality in a wider meaning– are applied, such as service environment or in one of newest model, the social role of the service provider.

By synthesizing the individual models and stressing the common elements M. Suuroja (2003) established a theoretical model, which may serve as basis of further studies in this area. The synthesized perceived service quality model is based on the following premises (to be considered for further research purposes):Service quality is based on performance indicators and not on the discrepancies between expectations, norms and performance. Expectations of course influence service quality but only in an indirect manner. Service quality cannot be interpreted by simply aggregating the results of evaluating the individual dimensions. Service quality is perceived on multiple levels (overall, dimensional, sub dimensional), where the individual dimensions are not components, but rather the antecedents of the overall evaluation of the service quality.

Service quality characters vary depending on the service and are not universal. The focus of the synthesized model is the quality of the service process, and the quality of the service result. In the hierarchical model the central elements are surrounded by the physical environment of the service. Service quality models go through constant changing and development. Besides the theoretical issues (definition of service quality, validity of performance paradigm as opposed to disconfirmation) the models vary as to the number, the structure of thecharacteristics of the dimensions determining service quality. The publications and the models proved that dimensions change depending on the service line, thus there is very little chance to develop a general model.

With every newer model, newer ideas and theoretical and practical considerations were added to the field of service quality studies. This development process does not stop or cannot stop. A generally accepted, exact base-model, the general dimensions describing the individual service sectors as well as their theoretical and practical verification are still to be accomplished.

A further challenge for researchers is to adjust the existing service quality models to the changing economic and technical environment as well to extend to areas such as transportation services like railways.

2.6 The relation between service quality and satisfaction

According to some researchers (for instance, Parasuraman et al., 1988; Woodside et al., 1989, Cronin and Taylor, 1992), quality results in satisfaction, while other researchers (Bitner, 1990; Bolton and Drew, 1991) proved in their essays that the causal relation functioned right reversely: quality originates from satisfaction. Other analyses did not find any causal relation between the two instruments. According to Hofmeister et al., the positive quality assessment does not definitely exclude dissatisfaction, for instance, a person finding a too expensive hotel room by fortune (i.e. that he could find a room at all) will not probably be satisfied with the result even if he appreciates the quality of the service (Hofmeister et al., 2003, p. 52.). Bowers et al. (1994) drew the conclusion that both the quality and the satisfaction were determined by the same factors. Iacobucci et al. (1995) précised this latter statement in their research so that the service quality and satisfaction were determined by different factors. The price, customer service, expertise can rather be related to the quality, while accuracy, physical environment and development of the service to the satisfaction.

Disputes concerning the causal relation between the two concepts basically derive from reading of the extension of satisfaction and service quality (i.e. whether it concerns a specific transaction or it is a result of an overall assessment) as well. Parasuraman et al. (1988) defined the perceived quality as the overall assessment of the service. According to their reading, quality may only relate to the full and long- term relation to the service provider, while the satisfaction only to the event of shopping/servicing in question (Parasuraman et al., 1988). In their later works during disputes concerning the SERVQUAL model (Parasuraman et al., 1994a), they connected the opposing theories by mixing the two approaches. In case we regard satisfaction as transaction-specific, then, according to their theoretical model, this can be described as the function of service quality, product quality and the price . This corresponds to the findings of researchers (Woodside et al., 1989) supposing the relation service quality customers satisfaction (SQ SAT). Customers, however, form a global view on the service provider by summarizing the transactions; this means the overall reading. Of course, this impression is determined by the customer's overall satisfaction, the perceived overall service quality, product quality and price.

In this aspect the satisfaction related to single transaction determines service quality (SAT SQ) as proven by Bitner (1990), Bolton and Drew (1991). Most of the recent researches on the relation between satisfaction and quality support the transaction-specific relation of service quality customers' satisfaction (Cronin, Brady and Hult, 2000).

In a previous work, Dabholkar et al. (1995) were of the opinion that the logical relation between satisfaction and quality depended on the situation and orientation: if the answering person is oriented by emotions (affects), the satisfaction causes positive service quality in his perception. However, in case he is a cognitive person, then he feels that the satisfaction depends on the perceived quality. In order to test this statement, Brady and Robertson (2001) conducted examinations concerning the services of American and Latin-American fast-food restaurants in various fields of culture. As experienced by them, although people in Latin-America are rather oriented by emotions and in the United States the cognitive orientation is characteristic, there was no difference regarding trends of satisfaction and quality: the perceived quality determined satisfaction. This relation was supported by further essays. For instance, Lee et al.’s (2000) research in three fields of services as well as Olorunniwo et al.’s (2006) analysis concerning hotels and motels.

2.7. Evaluation and Operationalization of Service quality

It is generally recognised that for any research to be of any value, the underlying construct needs not only to conceptually defined, but operationally delineated. The purpose of operationalizing service quality is to bridge the gap between theoretical concept of what it is and the reality of how it can be evaluated. For example, service quality is regarded as global attitude, an abstraction that cannot be observed and measured directly. Therefore, an operational definition of service quality will transform such a concept into observable events. It also allows the concept of service quality to be “transportable” to other industry settings, uniformly understood and used by all interested parties. To neglect the operationalization of service quality is tantamount to overlooking the definition of a problem before attempting to determine a solution to the problem. Since the proliferation of service quality studies in the 1980s, different evaluation methods have been applied. In the following sections, the operationalization of the service quality construct will be explained in detail under both qualitative and the quantitative approaches.

2.7.1 Evaluation Approaches

Since the exploratory study of service quality by Grönroos (1984) and Parasuraman et al. (1985) in the mid 1980s, the subject has triggered intense interest among academics and practicing managers leading to a proliferation of relevant research studies using a wide variety of evaluation approaches. Some studies on service quality are geared to comparisons of service quality level in different countries (e.g., Lewis, 1991; Schlegelmilch, Carman and Moore, 1992) where as some are undertaken for inter-firm (e.g., Ennew, Reed and Taylor, 1992; Parasurman et al., 1988, 1991a).Given similarity of concepts between service quality and customer satisfaction, a need to examine these two constructs is also important. Selected empirical studies on service quality and customer satisfaction are summarised in tables 2.1 and 2.2 respectively.

Table 2.1 Summary of Selected Empirical studies on service quality

Methodology	Parasuraman, Zeithmal and Berry (1985)	Parasuraman, Zeithmal and Berry (1988)
1.Research objective	To develop a conceptual model of service quality	To develop a multi –item service quality measurement instrument.
2.Research Design	14 in-depth interviews and 12 focus group interviews on retail banking, credit card, securities brokerage, and product repair & maintenance industries.	1st Stage: Survey of 200 respondents of 5 service industries. 2n Stage: Survey of 200 respondents for each of 4 firms: a bank, a credit card company, an appliance repair and maintenance company, and a long distance telephone company.
3.Measurement	Open –ended questions	First Stage: Development of a 97-item instrument to capture expectations and perceptions separately on a 7 – point scale from “strongly agree” (7) to “strongly disagree” (1); about half of the statement pairs were worded negatively. Second Stage: Refinement to a 34 – item instrument from stage one and added questions on overall service quality evaluation.
4.Validity and Reliability Evidence	None	Coefficient alpha, content validity, Convergent validity
5.Statistical Analysis	None	Factor analysis, MANOVA
6.Major Strengths	1.Use of objective measures 2Measuement taken from both sides 3.Representative samples	1. Representative sample. 2. Rigorous construct development and measurement. 3. Consistent factor structure 4.High reliability (.87 to 0.90) 5. Strong convergent validity across 4 independent samples.
7.Major Weaknesses	See Teas (1993b) for definitional Problems of expectations minus perception	See Babakus and Boller (1992); Brown,Chrchill, and peter (1993);Carman (1990);Cronin and Taylor(1992,1994); and Teas (1993b) for arguments against the scale
8.Research Findings	Development of the “gap” model And 10 determents of service quality	Development of 22 item measurement instrument (SERVQUAL) to measure service quality across 5 dimensions.

Table 2.1 Summary of Selected Empirical Studies on Service Quality (contd..)

Methodology	LeBlanc and Nguyen (1988)	Carman(1990)
1.Research objective	To measure service quality of credit unions	To report on the findings of replication studies using SERVQUAL measurement instrument
2.Research Design	Mail survey of 2500 members of credit unions. Usable questionnaires : 1224	Survey of 200 customers from each of the following service organisations: a dental school patient clinic, a business school placement centre, a tyre store and an acute care hospital.
3.Measurement	Rating of 45 statements and an overall evaluation on a 7 – point Likert scale	22 – item SERVQUAL instrument (Parasuraman,Zeithaml, and Berry, 1988) with modification on wording for each service category.
4.Validity and Reliability Evidence	Coefficient alpha,content validity	Coefficient alpha , content validity, construct validity,nomological validity,discriminant validity
5.Statistical Analysis	Factor analysis, multiple regression	Factor analysis
6.Major Strengths	1.Large sample 2.High reliability (0.71 to 0.90) 3.Comprehensive scale measurement instrument	1. Scales already defined in previous SERVQUAL studies. 2.Consturct validity and nomological validity indicated
7.Major Weaknesses	Seven factors identified only accounted for 58% of total variance.	1.Factors with high reliability inconsistent across different replication studies (051 - 0.87) 2. Quesionable discriminant validity. 3.Problem of difference score (see brown, Churchill and peter,1993)
8.Research Findings	Customer satisfaction was positively related to and had the greatest impact on overall service quality evaluation	Highlight drawbacks of SERVQUAL instrument : 1. Need to customise SERVQUAL instrument to suit individual settings. 2.Service quality dimensions not generic 3. Need to account for service quality of multiple service functions separately.

Table 2.1 Summary of Selected Empirical Studies on Service Quality (contd..)

Methodology	**Parasuraman, Berry and Zeithaml (1991a)**	**Babakus and Boller (1992)**
1.Research objective	To refine the SERVQUAL instrument ; and to compare with other studies using SERVQUAL instrument	To assess the shortcomings of the SERVQUAL instrument (Parasuraman, Zeithaml, and Berry,1988)
2.Research Design	Mail survey of 1800 -1900 customers for each of 5 companies (1 telephone company,2 insurance companies and 2 retail banks); response rate ranged from 17-25% ; aggregate response rate :21%	Mail survey of 2375 users of electricity and gas; usable questionnaires : 689
3.Measurement	22 – item SERVQUAL instrument; "should" terminology changed to "will"; negatively worded items changed to positively worded items;2 new items under tangibles and assurance substituted; other minor wording adjustments to original SERVQUAL; relative importance of 5 dimensions added by allocating 100 points	22 – pair statements of SERVQUAL with additional questions on complaint behaviour, single-item satisfaction on a 7 – point scale, an overall rating of service quality on a 4-point scale
4.Validity and Reliability Evidence	Coefficient alpha, content and construct validity; predictive validity	Coefficient alpha , convergent validity and discriminant validity
5.Statistical Analysis	Factor analysis, multiple regression	Confirmatory factor analysis
6.Major Strengths	1.High reliability and construct validity 2. Gap scores generated by revised SERVQUAL fairly stable. 3. Consistent factor structure.	1.Large sample size 2.Scale measurement already defined in other SERVQUAL studies 3.High reliability (0.67 to 0.83) across 5 dimensions
7.Major Weaknesses	1.Interdimensional overlap is greater than The original SERVQUAL scale 2. See Babakus and Boller (1992); Brown,Chrchill, and peter (1993);Carman (1990);Cronin and Taylor(1992,1994); and Teas (1993b) for arguments against the scale	1.See Bolton and Drew (1991a) for concerns for measuring service quality of utility companies. 2.Questionable convergent and discriminant validity.
8.Research Findings	Revised SERVQUAL scale performed better than the original SERVQUAL scale in terms of reliability, factor structure, and validity	5-dimensional structure of the SERVQUAL instrument not envisaged

Table 2.1 Summary of Selected Empirical Studies on Service Quality (contd..)

Methodology	**Cronin and Taylor (1992)**	**Brown, Churchill and Peter(1993)**
1.Research objective	To suggest that SERVQUAL model is inadequate; and to examine the relationship between service quality, customer satisfaction and purchase intention	To suggest an alternative method (non-differential score) to SERVQUAL instrument to measure service quality of financial institutions.
2.Research Design	Personal interview s of 730 customers(banking 188,pest control 175,dry cleaning 178,fast food 189); usable questionnaires: 660	2 versions of questionnaire (1 and 2 below) to 230 undergraduate business students. About half of the participants completed each version.
3.Measurement	22- pair SERVQUAL statements; 22 statements of importance measures; 1 statement on purchase intentions; 1 statement on overall quality;1 statement on overall satisfaction; rating on 7 point semantic differential scales.	First version: 22 item statements from SERVQUL but rephrased to “How”; 7-point scale with verbal descriptors (“much worse than I expected” to “much better than I expected”);single-item to measure overall service quality;5 global measures to assess 5 dimensions ; 3- item behavioural intentions measure. Second version: SERVQUAL instrument
4.Validity and Reliability Evidence	Coefficient alpha, content validity ,convergent validity ,discriminant validity	Coefficient alpha, content validity, convergent validity , discriminant validity and Nomological validity
5.Statistical Analysis	Factor analysis, multiple regression and structural equation modelling	Correlation, multiple regression
6.Major Strengths	1.Large sample size 2.Introduction of performance-based service quality measurement instrument 3.High reliability (0.85 to 0.96)	1. Introduction of non-difference score approach. 2.High reliability: modified SERVQUAL (0.96); SERVQUAL (0.94)
7.Major Weaknesses	1.Bias on limiting the study to highest market share firms 2.Firms investigated mostly from low involvement service categories	See Parasuraman,Berry and Zeithaml(1993) for arguments against the psychometric and practical issues of the proposed non-difference score measurement instrument .
8.Research Findings	Performance based SERVPERF outperformed SERVQUAL; service quality was an antecedent of customer satisfaction and had less effect on purchase intention.	Non-difference score SERVQUAL outperformed difference – score SERVQUAL in terms of reliability, discriminant validity, and variance restriction effects. It also reduced the length of the questionnaire.

Table 2.1 Summary of Selected Empirical Studies on Service Quality (contd..)

	Bienstock,Mentzer,and Bird (1997)	**Durvasula,Lysonski,and Mehta (1999)**
1.Research objective	To develop a valid and reliable scale for measuring physical distribution service quality perception of industrial customers	To replicate the SERVQUAL instrument in an ocean freight shipping setting.
2.Research Design	The instrument was pretested to 33 respondents. The refined instrument was mailed to 797 respondents.446 questionnaires were usable	Personal interview of 114 shipping managers.
3.Measurement	Both expectation and perception battery of items were included in the questionnaire. The questionnaire contained 36 service quality items, 2 items on overall service quality, and 2 items on purchase intentions. The survey data were divided into halves. The first half was used to further refine the 36 items whereas the second half was used to verify the unidimensionality and reliability of the scale	The SERVQUAL instrument
4.Validity and Reliability Evidence	Coefficient alpha, ,convergent validity ,predictive validity	Composite reliability, convergent validity, discriminant validity, nomological validity, and predictive validity.
5.Statistical Analysis	Confirmatory factor analysis	Confirmatory factor analysis and correlation analysis
6.Major Strengths	1.Moderate sample size. 2.The data analysis compared both the gap and perception only measurement frameworks. 3. Strong evidence of reliability and validity. 4. Extended the service quality research to a business-to-business setting.	1. The data analysis compared both the gap and perception only measurement frameworks. 2. Strong evidence of reliability and validity. 3. Extended the service quality research to a business –to –business setting.
7.Major Weaknesses	Only 27% (gap) and 34% (perception only) of the variance in the overall SQ was accounted for by the SQ items	Relatively small sample size.
8.Research Findings	The gap-based framework outperformed the perception-only framework in terms of model fitness.	Overall, the perception – only measurement achieved better results than the gap-based measurement.

Most of the service quality studies from mid 1980s to mid 1990s focussed on gap based (perception minus expectation) evaluation framework (e.g., Babukus and Boller,1992; Carman,1990; Parasuraman et al., 1988,1991 a) and finding determinants of service quality (e.g., Bienstock et al.,1997; Parsuraman et al., 1988,1991a) in accordance with established scale development process (e.g., Churchil,1979) for different industries. The major strengths of these studies, among others, include using large samples and multiple industries to develop and validate the measurement scales by means of exploratory factor analysis and confirmatory factor analysis (e.g., Babukus and Boller, 1992; Parsuraman, Zeithmal and Berry, 1988, 1991a). However, generic service quality dimensions and consistent factor structure were not found in replication studies (e.g., Babukus and Boller, 1992; Carmand,1990).

On the other hand, customer satisfaction research during that period was related mostly to investigating multiple comparison standards in satisfaction formation (e.g.,Spreng, MacKenzie, and Olshavsky,1996;Tse and Wilton,1988). The product – oriented satisfaction research in the 1980s (e.g., Churchill and Supernant, 1982; Oliver,1980) was moved to a more service-oriented satisfaction research in the 1990s (e.g., Bitner, Booms, and Tetreault,1990; Halstead, Hartnan, and Schmidt,1994). This may be attributable to the rapid growth of the service industry in the world economy. One of the common features of these studies involves the use of structural equation modelling technique for testing model ~~robustness. Halstead et al.(~~1994), summarise four major advantages of using structural equation modelling technique : (1) parameter estimates can be made through the use of weighted least squares method (WLS), even when assumptions of normality have been violated; (2) estimation of latent variables can be made by measuring multiple indicators of latent variables with measurement errors; (3) measurement models can be evaluated for uni dimensionality by placing a priori constrains on the off-factor loadings; and (4) competing theoretical models can be systematically evaluated to establish the best representation of the data. These model-testing studies have enriched customer satisfaction literature with a greater understanding on the comparison standards and the satisfaction formation process as well as its consequences.

Table 2.2 Summary of Selected Empirical Studies on Customer Satisfaction

Methodology	**Oliver (1980)**	**Swan and Trawick (1981)**
1.Research objective	To test the relationship among expectation,disconfirmation,satisfaction, attitude,and intention.	To test the disconfirmation model of satisfaction in a retail service setting through a longitudinal study.
2.Research Design	First stage : Mail survey of 2,000 residents and 1,000 university students. Responded: residents (28%) and students (45%). Second Stage : Mail survey 1st stage respondents on feelings toward the federal flu programme and flu shots. Responded: 291 resident and 162 student "vaccines"; and 65 resident and 86 student "non-vaccinees"	Self-administered questionnaires to 346 customers aged 15 and above of a restaurant. 243 customers responded.
3.Measurement	Pre – exposure variables: Expectations : 5 - point scale from "no change" to "certain"; evaluation : 5-point good-bad scale; overall attitude: one-item semantic differential scale; behaviour intention:11 point scale from "no chance" to "certain". Post exposure variables: Disconfirmation : 2 item overall disconfirmation on a 7 point scale; satisfaction 6-item Likert scale;behaviour:self respect.	Before the meal : Rate the expectation on food and services on seven attributes. To be completed before order was taken. After the meal : Rate the evaluation of food and services on the attributes and to measure satisfaction and intentions.
4.Validity and Reliability Evidence	Coefficient alpha	Split- half sample.
5.Statistical Analysis	Multiple regression	Step wise regression, structural equation modelling
6.Major Strengths	High reliability(0.94 for combined sample on pre-exposure variable and 0.82 on post exposure variables)	" Before" measures did not bias the "after" measures through the use of " after only" group Longitudinal study rather than cross sectional study preferable.
7.Major Weaknesses	1.Multicollinearity of the complete recursive system for data analysis 2.Community sample, rather than national sample, was considered non representative; low response rate.	1.Incentive for recruiting respondents might cause bias. 2. Respondents might interact with each others while completing questionnaires.
8.Research Findings	Disconfirmation was a positive predictor of satisfaction(and attitude and intention).Expectations were also positively related ,but disconfirmation had the greater effect on satisfaction.	Inferred disconfirmation was a positive predictor of satisfaction and had a greater influence on satisfaction than either expectations or perceived disconfirmation.Perceived disconfirmation had the smaller effect on satisfaction for all variables tested

Table 2.2 Summary of Selected Empirical Studies on Customer Satisfaction (contd..)

Methodology	**Churchill and Superenant(1982)**	**Cadotte,Woodruff,and Jenkins(1987)**
1.Research objective	To test the interrelationships among expectations,perceivedperformance,disconfirmation and satisfaction for a durable and non durable goods	To propose experience-based norms as standard for comparison under the confirmation / disconfirmation paradigm.
2.Research Design	Field survey of 126 respondents who were aged 19 and 65 were recruited at a shopping mall. Incentive was offered. Half of the video disc player (VDP) and half for the hybrid plant.	Two-stage on site survey (before and after dining) of a consumer panel of 120 persons randomly selected to capture the norms construct in restaurant dining.87 panel members completed the entire study.
3.Measurement	Three levels of expectation and three levels of performance for two goods. Both attribute-specific and global measures were taken.	Pre consumption measures: Product type norm: 5 point rating scales on 9 attributes. Best brand norm: 5 point rating scales on best restaurant, Brand Expectations: 5 point rating scales on focal restaurant. Post consumption measures : Performance: composite score on 7 attributes together with a single- item overall measurement; disconfirmation: a single item for each norm/expectation on a5 point scale; feeling: bipolar 5- point scales.
4.Validity and Reliability Evidence	Coefficient alpha	Composite reliability, convergent validity, discriminant validity, nomological validity,
5.Statistical Analysis	Analysis of variance, structural equation modelling	Structural equation modelling
6.Major Strengths	1.High reliability (ranged from 0.85 to 0.95 for both goods) and convergent validity 2.Research on satisfaction process for durable products 3. Explored role of performance in determining satisfaction directly.	1.All the constructs(except two) exhibit high reliability (i.e. over 0.70) 2. Measure taken to test the demand effect by including handout/mailback questionnaire to customers.
7.Major Weaknesses	Some constructs were operationalized using a single item or two items.	1. Disconfirmation measure with single item scale. 2. Particular standard used by each respondent not identified.
8.Research Findings	Disconfirmation and performance were both positively related to satisfaction for the plant, but disconfirmation had the greater effect. For the VDP, only performance had a significant positive impact on satisfaction, accounting for 88% of the satisfaction variance	Disconfirmation was positively related to satisfaction for all three restaurant settings. Disconfirmation of product norms and best-brand norms was consistently better than brand expectations in explaining satisfaction variation. Performance was positively to disconfirmation.

Table 2.2 Summary of Selected Empirical Studies on Customer Satisfaction (contd..)

Methodology	Tse and Wilton (1988)	Oliver and Swan (1989)
1.Research objective	To examine the role of perceived performance and compared the effects of alternative disconfirmation and comparison standards.	To study customer perception of equity and satisfaction with the salesperson in an automobile purchase.
2.Research Design	Laboratory experiment of student volunteers from advanced marketing management courses of a university about psychological states towards new electronic, hand-held, miniature record player.62 students completed the experiment.	Onsite survey of new car buyers on equity consideration towards salesperson and dealer followed by a mail survey on customer feelings of equity towards the transaction with salesperson. Total responses were 426 from 791 requests. Usable : 415
3.Measurement	Three comparison standards (expectations, ideal and equity), four disconfirmation constructs (subjective, perceived-expected, perceived-ideal, and perceived – equitable) together with perceived performance	Perception of input and output: 28 items on 4 elements measured on a 7-point Likert scale; equity : 5 items on a 7-point Likert scale; satisfaction: 6 items with bipolar adjective,disconfirmation:3 items with "worse than expected" to "better than expected" scale; intention : 4 items bipolar adjective scale
4.Validity and Reliability Evidence	Discriminant and convergent validity	Item reliability and convergent validity
5.Statistical Analysis	2*2 factorial design, pairwise correlation	Structural equation modelling
6.Major Strengths	Extended further the Churchill and Superenant's (1982) performance-only measurement of customer satisfaction.	1.Multiple items for east construct 2.Large sample size
7.Major Weaknesses	1. High collinearity among independent variables produced inflated standard errors. 2.Small sample size	1.Problems of multi-collinearity 2.Did not consider the various dimensions of equity
8.Research Findings	Performance and disconfirmation were both positively related to satisfaction, but performance exceeded all the expectation measures and disconfirmation as a predictor of satisfaction	Disconfirmation was a positive predictor of satisfaction. But fairness had the greatest effect on satisfaction.

Table 2.2 Summary of Selected Empirical Studies on Customer Satisfaction (contd..)

Methodology	Bitner,Booms,and Tetreault (1990)	Halstead,Hartman and Schmidt (1994)
1.Research objective	To Study critical service encounters Leading customer satisfaction/dissatisfaction	To examine the relationships among performance, disconfirmation, and satisfaction in a higher educational setting.
2.Research Design	Personal interviews of 719 customers of hotels, restaurants, and airlines. Usable responses :699	1223 questionnaires were sent to alumni.475 usable responses were returned.
3.Measurement	Use of Critical Incident Technique (CIT) to capture a specific instance in which good or poor service interactions occur and to classify the incidents into 12 resulting categories.	Performance: 5 items for intellectual environment, 2 items for employment preparation. Both on a 5 point scale ranging “very strong” (5) to “very week” (1) .Disconfirmation: 2 items for two performance measures. Satisfaction: 3 items to measure overall satisfaction.
4.Validity and Reliability Evidence	None	Item reliability, convergent validity and discriminant validity.
5.Statistical Analysis	Descriptive Statistics	Structural equation modelling
6.Major Strengths	1. CIT was useful in commercial applications. 2.More than 700 incidents were collected	1.Large sample size to compensate for non-normality of variables through the use of polychoric correlation matrix
7.Major Weaknesses	Problems with CIT processing and analysing anecdotal materials (Johnston,1995)	Students’ expectations were not accounted for. Single item to measure disconfirmation Variance explained not mentioned. There might be other antecedents to alumni Satisfaction.
8.Research Findings	Identify sources of satisfaction and dissatisfaction.	Confirmed that a performance-disconfirmation model, which contained multiple sources o performance and separate disconfirmation provided a better representation of satisfaction formation process than the traditional single source model.

Table 2.2 Summary of Selected Empirical Studies on Customer Satisfaction (contd..)

Methodology	**Spreng,MacKenzie and Olshavsky(1996)**	**Patterson,Johnson,and Spreng(1997)**
1.Research objective	To test a comprehensive model of the determinants of consumer satisfaction involving two comparison standards	To examine the determinants of customer satisfaction or dissatisfaction in the context of business professional service
2.Research Design	207 subjects recruited from a local church to participate in an experiment about camcorder. Subjects were asked about their views on desire,expectation,and perceived performance about the camcorder	Mail survey of 142 client of management consulting services.usable :128
3.Measurement	Multi-item scales were developed to measure : (a) desires, expectation and perceived performance; (b) desires congruency and expectations congruency;(c) information satisfaction;(d)attribute satisfaction; and (e) overall satisfaction.	Multiple items were used to measure the purchase situation variables (Novelty,importance,complexity),Individual characteristics (Uncertainty an stakeholding),expectations,performance,disconfirmation,fairness,satisfaction/dissatisfaction,and repurchase intentions.
4.Validity and Reliability Evidence	Item reliability, discriminant validity	Reliability, convergent validity, discriminant validity.
5.Statistical Analysis	ANOVA,Structural equation modelling	Confirmatory factor analysis, path analysis.
6.Major Strengths	The results provided strong support for the hypothesis and helped clarify the roles of desires, expectations and performance in the satisfaction formation process	Longitudinal design
7.Major Weaknesses	The subjects did not actually purchase the product which might affect the depth or intensity of their satisfaction reactions to some extent.	Small sample size
8.Research Findings	Confirmed the importance of desires congruency and information satisfaction in the satisfaction formation.	The disconfirmation paradigm could be applied to industrial buying situation.

Also revealed in Table 2.1, the methods used to measure service quality are based on different schools of thought and can be mainly classified into two groups: incident and attributes based methods (Stauss and Hentschel, 1991; Mattsson, 1994).The former method tends to qualitative and concerns deviations from the normal case whereas the latter is quantitative and forces the respondents to assume a certain level of normal performance. Therefore, these methods are, in fact, measuring different aspects of quality and processes.

2.7.1A Qualitative Approaches

One qualitative approach to measure service quality is by using critical incident technique (CIT). Strauss and Hentschel (1991) consider CIT as essentially a method of collecting and classifying. They refer to critical incidents as “specific interactions between customers and service employee that are especially satisfying or especially dissatisfying” (p.29).They also point out four reasons that CIT is particularly useful to measure quality. Firstly, Services are process- oriented and the dominating and the dominating mode of experience within the process is episodic and not attitude based. Secondly, services are basically intangible. Therefore, the transformation of concrete incident-based experience in abstract attitude-based evaluations is more difficult than products. Thirdly, the customer is partly involved in the service production process. She/he will experience her/his participation as sequence of incidents and not as a sum of attributes. Lastly, face-to-face communications are not abstract discussions of service quality attributes, but of special incidents.

Other qualitative techniques may include focus group interviews, in-depth personal interviews, and observational methods. Since the proliferation of service quality research in mid-1980s, focus group interview and in-depth personal interview have been primarily used for exploratory study and for development of an attribute – based measurement instrument (e.g., Parasuraman et al., 1985, 1988).

About observational methods, Grove and Fisk (1992) claim that: These methods are well suited to capture the process nature of services phenomena due to their ability to examine service interactions unconstructively as they occur. This is crucial since service quality includes both process and outcome dimension and processes are the raw material by which services are constructed.

The above review on the qualitative approach to the study of service quality suggests that no single technique is ideal as there are both advantages and disadvantages. An appreciation of the strengths and weaknesses of each construct is required to match the situational factors and the unique features of the industry under study. Recent empirical studies on service quality tend to combine both qualitative and quantitative approaches in research design (e.g., Bienstock et al., 1988. Therefore, an understanding of the quantitative approach is also required. The following section will address the main features of quantitative approaches.

2.7.1B Quantitative Approaches

The quantitative approach to measuring service quality is typically attributes-based. In addition, the investigation of service quality tends to multi-dimensional because most services are bundled with core, facilitating, and supporting elements. For example, airline services include core element (transportation), facilitating elements (cheek-in procedures) and supporting elements (in-flight meals). The use of single statement, for example, rated on a poor to excellent scale, is conceptually unreliable in view of complex consumer behaviour and of less value to the management in shaping service delivery strategy. A number of empirical studies have used multi-item instruments to measure service quality.

For quantitative studies, Crompton and Love (1995) identify that there are five alternative operationalizations of quality, including: (1) attribute expectations; (2) attribute expectations and attributes importance; (3) attribute performance and attribute importance;(4) attribute performance and attribute expectations; and (5) attribute performance, expectations, and importance. The operationalization of the service quality concept in most empirical studies (e.g,Avkiran 1994, Brown and Swartz,1989;Carman,1990; Durvasula,Lysonski,and Mehta,1999; Lewes,1991; Parasuraman et al.,1988,1991a) tends to adopt P-E (perception minus expectation) measurement framework although Cronin and Taylor (1992) argue that there is little theoretical or empirical evidence supporting the relevance of the P-E as the basis for measuring service quality.

Underlying this P-E operationalization, perceived service quality is assumed to increase as the differences between P and E increases across various service quality attributes. It is important to note that this P-E service quality concept is different from the expectancy - disconfirmation paradigm in traditional customer satisfaction / dissatisfaction models. First, the P-E gap concert represents a comparison with a form (i.e., expectation as ideal standard) as opposed to the predictive standard used in customer satisfaction research. Bolton and Drew (1991a) propose another perspective to the comparison standard. They postulate that service quality is a function of a customer's disconfirmation experiences, expectations and perceived performance levels. Their research results confirm the importance of performance and disconfirmation experience in the quality evaluation of telephone service whereas expectations do not play a part. The discussion is summarised in Table 2.3.

Table 2.3 Current Operationalizations of Service Quality

Operationalization	Researcher/(s)	Primary characteristics
Perception –Expectation (ideal) model	Carman(1990) Babuksus and Boller (1992) Parasuraman,Zeithaml and Berry (1985,1988)	To moderate service quality as function of ideal standard of expectations and perceived performance. Service quality judgement depends on the size and magnitude of the gap between perceived performance and expectation. With expectations of service held constant, the higher the perception, the higher the service quality will be
Perception-Expectation (prediction) model	Parasuraman,Zeithaml and Berry (1991a)	To model service quality as a function of predictive standard of expectation and perceived performance. Unlike the perception –expectation (ideal) model, this approach emphasises the expectation as prediction as a comparison standard which is realistic in most of the service encounters.
Performance Disconfirmation Model	Bolton and Drew (1991a)	To model service quality as a function of perceived service performance for the prior period and the level of (dis)satisfaction with the current level of service performance.
Evaluated performance Model	Teas (1993b)	To model service quality as a function of the probability of optimal performance. This model posits that the perception of service quality is positively related to the maximum likelihood that the performance is close to the optimal point.
Perceived performance Model	Cronin and Taylor (1992)	To model service quality as a function of current perceived performance. Service quality is solely determined by the level of performance.
Importance – Performance Model	Ennew, Reed and Binks (1993)	To model service quality as a function of importance and perceived performance.

Despite the divergence in perceptive between P-E model and P only model there is no definitive study to confirm which model works better. It seems from review of literature, that P-E model works better in high involvement services or business to business services and P only model low involvement services or consumer services. Although there is no clear indication about the relative superiority between the P-E approach and P – only approach, the process of operationalizing service quality tends to be fairly similar. The process of operationalizing service quality involves three independent but related stages, including identifying service quality dimensions and attributes, specifying importance or weighting of service quality dimensions, and determining how each dimension is to be measured.

2.8 Chapter Review

This chapter has outlined the conceptual framework of service quality and its related construct, customer satisfaction as well their theoretical relationship. In addition, empirical issues about measuring service quality and customer satisfaction were examined. To conclude, there is no complete agreement that customer satisfaction and service quality are either the same or different constructs. Even if there are differences, some researchers feel that the differences are not significant or they are not aware that there are differences. Clarifying the conceptual differences between these two constructs is in many ways relatively easier than teasing apart the empirical differences. Although the current literature seems to put more emphasis on the quantitative approach to measuring service quality, qualitative techniques, in particular focus group interviews and in-depth personal interviews are a useful approach to uncover service quality dimensions and attributes before designing a quantitative study. In the following chapter the literature on transportation service quality will be explored before formulating a theoretical model for this study of Railway Passenger Service Quality (RSPQ).

2.9 Chapter References

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3

CHAPTER 3: CONTEXTUAL RESEARCH REVIEW

3.1 Introduction

The aim of this chapter is to investigate quality attributes and dimensions in the area of railway passenger services and to identify the knowledge gap shown in the conceptual literature. This aim is achieved in three steps. The first step uses the conceptual framework identified in chapter Two and evaluates its applicability to model passenger satisfaction in railway passenger services. The second step attempts to unfold contextual issues necessary for possible adjustments to be made in the conceptual framework supported by literature through focus group discussions. The aim of the last step attempts to identify quality attributes and domains in global railway passenger services obtained from past research studies for the purpose of refining them to suit real-life environments, upon which provisional models may be developed to evaluate passenger satisfaction in a dynamic railway passenger setting in Indian Railways through expert opinions. This chapter therefore reviews the contextual research literature pertaining to service quality and passenger satisfaction from the service quality perspective in railway passenger services. The review provides a theoretical framework for the development of RAILQUAL Instrument – incorporating existing research findings – is ultimately offered to conceptualise the formation of the related to service quality attributes in Indian Railway passenger services.

3.2 THE INDIAN RAILWAYS

The Indian Railways (IR), more than 150 years old, is among the one of the largest and oldest railway systems in the world. It has an extensive network with 63,974 route kilometres of route length and played an integrating role in the social and economic development of the country. IR is the principal mode of transportation for the long haul freight movement in bulk, long distance passenger traffic and mass rapid transit in suburban areas. It occupies a unique position in the social economic map of the country and is considered as a vehicle and a barometer of growth. It is also biggest state owned enterprise in India and contributes about 1% of India's GNP. Indian Railways is running approximately 13,000 trains a day, including 9000 passenger trains which carries 20 million passengers and 2.44 million of freight between 7000 railway stations each day. To fathom the scale, consider the fact that each day Indian trains travel four times the distance to moon and back (Raghuram G 2008, Sudhir Kumar, 2009).

The journey of railways in Indian sub-continent started modestly in 1853 with 34 kilometres (kms). Iron wheels rolled on rails on 16th April, 1853, where the first- ever train, with a capital of 3.8 million, carrying 400 people in 14 carriages, covered the 21 mile distance in about 75 minutes from Bombay to Thane (Sailaja, 1988, Alivelu, 2008). By 1950, India had a net-work of about 34,000 miles. In 1948, immediately after Independence, there were as many as 42 different railway systems consisting of 13 class I Railways, 10 class II railways and 19 class III Railways. The class of Railway is fixed depending on gross earnings. The major task of the Indian Railways (IR) is to integrate the above mentioned divided railway systems of the sub-continent such as princely state railways, state owned railways and to bring them under one management. The Railway Board in 1950 decided for the regrouping of the Indian Railways into six zonal systems, namely the Northen, the North Eastern, the Southern, the Central, the Eastern and the Western Railways. The unequal distributions of workload on some of the railways have led to further bifurcation of zones. Eastern Railway was split into two zones, namely, Eastern Railway and South Eastern Railway. Similarly, North Eastern was split into North Eastern Railway and North East Frontier Railway. Thus, by the year 1958, there were eight zones on Indian Railways.

The functioning of the new zones continued to be watched closely and based on regular analysis of their working, minor adjustments are carried out whenever necessary, with a view to improve their utility and efficiency. Particularly close watch is kept on the rapidly increasing workloads of some of the new zones, in order to provide relief and streamline their operation. The formation of South Central Railway in 1966 as the ninth zone, in order to improve the services of southern parts of India, is made with some marginal adjustments from Southern and Central Railways. Carving out of South Central Railway has resulted in stability in the zonal formation at least for little more than three decades in the history of IR. In order to bring about greater efficiency in administration, speedy implementation of the on - going projects, better customer care, reduction of work load on the administrators of each zone, Indian Railways have decided to create seven new zones by territorial re-adjustment of existing zones.

Thus IR has been reorganized into sixteen railway zones by adding seven new zones to the already existing nine zones namely East Central, East Coast, North Central, North Western, South Western, West Central, South East Central from 2003 onwards. Recently Metro Railway, Kolkata has been declared as New 17th Zonal Railway wef 29.12.2010. Five Year Plans from 1950 onwards threw up enormous challenges to the railways for playing key role in the industrial and all round development of the Indian Economy. Thus, what started as a system to the interests of the foreign masters has in the last hundred and fifty eight years, developed into a significant means of transportation for socio-economic development of a welfare society like India.

IR is state owned and operated under the Ministry of Railways (MOR), Government of India (GOI).The MOR functions under the guidelines of Minister of Railways assisted by Minister of State for Railways. The policy formation and management of Indian Railway board comprises of Chairman and six functional Members (Figure 3.1). Wide powers are vested in the board to effectively supervise the running of 17 Zonal railways each headed by a General Manger. Zonal Railways are further divided into smaller operating units called Divisions. There are 68 Operating Divisions in Indian Railways at present, each under a Divisional Railway Manager. In addition, there are a number of production units, training establishments, construction organization and other railway establishments. These are generally headed by General Managers. 12 subsidiary organizations under the MOR also doing specialised jobs contributing to IR's growth and progress. (Raghuram G., Rachna Gangawar, 2007)

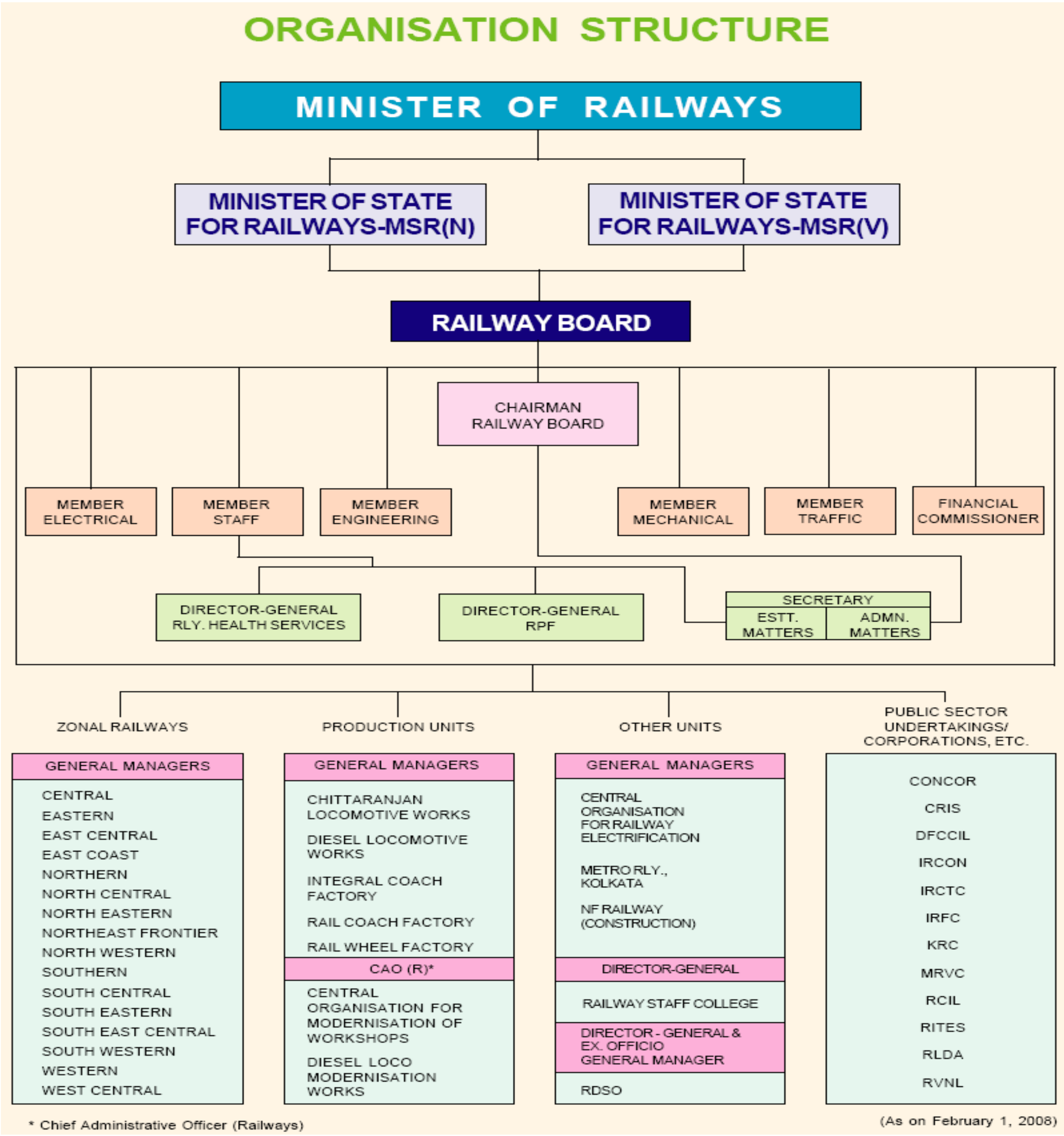

Figure 3.1 Organisational Structure of Indian Railways

3.2.1 Indian Railway Passenger Business

Indian Railways is a commonly used mode of public transportation in the country. During 2009-10, it carried 7,246 million passengers. Passenger kilometres, which is calculated by multiplying the number of journeys by mean kilometric distance was 903 billion and passenger earnings is Rs 1547.96 crore (Sudhir Kumar, Shagun Mehrotra, 2008).

The trend of passenger traffic since 1950-51 is shown below in Table 3.1.

Table 3.1 Number of passengers originating (in millions)

Year	Suburban (all classes)	Non suburban				Grand Total
		Upper Class	Mail Express	Ordinary	Total	
1950-51	412	25	52	795	872	1,284
1960-61	680	15	96	803	914	1,594
1970-71	1219	16	155	1041	1,212	2,431
1980-81	2000	11	260	1342	1,613	3,613
1990-91	2259	19	357	1223	1,599	3,858
2000-01	2861	40	472	1460	1,973	4,833
2006-07	3514	58	713	1934	2,705	6,219
2007-08	3689	66	776	1993	2,835	6,524
2008-09	3802	76	895	2147	3,118	6,920
2009-10	3876	86	983	2301	3,370	7,246

Source: Indian Railways' year book 2009-10

Passenger revenue in different classes with corresponding number of passengers and passenger kms in 2009-10 is shown below in Table 3.2.

Figure 3.2 Indian Railway network

Table 3.2 Passenger kilo metres

Segment	No of passengers		Passenger kms		Revenue	
	Million	Percentage	Million	percentage	Rs in Crore	percentage
Non suburban: Upper	86	1.19	55,182	6.11	5,668.27	24.21
Sleeper class	983	13.56	463,321	51.28	12,135.42	51.83
Ordinary	2,301	31.76	254,045	28.12	3,941.70	16.83
Total	3,370	46.51	772,548	85.51	21,745.40	92.87
Suburban(all Classes)	3,876	53.49	130,917	14.49	1,669.04	7.13
Grand Total	7,246	100.00	903,465	100.00	23,414.44	100.00

Source: Indian Railways Vision 2020 report

Indian Railways plays an important role in the transportation of passengers. Passenger services can be segmented into suburban and non-suburban. It is estimated that the Indian Railways have a share of about 20% in the passenger transport market, in terms of passenger kilometres. Approximately 90% IR passenger revenues come from non-suburban segment. Passenger services account for nearly 60% of IR's total transport effort, in terms of train kilometres, but yield less than 30% of total revenues. The growth in terms of transportation output in passenger segments has been increasing in recent past particularly in "premium" segment, but overwhelming share of passenger traffic remains in the lower classes. Suburban passenger business is viewed as non-profitable venture for IR due to the low fare structure and low priced monthly season tickets. The subsidy provided to this segment in the year 2009-10 amounted to approximately Rs 16,000 crores (MOR, 2010, yearbook 2009-10). Suburban accounted for approximately 54% of the originating passengers in 2009-10, while contributing to only 7 % of passenger revenue. Nearly 3.3 billion passengers make use of IR’s non-suburban passenger services annually. The upper class travellers, though comprise just 1.19% of originating passengers, account for nearly 24.21% of the passenger revenues.

3.2.2 Cross - Subsidization

Freight earnings today account for over 66% of the total traffic earnings of IR. Freight tariff on Indian Railways is among the highest in the world as would be seen by a comparison with the freight rates per tonne kilometre of the other world railways. Particularly, as compared to the major freight railways like US Railroads, Chinese and Russian Railways, the freight rates of Indian Railways are extremely high. In fact, the rate of US Railroads is one fourths that of IR’s as seen below in Figure 3.2.

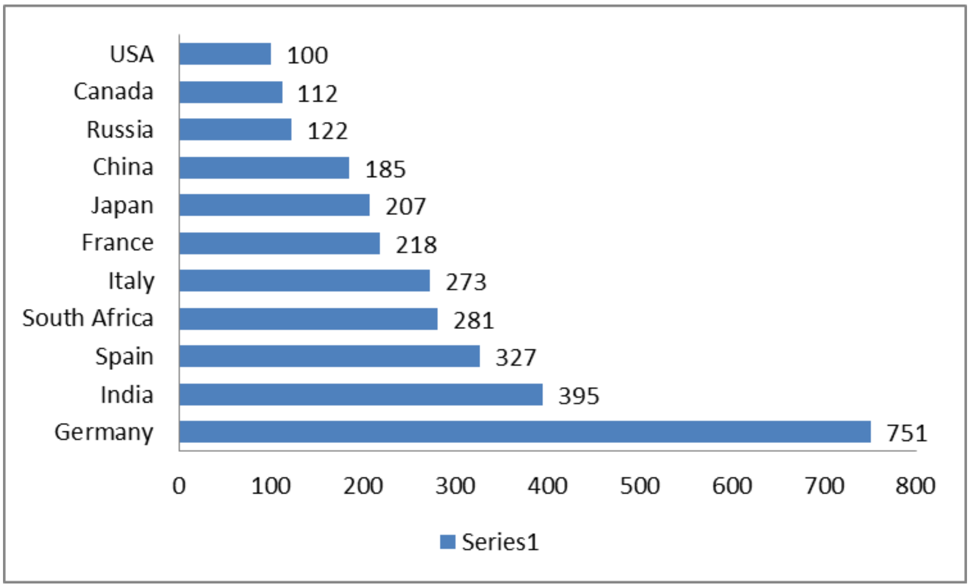

Figure 3.3a Average Freight Revenue per Tonne Kilometre

Source: World Bank report as quoted in Indian Railways vision 2020 report

On account of the large volume of passenger traffic in India and the inevitable financial impact on them of any fare increase, increasing passenger fares has always been sensitive issue, particularly for second class passengers. As a result, passenger fares in India are low compared to most foreign railways. The high freight rates and low passenger fares make the fare-freight ratio of India Railways one of the lowest in the world. Over the past 5 years, it reduced from a level of 0.32 to 0.36 (Table below). The fare-freight ratio in case of China is 1.2 and Korea is 1.4 as shown in Table 3.3 and Figure 3.3.

Table 3.3 Fare Freight ratio

	2004-05	2005-06	2006-07	2007-08	2008-09
a. Earnings per NTKM (Paise)	74.84	80.83	85.39	90.98	98.73
b. Earnings per PKM (Paise)	24.52	24.53	24.75	25.74	25.93
Fare-Freight Ratio (b/a)	0.32	0.30	0.39	0.28	0.26

Source: White paper on Indian Railways 2009-10

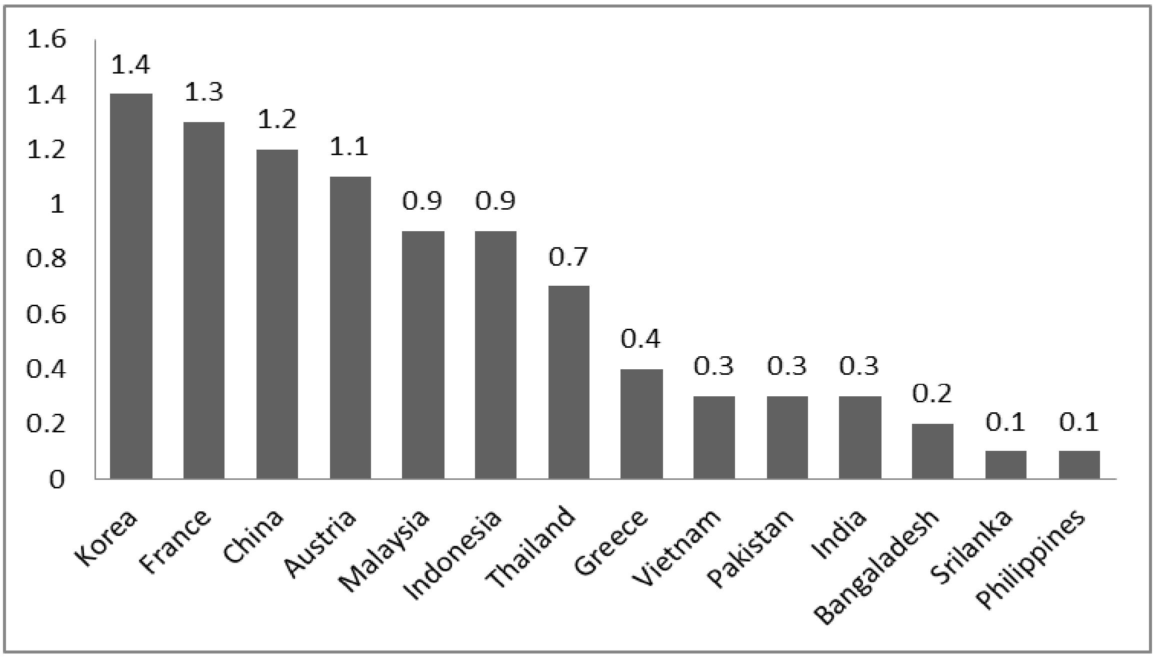

Figure 3.3b Ratio of average passenger fare to average freight rates
Source : World Bank report quoted in white paper on Indian Railways 2009-10

3.2.3 Market Share of Indian railways

Even though traffic volumes on Indian Railways have gone up over the years, rail shares has gone down steadily over the past few decades. There is unfortunately no fully authentic data on the market share on rail transport. However, a study conducted by Rail India Transport and Economic Services (RITES) for the planning Commission in 2009 called the 'Total transport system study on traffic flows and modal costs' gave a historical overview of the shares of different transport modes in India as show below Table 3.4.

Table 3.4 Trends in Road and Rail Passenger Traffic shares, 1950/51 – 2000/01

FY	Railway		Road		Total
	Pkm billion	% of total	Pkm billion	% of total	Pkm billon
1951	67	68	31	32	98
1960	74	51	71	49	145
1970	113	37	189	63	302
1980	199	32	421	68	620
1990	281	21	1,029	79	1,310
1991	296	22	1,079	78	1,375
1996	342	20	1,368	80	1,710
2001	457	13	3,000	87	3,457

Source: Ministry of Railways, Planning commission.

3.2.4 Earnings of the Indian Railways

The years spanning 2003-04 to 2007-08 saw unprecedented growth, led by strong economic fundamentals. Passenger earnings exceeded the growth in passenger kilometres. The passenger earnings grew at a CAGR of 10.52% in the period under review as compared to 9.24% during the period 1999-2004 while passenger kms grew by 9.13% as shown in Table 3.5

Table 3.5 Growth in Passenger Earnings and Realisation per pkm

	2004-05	2005-06	2006-07	2007-08	2008-09	CAGR 2004-09	CAGR 1999-2004
Passenger Earnings (cr)	14113	15126	17225	19844	21931		
YOY Growth	6.12%	7.18%	13.87%	15.21%	10.52%	10.52%	9.24%
PKMs	575608	616632	695821	771070	839159		
YOY Growth	6.19%	7.13%	12.84%	10.81%	8.83%	9.13%	6.02%
Earnings per PKM	24.52	24.53	24.75	25.74	26.13		
YOY Growth	-0.04%	0.04%	0.90%	4.00%	1.52%	1.27%	3.03%

Source: White paper on Indian Railways 2009-10

PKM - Passenger Kilo Metres YOY - Year on Year Growth Rate

CAGR – Compounded Annual Growth Rate

The lower CAGR of 1.27% in earnings per PKM during the period under review compared to 3.07 % in the previous five year period is primarily because of no direct increase in fares and in fact reduction in some classes.

3.3 Refining and modifying SERVQUAL model

Parasuraman et al., (1991a) asserts that the SERVQUAL instrument is a concise multi item scale to be applicable across a broad spectrum of service industries. It can be used to understand better service expectations and customer perceptions. The SERVQUAL developers also stress the practical and diagnostic value of capturing both expectations and perceptions for the sake of identifying service shortfalls rather than explaining variance in an overall measure of perceived service quality by simply using performance based measurement. Pitt, Oosthuizen, and Morris (1992) also tested the SERVQUAL scale in a high-tech industrial setting and found that it is a reliable and valid instrument amid the concerns that the five factor solution evidenced and factor structure is not generic. But the studies of SERVQUAL replication studies show that the scale possesses moderately high reliability in terms of coefficient alpha which serves as bench mark of internal consistency.

As a concluding remark, Lewis and Mitchell (1990) consider that "in the meantime, SERVQUAL remains the most reliable tool available for the measurement of service quality in the 1990s".

Despite all these strengths, the SERVQUAL instrument has come under much criticism in the areas of conceptual foundation and operational difficulties. Carman (1990) questioned the replication of service quality dimensions under the SERVQUAL methodology across a number of different service industries without modifying wording and adjusting number of items which are unique to certain industry settings. Figure 3.4 shows the SERVQUAL model in a explanatory way and Table 3.6 summarises some of the major criticisms and suggestions for improvement of the SERVQUAL instrument.

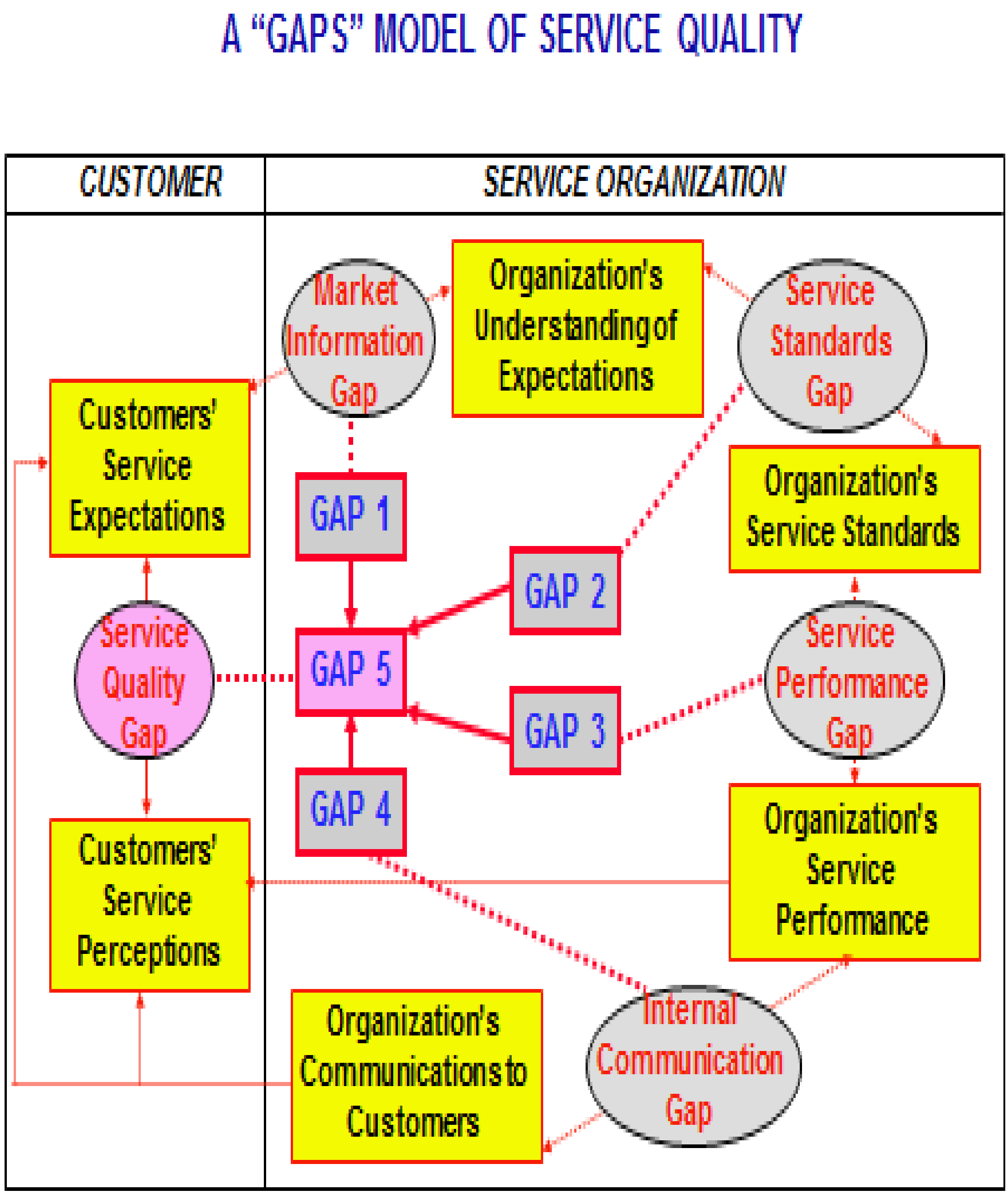

Fig 3.4 SERVQUAL (Parasuraman, et al, 1991a)

Table 3.6 Weakness of SERVQUAL Instrument

Weaknesses of SERVQUAL	Suggestions for improvement
1.SERVQUAL treats all 22 items in the scale equally important	1. Introduction of weighting (Carman, 1990; Lewes and Mitchell, 1990). 2.point allocation across 5 dimensions(Parasuraman,Zeithaml and berry,1991a)
2. Negatively worded items create difficulties to respondents (e.g. more time to read, more comprehension mistakes and more likely to attach negative emotional connotations).	1. Use of warning to the respondents on the existence of negative/positive wording in the instruction section (Babukus and Boller,1992) 2.All negatively worded items to be changed to positively worded items (Parasuraman,Zeithaml and berry,1991a)
3. Problems of operationalizing service quality as differential score (e.g. psychological constraint and unstable factor structure)	1.use of performance based SERVPERF (Cronin and Taylor,1992) 2. Use of non-differential score by rephrasing each item it the form of “How” (Brown,Chrchill and Peter,1993)
4.The word “ should’ in the expectation statements is unrealistic and causes confusion	1. “Should” expectations changed to “would” expectation(Parasuraman,Zeithaml and berry,1991a)
5. Separate lists of statements may be less accurate than comparisons made almost the same point in time	1.Comparision of expectation and perception measures at the same time using bipolar semantic differential graphical scale (Lewis and Mitchell,1990) 2. Use of direct measurement. For example “The visual appeal of XYZ’s physical facilities are (much better, better, about the same, worse, much worse) than I expected” (Carman,1990)
6.Restricting customers’ responses to a 7 point mask subtle variation in their expectations and perceptions	1. Use of graphical scale (Lewis and Mitchell,1990)
7. Adjectives used in the scale cause ambiguity (e.g. How “up-to-date”is it?)	1.Use of bipolar semantic differential scale (Lewis and Mitchell,1990) 2. Certain items to be modified. For example “up to date” was changed to “modern looking”

	Parasuraman,Zeithaml and berry,1991a)
8.Increased length of the questionnaire	1. Expectaions and perception measures to be combined by using bipolar semantic differential graphical scale or using direct measurement approach.
9.Dimensionlity of 22 item instrument not generic	1.Number of items and wording for particular services setting to be modified (Carman,1990)
10.Measure should account for multiple service functions	1. Measures for each service function.
11. Only focuses on the process quality attributes	1.Outcome quality attributes to be included(Rechard and Allaway,1993
12.Questionable reliability, convergent validity and discriminant validity	1.Convergent and discriminant validity to be strengthened with additional more stringent evaluation criteria (Babukus and Boller,1992) 2.Use of non-difference score to improve reliability and discriminant validity (Brown, Churchill and Peter,1993)
13 Problem in dealing with finite ideal point attributes (i.e. one on which customers' ideal point is at a finite level and therefore, performance beyond which displease customers.	1.Need to evaluate the models in situation which there is a high incidence of finite ideal point attributes (Teas,1993b

3.4. Critiques of the SERVQUAL model

The authors in their study published in 1991 (Parasuraman et al., 1991a) refined the model. The amendments were mostly connected to the statements applied by the model. On one hand they modified the text of the scale statements and on the other hand they have exchanged the original statements by new ones and negative statements by positive ones. They held that the high average values of the original model were caused by the normative wording of the statements. The amended definition focuses on what the customers expect of a supplier supplying excellent services (such as excellent companies *will* insist on error-free records), rather than on how an organization has to conduct an activity (such as companies *should* keep their records accurately). Besides the statements of the expectation scale, the statements of the perception scale were rephrased as well. Within the dimension of tangibility, they have introduced questions aimed at communication materials; in the assurance dimension aimed at the knowledge and expertise of the employees. In addition to the already existing expectation, perception scales, they have introduced a third scale into the model. They asked the respondents to divide 100 points between the dimensions, according to how important they find it relevant to a certain service. They thought that by correcting the service quality values of the individual dimensions by these relative importance values, a more accurate and reliable total service quality value may be derived.

Based upon the results of the tests, carried out after the amendments, the authors refined their original findings on the dimensionality of the model. They argued that the five dimensions of SERVQUAL may be clearly separated, but the factor- analysis often can not reflect the difference of the characteristics. They concluded that the "*refinement still reflects the basic five-dimensional structure of the original scale*" (Parasuraman et al., 1991a, p. 431.), but the individual factors are not clearly separated, and the correlation between them took a higher value as compared to the original researches (this is particularly true in case of responsiveness and the assurance dimensions). The tangibles factor, proved to be one-dimensional in the original scale, was divided into two-sub dimensions (one is connected to physical appearance the other to the appearance of the employees and communication material).

In 1993 the model was subjected to a further revision mostly based on the criticism directed at the expectation concept. Contrary to the former interpretations, expectations were defined as zone of tolerance, with the two end-points of the desired and adequate service levels (Parasuraman et al., 1993). In the new examination this expectation theory was included in the SERVQUAL model by using these three different models. On the questionnaire of the three-scale model, the responders were asked to form a judgment regarding the desired, the adequate and the perceived service. In the two-scale version the responders were asked to compare the perceived service with the desired and the adequate level, while the one-scale form only asked that the perceived performance is evaluated relevant to the desired service level. This time they have used a nine point Likert-scale adding the “I do not know / I do not have opinion” evaluation option. They ceased correcting by the relative value, because weighing did not improve the explanatory potential of the model.

The test results showed that all three forms have high reliability as well as their projective, differentiating and similarity validity is adequate. They found that although the one-scale method has the best projection capabilities, the most information is carried by the three-scale form. Thereby they showed that by applying SERVQUAL’s disconfirmation approach, managers will acquire more adequate and usable information for their decisions on service quality, incomparison with the other forms. Their conclusion, that the original five dimensions of the SERVQUAL cannot be identified clearly, is of great importance. Responsiveness, assurance and empathy overlaps, thus finally three dimensions may be identified: tangibles, reliability and the common dimension of responsiveness and assurance and empathy (Parasuraman et al., 1994b, p. 221.).

Parasuraman et al.’s confident declarations concerning the SERVQUAL model’s general character, reliability and validity resulted in further analyses and critical remarks taking these as starting points among experts of both theory and practice, (Coulthard, 2004, p. 481.).

Based on the first criticisms (Carman, 1990) concerning, among others, necessity of negatively worded statements and reading of the concept of expectation, Parasuraman et al. (1991a, 1994a, 1994b) conducted modifications on the model and re-defined certain statements for the sake of easier intelligibility.

However, most of the repeated researches did not support the authors’ statements. It must be added, however, that these repeated researches most often applied research methods somewhat modified as compared to the original model. The original statements were changed; the 22 statements were re-defined and several ones were detracted from and added to them, depending on the service sector where the research was conducted. Various technologies were introduced also in methodology. For instance, other scales were applied instead of the Likert scale of 7 points and polling by questionnaires as well as the related administration were conducted in various ways.

Parasuraman et al. (1991a) drew attention to the fact that researchers could get a proper result on the quality of services only if they apply the original model in its entirety, without any modification. In their opinion, minor modifications on the definition of the statements do not hurt the integrity of the entire model, however, omission of certain statements or insertion of new statements would question the entirety and reliability of the model. The following are the criticisms on SERVQUAL till date across the world by different researchers.

3.4.1. Theoretical Bases

Criticisms concerning the theoretical bases of SERVQUAL essentially question the validity, reliability and applicability of the model. By comparison of customers' expectations to the perceived performance of service providers, SERVQUAL interprets the perceived quality as an instrument which is related to customers' satisfaction but does not coincide with it. However, according to the arguments of Oliver (1980), Cronin, Taylor (1992, 1994) and Iacobucci (1994), the perceived quality is much rather an *attitude.* Cronin and Taylor stated that the disconfirmation-based SERVQUAL model did not measure the service quality or the customers' satisfaction, it was a model based on a "flawed paradigm" (Cronin and Taylor, 1992, p. 64.).

Andersson (1992) questions the economic, statistical and psychological bases of the SERVQUAL model's formation. First, the model disregards the *costs* of service quality improvement. Next, the *method of data collection applied* to the chosen statistical method (factor analysis) is false as it applies an ordinal scale (Likert scale) instead of the interval scale, which is more applicable to factor analysis. Deriving from the application of ordinal scale, it can hardly handle connections and interactions between the individual dimensions. And finally, *psychological factors* were poorly considered during formation of the model.

3.4.2. Process Orientation

The nordic model (Grönroos, 1984) examined among service quality models and the further methods developed from that (Lehtinen and Lehtinen, 1991; Rust and Oliver, 1994) interpret service quality in a broader sense. They separate the dimensions concerning the service's result (technical quality, result quality) and process (functional quality, process quality), completing them by the dimension of image (Grönroos, 1984), company quality (Lehtinen and Lehtinen, 1991) or organisational environment (Rust and Oliver, 1994).

In essence, the SERVQUAL model only focuses on the process; in fact, *it examines only one segment of service quality*, the quality of the servicing process. Although several statements can lead to the reading of further quality-related aspects, the model is still process-directed. Further components displaying the general reading of service quality are missing, such as factors concerning the core service, the service as "product", the judgement of the organisation as participant of market and society or, even the business policy of the organisation (Sureschandar et al., 2001). Recent researches (Brady et al., 2002; Chui, 2002) miss further factors: they urge on that the model should cover the rate of the service as well as feelings and emotions related thereto.

3.4.3 Dimensions

A major part of criticisms in relation to the SERVQUAL model concerns the dimensionality of the model. The repeated researches (like Babakus and Mangold, 1989; Carman, 1990; Finn and Lamb, 1991, Saleh and Ryan, 1992; Babakus and Boller, 1992; Bouman and van der Wiele, 1992; Gagliano and Hathcote, 1994; S. Llosa et al., 1998; Dabholkar et al., 2000; Cunningham and Young, 2002) most often could not reproduce the five original service quality dimensions. Based on the settings of the applied factor analysis methods, several researches could identify from six to nine dimensions (Carman, 1990), while other researches only one (Cronin and Taylor, 1992; Brown et al., 1993). The latter researchers expressly argued in their essay for the one-dimensional service quality. Llosa et al.'s (1998) research did not support this latter assumption but neither did it prove Parasuraman et al.'s (1988) results. Nearly 74 per cent of the persons polled by researchers classified the 22 original statements into 3-6 groups.

The number of dimensions varied on a broad scale *depending on the field of service* examined. According to Babakus and Boller, the domain of service quality may be factorially complex in some industries and very simple and unidimensional in others" (Babakus and Boller, 1992, p. 265.). Carman's (1990) research on hospitals identified nine dimensions: (reception of patients, accommodation, food, secrecy, nursing, introduction to treatment, courtesy, directing visitors, planning of dismissal, invoicing). Gagliano and Hathcote (1994) examined the clothing retail industry and defined four dimensions (personal attention, reliability, tangibles, comforts). Bourman and van der Wiele (1992) described three factors in car servicing, namely gentleness to the customer, tangibles and fairness.

Parasuraman et al. (1994) also faced the problem of dimensionality when examining the SERVQUAL model repeatedly. In the repeated research, they could identify only three dimensions instead of the five original ones. Above tangibles and reliability, the three other dimensions (responsiveness, assurance and empathy) fused to one common factor.

3.4.4 Problem of the Factor Structure

It is a further problem that the statements forming the original factors do not clearly fit in the factor to which we would expect them. In Carman's (1990) essay, for instance, two of the statements originally belonging to the SERVQUAL's empathy factor came into the dimension of tangibles during analysis of a dental clinic's service quality and similar anomalies were experienced during examination of other service sectors as well. This observation was supported by further essays (Buttle, 1996).

The five factors of SERVQUAL are "composed" by 4-5-4-5-4 statements sequentially. The few composing items (statements) attached to each dimension result in the changeability of the factor structure. By application of more statements, the stability of the single dimensions can be increased, which was also accepted by Parasuraman et al. (1991). Carman (1990) applied 40 statements upon analysis of the hospital service quality, Bouman and van der Wiele (1992) did 48 in the field of car services, Dabholkar et al. (1996) did 28 in the case of retail services, while Sureshchandar et al. (2001) did 41.

The definition of the single statements i.e. the positive or negative coding can also affect the factor structure. Thirteen of the SERVQUAL's 2 statements were worded in positive, while nine in negative form. Each of the "denying" statements belonged to one factor (responsiveness and empathy). Although Parasuraman et al. aimed to decrease the possibility of systematic yes-no answering, later this practice was still rejected (Parasuraman et al., 1991a). This happened in part because this method increased the time to fill in the questionnaires: twenty-two statements had to be assessed twice and in addition, even the negative statements had to be interpreted by the answering person. The other reason was that Babakus and Boller (1992) had proved during application of the factor analysis that the positive-negative definition results in "*method factors*" and not dimensions to be derived from the statements themselves (Buttle, 1996, p. 22.).

Analysing the research, we can state that the foregoing research have not found a generally applicable dimension structure describing the service quality universally and comprehensively. Dimensions may vary depending on both the examined field of service and the applied research method.

3.4.5 Role of Expectations

Several researchers have questioned *the wording of the statements of the expectation scale*. It is not clear what the expectations must refer to: the level expected under ideal, excellent or the given environmental conditions. The wording of the expectation scale upon formation of the model effected that most of the answering persons gave the mark of six or seven to the statements on the Likert-scale of seven degrees (where the two ends meant " do not agree at all" and " totally agree"). Authors were recognizing that the "should" terminology might be contributing to unrealistically high expectation scores, which questioned the model's applicability, therefore the wording of each statement were modified (Parasuraman et al., 1991a, p.422.). For instance, they indicated the statement "excellent companies *will* insist on error-free records" instead of the statement "companies *should* keep their records accurately". However, Brown et al. (1993) noted that this modification had little effect.

Based on his researches, Teas (1993, 1994) reached the conclusion that answering persons read expectations in different ways. In his opinion, differences between the single expectation-scores related to each statement do not derive from the different judgement of each answering person related to the given statement but much rather from the fact that everybody reads the concept of expectation in another way. He thought that answering persons applied any of the following six readings in relation to expectations (Teas, 1993).

Service attribute importance – how important is the given statement for the answering person

Forecasted performance – possibility of the future realisation of the performance expected by the answering person (can be)

Ideal performance – optimal level, which *may be* the performance of the service provider

Deserved performance – which *should be* the performance of the service provider *considering the investments* for the use of services,

Equitable performance –which *ought to be* the performance of the service provider *at* given *costs*,

Minimum tolerable performance – which minimally *must be* the performance of the service provider.

Based on the conclusions reached from analysis of reading of the concept of expectation, Teas (1993, 1994) deemed the expectation an ideal base of comparison in his models (Evaluated Performance and Normed Quality).

In relation to the role of expectations in the model, Teas (1993, 1994) raises further questions. The –1 value of the perceived service quality (P-E) measured according to the disconfirmation (concerning a given statement) can arise based on six different combinations of P (performance) and E (expectation) scores (P=1, E=2; P=2, E=3; P=3, E=4; P=4, E=5; P=5, E=6; P=6, E=7). Do the values determined by the different pairs of scores mean the same perceived service quality? Are the expectation rates universally valid for all service providers in a given sector or do different expectations belong to the different service providers? Does one standard expectation of general validity belong to each (SERVQUAL) statement and dimension or does the customer have other expectations in case of the different services depending on their location, for instance?

Accordingly, Iacobucci et al. (1994) would rather apply some general standard instead of the subjective and ambiguous concept of expectation in the model. Similarly, according to the definition of Voss, Roth, Rosenzweig, Blackmon and Chase, service quality is „based on the meeting or exceeding of certain established service standards" undertaken by the given service provider (Voss, Roth, Rosenzweig, Blackmon and Chase, 2004, p. 213.). Thus, according to their wording, expectations are not based only on the customer's subject but on the performances undertaken by service providers, which may be influenced by the ability of service provider as well.

3.4. 6 Two Administration, Order Keeping

It was a further criticism that the execution of the method, *administration of the double scale is difficult,* as an answering person must assess the same 22 statement twice: first on the basis of the expectations and then based on the perceived performance. This is not only time-consuming and boring but it often leads to the so-called exhaustion effect, which questions the suitability and truth of the collected data (Bouman and van der Wiele, 1992).

It is neither the same *in what order* are the answering persons polled on the two scales: first the expectation scale and then the perception scale, eventually in reverse order or perhaps both at the same time. Caruana (2000) proved by analysis of the SERVQUAL's developed, three-scaled model (Zone of tolerance) that the answers given first to the expectation scales (desired, adequate) influenced the perception rates significantly. These results correspond to the psychological research showing that answering persons are influenced by the previous answers and experiences related to the same question (Strack and Martin, 1987).

3.4.7 Dynamism

Customers insert their previous experiences into their expectations and they modify them flexibly, eventually influenced by technical development. It is not clear how the model captures this continuing, dynamic change of the expectations. According to several longitudinal researches, expectations may be higher and higher by progress of time (Parasuraman et al.'s works, for instance) but they also may decrease (in the medical sector, for instance). Researchers agree that research on service quality should focus on study of dynamic models in the future (Buttle, 1996).

3.4.8. Psychometric problems due to Difference Rates

Some researchers (like Brown, 1993; Spreng and Singh, 1993; Van Dyke et al.,(1997) Drew attention to psychometric problems concerning analysis of SERVQUAL's difference rates. According to their arguments, further analysis of a new variable deriving from the difference between two different index numbers (in the specific case the index concerning the perceived performance and that representing the expectations) leads to psychometric problems related to reliability and validity of differences. Thus, the question arises as to what the scale measures infect. In addition, researchers also questioned usability of the generally applied Cronbach-alpha as regards to difference rates (Buttle, 1996).

3.4.9. Problems Deriving From the Applied Likert-Scale

Although most researchers modified the number of statements of the original SERVQUAL model, their wording and the applied methods in their essays, almost all of them insisted on the application of the Likert-scale. However, two main problems have to be stressed in relation to this evaluative scale: the issues of centring and the number of categories (Smith, 1995; Buttle, 1996).

3.4.9A Centring

Answering persons, who, in the lack of knowledge and experiences, can not assess some questions, indicate the centre (meaning rate 4 in the case of SERVQUAL) as the "do not know" choice is missing. Thus, final results are distorted significantly.

However, Babakus and Mangold (1992) have shown that, in the lack of the "do not know" choice, a significant number of answering persons leave one or more questions unanswered and cause problems in processing of the questionnaire this way. On the other hand, the lack of the "do not know" choice may move the answering person still to indicate something (despite the fact that he does not know the statements in question and does not have related experiences). This, however, may lead again to distorted final results and false service quality rates.

Besides that centring can be regarded as a neutral value judgement or a “do not know” answer, centring may raise a further problem. Namely, it means some satisfactory solution from the answering person’s point of view: by filling in the questionnaire quickly, he did what he was asked to do but, as a consequence of the hurry, he did not thought over the statements. Instead, rather choosing the middle course, he did not give too high or too low rates, either. Of course, neither these rates reflect the answering person’s actual attitude, thus they may lead to false conclusions in the long run (Krosnick et al., 2002).

3.4.9B Number of Categories

When Likert-scale is applied, the answering person must indicate how much he agrees or disagrees with a number of statements concerning the examined unit. (Malhotra, 2005, p. 336.). The number of the scale’s categories and the wording of the specific category rates, among others, however, significantly influence answers.

The SERVQUAL scale contains seven categories, which corresponds to the traditional suggestions concerning the number of categories. Only the ends of the single categories are verbalized by definitions of “totally agrees” and “totally disagrees”. Some researchers (Smith, 1992) state that definition of only the ends may move the answering persons rather to choose the extreme rates. This shift to the positive direction was verified by several repeated researches related to the SERVQUAL model and Parasuraman et al. (1994a) acknowledged the phenomenon as well. However, defining each scale category one by one does not definitely improve the accuracy and reliability of the data (Andrews, 1984).

In the repeated researches related to the SERVQUAL model, most researchers (like Finn and Lamb, 1991; Babakus and Mangold, 1992, Dabholkar et al., 1996) applied a scale of five points as an alternative of the Likert scale of seven points. Other researchers (like Robledo, 2001; Brady et al., 2002) also applied a disconfirmation scale of five points, which however, was formed by re-definition of the ends of the scale („much better than expected"; „much worse …"). Robledo (2001) tested the SERVPEX model consisting of 26 statements and of three dimensions determined by the statements (tangibles, reliability, customers' relations), by means of analysis of the service quality of airlines, applying the disconfirmation scale of five points. In the essay, the SERVPEX model's better validity was justified as compared to the SERVPERF (a model based on perceived performance only) and SERVQUAL models.

Notwithstanding the above, the issues of the applied scale, the number of the scale's categories and the wording of the single categories are still open.

3.5 Review of Service quality in Public Transport Industry

Allen and DiCesare (1976) considered that quality of service for public transport industry contained two categories: user and non-user categories. Under the user category it consists of speed, reliability, comfort, convenience, safety, special services and innovations. For the non-user category, it is composed of system efficiency, pollution and demand. Silcock (1981) conceptualized service quality for public transport industry as the measures of accessibility, reliability, comfort, convenience and safety. Pullen (1993,p261) defined quality of service for local public transport industry as a concept that involves " those attributes of the service which affect its fitness for purpose" and " the attributes, and indeed fitness for purpose, required detailed definition in relation to local objectives and circumstances".

Traditionally, the performance indicators for public transport industry are divided into two categories: efficiency and effectiveness. Under the efficiency category, the measures are concerned with the process that produce the services while the measures in the effectiveness category are used to determine how well the services provided are with respect to the objectives that are set for them (Pullen,1993). Quality of service is one of the performance indicators under the effectiveness category. It is composed of accessibility, reliability, comfort, convenience and safety. Allen and DiCesare (1976) classified the performance measures into three categories: quantity of service, quality of service and cost/revenue of which are further divided user and non- user measures. Passengers waiting time, lost mileage and characteristics of each journey mode (time of arrival, time spend, time of arrival at destination) are commonly used measures to measure quality of service (Pullen, 1993). More recently, output quality measures that have been used for the rail system in Britain include train performance (delays per passenger train), train overcrowding, asset condition (broken rail per train mile) and safety or accident risk (signal passed at danger per train mile (Pollit and Smith, 2002).

Of late, psychometric measures caught the attention of many transport undertakings. The level of transport service (LOTS) was developed to measure the quality of service based on travel speed and comfort. The rating scale is from A (excellent) to F (not suitable). Each attribute was assigned a weight that reflects the importance of each attribute. The weighted score reflects the performance of that attribute. The overall performance (i.e. overall LOTS value) can be obtained to reflect the quality of service. Other measurement systems are discussed in Du Plessis (1984), McKnight et al (1986), Forsyth and Smyth (1986), Miller (1995).

Hanna and Drea (1998), and Drea and Hanna (2000) have studied the quality of service in part of the Amtrak passenger rail system in USA. Their research focus was on the attributes of service quality that influenced the transport choice of the survey respondents, e.g. rail vs. automobile. The attributes used in the first research were comfort, cost, timing (ability travel when I want), location (ability to travel where I want) and in- transit productivity (ability to work while travelling). In the later part of research cost, convenience getting to station , parking availability, Amtrak comfort, seat comfort, ride, seating area cleanliness, and courtesy of on board staff were the service quality attributes tested.

Tripp and Drea (2002) also used a survey of Amtrak passengers to assess the "direct and indirect" relationship between pre-core/ peripheral and core service performance components and their impact on the likelihood of repeat purchase (p.433). They found that the core experiences on-board that determined the customer's attitudes to the service provider and subsequently their intention to use the train again. These attributes included announcements, seat comfort, ride, cleanliness of seating area, courtesy of on board staff, rest rooms and café car conditions.

The gap model of service quality and the concept of service quality showed consistency that service quality should be measured on a multidimensional basis. Some transport service quality literature pointed out those different methods could be used for measuring service quality. It depends on the type of users, purposes for using the measures and the environments in which the services were provided. From this point of view, SERVQUAL is an instrument that could be used to fulfil the purpose of measuring perceived service quality from the customer's perspective in this industry.

On the other hand, inconsistency is also found when comparing these two. They have different dimensions in conceptualization of the service quality. SERVQUAL is much more service oriented. Those commonly used in public transport industry are more industry-based. SERVQUAL is much more humanistic, or customer related, while most of the measures used in public transport industry are much more mechanistic, or have a technical focus, or use more objective measures. This led to the criticism that SERVQUAL could not tell the whole story. In Genestre and Herbig's (1996) study, it was shown that by adding product quality to SERVQUAL, several strong product related factors are identified. In the airline industry, Young et al., (1994) added industry – based measures to SERVQUAL measures and the predictive power to satisfaction was significantly increased.

In summary, in order to measure the quality of service thoroughly, the attributes used in SERQUAL, the public transport industry, and the railway service sector should be grouped together to form a pool of items for measurement which is named as RAILQUAL instrument.

The value of adopting RAILQUAL instrument is that the diagnostic value is very high. The broad areas that are not doing well and their importance to the evaluation can be unfolded. While SERVQUAL has the ability to capture some dimensions, elements that not captured can be incorporated in the additional measures. The Gap model has already been gone through a complete building process since 1985 and was fully tested afterwards.

From the literature review, it is clear that a set of attributes are needed that could be classified into different dimensions to measure service quality. Also these attributes and dimensions will need to be more context-specific than the basic SERVQUAL dimensions. The traditional measures in public transportation industry lack information about the underlying perception of customers, while SERVQUAL model is too service-oriented and lacks information about the service offering. Therefore the combination of the dimensions from these two different aspects of measuring service quality could increase the understanding of the quality construct for the railway passenger service sector.

3.6 Qualitative Research on Railway passenger services

Positivist research methodology derives from the natural sciences where objectivity, measurement, reliability and validity are emphasised (De vaus, 2002; Lee, 1992; Neuman, 2003). Positivism has evolved to encompass different approaches including logical empiricism, post-positivism and behaviourism (Neuman, 2003). Positivist research is generally based on quantitative data and derives from an objective perspective and endeavours to explain and predict occurrences in society by identifying regularities and casual relationships between events (Lee, 1992; Neuman, 2003). Quantitative research facilitates the development of clearly defined statistical relationships between dependant and independent variables. Critics of positivism argue that the focus on confirming abstract relationships fails to reflect vagaries of reality (Neuman, 2003) and that the interdependence between variables can provide a unjustified clarity to the results (Lee, 1992). In contrast positivist researchers would argue that the research approach combines "deductive logic with precise empirical observations … to discover and confirm a set of probabilistic casual laws that can be used to predict general patterns of human activity" (Neuman 2003 pg71).

Interpretive research reflects the theory of symbolic interactionism and encompasses a range of theoretical approaches including hermeneutics, phenomenology, subjectivism and ethno-methodology (Neuman, 2003). The research approach in interpretive research is normally qualitative and involves participant observation and field based research (Neuman, 2003). Although derived from the major work by Dilthey (1883) interpretism is a relative newcomer to business research methodology and suffers from being "overshadowed by the inordinate recognition given to quantitative research … if it's not experimental, empirical, or statistical, it is not research"(Leedy, 1993, p140).

The third approach, critical social science, encompasses the approaches of dialectical materialism, class analysis and structuralism and is critical of both positivist and interpretive approaches (Neuman, 2003). Advocates of the critical social science approach criticise positivism for being impersonal, ignoring the social context and supporting the status quo. They equally criticise interpretive research as being too subjective and focussing on subjective reality. Critical social science endeavours to identify the underlying social structures and myths with the explanation acting as a catalyst for the change of social structures. (Neuman, 2003)

The majority of business research is encompassed with the positivist, or quantitative, and the interpretive, or qualitative, approaches and following discussion will focus exclusively on these approaches. The distinction between the research methods derives from a fundamental and diametrically opposed vies as to the best approach to understand social behaviour. From an ontological perspective the research methods contrast objectivity with subjectivity. Quantitative research adopts an objective stance and seeks to identify the precise nature of relationships among social phenomena whilst qualitative research aims to identify the motives and reasons which lead people to act in the ways they do (Lee,1992; Neuman 2003).From an epistemological position, the research methods contrast positivism with phenomenology, that is, the quantitative researcher seeks to decompose social world into its separate parts thus enabling the determination of casual relationships between the separate parts thus enabling the determination of casual relationships between separate parts, whilst the qualitative researcher seeks the unfolding of social processes and the meaning of social life(Lee,1992; Neuman, 2003). Although advocates of both approaches may take strong position on the merits of their flavoured methods the importance and validity of both are well recognised (Lee, 1992; Neuman, 2003).

3.7 RAILQUAL Research Context

In broad overview, this research investigates the antecedents of service quality with in Indian Railways passenger services. The research investigates the direct relationship between reservation and ticketing, platform services, In train service, safety and security, punctuality, Employee service with railway passenger service quality, and also investigates the influence service quality on passenger satisfaction, either directly or indirectly and of passenger satisfaction on behaviour intention.

Previous research across a number of domains has identified a sequential relationship between service quality, customer satisfaction and behaviour intentions. This research extends the previous work by investigating the relationship in the railway passenger services sector. The research included the identification of the aspects of the railway passenger service quality that are important to passengers and passenger satisfaction in relation to these aspects. The research also investigates a number of aspects that mediate between the relationship between railway passenger service quality, passenger satisfaction and behaviour intentions including perceived value.

The role of perceived value is important to evaluation of satisfaction by consumers (Bojanic, 1996; Day, 2002; Rosen and Surprenant 1998) and acts as mediating variable between service quality and customer satisfaction (Bojanic, 1996; Day, 2002; Rosen and Surprenant 1998)

3.8 Chapter Review

This chapter examined the concept of transportation sector service quality in general and railway passenger service quality in particular. The existing measurement approaches discussed. The strengths and weaknesses of SERVQUAL is observed minutely and refining and modifying the model is suggested. After that the total flaws in the SERVQUAL model elaborately presented. Finally the need of modifying the SERVQUAL to be suitable for evaluation of railway passenger service quality is presented and the procedure to develop and test a new measurement instrument RAILQUAL is described in brief. The following chapter will review about identifying and pruning the attributes which are significant predictors of railway passenger service quality with the methodology followed and its relevancy to the research context

3.9 Chapter References

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CHAPTER 4: DEVELOPING AND VALIDATING RAILQUAL INSTRUMENT

4

4.1 Introduction

Previous research across a number of domains has identified a sequential relationship between service quality, customer satisfaction and behaviour intentions. This research extends the previous work by investigating the relationship in the railway passenger services sector. The research included the identification of the aspects of the railway passenger service quality that are important to passengers and passenger satisfaction in relation to these aspects. The research also investigates a number of aspects that mediate between the relationship between railway passenger service quality, passenger satisfaction and behaviour intentions.

The role of perceived quality is important to evaluation of satisfaction by consumers (Bojanic, 1996; Rosen and Surprenant 1998) and acts as mediating variable between service quality and customer satisfaction (Bojanic, 1996; Day, 2002; Rosen and Surprenant 1998)

4.2 RAILQUAL Scale Development

The need for a rigorous approach to scale development has been subject to attention in the literature since the early criticisms levelled by Jacoby (1978). Although the approach identified by Churchill (1979) in response to these criticisms have been widely recognised (Flynn & Pearcy, 2001; Hinkin,Tracey & Eng,1997), there is still criticism in the literature over the approaches used for the scale development (Flynn & Pearcy, 2001; Hinkin, 1995; Hinkin et al., 1997; Ping, 2004). Much of the criticism relates to the reliability and validity scales (Flynn & Pearcy, 2001; Hinkin, 1995; Hinkin et al., 1997; Ping, 2004) with examples, such as SERVQUAL, being cited where attempts by other researchers to replicate the scale have been unsuccessful (Flynn & Pearcy, 2001).

Several authors (Churchil, 1979; DeVellis, 2003; Hinkin, 1995; Hinkin et al., 1997; Llusar & Zornoza, 2002) have proposed a structure for the scale development process that reflects a number of component stages, although there exits an inconsistency in the number of stages proposed. The number of components suggested as appropriate for the scale development process have been six stages (Hinkin, 1995; Ping, 2004), seven stages (Hinkin et al., (1997), eight stages (Churchil,197; DeVelli, 2003) and ten stages (Llusar & Zornoza, 2002). The essential outcome of the process is that the resultant scale maximises reliability and demonstrates content, criterion and construct validity (DeVeliis, 2003; Hinkin, 1995). In this research, a seven stage process has been adopted that is derived from Churchil (1979). It also reflects the consensus from subsequent authors. The scale development stages are as shown in Table 4.1.

Table 4.1 Scale Development Stages

Stage	Scale development Component
1	Construct Framework and Definition
2	Attribute Generation
3	Attribute pool review
4	Pilot Study
5	Scale purification
6	Data Collection
7	Reliability and validity Assessment

4.2.1 Construct Framework and Definition

Both Churchill (1979) and DeVellis (2003) include this stage within their development process, although the other authors omit this stage, perhaps seeing it as implicit in an earlier stage of the research process. The importance of clearly identifying the aspects and parameters of the measurement process is critical if an appropriate level of specificity and accuracy is to be achieved in the attribute generation (Churchill, 1979; and DeVellis, 2003). In this research, the construct framework and definition were derived from the literature review in Chapter 2 and 3 and the research model proposed in Chapter 4.

4.2.2 Attribute Generation

The objective of this stage is to generate a pool of attributes that are specific to the construct being investigated, cover the full dimension of the construct and do not stray into other dimensions (Churchill, 1979; Hinkin, 1995). The attribute pool should form a random subset of the construct to be measured (DeVellis, 2003). The pool can be generated either inductively, due to lack of available theory, by asking respondents to describe attitudes and feelings, or deductively from previous research (Hinkin, 1995; Hinkin et al., 1997). Hinkin (1995) describes the attribute generation stage as possibly the most important of scale development process. A number of aspects of good practice have been reported in relation to attribute generation. To start with the attributes should address only a single issue and should not be 'double-barrelled' (DeVelllis, 2003; Hinkin et al., 1997). Next, the attributes that assess attitudes and behaviours should not be included in the same scale (Hinkin et al., 1997). And then the items should be short and use simple language that is easily understood by the respondents (DeVellis, 2003; Hinkin et al., 1997) and finally the use of negatively worded attributes should be avoided or used with considerable caution (DeVellis,2003; Hinkin et al., 1997).

In summary, the items generated should reflect the whole construct being investigated and not focus unnecessarily on specific aspects of the construct. Whilst specific recommendations for the attribute format have been suggested, the overall requirement is that the item is easily understood and correctly interpreted by the respondents in relation to the researcher's intent. Items can result from either an inductive or deductive approach and in this research, a combination of inductive and deductive approaches was used.

4.2.3 Deductive Attribute Generation

The deductive approach uses existing theory as a source for the generation of attributes and thorough review of literature in respect of the constructs to be measured was undertaken. This literature review was used both as source of attributes and as an information source to evaluate attributes generated inductively. The existing literature on railway passenger service quality, passenger satisfaction, value and behaviour intentions was reviewed to gain a good conceptual understanding of the constructs and interrelationships.

The research model proposed incorporates a number of scales that have been derived by from the literature, as well as a scale to be derived from qualitative research to measure service quality in railway passenger services. An overview of the scales derived from the literature is now provided.

4.2.3 A Perceived service quality

This scale measures passenger's attitudes towards quality. In addition to the items contained in the scale respondents were also asked to rate the railways passengers services in relation to their expectations**.**

4.2.3 B Passenger Satisfaction

The passenger satisfaction scale contained in the research is a four – item scale that reflects a strong focus on the core issue of satisfaction, for example "I am very satisfied with Indian Railway services" and "I made the right decision to travel by Indian Railway passenger services". In contrast to the work of Oliver (1993) there is no inclusion of the disconfirmation paradigm through the inclusion of a comparison with expectations.

4.2.3C Behavioural Loyalty

The behaviour loyalty scale contained in the research is a four item scale which reflected strong focus on the core issue of behaviour intentions. They are what we would recommend for the train journey to our friends and others, that we would like to travel in Indian Railways in the future, that we consider railways as the first choice for journey in our list and that we would continue to come even when the prices are higher.

4.2.4. Inductive attribute Generation

An inductive approach to the research process adopts qualitative research methods by gathering information about the construct from people who have experience and then content analysing the data to identify themes of commonality (Leedy, 1993). The inductive approach uses grounded theory as a methodology to derive theory, or in this case attributes, from respondent observation and comments (DeVellis, 2003).

As discussed earlier in the chapter the qualitative research comprised focus groups of railway officers of both supervisor and managerial cadre of all the functional departments of Indian Railways and train passengers of both frequent travellers as well as occasional train travellers. Although the full results of the data analysis of the qualitative research is contained in Chapter 6, the scales relating to railway passenger expectations and performance that are derived from the qualitative stage of the research are discussed here.

The focus groups comprised separate groups of supervisors and junior management cadre and middle management and top management cadre from Indian Railways and one group each from the upper class travellers and the lower class travellers of frequent and occasional travellers set and these groups demonstrated considerable differences in their expectations of railways performance. Key, and frequently used, words and themes were translated into items for inclusion in the quantitative survey. The items derived from the focus groups were used in relation to railway passenger expectations and performance and were grouped into contextual areas, such as reservation and ticketing, platform amenities, in train service, train punctuality, safety and security and employee service.

A full list of 45 attributes found out of these focus groups and literature review on transport service quality is as follows.

Table 4.2 Total Attributes identified for the study

1.	Ticket buying facilities
2.	Provision of information about train times / platforms
3.	Upkeep / repair of the station building and platforms
4.	Cleanliness of the station
5.	The facilities and services at the station
6.	The attitude and helpfulness of the staff
7.	Connections with other forms of public transport
8.	Facilities for parking
9.	The overall station environment
10.	Our personal security whilst using station
11.	How the request to station staff was handled

12.	Availability of staff at the station.
13.	Catering facilities in the station
14.	Waiting room and retiring rooms in the station
15.	Frequency of the train on that route
16.	Punctuality/reliability (i.e., train arriving/departing on time)
17.	Length of time the journey was scheduled to take (speed)
18.	Connection with other train services
19.	Value for the money for the price of our ticket
20.	Cleanliness of the train
21.	Upkeep and repair of the train.
22.	Provision of information during the journey
23.	Helpfulness and attitude of staff on train
24.	Space for luggage
25.	Toilet facilities
26.	Sufficient room for all passengers to sit/stand
27.	Comfort of the seating area
28.	Ease of being able to get on and off the train
29.	Availability of staff on the train
30.	Cleanliness of the inside of the train
31.	How well railways dealt with the delay
32.	Safety and security in the train
33.	Catering facilities in the train
34.	Water facility during journey
35.	Queue/waiting time at ticket counter
36.	Knowledgeable /informative employees
37.	Announcements on the platform
38.	Timing of trains
39.	Availability of Coach Attendant/Helper on train
40.	Waiting room facility on platform
41.	Medical facility on train

42.	ATM facility on trains
43.	Availability of carriers (Coolie and Trolley)
44.	Ambience/Environment.
45.	Dealing in emergencies

4.2.5 Attribute Pool Review

Following the scale development process, the researcher and the academic colleagues reviewed the initial pool of attributes. The objective of this review process was to ensure that the attributes reflected both face and content validity and to remove unclear and repetitive items. The use of an expert panel to review attributes intended to use in the scale development is recommended (Churchill, 1979; Devellis, 2003; Hardesty & Bearden, 2004; Llusar & Zornoza, 2002). Devellis (2003) also recommends that attribute pool review be over – inclusive at this stage rather than the researcher be concerned with the parsimony and comments that it is acceptable to have considerable redundancy in the attribute pool.

On the basis of natural selection, the literature and the recommendations of the expert panel the attributes were grouped into functional areas that reflected coherent aspects of the rail passenger experience as discussed above. The resultant headings included the following dimensions in relation to the aspects of the rail travel considered important by passengers. Reservation and Ticketing, Platform amenities, In train Service, Punctuality, Safety and Security and Employee Service. In addition, constructs were included relating to perceived quality issues, satisfaction, loyalty and behaviour intentions and perceived value etc.

In line with previous research using multi attribute models, the term “Importance” was used for railway passenger service quality criteria (Ananth et al., 1992; Lockyer, 2002), whilst performance measures were also identified in line with the research into service quality (Carman., 1990; Parasuraman et al., 1994; Teas, 1993; Teas, 1994). Expectation measures were not collected in this study as literature suggests that the performance-expectation gap does not form a valuable alternative to the performance only measurement (Carman., 1990; Parasuraman et al,. 1994; Teas, 1993; Teas, 1994).

4.2.6 Expert Opinions

The attributes identified by focus group discussions were reviewed by three top level railway officers who are Heads of Departments in Indian Railways. These three professionals had more than twenty years of experience in railway operations and they are from Indian Railway Traffic Service (IRTS), Indian Railway Mechanical Service (IRME) and Indian Railway Engineering Service (IRES) and they held professional qualifications at the master’s level and above. The objective of this review process was to remove unclear, biased or repetitive attributes identified in the focus group discussions.

4.2.7 Conclusion about Focus Group Analysis

The principal objective of the focus groups was to identify items relating to railway passenger services quality that could be used in a survey instrument to be distributed to railway passengers in upper class and lower class trains in express as well as passenger train services. From the data collected it was evident there was a definite and clear distinction between the perceptions of upper class and lower class passengers. The lower class travellers were mostly of the opinion that Indian Railway passenger services offer cheap and convenient mode of transport and there is no alternative to it – in a sense they felt where they belonged to. They did not want something that was out of ordinary as they, implicitly, saw themselves as normal people and did not want any luxury except the trains maintaining punctuality as well as availability of tickets on demand.

In contrast the upper class passengers expected the train services to be exclusive, that treats them special. They wanted good catering facilities, personal attention from staff throughout journey, some form of entertainment to make journey interesting. Thus by implication they were looking for something out of the ordinary.

These findings were translated into items for inclusion in the survey instrument. For all dimensions an approximately equivalent mix of items between upper class and lower class passengers’ opinions were included.

4.3 Pilot Study

In business research study, a pilot study is a very common exercise before carrying out a survey questionnaire. According to Ticehurst and Veal (2000, p-151), a pilot study is important (Table 4.3 below). A pilot study is a common practice in business research for developing instrument which shows the survey instrument reliability and validity. Initially, for assessing reliability of the instrument, Cronbach's alpha was analysed and face validity of the survey instrument was done through experts. In this connection, a few surveys were given to focus group members for confirming face validity. Through that, the researcher was able to fine tune questions, ensure accuracy of language and responses. According to Kriel (2006, p109), pre testing allows testing most aspects of the questionnaire with respect to time taken, ease of completion and ease of data collection.

Table 4.3 Purpose of Pilot Survey

ID	Purpose	Applicable
1	Testing questionnaire wording	Yes
2	Testing questionnaire sequencing	Yes
3	Testing questionnaire layout	Yes
4	Gaining familiarity with respondent	No
5	Testing field work requirement	No
6	Testing and training field workers	No
7	Estimating response rate	Yes
8	Estimating questionnaire completion time	Yes
9	Testing analysis procedure	Yes

Source: Adapted from Ticchurst and Veel (2000, p-151)

The attributes selected for retention were then formed into a questionnaire. A particular aspect of the questionnaire development is the approach chosen as a measurement format (DeVellis, 2003; Hinkin et al1997; Wegener & Fabrigar, 2004). It was determined that an Likert scale was most appropriate as this provided more comparative information than either a nominal, ordinal or interval scale would provide (De Vaus, 2002).

Although an enhanced potential to capture subtle distinctions is provided by a greater range of response points the appropriate number of response points is also limited by respondent ability to distinguish between them (Wegener & Fabrigar, 2004).

A Likert scale ranked from one to five was chosen, as this range of values is familiar to most respondents (Graziano & Raulin, 2000) and provides sufficient range of response points to enable respondents to respond. An additional not applicable option was also given which reduces the non-response bias. In addition, at the end of each dimension an overall performance question was included in the format "To what extent did the overall dimension e.g. "In-train service "compare with the expectations you held prior to the train journey?" This item was included in a Likert scale format with full labelling. The Likert scale format was adopted for these attributes as a five point response was considered adequate.

The resultant survey instrument was distributed to a purposive sample of train passengers at Secunderabad station of South Central Railway over a period of one week in different timings of the day. Participants in the focus group were also given the survey instrument to fill it. Approximately 200 survey forms were distributed, with 185 completed and usable responses being received.

There has been considerable debate over what constitutes an acceptable sample size for the results to be statistically valid (Hinkin et al.,1997), with there being no accepted rule to define an appropriate sample size (Flynn & Pearcy,2001). Different authors have suggested different sample sizes as appropriate, including an absolute sample from one hundred to two hundred (Spector,1992 cited in Flynn and Pearcy 2001), one hundred or larger (Hair, Anderson, Tatham & Black,1998) and ratios of attributes to respondents form 1:4 to 1:10 (Hinkin 1995 cited in Flynn and Pearcy 2001). In this research, there were a number of scales being examined, with a maximum of ten attributes in any individual scale. On this basis, a sample of over one hundred would comply with the absolute range suggested above and also fall within the parameters of the ratios suggested.

4.4 RAILQUAL Instrument Purification

The data were entered into SPSS. The data were cleaned to remove any entry errors or invalid responses and checked for normality through an examination of skewness and kurtosis (Hair et al, 1998). Following the data cleaning, the data were subject to an exploratory R type factor analysis using principal components analysis and an orthogonal (Varimax) rotation. Principal components analysis was used as it explains common, specific and random error variances (Hair et al., 1998; Hinkin et al., 1997). For each scale, factors demonstrating an Eigen value greater than one were extracted, although scree plot was also obtained to clarify if any other factors might be present (Hair et al., 1998; Tabachnick & Fidell,2001). The resultant component analysis was examined and items that were complex - which showed substantial and similar loadings on more than one factor - (Hair et al., 1998) were removed. Items that demonstrated a factor loading of 0.55 or below were examined and unless there was a specific theoretical reason for retention, these items were also deleted. The factor loading of 0.3 was determined as significant at the 0.05 level using a sample size of one hundred (Hair et al., 1998). Tabachnick and Fidell (2001) suggest that a factor loading of above 0.32 is acceptable as a rule of thumb. They cite Comrey and Lee (1992) as suggesting loadings above 0.71 be considered excellent, above 0.63 very good, above 0.55 good, above 0.45 fair and below 0.32 as poor. The use of a loading of 0.35 at this stage in this research is considered to be a conservative guideline, and thus an acceptable level of certainty of the item validity is attained (Hair et al., 1998).

The Cronbach alpha for each scale was also calculated to ensure scale consistency and reliability. Cronbach’s alpha is a measure of the internal consistency of a scale and widely used as a means of assessing the reliability of a scale (Churhill, 1979; DeVellis,2003; Hair et.al., 1988; Tabachnick & Fidell , 2001). A Cronbach alpha value of 0.70 or above is generally accepted to determine a high level of homogeneity with in the scale and to accept that items do reflect a single dimension (Churchill, 1979; Hair et al., 1998; Hinkin et al., 1997).

The resultant scale comprised 36 items and was divided into 9 sections with items grouped conceptually for ease of response. The revised questionnaire was then, after a further evaluation by the researcher and expert colleagues, deemed finalised for the main data collection. A copy of the survey instrument is attached as Appendix 1.

4.5 RAILQUAL Research Model Overview

The research model proposes a number of hypothesised relationships. The hypothesised relationship is that the railway passenger service quality derives from a number of dimensions and directly impacts on passenger satisfaction although the impact is moderated by perceived value. The model then hypothesises a direct relationship between passenger satisfaction and behaviour intentions.

4.5.1 Dimension Evaluation and Hypotheses

In this section each of the dimensions are discussed. The discussion will include a brief overview of the relevant theory, the significance of the dimension with in the research and the contribution of the dimension to the research model. In each section hypotheses will be proposed for testing the relationship between the dimensions.

4.5.1A Reservation and Ticketing

Reservation and ticketing comes under pre core services of railway passenger services. Convenience of reservation and ticketing, promptness and accuracy in reservation and ticketing and ticket purchasing facilities are the three attributes which are loaded on to this dimension. No research which can address the relationship between railway passenger service quality and its antecedents has been found. Hence the first hypothesis posits:

H_1 Reservation and Ticketing have a significant effect on Railway passenger service quality

4.5.1B Platform Services

Platform services come under pre core services of railway passenger services. Provision of information on train times/ platforms, upkeep and repair of station building and platform, amenities at the station, catering and other facilities at station, connection with other forms of public transport and the ease of being able to get on and off the train at station platform are the six attributes loaded on to this dimension. All the six attributes are the significant contributors of platform services quality. Hence the second hypothesis posits:

H_2 Platform services have a significant effect on Railway passenger service quality.

4.5.1C In train Service

In train service comes under core services of railway passenger service. Cleanliness of the train, toilet facilities, comfort of seating area, provision of information during journey, journey comfort, quality and price of catering in the train are the six attributes with significant contribution towards in train service dimension. It would appear likely that in train service will influence railway passenger service quality. Hence the third hypothesis posits:

H_3 In Train services have a significant effect on Railway passenger service quality

4.5.1D Punctuality

Punctuality comes under core services of railway passenger services. Train departure on time, length of time the journey scheduled to take (speed), train arrival on time (i.e. intermarry accuracy) and connections with other train services are the four attributes which are the significant contributors of punctuality and reliability dimension. It would appear likely that punctuality and reliability will influence railway passenger service quality. Hence the fourth hypothesis posits:

H_4 Punctuality and Reliability have a significant effect on Railway passenger service quality

4.5.1E Employee Service

Employee service comes under peripheral service dimension. Enquiry handling at the ticket counter, ease of ticket purchasing, availability of railway staff on train and how the request to railway staff was handled are the four attributes which are the significant contributors for employee service dimension. It would appear likely that employee service will influence railway passenger service quality. Hence the fifth hypothesis posits:

H_5 Employee service has a significant effect on Railway passenger service quality

4.5.1F Safety and Security

Safety and security comes under peripheral service dimension. Personal security at station, personal security on train, safety of the train journey, security of luggage on train are the four attributes which have a significant loading on to this dimension. It would appear likely that the safety and security dimension will influence railway passenger service quality. Hence the sixth hypothesis posits:

H_6 Safety and Security have a significant effect on Railway passenger service quality

4.5.1G Railway Passenger Service quality

Although there is no fully accepted definition of service quality, there is consensus that service quality reflects the evaluation by consumers of business performance in relation to prior expectations (Carman., 1990; Cronin & Taylor, 1992; Iacobucci et al., 1995; Parasuraman et al 1985; 1988). Service quality has become an important topic because of its relationship to customer satisfaction (Brady et al., 2002; Caruna, 2002; Cronin & Taylor, 1992, Lacobucci et al.,1995; Oh,1999; Oh & Parks,1997; Selnes,1993), consumer loyalty (Bloemer et al., 1998; Bloemer & Kasper, 1995; Bowen & chen,2001; Caruana, 2002; Desney, 1999; Dube & Renaghan,1999a; Selnes,1993; Wong & Sohal, 2003) and business performance (Bowen & Chen, 2001; Bowen & Shoemaker,1998; Oliver,1999; Reichheld & Sasser Jr, 1990). Although there has been considerable debate in the literature over sequence, it is now generally accepted that service quality is antecedent to customer satisfaction (Cronin & Taylor, 1992; Cronin & Taylor, 1994; Parasuraman et al., 1994, Teas, 1993, which acts as a mediator between service quality and consumer loyalty (Caruana, 2002). Hence the seventh hypothesis posits:

H_7 Railway passenger service quality has a significant effect on passenger satisfaction.

4.5.1H Passenger Satisfaction

Although the concept of customer satisfaction is well understood, it has eluded finite definition. It has been described as a relative concept (Yu & Dean, 2001), as the difference between prior expectations and post consumption evaluations (Lacobucci et al., 1995) and as the summation of satisfaction with component aspects of the experience (Garbarino & Johnson, 1999).

Previous researchers have suggested customer satisfaction is a moderating variable between service quality and customer loyalty (Bloemer et al., 1998; Caruna,2002; Parasuraman et al.,1994). In their meta-analysis of satisfaction literature, Szymanski and Henard (2001) identify repeat purchase behaviour as a consequence of customer satisfaction, whilst Oliver (1999) suggests loyalty derives from cumulative satisfaction. Hence the eighth hypothesis posits:

H_8 Railway passenger satisfaction has a significant effect on passenger behaviour intentions.

4.5.1I Passenger Behaviour Intention

Passenger behaviour intention can also be called as loyalty of the consumer. A loyal consumer will do repeat purchase and he will do positive word of mouth to others. This act improves the business performance of the organization. Passenger satisfaction acts as a moderating variable between service quality and behaviour intentions. Hence the ninth hypothesis posits:

H_9 Railway passenger service quality has a significant effect on passenger behaviour intentions

4.6 Chapter Review

This chapter is the qualitative part of the research where railway passenger service quality attributes are identified through focus group discussions, in depth interviews w and the identified attributes are pruned for suitability to include in the instrument through pilot study and taking expert opinions. After pilot study the validity and reliability of the instrument is tested before going for the main study. The following chapter presents the main study and development of RAILQUAL theoretical model through exploratory factor analysis.

4.7 Chapter References

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5

CHAPTER 5: DEVELOPING RAILQUAL THEORETICAL MODEL

5.1 Introduction

A distinction is frequently made between two types of research, exploratory (theory building) and confirmatory (theory testing) research (Grover, 1997). Between these, there is a middle ground where conceptual refinements are made to existing theory (Straub & Carlson,1989).This research occupies that middle ground. There is a very extensive body of research for service quality across 30 sectors. However the review of literature suggests that new affordances need to be included in measures on Railway Passenger Service Quality (RPSQ). This suggests that exploratory research, aimed at making conceptual refinements to existing measures, is appropriate.

5.2. Approach to Exploratory Factor Analysis

5.2.1 Conducting the Survey

The survey was done dynamically across the South Central Railway zone of Indian Railways. The respondents were chosen while they were on their journey; having completed 50 per cent of journey, the instrument was distributed and the filled responses were collected when they were about to complete their journey and ready to get down at the destination stations. The survey was done for a period of four months across 47 trains which included Mail/Express, passenger and suburban trains proportionally chosen according to the revenue generated to the total passenger revenue. Both upper class and lower class passengers were included and all types of passengers were chosen so that a valid instrument and model could be developed without any bias.

5.2.2 Data analysis for EFA

Data analysis proceeds in two steps. First the exploratory factor analysis is used to identify the underlying dimensions of service quality for railway passenger services. For this the sample was split into two approximately equal sub-samples, sample 1 (n=607) and sample 2 (n=608). This was done by randomly selecting ~ 50 per cent of the cases using a filtering algorithm in SPSS16. Next an exploratory factor analysis was performed on the 36 attributes of the measurement scale using principal component analysis using varimax rotation.

5.2.3 Descriptive statistics

The descriptive statistics for the exploratory survey are included as Table 5.1. Several interesting observations can be made about these responses. First, the standard deviations were very low overall, suggesting that there is relatively high level of agreement from the respondents about the importance of railway service quality being evaluated.

Table 5.1 Descriptive Statistics of the attributes developed for the study

Attributes	Mean	Std. Deviation
promptness and accuracy in reservation and ticketing	3.73	.817
provision of information about train times/platforms	3.52	.888
the upkeep/repair of station buildings and platforms	4.04	.736
ticket purchasing facilities	3.91	.779
amenities at the station	3.46	.864
enquiry handling at ticket counter	3.82	.765
train departure on time	3.55	.908
the length of time the journey was scheduled to take (speed)	3.98	.746
train arrival on time without late (i.e. itinerary accuracy)	3.93	.751
convenient train schedule	3.87	.746
connections with other train services	3.77	.821
catering and other facilities at station	3.56	.816
condition of fans and air conditioners	3.92	.681
train availability	3.29	.855
the space for luggage	3.58	.890
coach maintenance	3.52	.838
connections with other forms of public transport	3.65	.741
the ease of being able to get on and off the train at station platform	3.79	.750
courtesy of employees	3.99	.677
how request to railway staff was handled	3.85	.808
the easiness of ticket purchasing	3.80	.795
cleanliness of the train	3.59	.822
the toilet facilities	3.73	.948
the attitudes and helpfulness of the railway staff	3.69	.958
availability of railway staff on train	3.35	.892
the comfort of seating area (i.e. berths and seats)	3.53	.876

the provision of information during journey	3.66	.869
Journey comfort	3.79	.852
quality and price of catering in train	3.62	.993
personal security at the station	3.72	.985
facilities for parking	3.45	.976
personal security on train	3.22	.929
safety of train journey	3.45	.974
the value of money for price of your ticket	3.30	.924
security of luggage on train	3.88	.725

5.3. Exploratory Factor Analysis

The Exploratory Factor Analysis technique is used to examine the service quality attributes among the passengers in South Central Railway in Indian Railways. As factor analysis is a multivariate analysis technique that determines underlying factors (domains) in a set of correlated attributes (Hair et al.2003; Nannually & Bernstein 1994), EFA was the most appropriate method to identify the quality domains and pertinent correlated attributes. The preliminary purpose of the factor analysis was to simplify the understanding of the data, which can be achieved from EFA. The process of EFA in this research involved five key steps, which are pre-analysis checks, sampling adequacy, factor extraction, factor rotation and factor interpretation.

5.3.1. Pre – analysis checks

Prior to using EFA, a pre-analysis check was conducted so that:

- A stable population factor structure emerges from the sample;
- Attributes are scaled correctly and bias free; and
- The dataset is appropriate for the factor EFA (Ferguson & Cox 1993;85)

5.3.2 Stable factor structure

Fergson and Cox (1993:85) propose that four types of heuristics need to be satisfied to ensure a stable factor structure in EFA, as indicated in the Table 5.2

Accordingly the research study utilised the general rule introduced by Hair et al.(1998: 99) and Hair, Anderson and Black (1995), cited in Okoroafo (1997), which suggests that the sample size be at least five times as large as the number of attributes in the study. This complies with the requirements made by Kline (1996) and Gorush (1983), as indicated in table 5.2.

Table 5.2: Type of Heuristics for Stable Factor Structure

Rule	Range	Advocate
Subject to attributes (N/p ratio)	Between 2:1 to 10 :1	Grosuch (1983),Kline (1996), Nunnally (1978)
Absolute minimum number of subjects (N)	100 – 200	Kline(1996), Comerry (1978)
Relative proportions of attributes (p/m ratio) and subjects to expected factors(N/m ratio)	Between 2:1 and 6 :1	Cattell (1978)

Source: Ferguson and Cox (1993:85)

In addition, this study complied with the second heuristic rule for the reason that total sample size was more than 100, as it was expected to use a minimum of thirty attributes. However, because it was difficult to determine the factor structure before the exploratory part of the study, the third set of consideration was not applied.

5.3.3 Attribute Scaling

As Likert scales are generally deemed appropriate for attitudinal studies (Furguson & Cox 1993; Cooper & Schindler 2006: 373; Kotler 2000:100), this study adopted a five point Likert scale to provide the interval data making the attribute appropriate/fit the factor analysis.

5.3.4 Appropriateness of dataset

Factor analysis should use the attributes in univariate normality. The attributes are required to show normal distribution. This research therefore adopted this technique to maintain univariate normality through skewness, as ± 2.0 (Muthen & Kaplan 1985:175).

5.3.5 Sampling Adequacy

The Kaiser – Meyer – Olkin (KMO) test of sampling adequacy was run on the sample to comprehend whether or not the factor analysis was appropriate for the study (Garson 2008; Pett, Lackey and Sullivan 2003). A value of 0.60 or above on the KMO measure of sampling adequacy test was used to denote the adequacy of data available for EFA (Tabachnick & Fidel 2001)

5.4. Determine the overall suitability of the data for the factor analysis

First, it is important to establish that the data set is suitable for factor analysis. For which the following recommended guidelines are followed.

5.4.1 Degree of correlation between the variables

It is a generally believed that variables that are supposed to be measuring the underlying factor should be correlated. The degree of correlation is usually suggested to be reasonably high, but not perfect, or this would suggest that the two perfectly correlated variables are measuring exactly the same thing. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is a commonly – used measure of the pattern of correlation between the variables. A value of 0 indicates a high degree of diffusion in the pattern of correlations, suggesting that factor analysis is inappropriate. A value close to 1 suggests that the patterns of correlations are quite compact and therefore factor analysis is appropriate. A KMO value above .9 is considered ideal (Field, 2005).The KMO measure for this sample is 0.922.

The null hypothesis, that the variables are not co-related, can be tested using Bartlets's test of sphericity. An insignificant result would suggest that there is no correlation between the variables, and therefore factor analysis is appropriate. A significant result (<0.05) tells us that there are some relationships between the variables (Field, 2005). In this sample Bartlett's test is highly significant (p<.01) suggesting factor analysis is appropriate. Results for KMO measure of sampling adequacy and Bartletts's test of sphericity are shown in Table 5.3.

Table 5.3 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.922
Bartlett's Test of Sphericity	Approx. Chi-Square	27734.768
	Df	630
	Sig.	.000

5.4.2 "Spot Check" for linearity

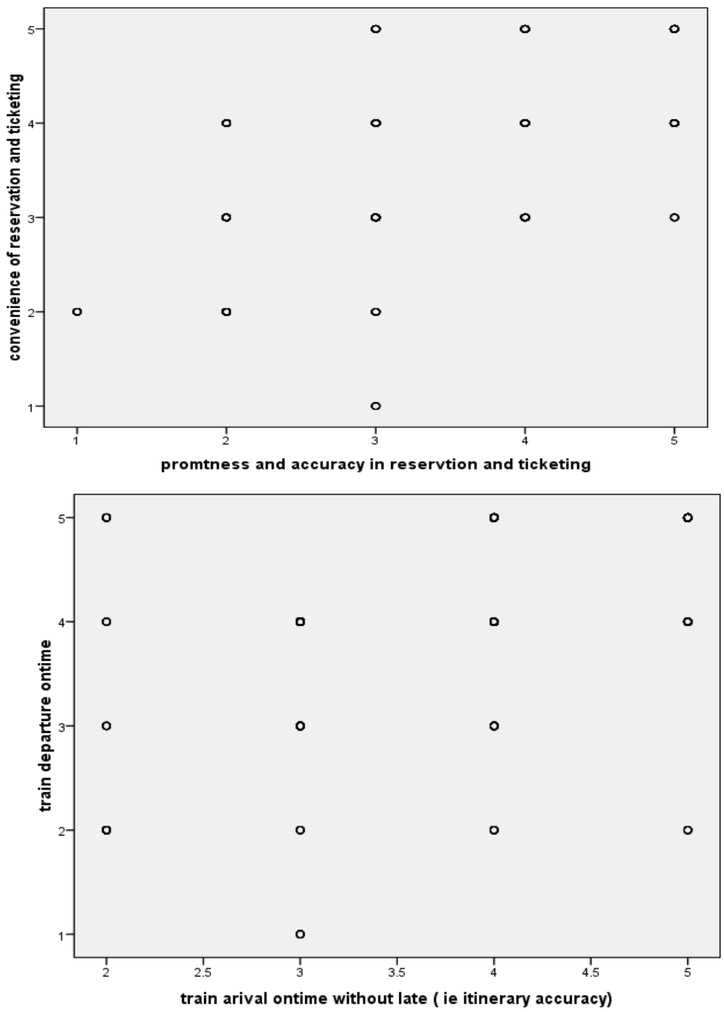

Figure 5.1: Sample of scatter plots of variables

Factor analysis is based on correlation and it assumes a linear relationship between the variables. It is not practical to carry out a scatter plot of every variable against every other variable, but a spot check can be carried out on selected variables (Field, 2005; Pallant, 2005). These should show no evidence of curvilinear relationship. Two sample scatter plots were generated between variables that were hypothesised to load to the same factor (convenience of reservation and ticketing and promptness and accuracy in reservation and ticketing hypothesised to reservation and ticketing dimension, and train departure on time and train arrival on time, hypothesised to load to punctuality and reliability dimension). Those are shown in Figure 5-1. Although these do not show clear linearity, there is no evidence of curvilinear relationships, suggesting that factor analysis would be appropriate.

5.5.0 Ensure each variable is suitable for inclusion

5.5.1 KMO values

The KMO values for individual correlations between variables by examining the diagonal elements of the anti-image correlation matrix. This test will determine if there are any individual variables with very low correlations with others that should be considered for removal from analysis. A minimum value of 0.5 is suggested for variables to be retained for factor analysis (Field, 2005). The individual correlations between variables in this research study had KMO value of 0.7 or higher. This suggests that all the variables should be retained for the analysis.

5.5.2 Correlation matrix

Then correlation matrix has been examined. It has been suggested that the correlation matrix should have coefficients of 0.3 or above for the data to be considered "factorable" (Field, 2005). There should be reasonably high inter-correlations between variables relating to sub-traits of the same factor and any variables that do not correlate with any other should be excluded from the factor analysis run. It has also been suggested that any variable that correlated too highly (>0.9) with another should be excluded, because it is impossible to determine the individual contribution of these variables to total variance (Field, 2005). This data set meets these criteria. All the coefficients in the correlation matrix are more than 0.3 and less than 0.9.

5.5.3 Determinant of the correlation matrix

The determinant of the correlation matrix is not > 0.0001. Some theorists suggest that this means some variables should be eliminated (Field, 2005). However, this needs to be interpreted in the context of other criteria and overall judgment made (Field, 2005).

5.5.4 Determine the number of factors to extract

Having established the suitability of the data for factor analysis, the next step is to determine the number of factors to extract. There are a number of criteria available for determining the number of factors to extract. It has been suggested that there is no single "best" rule, and that it is valuable to use a range of methods (Habing, 2003).

5.5.4A The Eigen value rule (Kaiser's Criterion)

The most commonly used techniques for determining the number of factors to extract is Kaiser's criterion, or the eigen value rule. The eigenvalue of a factor represents the total amount of variance in the data that is explained by that data. Using Kaiser's criterion, the number of factors with an eigenvalue of 1.0 or more are retained (Field, 2005 and Pallant, 2005). This is also the default criterion used in SPSS. Although this is a widely used criterion, it is not without critics. It has been suggested that retaining as many factors which have an eigenvalue > 1.0 can result in too many factors (Pallant, 2005), or too few (Field, 2005). Research has suggested that taking the number of factors with an eigenvalue > 1.0 is most reliable when there are 20 – 50 variables (Hair, Anderson, Tatham and Black, 2003) and the communalities are greater than 0.7 (Habing, 2003). If the sample size is > 500, average communalities of 0.5 can be considered acceptable (Field, 2005). The data set met both of these suggested guidelines, with a sample size of 608 and average communalities of 0.503. This suggests that Kaiser's criterion for the maximum number of factors to extract, using eigenvalues above 1.0, is likely to be appropriate in this situation. The eigenvalue and total variance explained are shown in Table 5.4. This suggests that up to seven factors should be retained.

Table 5.4: Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance
1	13.919	38.663	38.663	13.919	38.663	38.663	4.541	12.615
2	3.268	9.079	47.742	3.268	9.079	47.742	4.339	12.053
3	1.442	4.006	51.749	1.442	4.006	51.749	3.380	9.390
4	1.362	3.784	55.533	1.362	3.784	55.533	3.316	9.210
5	1.208	3.357	58.890	1.208	3.357	58.890	2.843	7.897
6	1.161	3.224	62.113	1.161	3.224	62.113	2.709	7.526
7	1.012	2.810	64.924					
8	.881	2.448	67.372					
9	.818	2.272	69.644					
10	.801	2.226	71.870					
11	.744	2.066	73.935					
12	.706	1.962	75.897					
13	.663	1.842	77.740					
14	.639	1.775	79.515					
15	.595	1.653	81.168					
16	.530	1.473	82.641					
17	.511	1.418	84.060					
18	.508	1.412	85.472					
19	.494	1.373	86.845					
20	.438	1.218	88.063					
21	.422	1.171	89.234					
22	.402	1.116	90.350					
23	.366	1.017	91.366					
24	.346	.961	92.327					
25	.327	.907	93.234					
26	.292	.810	94.044					
27	.284	.790	94.834					
28	.274	.760	95.594					
29	.252	.700	96.294					
30	.242	.673	96.967					
31	.221	.615	97.582					
32	.210	.582	98.164					
33	.198	.550	98.714					

34	.172	.478	99.192					
35	.151	.418	99.610					
36	.140	.390	100.000					

Extraction Method: Principal component Analysis.

5.5.4B Catell's Scree Criterion

Another popular test for the number of factors is Catell's scree criterion (Pallant, 2005).This criterion involves plotting the eigen values of the factors and looking for the point at which the plot begins to level off from vertical to horizontal. Some research has suggested that Catell's scree criterion tends to keep one or more factors more than the eigenvalue rule (Hair, Anderson, Tatham and Black, 2003) or that both the eigenvalue rule and scree plot are accurate if sample is > 250 and the commonalities are greater than 0.6. The results of Catell's scree plot are shown in Figure 5.2

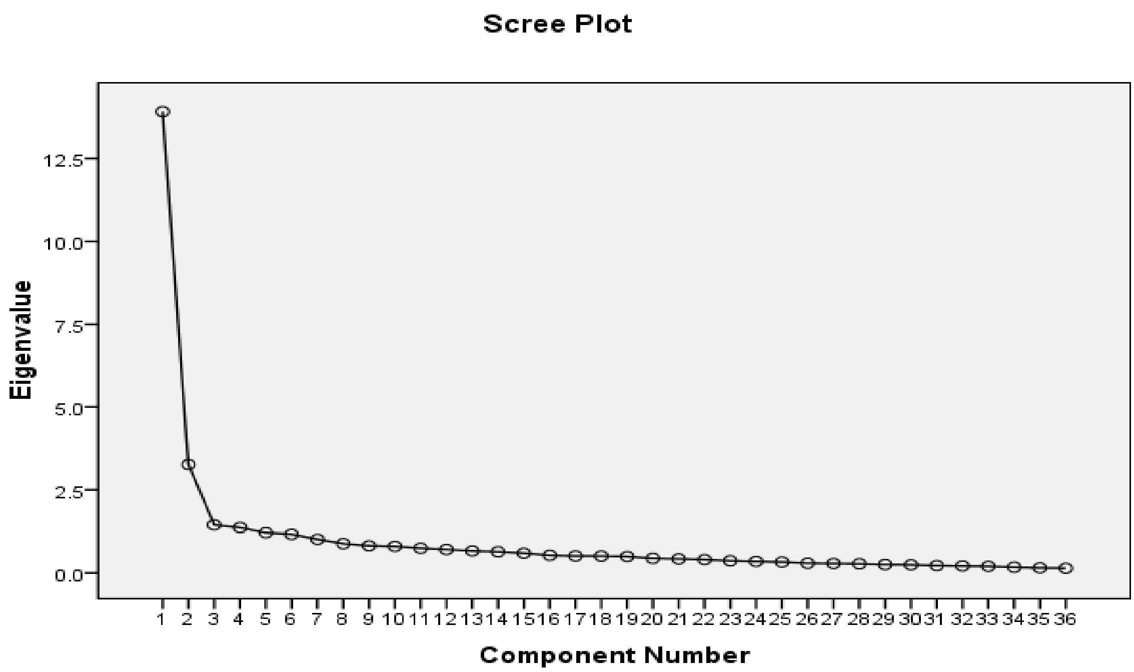

Fig 5.2 Catell's Scree plot of the Factor analysis

5.5.4C Judgement and previous research findings

Another acceptable method for determining the number of factors is “a priori”, which suggests “if you have a hypothesis about the number of factors that should underline the data, then that is probably a good (at least minimum number) to use”(Habing, 2003, p.4). Previous research in this area has found support for between four to seven factors. Hence in this research six factors were opted for extraction, which was the number initially hypothesised.

5.6 Determining the most appropriate method of factor analysis and factor rotation

There are a number of different approaches to discovering the factors. Due to the fact that approaches with different underlying mathematics often yield similar results, there tends to be lack a lack of rigour in the use of the terms such as principal component analysis and factor analysis (Field, 2005). In the following sections the available methods are reviewed for discovering the factors and the appropriate approach undertaken in this research are discussed with justification.

5.6.1. Method of Extraction

Exploratory factor analysis is useful for exploring data rather than testing the hypotheses. This can be useful for generating future hypotheses. This research is aimed to generate hypothesis about the nature of perceived Railway passenger service quality, for inclusion in a future confirmatory study, so EFA is appropriate.

It should be noted that the terms principal component analysis and factor analysis are often used inter-changeably, although they are based on different mathematical concepts. Principal component analysis is only a data reduction method and heavily data driven. It is calculated without regard to any underlying structure caused by latent variables; components are calculated using all of the variance in the data, and all of that variance appears in the components constructed in the final solution (Ford, MacCallum and Tait, 1986). However, researchers rarely collect and analyse data without some idea about how the variables are, or should be related. In factor extraction the co-variance between variables is portioned from each variable is, or should be related. In factor extraction the co-variance between variables partitioned from each variable’s unique variance and error variance appears in the solution.

This portioning of variance is also the approach taken in co-variance based methods such as confirmatory factor analysis.

Field, while acknowledging the underlying differences, notes that for most practical purposes, the solutions that are produced are very similar and principal component analysis (PCA) has been found to less complex than factor analysis (Field, 2005). Principal components and factors are often conflated by researchers who use the terms interchangeably and SPSS includes PCA as an option under the "Factor analysis" tab. This phase of the research uses principal component analysis, primarily because that is the technique used by most service quality authors in their iterations of the instrument. Hence in this research also the same practice has been followed.

5.6.2. Method of Rotation

Once the factors have been extracted, it is possible to calculate the degree to which variables load into these factors. There are two commonly-used types of rotation. Orthogonal rotation assumes that all the factors identified are independent and do not correlate with one another at all. Oblique rotation assumes that there may be a degree or correlation between the factors. Within these, there are several methods of rotation that are available in SPSS and used in social science research. Varimax rotation is the most popular orthogonal rotation method, because it aims to maximise the dispersion of variable loadings within factors. This tends to produce a smaller number of variables loading more highly onto each other. This method often produces a clearer and simple structure which is easy to interpret (Conway and Huffcut, 2003; Field, 2005). As the underlying attributes of the service quality were discrete, the Varimax procedure of orthogonal rotation is employed in this research. According to Hair et. al., (1988:150-151), the Varimax procedure is preferred because it minimises the correlation across factors and maximises it with in the factors.

5.6.3 Factor Interpretation

The cut off point for factor loading is arbitrary, and it varies among studies. For instance, loadings of less than 0.4 are considered weak, more than 0.6 as strong and 0.4 -0.6 as moderate (Garson 2008). For dichotomous items, however, a loading of 0.45 is regarded as high, but for Likert scales, 0.6 is high (Garson 2008). Therefore, this study employed 0.6 as the cut off point for factor interpretation.

5.7 Best Solution of EFA

Extensive exploratory analysis was carried out excluding various combinations of variables, to ensure that this solution was robust. This is the only clear factor structure that can be argued for this dataset. It represents a clear “consensus” that confirms, with minor variations, the use of Varimax rotation with factor loading 0.6 and above for this research across multiple analyses using rotated component matrix and principal component analysis. This is as shown in Tables 5.5 and 5.6 below.

The comparison table shows the best solution which is cleaner with few or no weak or cross-loading variables. In factor analysis, it need not necessarily be expected that the factors will extract all variance from the items, rather they will only extract that proportion that is due to the common factors and shared by several items. The proportion of variance of an item that is due to common factors and therefore shared with other items is called communality (Darlington, 2010)

Low communalities are evidence that the variables analysed have little in common with one another (Darlington, 2010). In the rotated solution, the items have relatively high communalities (Table 5-5). This is expected, as very similar item sets have showed significant loadings on common factors in past studies (Barnes 2001; Barnes and Vidgen, 2001, 2002).

Table 5.5 Best solution of EFA

	Components					
	1	2	3	4	5	6
convenience of reservation and ticketing					.681	
promptness and accuracy in reservation and ticketing					.751	
provision of information about train timings/platforms		.735				
Upkeep/repair of station buildings and platforms		.668				
ticket purchasing facilities					.530	
amenities at the station		.648				
Enquiry handling at ticket counter						
train departure on time				.697		
Duration of the journey (speed)				.747		
train arrival on time without being late (ie itinerary accuracy)				.635		
convenient train schedule				.563		
connectivity with other train services				.702		
Catering and other facilities at station		.562				
condition of fans and air conditioners						
train availability						
space for luggage						
coach maintenance						
connectivity with other forms of public transport		.618				
ease of being able to get on and off the train at the station platform		.574				
courtesy of employees						.775
handling of request to railway staff						.630
ease of ticket purchasing						
cleanliness inside the train	.814					
toilet facilities	.697					
Attitude and helpfulness of railway staff						.516
availability of railway staff inside the train						.512
Comfort of seating area (i.e., berths and seats)	.512					
provision of information during journey	.592					
Comfort during the journey	.602					
quality and price of catering services in train	.680					
personal security at the station			.597			
facilities for parking						
personal security on train			.807			
safety during train journey			.753			
value of money for price of your ticket						
Security of luggage on train			.712			

Table 5.6 Communalities

Attributes	Initial	Extraction
convenience of reservation and ticketing	1.000	.625
promptness and accuracy in reservation and ticketing	1.000	.763
provision of information about train timings/platforms	1.000	.770
upkeep/repair of station buildings and platforms	1.000	.607
ticket purchasing facilities	1.000	.603
amenities at the station	1.000	.581
enquiry handling at ticket counter	1.000	.503
train departure on time	1.000	.674
duration of the journey (speed)	1.000	.734
train arrival on time without being late (ie itinerary accuracy)	1.000	.763
convenient train schedule	1.000	.637
connectivity with other train services	1.000	.726
catering and other facilities at station	1.000	.532
condition of fans and air conditioners	1.000	.553
train availability	1.000	.657
space for luggage	1.000	.603
coach maintenance	1.000	.564
connectivity with other forms of public transport	1.000	.663
ease of being able to get on and off the train at the station platform	1.000	.625
courtesy of employees	1.000	.725
handling of request to railway staff	1.000	.622
ease of ticket purchasing	1.000	.514
cleanliness inside the train	1.000	.785
toilet facilities	1.000	.692
attitude and helpfulness of railway staff	1.000	.673
availability of railway staff inside the train	1.000	.622
comfort of seating area (i.e., berths and seats)	1.000	.664
provision of information during journey	1.000	.675
comfort during the journey	1.000	.590
quality and price of catering services in train	1.000	.677
personal security at the station	1.000	.542
facilities for parking	1.000	.554
personal security on train	1.000	.708
safety during train journey	1.000	.718
value of money for price of your ticket	1.000	.687
security of luggage on train	1.000	.740

Extraction Method: Principal Component Analysis.

5.8 Reliability of RAILQUAL theoretical model

Reliability measures the degree of correlation within constructs rather than between the constructs, in other words, the extent to which measures correlate or move together (Straub et al., 2004). The most commonly used reliability index and in many published studies, the only reliability test that is Cronbach's α. research validation heuristics suggest that in order for the factor structure to be considered reliable, α should be >0.7 for confirmatory research and >0.6 for exploratory research (Straub et al., 2004). These authors also note that more is not necessarily better with regard to reliability. A very high Cronbach's α (>0.95) may suggest common method bias in the study. Although some of the Cronbach's α are high they are not greater than 0.95.

Reliability statistics are affected by the number of items included for a construct. As noted earlier, various heuristics exist for the number of items required to test the homogeneity of items with in a construct. It has been suggested that as few as three items or four items can provide convergent validity (Harvery et al., 1985). It has also been suggested that a smaller number of items provides greater confidence, as scales with a large number of items tend to have higher reliability over item correlations that are quite low (Hinkin, 1988).

The reliabilities for the six factors emerging from this study are included below as tables 5.7 to 5.12. Factor 2, 3 and 4, which make the largest contribution explaining the overall variance in the data have very high values for Cronbach's α (i.e., 0.858, 0.857 and 0.832). Factor 5 i.e., Employee service has reliability value of 0.738 which makes the least contribution in terms of overall service quality.

Table 5.7 Reliability Analysis of Factor 1: Reservation and Ticketing

Item –Total Statistics for Factor 1 – Reservation And Ticketing	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha N of Items (3)
convenience of reservation and ticketing	6.97	2.414	.623	.728	
promptness and accuracy in reservation and ticketing	7.19	2.015	.736	.598	.791
ticket purchasing facilities	7.24	2.434	.550	.804	

Table 5.8 Reliability Statistics of Factor 2 – Platform Services

Item-Total Statistics Factor 2 Platform Services	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha No of items(6)
provision of information about train timings/platforms	19.43	7.751	.731	.818	
upkeep/repair of station buildings and platforms	19.56	7.762	.672	.829	
amenities at the station	19.65	7.926	.645	.835	.858
catering and other facilities at station	19.56	8.374	.622	.839	
connectivity with other forms of public transport	19.68	8.012	.639	.836	
get on and off the train at the station platform	19.49	8.550	.576	.846	

Table 5.9 Reliability Statistics for factor 3 In train service

Item-Total Statistics Factor 3 Intrain Services	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha No of items(6)
cleanliness inside the train	18.21	12.538	.726	.818	
toilet facilities	18.26	12.714	.685	.825	
comfort of seating area (i.e., berths and seats)	18.29	13.376	.657	.831	
provision of information during journey	18.15	13.375	.676	.828	.857
comfort during the journey	18.33	12.694	.655	.831	
personal security at the station	18.50	13.789	.493	.862	

Table 5.10 Reliability Statistics for factor 4 Punctuality

Item-Total Statistics Factor 4 Punctuality	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha No of items(4)
train departure on time	11.36	3.673	.698	.771	
duration of the journey (speed)	11.41	3.509	.766	.739	
train arrival on time without being late (i.e. itinerary accuracy)	11.46	3.758	.662	.787	.832
connectivity with other train services	11.78	3.859	.532	.848	

Table 5.11 Reliability Statistics for factor 5 Employee Service

Item-Total Statistics Factor 5 Employee service	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha No of items(4)
courtesy of employees	10.67	4.053	.513	.688	
handling of request to railway staff	10.73	4.106	.508	.691	
attitude and helpfulness of railway staff	11.17	3.743	.532	.678	.738
availability of railway staff inside the train	10.99	3.698	.568	.656	

Table 5.12 Reliability Statistics for factor 6 Safety and Security

Item-Total Statistics Factor 6 Safety and security	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha No of items(4)
personal security at the station	10.36	5.996	.538	.807	
personal security on train	10.35	5.627	.638	.761	0.812
safety during train journey	10.51	5.814	.641	.760	
security of luggage on train	10.20	5.327	.710	.725	

5.9 Validity of RAILQUAL Theoretical Model

Straub has been advocating for improved validity in survey research since 1989 (Straub and Carlson, 1989), but a recent "state of the art" study (Boudreau et al., 2001) found plenty of room for improvement. Specifically they found that many published studies do not validate their instruments (apart from reliability assessment) and that there has been a trend towards using existing instrumentation, possibly because of an increased awareness of the effort involved in developing and validating a new instrument.

Straub et al. suggest that both Principal Component Analysis (PCA) and Confirmatory Factor Analysis (CFA) are appropriate for establishing convergent and discriminant validity (Staraub et al., 2004). In combination, when using principal components analysis or confirmatory factor analysis, these two are described as factorial validity. At this stage of research only principal component analysis is only carried out. Confirmatory factor analysis using SEM will be carried out in a later stage. The six factors extracted had eigenvalues of 13.919, 3.268, 1.442, 1.362, 1.208 and 1.012 respectively, which are all above the validation heuristic of 1.

A clean six factor structure was established with all items loading at above 0.6 with out any cross loadings.

5.10 Discussion about RAILQUAL theoretical model

This exploratory research provides six factor structure for Railway Passenger Service Quality in Indian Railways. The emergent factors are reservation and ticketing, platform services, punctuality and reliability, in train service, safety security and employee service.

After exploratory factor analysis only 27 of the 36 attributes identified in the pilot study have been loaded on to the following six dimensions when factor loading of 0.50 and above was taken into consideration.

5.10.1 Reservation and Ticketing: Reservation and ticketing comes under the pre core services category of railway passenger services. Convenience of reservation and ticketing, promptness and accuracy in reservation and ticketing and ticket purchasing facilities are the three attributes which are loaded on to this dimension.

5.10.2 Platform Services: Platform services come under the pre core services of railway passenger services. Provision of information on train times/ platforms, the upkeep and repair of station building and platform, amenities at the station, catering and other facilities at station, connection with other forms of public transport and the ease of being able to get on and off the train at the station platform are the six attributes loaded on to this dimension. All the six attributes are the significant contributors of platform services quality.

5.10.3 In-train Service: In-train service comes under core services of railway passenger service. Cleanliness of the train, toilet facilities, comfort of seating area, provision of information during journey, journey comfort and quality and price of catering in the train are the six attributes which significantly contribute towards in-train service dimension.

5.10.4 Punctuality: Punctuality comes under core services of railway passenger services. Train departure on time, length of time the journey scheduled to take (speed), train arrival on time (i.e., intermarry accuracy) and connections with other train services are the four attributes which are the significant contributors of punctuality and reliability dimension.

5.10.5 Employee Service: Employee service comes under peripheral service dimension. Courtesy of the railway employee, attitude and helpfulness of railway staff, availability of railway staff on train and the way the request to railway staff was handled are the four attributes which are the significant contributors for employee service dimension.

5.10.6 Safety and Security: Safety and security comes under peripheral service dimension. Personal security at station, personal security on train, safety of the train journey and security of luggage on train are the four attributes which have a significant loading on to this dimension.

5.11 Chapter Review

Exploratory factor analysis using principal component analysis enables the researcher to make generalisations about the characteristics of the data-set collected. These results can form the basis for generating hypotheses, which need to be confirmed with an additional confirmatory study. This study exemplifies the difficulties involved in carrying out conceptual refinements to existing theory (Straub & Carlson, 1989), especially where that theory is not stable. In effect RAILQUAL is an entirely new instrument. In the next chapter the findings evolved through Exploratory Factor Analysis will be confirmed though Confirmatory Factor analysis.

5.12 Chapter References

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6

CHAPTER 6: DEVELOPING RAILQUAL MEASURMENT MODEL

6.1 Introduction

Latent variables represent concepts that cannot be observed directly. Since they cannot be observed directly, they cannot be measured directly, but can be measured in terms of observed variables (indicators) that are believed to represent the latent variable (indicators) by an assumed relationship between them. The measurement model deals with latent variables and their indicators. A pure measurement model is a Confirmatory Factor Analysis (CFA) model in which there is hypothesised to be unmeasured co-variance between each possible pair of latent variables. CFA assumes that there are direct effects from the latent variables to their indicators and direct effects from the error and disturbance terms to their respective variables, but there are no hypothesized casual effects connecting the latent variables. In the previous chapter using Exploratory Factor analysis a six dimension 27 attribute RAILQUAL theoretical model was developed which are to be confirmed and tested in this chapter using confirmatory factor analysis of each dimension. First, CFA model is performed for all the six dimensions of railway passenger service quality, to determine the reliability and validity of the model's constructs and to evaluate the fit between observed and estimated covariance matrices. Secondly three alternatives - RAILQUAL models of first order, second order and third order were developed and tested with fit indices to identify the best fitted model to be used for developing and testing the structural model.

6.2 Testing Data Normality

In statistics, normality refers to the data distribution which is a fundamental assumption in measuring the variation of variables. For analysing the data, it is not always required but is found better if the variables are normally distributed (Tabachinick and Fidell, 2007). According to Hair et al. (2006, p-79), if the variation from the data normal distribution is sufficiently large, all resulting tests are invalid, because normality is required to use the statistics.

Normality of data can be assessed by statistical methods (Tabachnick and Fidel, 2007) and Hair et al., 2006). In statistical method, normality of data distribution can be measured by Kurtosis and Skewness test and Kolmogorov and Shapiro method (Field, 2006; Tabachnick and Fidell, 2007; Hair et. al., 2006). For that, initially descriptive statistics were applied in SPSS 16 for Windows to know the skewness and kurtosis (Table 6.1). All variables were found normally distributed; however values for skewness were found negative and for kutosis values were positive. In addition, Kolmogorov and Sharipo test (Field, 2006) was applied to find the data normality. Results of this test (Table 6.2) were found significant for all variables., which might be due to the large sample size (n=1215), because this test is very sensitive to large sample size and minor deviation from normality would show this test as significant, hence significant K- S test does not reveal departure from normality of data (field, 2006, p.93).

Table 6.1 Descriptive Statistics of dimensions

Dimensions	N	Minimum	Maximum	Mean	Std. Deviation	Skew ness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
In train service	1215	-4	3	.00	1.000	-1.294	.070	2.952	.140
pf service	1215	-4	3	.00	1.000	-.237	.070	1.068	.140
safety and security	1215	-4	2	.00	1.000	-.627	.070	1.380	.140
punctuality	1215	-3	2	.00	1.000	-.432	.070	.488	.140
reservation	1215	-4	2	.00	1.000	-.778	.070	1.472	.140
Emp service	1215	-3	3	.00	1.000	-.306	.070	.818	.140
Valid N (list wise)	1215								

Table 6.2 Tests of Normality

Dimensions	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
In train service	.130	1215	.000	.893	1215	.000
pf service	.050	1215	.000	.987	1215	.000
safety and security	.065	1215	.000	.973	1215	.000
Punctuality	.040	1215	.000	.982	1215	.000
Reservation	.072	1215	.000	.965	1215	.000
Emp service	.052	1215	.000	.986	1215	.000

a. Lilliefors Significance Correction

Note: In train service, Platform service, safety and security, punctuality, reservation and ticketing and employee service are six variables.

6.3 Testing Data Linearity

Linearity means the correlations between variables which is represented by a straight line. In data analysis, it is important to know the level of relationship of variables. An implicit assumptions of all multivariate techniques based on co-relational measures of association, including multiple regression, logistic regression, factor analysis, and structural equation modelling is linearity (Hair et al.,2006). Thus, examining the relationships of variables is important to identify any departures that may effect the correlation. In statistics, linearity can be measured by Pearson's correlations or a scatter plot (Files, 2006; Tabachnick and Fidell, 2007; Hair et al., 2006). This study applied Pearson's correlations and found all variables significantly and positively correlated to each other (Table 6.3). Results of the test showed that all variables are linear with each other.

Table 6.3 Pearson's Correlations

	X1	X2	X3	X4	X6	X8	X9	X10	X18	X21	X23	X24	X25	X29	X30	X33	X34	X36
X1	1	.674**	.451**	.457**	.370**	.409**	.367**	.283**	.412**	.273**	.244**	.275**	.293**	.236**	.215**	.170**	.243**	.156**
X2	.674**	1	.504**	.530**	.386**	.363**	.369**	.338**	.459**	.322**	.260**	.309**	.373**	.289**	.201**	.134**	.240**	.161**
X3	.451**	.504**	1	.637**	.585**	.492**	.453**	.479**	.491**	.344**	.372**	.340**	.270**	.293**	.172**	.087**	.263**	.109**
X4	.457**	.530**	.637**	1	.478**	.383**	.417**	.407**	.575**	.323**	.341**	.359**	.291**	.302**	.285**	.174**	.308**	.192**
X6	.370**	.386**	.585**	.478**	1	.377**	.440**	.430**	.495**	.285**	.351**	.363**	.258**	.274**	.251**	.073*	.276**	.170**
X8	.409**	.363**	.492**	.383**	.377**	1	.688**	.591**	.455**	.334**	.212**	.328**	.270**	.182**	.093**	-.007	.120**	.041
X9	.367**	.369**	.453**	.417**	.440**	.688**	1	.671**	.498**	.344**	.215**	.319**	.237**	.204**	.068*	.050	.271**	.142**
X10	.283**	.338**	.479**	.407**	.430**	.591**	.671**	1	.496**	.288**	.142**	.240**	.220**	.236**	.134**	.108**	.267**	.129**
X18	.412**	.459**	.491**	.575**	.495**	.455**	.498**	.496**	1	.363**	.317**	.390**	.409**	.300**	.305**	.141**	.341**	.178**
X21	.273**	.322**	.344**	.323**	.285**	.334**	.344**	.288**	.363**	1	.357**	.435**	.335**	.389**	.315**	.116**	.202**	.318**
X23	.244**	.260**	.372**	.341**	.351**	.212**	.215**	.142**	.317**	.357**	1	.675**	.581**	.564**	.628**	.314**	.343**	.503**
X24	.275**	.309**	.340**	.359**	.363**	.328**	.319**	.240**	.390**	.435**	.675**	1	.528**	.524**	.552**	.259**	.389**	.486**
X25	.293**	.373**	.270**	.291**	.258**	.270**	.237**	.220**	.409**	.335**	.581**	.528**	1	.503**	.444**	.405**	.476**	.461**
X29	.236**	.289**	.293**	.302**	.274**	.182**	.204**	.236**	.300**	.389**	.564**	.524**	.503**	1	.630**	.318**	.433**	.512**
X30	.215**	.201**	.172**	.285**	.251**	.093**	.068*	.134**	.305**	.315**	.628**	.552**	.444**	.630**	1	.388**	.377**	.505**
X33	.170**	.134**	.087**	.174**	.073*	-.007	.050	.108**	.141**	.116**	.314**	.259**	.405**	.318**	.388**	1	.517**	.668**
X34	.243**	.240**	.263**	.308**	.276**	.120**	.271**	.267**	.341**	.202**	.343**	.389**	.476**	.433**	.377**	.517**	1	.560**
X36	.156**	.161**	.109**	.192**	.170**	.041	.142**	.129**	.178**	.318**	.503**	.486**	.461**	.512**	.505**	.668**	.560**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

x1= convenience of reservation and ticketing,x2= promptness and accuracy in reservation and ticketing,x3= provision of information about train timings/platforms,x4=upkeep/repair of station buildings and platform,x6= amenities at the station,x8= train departure on time, x9= duration of the journey (speed),x10= train arrival on time without being late (ie itinerary accuracy),x18= connectivity with other forms of public transport,x21= handling of request to railway staff,x23= cleanliness inside the train,x24= toilet facilities,x25= attitude and helpfulness of railway staff,x29= comfort during the journey,x30= quality and price of catering services in train,
x33= personal security on train,x34= safety during train journey,x36= security of luggage on train

6.4 Testing variables Homoscedasticity

Homoscedasticity estimates the variance of dependent variables with independent variables. In multiple regression analysis, the assumption of variation of variables should be constant (Field, 2006). According to Hair et. al., (2006, p-83) homoscedasticity is the assumption that dependent variable(s) exhibit equal levels of variance across the range of predictor variable(s). Thus, it refers to the assumption of normality because when the assumption of multivariate normality is met, the relationships between variables are homoscedasticity (Field, 2006; Tabachnick and Fidell, 2007). Homoscedasticity can be measured by graphical and statistical methods (Hair et. al., 2006; Field, 2006). In research, when data are grouped, homoscedasticity is known as homogeneity which can be measured by Levene's test of homogeneity of variance to confirm the results of variables with independent variables.(Table 6.4)

The results in the table show that many variables ensured that the assumption of homogeneity has not been violated. Nevertheless, it can be noted that like K-S test, the Levene's test is also sensitive to sample size, hence it can be significant when the sample size is large (such as n=1215 in the present study), which does mean that there is substantial departure from normality of data (Field, 2006, p.98).

Table 6.4 Test of Homogeneity of Variance

Dimensions with Statistical parameters		Levene Statistic	df1	df2	Sig.
In train service	Based on Mean	4.788	4	1210	.001
	Based on Median	3.289	4	1210	.011
	Based on Median and with adjusted df	3.289	4	1054.278	.011
	Based on trimmed mean	4.033	4	1210	.003
pf service	Based on Mean	1.184	4	1210	.016
	Based on Median	1.012	4	1210	.040
	Based on Median and with adjusted df	1.012	4	1146.719	.040

	Based on trimmed mean	1.139	4	1210	.036
safety and security	Based on Mean	4.086	4	1210	.003
	Based on Median	4.229	4	1210	.002
	Based on Median and with adjusted df	4.229	4	1100.635	.002
	Based on trimmed mean	4.102	4	1210	.003
punctuality	Based on Mean	1.145	4	1210	.034
	Based on Median	.810	4	1210	.059
	Based on Median and with adjusted df	.810	4	1121.776	.019
	Based on trimmed mean	.965	4	1210	.025
reservation	Based on Mean	5.992	4	1210	.000
	Based on Median	4.166	4	1210	.002
	Based on Median and with adjusted df	4.166	4	912.001	.002
	Based on trimmed mean	5.139	4	1210	.000
Emp service	Based on Mean	4.659	4	1210	.001
	Based on Median	4.817	4	1210	.001
	Based on Median and with adjusted df	4.817	4	1117.846	.001
	Based on trimmed mean	4.716	4	1210	.001

6.5 RAILQUAL Measurement Model

Confirmatory Factor Analysis was done on each factor to confirm the factor structure identified in the previous chapter.

6.5.1 CFA of Reservation and Ticketing

Reservation dimension was measured by 3 attributes namely convenience of reservation and ticketing, promptness and accuracy of reservation and ticketing and ticket purchasing facilities. CFA model of reservation and ticketing dimension is graphically presented in

Figure 6.1. Adequacy of the model is evaluated by the basic of fit indices. As there are only 3 attributes, fitness indices could not be calculated.

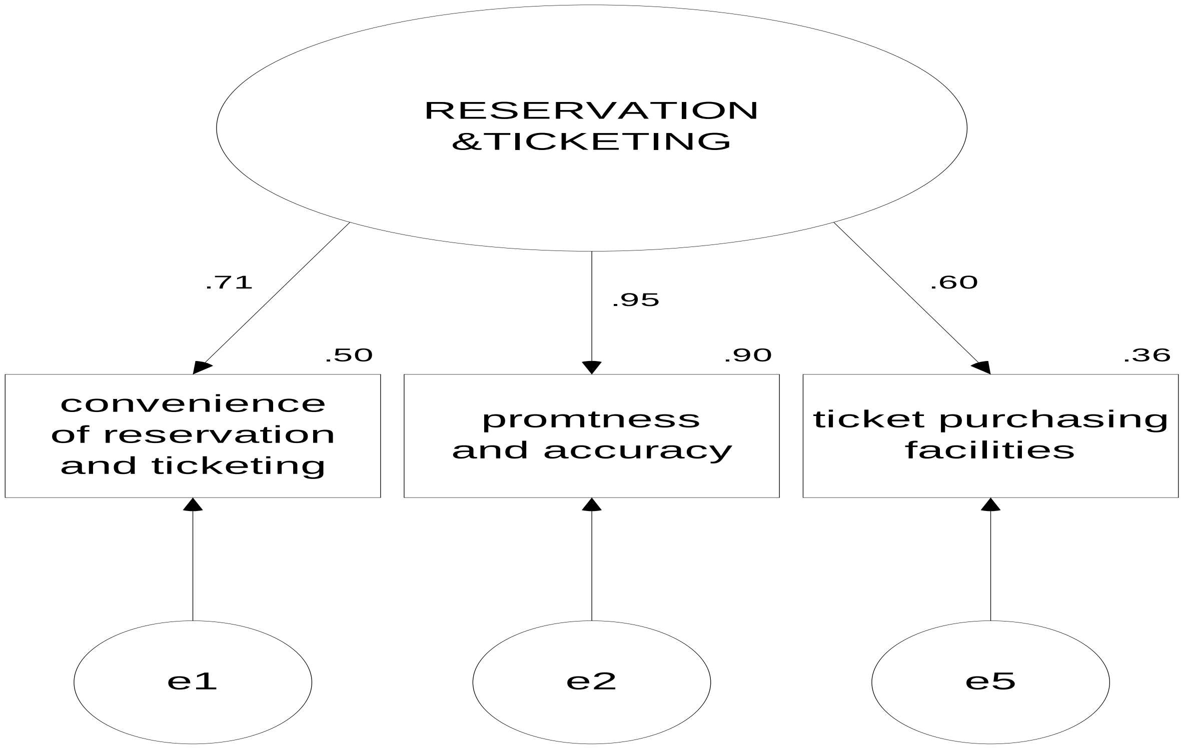

Figure 6.1 CFA model of Reservation and Ticketing dimension

The factor loadings are shown in Table 6.5.

Table 6.5 Reservation and ticketing factor loadings

Attribute	Standardised Factor Loading	Squared multiple correlations
Convenience of reservation and ticketing	0.709	0.502
Promptness and accuracy in reservations	0.951	0.905
Ticket purchasing facilities	0.602	0.363

In the reservation and ticketing dimension, ticket purchasing facilities attribute has a factor loading of 0.602 with error variance of 0.363. Therefore, in an effort to achieve better fit CFA model for reservation and ticketing construct the attribute ticket purchasing facilities has been deleted. The revised two factor solution, including retained attributes and standardised factor loadings is detailed in Figure 6.2.

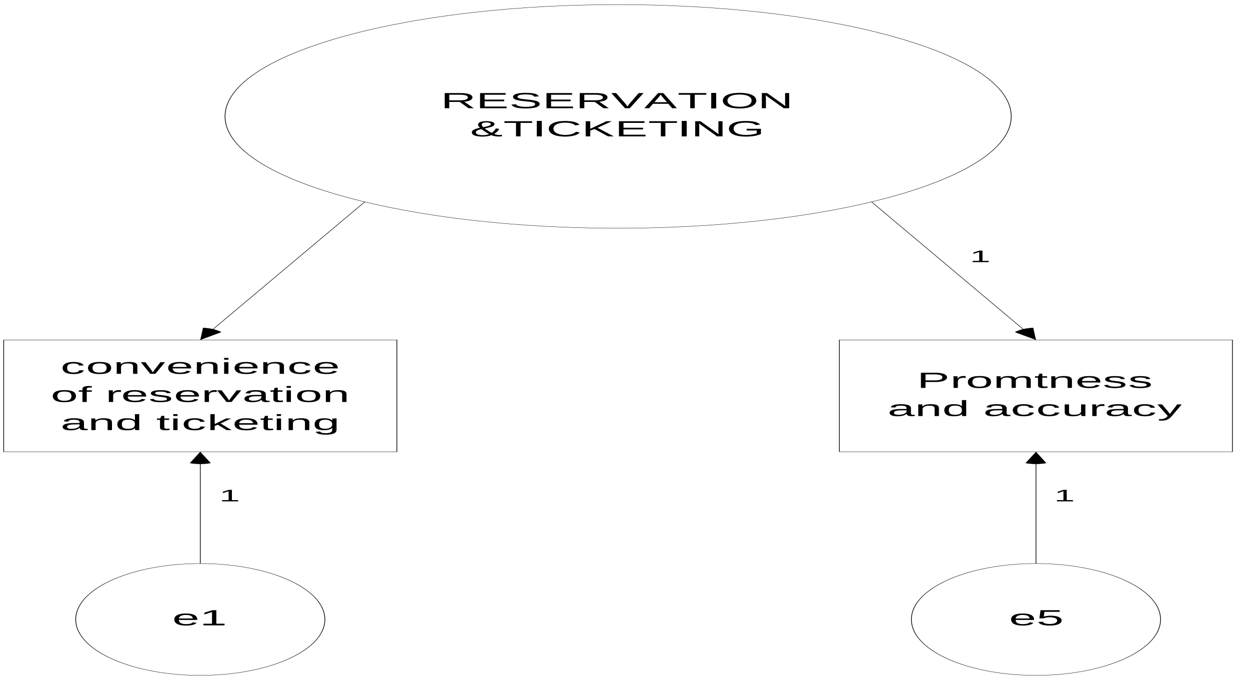

Figure 6.2 Final CFA model of Reservation and Ticketing dimension

6.5.2 CFA of Platform Services Dimension

Platform services come under the pre core services of railway passenger services. Provision of information on train times platforms, upkeep and repair of station building and platform, amenities at the station, catering and other facilities at station, connection with other forms of public transport and the ease of being able to get on and off the train at station platform are the six attributes loaded on to this dimension. All the six attributes are the significant contributors of platform services quality.

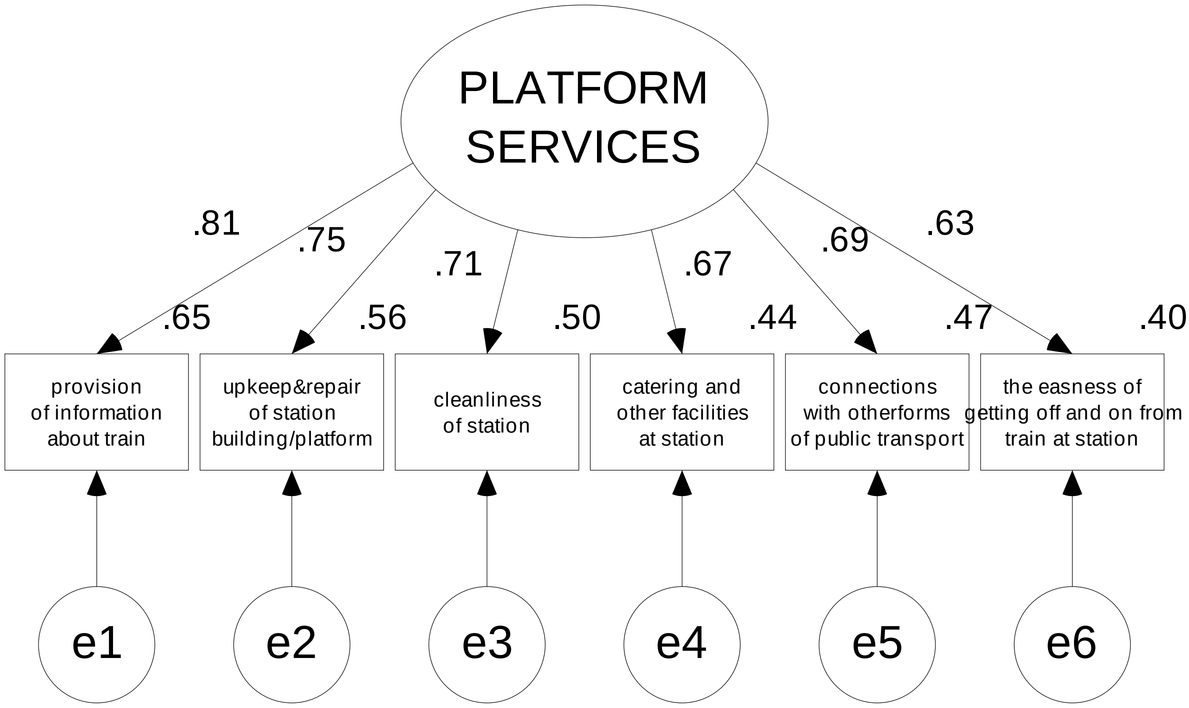

Figure 6.3 CFA model of platform services dimension

This dimension contained six attributes. The initial analysis indicated mixed results with normed Chi-square being above the recommended range from one to three although it falls within the higher range recommended by Wheaton et. al.(1977). The other fit indices are all within the recommended range. These results are reported in Table 6.6 and Table 6.7.

Table 6.6: Platform services – fit indices

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
166.239	9	0.961	0.909	0.946	0.944	0.946	0.911	0.20	0.120

Table 6.7 Platform services factor loadings and error variances

Attribute	Standardised Factor Loading	Squared multiple correlations
Provision of information about train (x3)	0.809	0.654
Upkeep and repair of station building (x4)	0.747	0.558
Cleanliness of station (x6)	0.707	0.499
Catering and other facilities at station (x13)	0.666	0.444
Connections with other forms of public transport(x18)	0.686	0.470
The easiness of getting on and off the station platform (x19)	0.634	0.402

On the basis of poor fit indices of the RMSEA and the normed Chi-square the factor structure was re-examined to identify a better model fit. An examination of the AMOS output including factor weights and squared multiple correlations, identified two components that contributed to poor fit. They are x13 (i.e., Catering and other facilities at station) and x19 (the easiness of getting on and off the station platform). These components were removed from the model and a four-item factor resulted.

The fit indices for the revised factor structure as shown in Table 6.8 provide improved fit. The absolute fit indices of GFI (0.975) is above the recommended lower value of 0.90 and RMR (0.18) are below the recommended higher value 0f 0.08. The incremental indices also a good fit with NFI (0.962) and CFI (0.963) being above the recommended value of 0.90. Finally the normed Chi-square value is 67.504 and is within the recommended range. The revised four factor structure has a Cronbach alpha of 0.826. On the basis of the improved fit indices and satisfactory reliability the revised dimension is accepted.

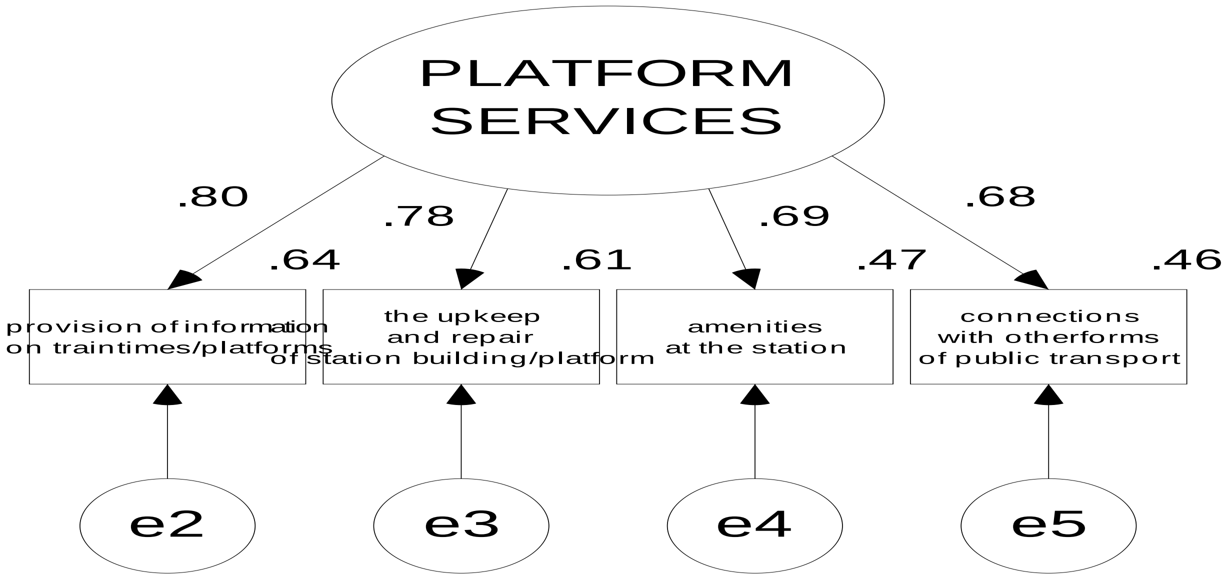

Figure 6.4 Final CFA model of platform services dimension

Table 6.8 Platform services – Revised structure.

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
67.504`	2	0.975	0.877	0.962	0.963	0.963	0.890	0.18	0.164

The four factor solution, including retained items and standardised factor loadings is detailed in Table 6.9.

Table 6.9 Platform services retained items factor loadings and error variances

Attribute	Standardised Factor Loading	Squared multiple correlations
Provision of information about train (x3)	0.800	0.640
Upkeep and repair of station building (x4)	0.783	0.613
Cleanliness of station (x6)	0.685	0.470
Connections with other forms of public transport (x18)	0.682	0.465

6.5.3 CFA of Railway Pre Core Services

This is the second order dimension of railway passenger services quality where both the dimensions of Reservation and Ticketing and Platform services have been clubbed together to form a single dimension by name Railway pre core services (shown in Figure 6.5).

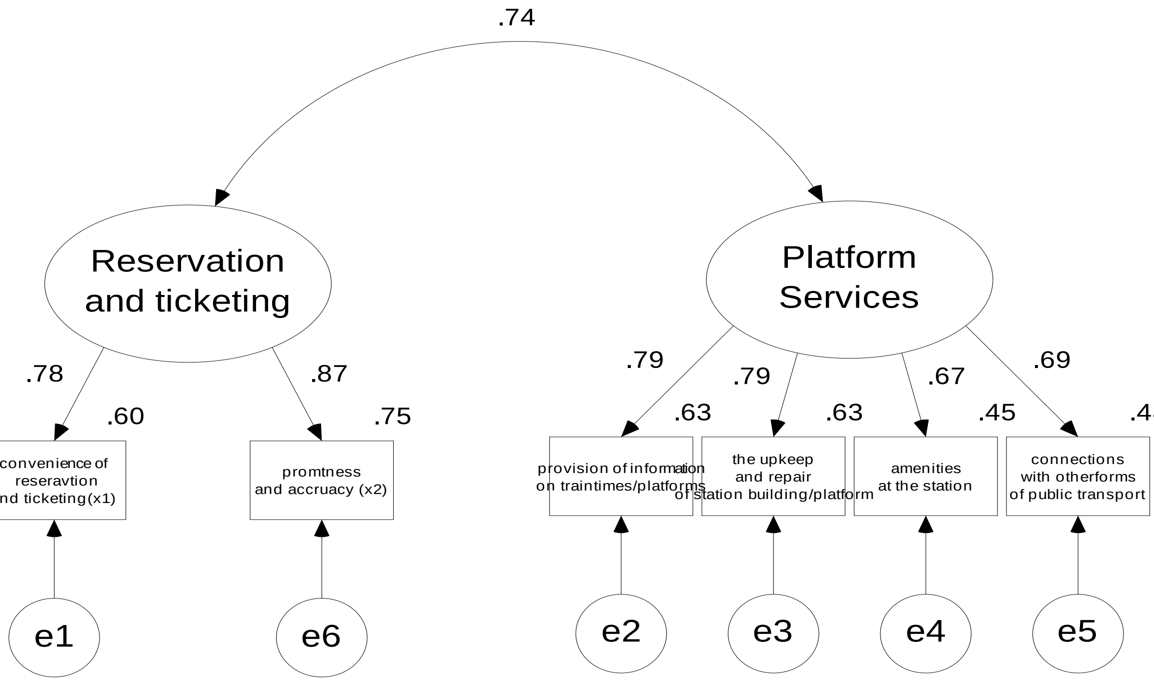

Figure 6.5 Final CFA model of pre core services dimension

This is the higher order dimension of Railway passenger service quality where the reservation and ticketing and platform services are clubbed together as pre core railway passenger services.

The fit indices reflect a very high level of fit. The absolute fit indices of the GFI (0.980), AGFI (0.947), the RMR (0.015) and RMSEA (0.86) are all within the recommended tolerances and confirm the factor structure. The incremental or comparative fit indices also indicate a hypothesised model that reflects the data with the NFI having value of 0.974 and

CFI a value of 0.977 both above the recommended value of 0.90. The normed Chi-square (80.644) falls with in the recommended range and these fit indices confirm the factor structure identified though exploratory factor analysis. The correlation between reservation ticketing and platform services is estimated to be 0.739 which substantiates the grouping of these two dimensions into a higher order single dimension as pre core railway passenger services. The fit indices are shown in the Table 6.10 and the standardised factor loadings detailed in Table 6.11.

Table 6.10 Fit indices of pre core services dimension

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
80.644	8	0.980	0.947	0.974	0.977	0.977	0.956	0.15	0.086

Table 6.11 Pre core services items and factor loadings

Attribute	Standardised Factor Loading	Squared multiple correlations
x18 ----- Platform Services	0.690	0.476
x6 ----- Platform Services	0.690	0.448
x4 ------ Platform Services	0.795	0.632
x3 ------ Platform Services	0.793	0.629
x2 ---- Reservation and ticketing	0.869	0.754
x1 ----- Reservation and ticketing	0.776	0.602

6.5.4 CFA of In-train Service Dimension

In-train service comes under core services of railway passenger service. Cleanliness of the train, toilet facilities, comfort of seating area, provision of information during journey, journey comfort and quality and price of catering in the train are the six attributes which significantly contribute towards in-train service dimension (shown in Figure 6.6).

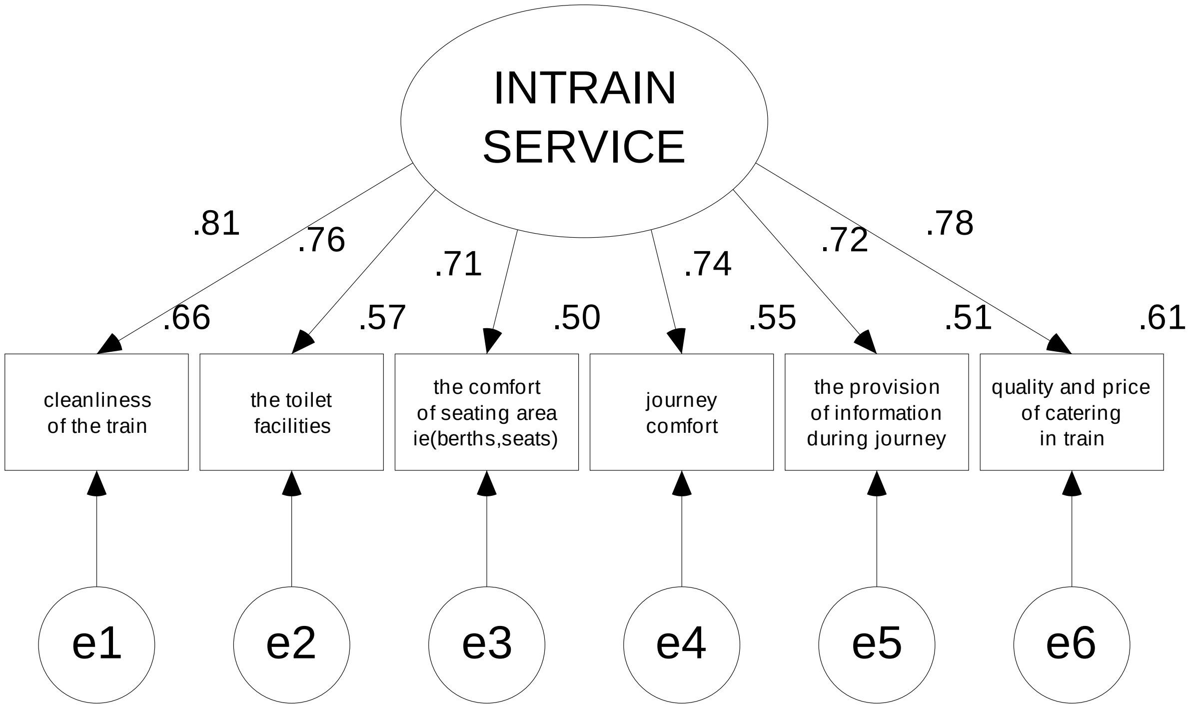

Figure 6.6 In train service basic model

This dimension contained six attributes and the results for this dimension are shown in Tables 6.12 and 6.13.

Table 6.12 In train service - Exploratory Structure

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
124.302	9	0.967	0.924	0.966	0.968	0.968	0.947	0.26	0.103

Table 6.13 In train services items and factor loadings and error variances

Attribute	**Standardised Factor Loading**	**Squared multiple correlations**
Cleanliness of the train	0.815	0.664
Toilet facilities	0.755	0.570
Comfort of seating area	0.708	0.501
Provision of information during journey	0.717	0,515

Journey comfort	0.742	0.551
Quality and price of catering in the train	0.782	0.612

The fit indices indicate a mixed result with some indices being above the recommended ranges whilst the other fit indices indicate a good level of fit. On the basis of the above the AMOS output was examined to identify a better fitting model. An examination of the output, including factor weights, squared multiple correlations and recommended modification indices, identified two components namely comfort of seating area and provision of information during journey that contributed to the poor fit. These two components were removed from the model and a four item factor resulted as shown in Figure 6.7 and the revised factor loadings and fit indices are shown in Tables 6.14 and 6.15.

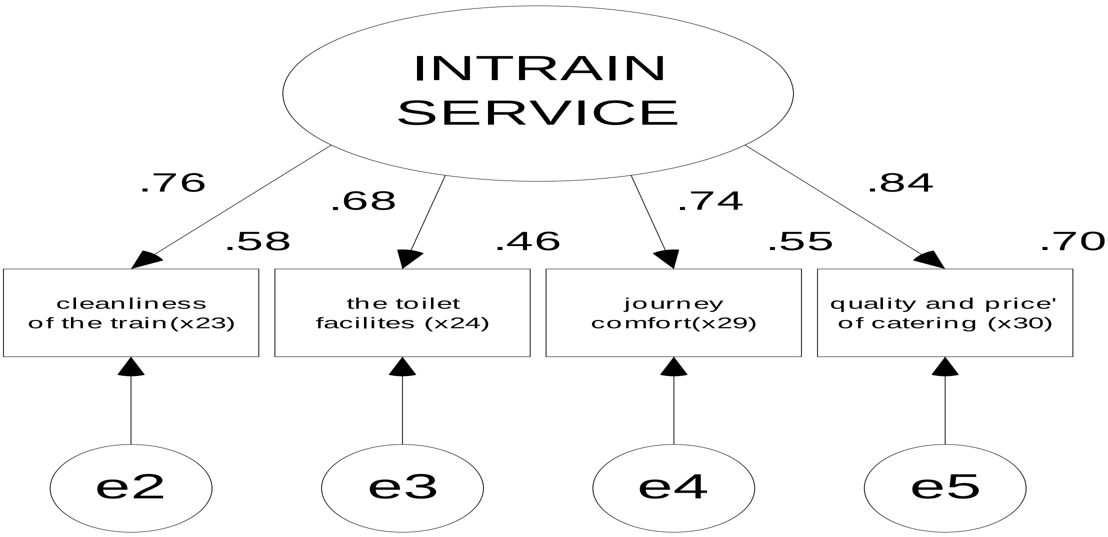

Figure 6.7 In train service final model

Table 6.14 In train service – revised structure fit indices

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
6.318	2	0.997	0.987	0.997	0.998	0.998	0.993	0.009	0.042

Table 6.15 In train services items and factor loadings and error variances of the revised and final model

Attribute	Standardised Factor Loading	Squared multiple correlations
Cleanliness of the train	0.762	0.581
Toilet facilities	0.678	0.460
Journey comfort	0.742	0.550
Quality and price of catering in the train	0.836	0.698

6.4.5 Punctuality

Punctuality comes under core services of railway passenger services. Train departure on time, the duration of journey (speed), train arrival on time without being late (i.e. itinerary accuracy) and connections with other train services are the four attributes which are the significant contributors of punctuality and reliability dimension. This dimension contained four attributes and the results of this dimension are show in Figure 6.8.

The fit indices indicate a mixed result with the normed chi-square (3.835), RMR (0.005) and RMSEA (0.027) being above the recommended ranges whilst the other fit indices indicate a good level of fit. On the basis of the above the AMOS output was examined to identify a better fitting model.

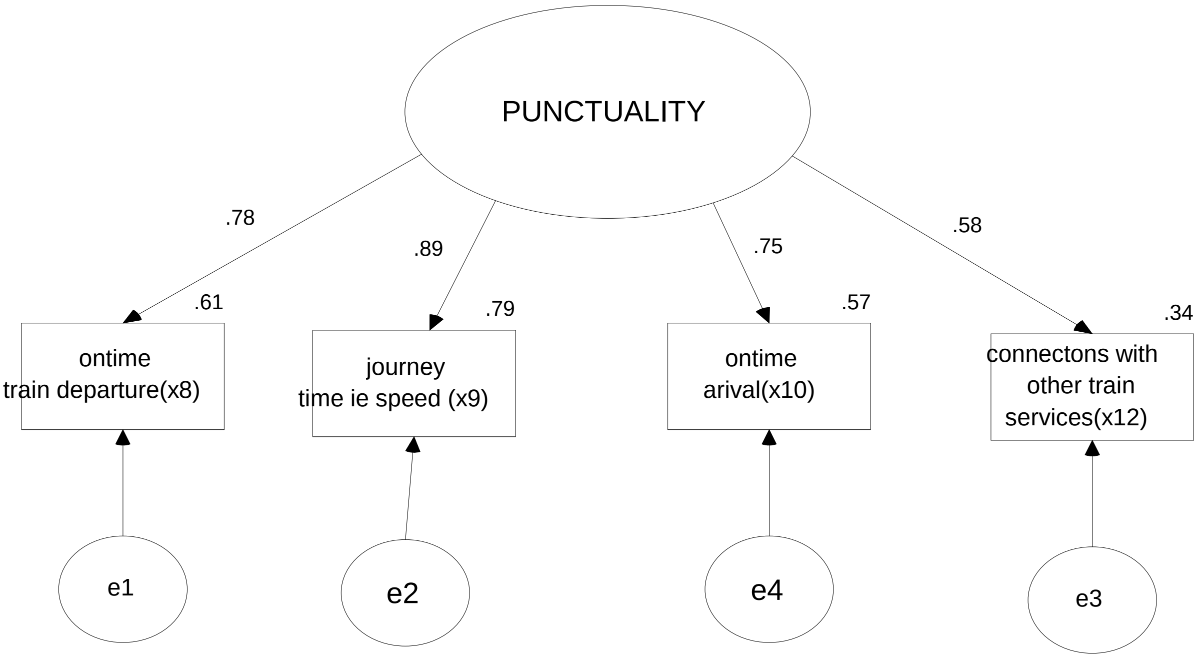

Figure 6.8 punctuality dimension basic CFA model

An examination of the output, including factor weights and recommended modification indices, identified one attribute connection with other train services (x12) that contributed to the poor fit. This attribute was removed from the model and a three item factor resulted. The revised fit indices are identified in Table 6.16and 6.17.

Table 6.16 Punctuality and reliability dimension fit indices

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
3.835	2	0.998	0.992	0.998	0.998	0.999	0.997	0.005	0.027

Table 6.17 Regression Weights of Punctuality dimensions

Attribute	Standardised Factor Loading	Squared multiple correlations
Train departure on time (x8)	0.781	0.610
Duration of the journey(x9)	0.887	0.786
Train arrival in time (itinerary accuracy) (x10)	0.753	0.568
Connectivity with other train services(x12)	0.579	0.336

The results of testing the modified solution indicate a very high level of fit. Adequacy of the model is evaluated by the basic of fit indices. As there are only 3 attributes the fitness indices could not be calculated. Hence retained items with standardised factor loadings and error variances are shown in Table 6.18. Figure 6.9 shows the punctuality dimension revised CFA model.

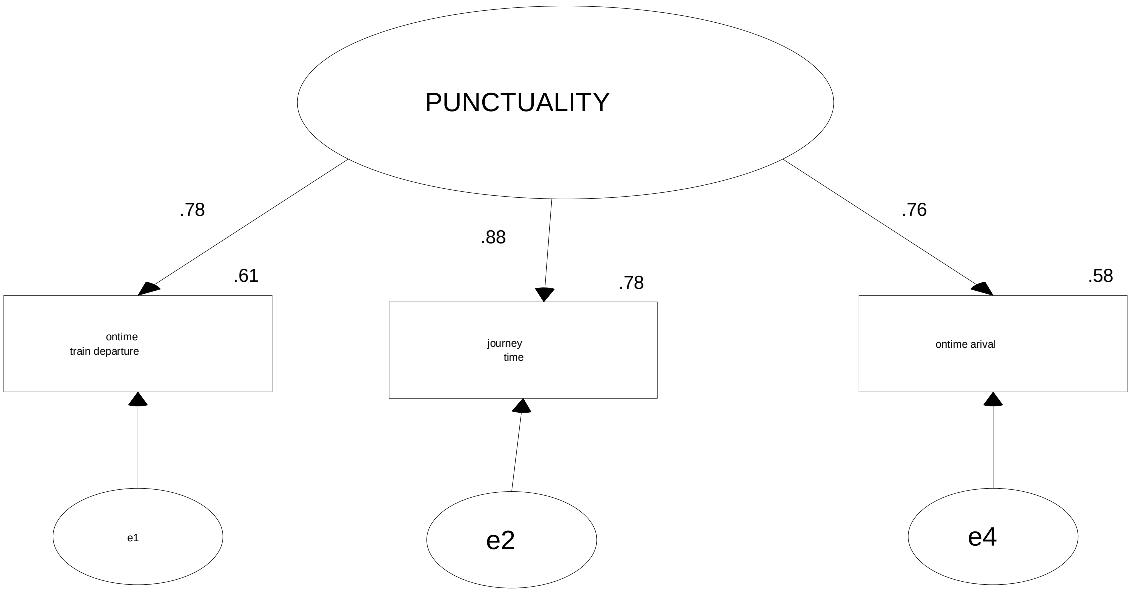

Figure 6.9 Punctuality dimension revised CFA model

Table 6.18 Punctuality dimension revised structure factor loadings

Attribute	Standardised Factor Loading	Squared multiple correlations
Train departure on time(x8)	0.778	0.606
Duration of the journey(x9)	0.884	0.781
Train arrival in time ie itinerary accuracy (x10)	0.760	0.577

6.5.6 Core train services:

This is the second order dimension of railway passenger services quality where both the dimensions of in train service and punctuality have been clubbed together to form a higher order dimension as core train services. Figure 6.10 represents the core train services CFA model.

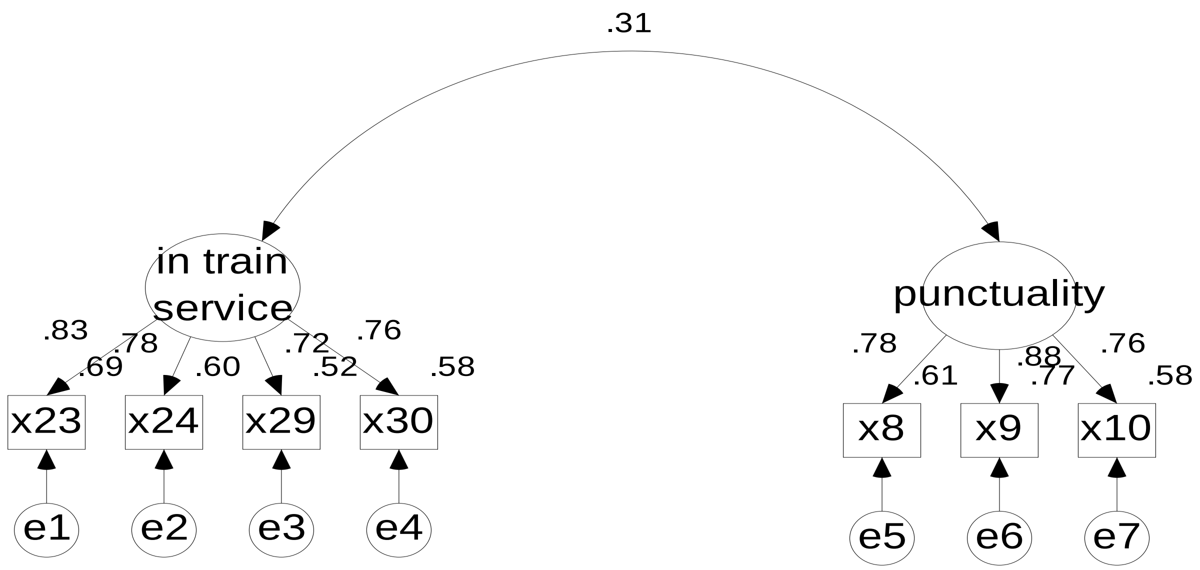

Figure 6.10 Core train services CFA model

The fit indices are shown in Table 6.19 and the standardised factor loadings are detailed in Table 6.20.

Table 6.19 Core services dimension fit indices

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
237.249	13	0.945	0.881	0.940	0.943	0.944	0.909	0.042	0.119

This is the higher order dimension of Railway passenger service quality where the in train services and punctuality are clubbed together as core railway passenger services.

The fit indices reflect a very high level of fit. The absolute fit indices of the GFI (0.945), the RMR (0.042) are all within the recommended tolerances and confirm the factor structure. The incremental or comparative fit indices also indicate a hypothesised model that reflects the data with the NFI having value of 0.940 and CFI a value of 0.943 both above the recommended value of 0.90. The normed Chi-square (237.249) falls with in the recommended range and these fit indices confirm the factor structure identified though exploratory factor analysis.

Table 6.20 Regression Weights of core services dimension revised structure

		Estimate	S.E.	C.R.	P	Standardized estimate	Squared multiple correlations
x29 ---	in train service	1.000				.720	.519
x24 ---	in train service	1.039	.042	24.513	***	.775	.601
x23 ---	in train service	1.099	.043	25.786	***	.829	.688
x10 ---	Punctuality	1.000				.761	.578
x9 ---	Punctuality	1.165	.043	27.326	***	.880	.688
x8 ---	Punctuality	1.028	.039	26.323	***	.782	.601
x30 ---	in train service	1.049	.043	24.144	***	.762	.519

S.E is an estimate of the standard error of the covariance

C.R is the critical ratio obtained by dividing the estimate of the co variances by its standard error. The value of exceeding 1.96 represents a significant level of 0.05

*** p-value < 0.001

6.5.7 Employee Service

Employee service comes under peripheral services dimension of Railway passenger services. It comprises courtesy of employees, attitude and behaviour of railway staff, availability of railways staff on train and the way the request to railway staff was handled (shown in Figure 6.11).

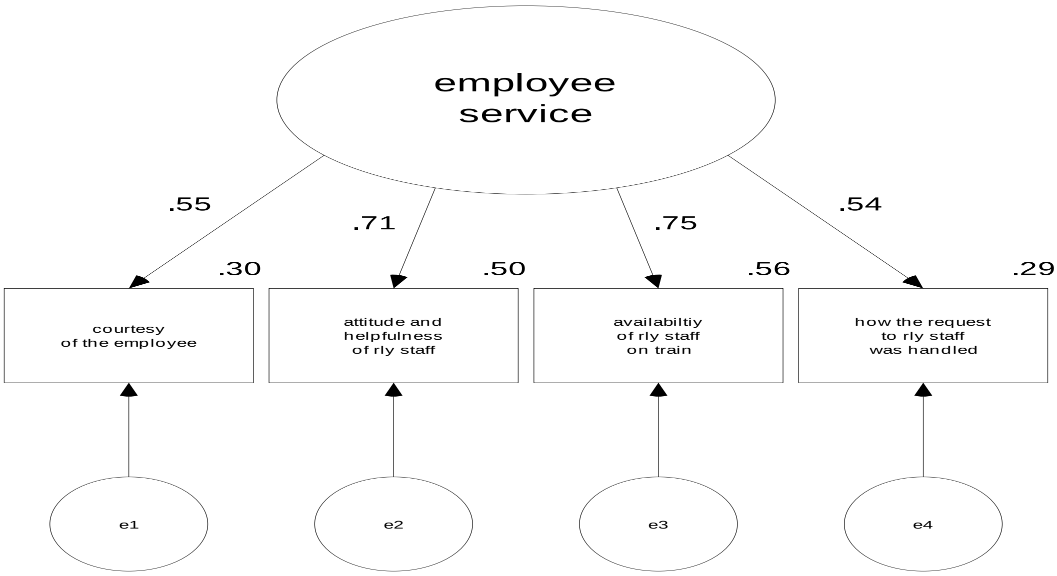

Figure 6.11 Employee services basic CFA model

The dimension contained four items. The initial confirmatory factor analysis indicated a poor fitting model. The results are shown in Tables 6.21 and 6.22. Although the GFI (0.908) indicates a good fit, the other absolute fit indices indicate a poor fit with AGFI (0.538) below the lower recommended value of 0.90 and RMR (0.062) being above the upper recommended value.

Table 6.21 employee service basic model fit indices

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
243.856	2	0.908	0.538	0.802	0.801	0.802	0.405	0.062	0.316

Table 6.22 employee service dimensions factor loadings

Attribute	Standardised Factor Loading	Squared multiple correlations
Courtesy of employee (x20)	0.549	0.301
Handling of request to railway staff (x21)	0.750	0.563
Attitude and helpfulness of railway staff (x25)	0.710	0.505
Availability of railway staff inside the train(x26)	0.538	0.289

The revised CFA model is as shown in Figure 6.12.

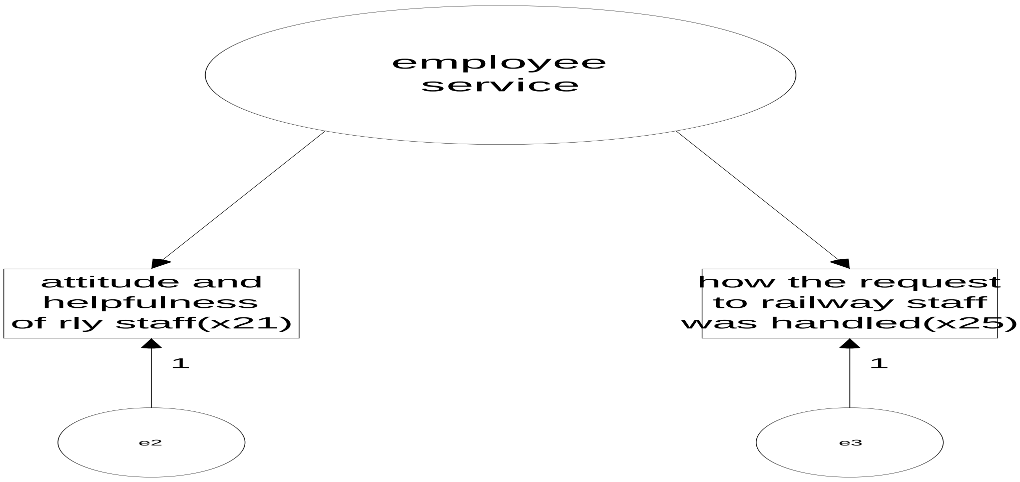

Figure 6.12 Employee services revised CFA model

An examination of the output including factor weights and squared multiple correlations identified two attributes namely courtesy of employee (x20) and availability of railway staff on train (x26) as the ones which contributed to the poor fit. These attribute was removed from the model and a two-item factor resulted.

As there are only two attributes loaded onto this dimension, it is not possible to derive fit indices and parameter estimates for this model. However these things can be tested in the final RAILQUAL CFA model.

6.5.8 Safety and security

Safety and security comes under peripheral service dimension. Personal security at station, personal security on train, safety of the train journey and security of the luggage on train are the four attributes which have a significant loading on to this dimension. CFA results of this dimension are shown below in Figure 6.13 and Tables 6.23 and 6.24

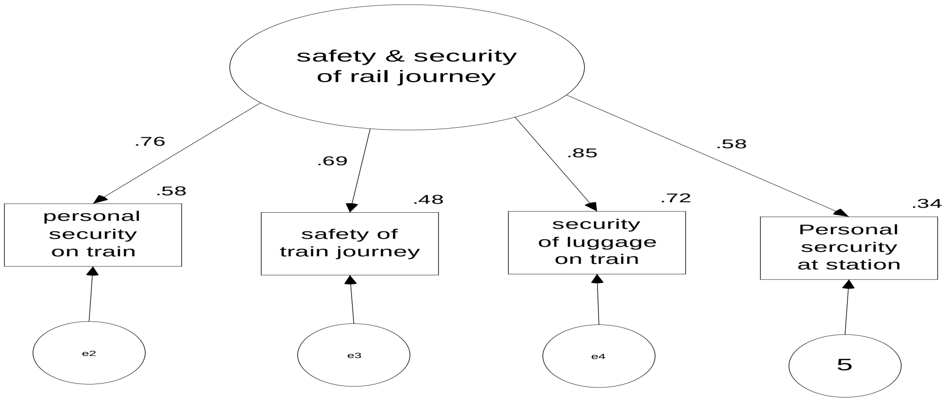

Figure 6.13 Basic model of Safety and security dimension

The fit indices indicate a poorly fitted model. Although the GFI (.976) indicates an acceptable fit the other indices are all outside the recommended ranges. An examination of the AMOS output, including factor weights and squared multiple correlations led to removal of one item namely personal security at station (x31) and this resulted in a good fitting model. The revised fit indices are reported in Table 6.25 with standard regression weights. The revised model of safety and security dimension is illustrated in Figure 14.

Table 6.23 Safety and Security basic model fit indices

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
60.320	2	0.976	0.878	0.964	0.965	0.966	0.965	0.035	0.155

Table 6.24 Factor Loadings of Safety and security dimension

Attribute	Standardised Factor Loading	Squared multiple correlations
Personal Security at the station (x31)	0.583	0.340
Personal security on train (x33)	0.764	0.584
Safety during train journey (x34)	0.690	0.476
Security of luggage on train(x36)	0.846	0.716

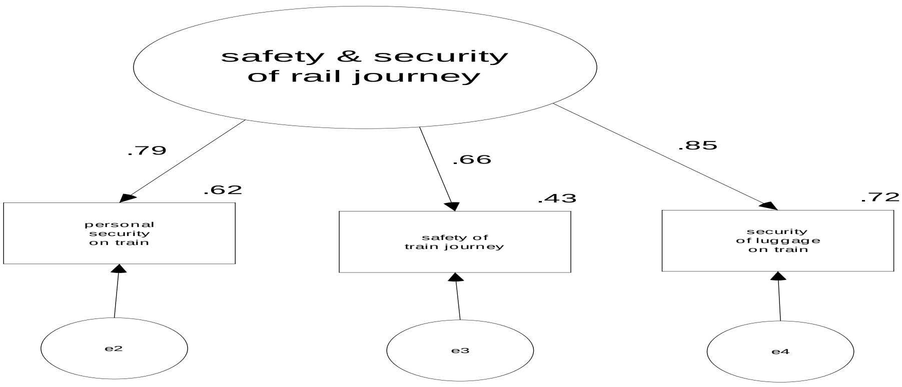

Figure 6.14 Revised model of Safety and security dimension.

Table 6.25 Safety and security dimension revised model factor loadings

Attribute	Standardised Factor Loading	Squared multiple correlations
Personal security on train (x33)	0.785	0.617
Safety during train journey (x34)	0.658	0.433
Security of luggage on train(x36)	0.850	0.713

6.5.9 Peripheral services dimension

This is the second order dimension of railway passenger services quality where both the dimensions of employee service and safety and security are clubbed together to form a higher order dimension by name peripheral services. It consists of 5 attributes from both the dimensions. The CFA model for peripheral services dimension is shown in Figure 6.15.

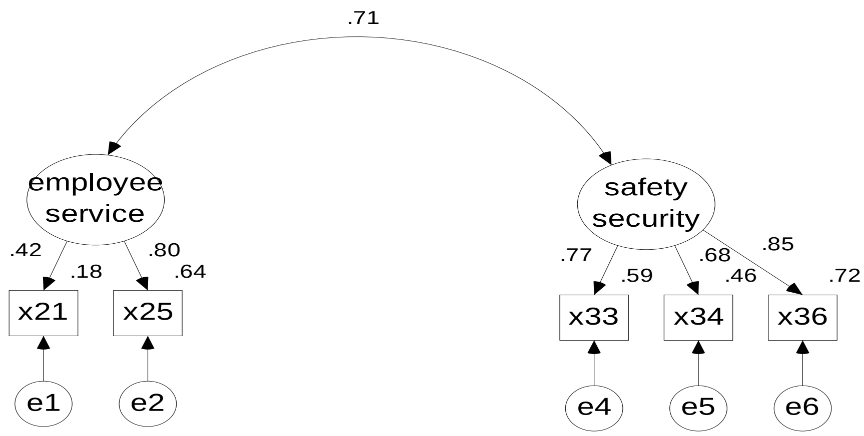

Figure 6.15 CFA model of peripheral services dimension

The fit indices reflect a high level of fit. The absolute fit indices of the GFI (0.967) and CFI (0.946) and the correlation between the two factors is 0.706 and factor score weights between the two dimensions are within the recommended range. This factor structure substantiates that peripheral services is a higher order dimension of railway passenger service quality with two factors as employee service and safety and security as sub dimensions as shown in Tables 6.26 and 6.27.

Table 6.26 Peripheral services model fit indices

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
106.084	4	0.967	0.877	0.944	0.945	0.946	0.864	0.034	0.145

Table 6.27 Correlations between the two dimensions

Peripheral services			Estimate
employee_service	<-->	safety_security	0.706

Table 6.28 Factor score weights between the two dimensions

	x36	x34	x33	x21	x25
safety_security	.364	.161	.223	.026	.103
employee_service	.123	.054	.075	.123	.484

6.6 RAILQUAL 1st order measurement model

After conducting a confirmatory factor analysis for each construct, to further assess the convergent and discriminant validity of all measures, a total measurement model with all the six dimensions is subjected to confirmatory factor analysis. The final measurement model is the one where all the constructs are free to correlate with one another (Hair et al., 1995).

The fit of the all the six constructs was assessed. An examination of the overall fit statistics for the measurement model is shown in Figure 6.16 and Table 6.29.

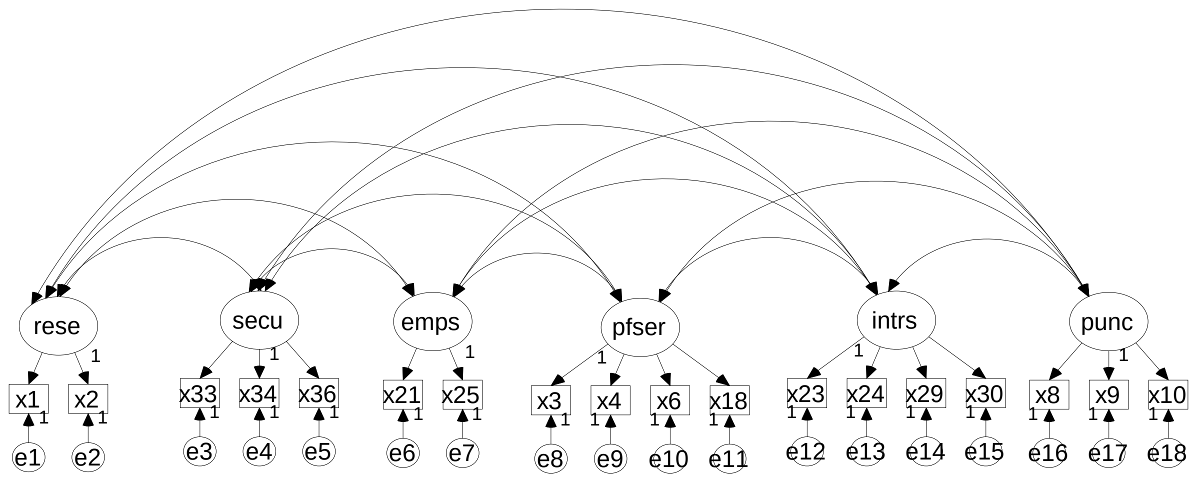

Figure 6.16 RAILQUAL CFA Model

Table 6. 29 RAILQUAL model fit indices

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
1177.470	51	0.906	0.866	0.899	0.908	0.908	0.882	0.043	0.085

The resutls for RAILQUAL model , a single order first ordr model,demostrate a range of fit characterstics that indicate an acceptable level of fit. The absolute fit indices of GFI (0.906), AGFI (0.866) and RMR (0.043) are all within the recommended tolerances.The incremental or comparitive fit indices also indicate an acceptable level of fit with NFI (0.899) and CFI (0.908) being above the recommended minimum value. The normed Chi-square (1177.470) is also within the broader recommended range. The Akaline Information Criterion (AIC) is a comparitive measure between models with lower values indicating better fitting models (Hair et al., 1998). In this reseach the AIC supports the model (1279.470) and is the best fitting model. Overall these results show that the measurement model of this study appears to have an acceptable fit.

6.7 Comparison of RAILQUAL theoretical model and confirmatory model

The factor loadings of exploratory factor analysis and confirmatory factor analysis were compared in Table 6.30 as given below. All the item loadings on to respective factors were quite good. When initially EFA was done there were 27 attributes which were subsequently reduced to 18 in CFA. As a result the factor loadings have increased a bit in the case of CFA.

Table 6.30 EFA AND CFA factor loadings on RAILQUAL

Constructs	Attributes	Exploratory Factor Analysis (EFA)	Confirmatory Factor Analysis (CFA)
Reservation Ticketing	Convenience (x1)	.681	.709
	Promptness(x2)	.751	.951
Platform Services	Provi infor (x3)	.738	.800
	Upkeep repair (x4)	.668	.783
	clean station(x6)	.648	.685
	Connections(x18)	.618	.682
In train service	Clean train(x23)	.814	.762
	toilet facility(x24)	.697	.678
	Journey comft(x29)	.602	.742
	Catering (x30)	.680	.836
Punctuality	Ontime depart(x8)	.697	.760
	Speed(x9)	.747	.778
	accuracy (x10)	.635	.884
Employee service	attitude &help (x21)	.630	.710
	request handling(x25)	.516	.538
safety security	secure journey(x33)	.807	.690
	Safe journey(x34)	.753	.764
	luggage security(x36)	.712	.846

6.8 Comparison of various proposed RAILQUAL models

It was hypothesised from the literature that Railway passenger service quality is a higher order construct and is a derivative from the components of the railway core services, pre core services and peripheral services.

In order to test this approach a range of plausible alternative models were developed and tested, using Structural Equation Modelling, to identify the model that provided best fit characteristics (Doll, Xia and Torkzadeh, 1994; Herington, 2004). The models tested are shown in Figures 6.17, 6.18 and 6.19.

In Model I it is proposed that the RAILQUAL is a single first order factor with varying aspects of Railway service quality attributes directly effecting Railway perceived service quality (RPSQ). In this model it is assumed that there are high levels of correlation between all the attributes as they are measuring the same construct (Herington, 2004) (i.e., Railway passenger Service quality). In this model it is presumed that factorisation is not a necessity.

In Model II it is proposed that the RAILQUAL model has six components like reservation and ticketing, platform services, in train service, punctuality and reliability, employee service and safety and security. It is presumed that RPSQ consists of all the six dimensions performance put together.

In Model III it is proposed that the RAILQUAL model has three 2nd order constructs namely pre core services, peripheral services and core services with each having two sub dimensions and all the 2nd order dimensions are correlated to each other. Again in this model Railway Passenger Service quality is assumed to be present as a higher order i.e., 3rd order construct. In this model it is proposed that the six first order factors load onto three second order factors and the three second order factors load on to the 3rd order factor (ie Railway passenger service quality). The results from these models are shown in Table 6.31.

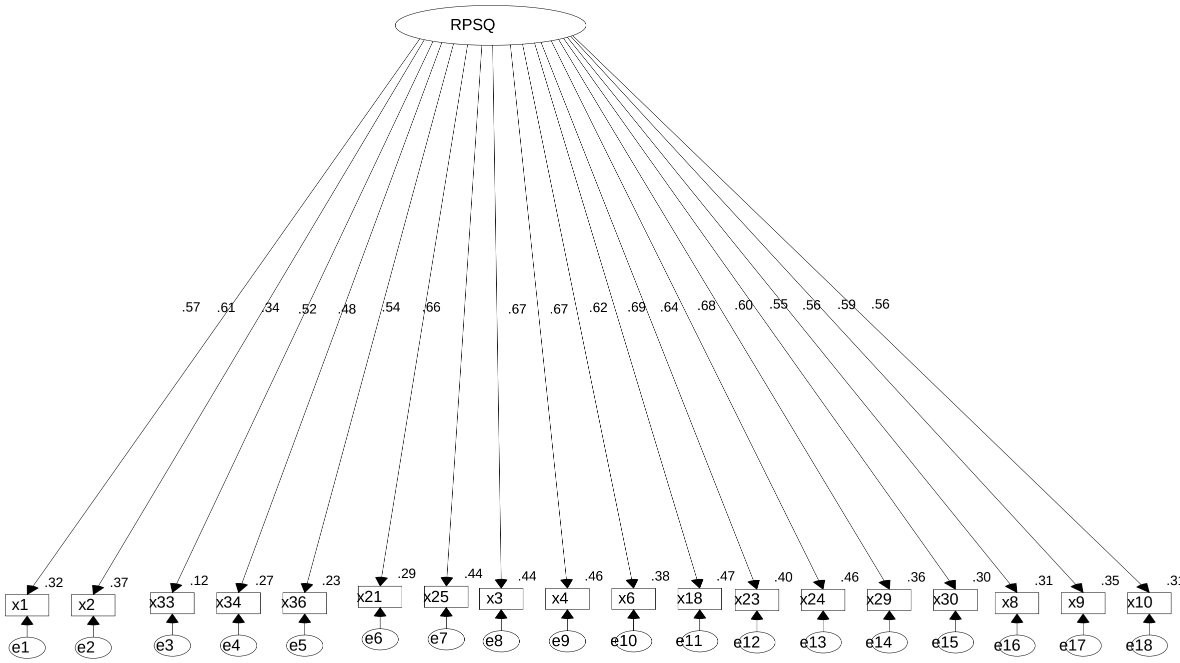

Figure 6.17 RAILQUAL 1st order CFA model (Model I)

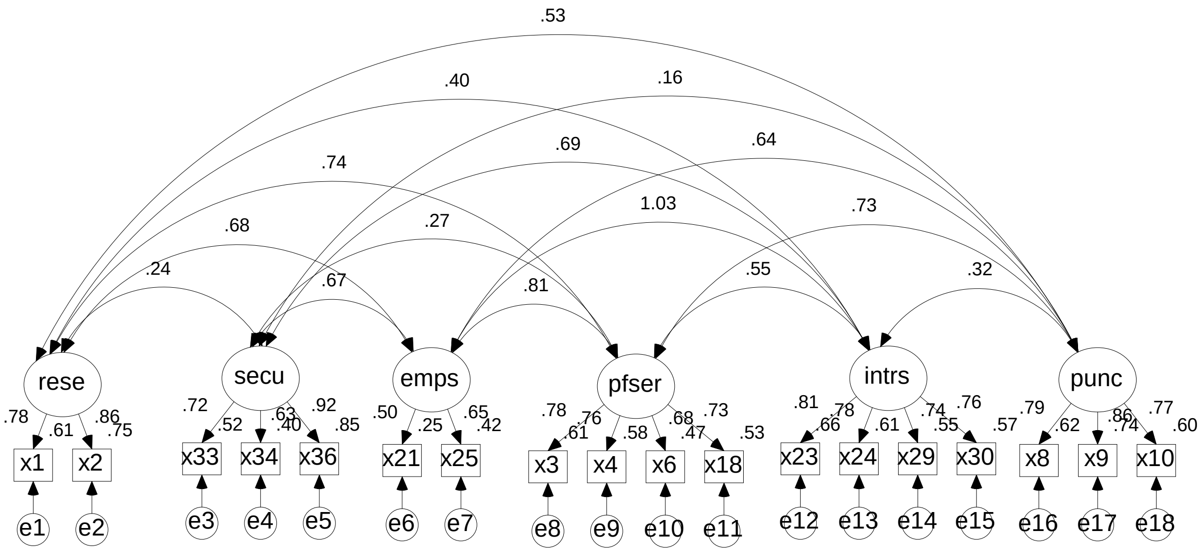

Figure 6.18 RAILQUAL 2nd order CFA model (Model II)

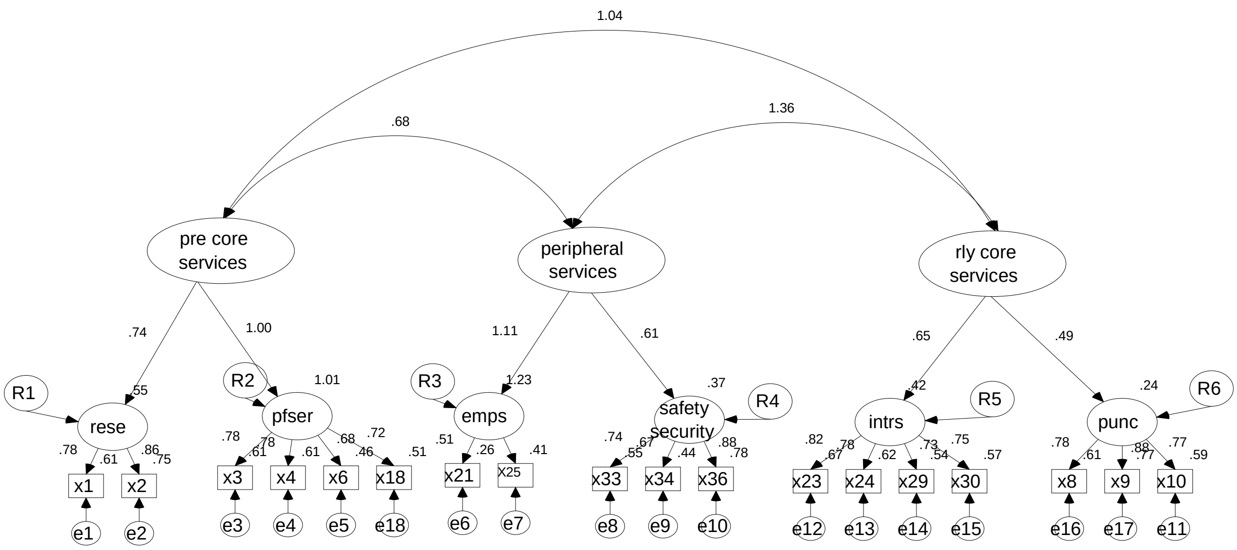

Figure 6.19 RAILQUAL 3rd order CFA model (Model III)

The results for the Model I, a single first order factor model, demonstrate a range of fit characteristics that fall outside the acceptable levels. None of the absolute fit indices of the GFI (0.591), the AGFI (0.481), the RMR (0.102) and the RMSEA (0.171) fall within the recommended tolerances. In addition the incremental or comparative fit indices also indicate unacceptable level of fit with the NFI (0.574) and the CFI (0.580) being below the recommended minimum value. On the basis of a poor fit, Model I was rejected.

The results of Model II, the 2nd order RAILQUAL model developed through exploratory factor analysis indicate an acceptable level of fit. The absolute fit indices of GFI (0.906), AGFI (0.866) and RMR (0.43) are all within the recommended tolerances. The incremental or comparative fit indices also indicate an acceptable level of fit with the NFI (0.899) and the CFI (0.908) being above the recommended minimum value. The Akaline Information Criterion (AIC) is comparative measure between models with lower values indicating better fitting models (Hair et al., 1998). In this study the AIC supports model II (1279.470) as the best fitting model. The results indicate that Model II is a good fitting model and is acceptable.

Table 6.31 Fit Statistics for proposed RAILQUAL Models

Description	Model I (RAILQUAL Ist Order)	Model II (RAILQUAL 2^{nd} Order)	Model III (RAILQUAL 3^{rd} order)	Key Goodness of fit indices Level of acceptable fit
χ^2	4947.055	1177.470	1528.859	If χ^2/df = > 0.05 = good fit < 2 = over fit ≤ 5= Good fit >5 = adequate fit
DF	135	120	126	
p	.000	.000	.000	p < 0.001
GFI	0.591	0.906	0.879	≥ 0.9 is Good fit
AGFI	0.481	0.866	0.836	≥ 0.9 is Good fit
NFI	0.574	0.899	0.868	≥ 0.9 is Good fit
CFI	0.580	0.908	0.878	≥ 0.9 is Good fit
RMR	0.102	0.043	0.062	≤ 0.05 = Good fit Between 0.05 to 0.1 Reasonable fit
RMSEA	0.171	0.085	0.096	≤ 0.05 = Good fit Between 0.05 to 0.1 Reasonable fit
IFI	0.581	0.908	0.878	≥ 0.9 is Good fit
TLI	0.525	0.882	0.851	≥ 0.9 is Good fit Between 0.850 to 0.9 reasonable fit
AIC	5019.055	1279.470	1618.859	Lower values indicating better fit

The results of Model III, the 3rd order RAILQUAL model indicate mixed results with some indices indicating good fit whilst others indicate a poor fit. The absolute fit indices of GFI (0.879), AGFI (0.836) and RMR (0.062) all fall outside the recommended tolerances. In contrast, Chi-square (1528.859) and NFI (0.878) indicate an acceptable level of fit. Hence the results indicate that Model III is unacceptable or, at least marginal.

6.9 Testing RAILQUAL Model Replication and generalizability

To test the extent to which the RAILQUAL measurement model is stable across different demographic traits the findings were replicated with the same sample splitting into grouping varibles on the basis of demographies in an attempt to reduce error due to capitalization of chance (MacCallum, Roznowski and Necowitz 1992). For cross validation a total of seven spilts were generated from the survey responses including travel class, gender, income group and travel frequency and the resutls are as shown in Table 6.32 below.

Table 6.32 Fit Indices of various demographic profiles

Sample Split	Group	n	χ^2	Df	GFI	AGFI	CFI	RMR	RMSEA
Travel Class	Lower Class	881	894.200	120	.903	.862	.906	.043	.086
	Upper Class	334	514.183	120	.855	.793	.875	.047	.099
Gender	Male	724	853.894	120	.888	.840	.895	.051	.092
	Female	491	546.619	120	.889	.842	.902	.040	.085
Travel Frequecy	Less Frequently	239	375.293	120	.859	.799	.888	.050	.095
	Frequently	641	712.314	120	.894	.849	.903	.045	.088
	Very frequently	242	372.334	120	.854	.792	.884	.051	.092

The 18 item six dimension RAILQUAL model was estimated by CFA for all the sample splits. The results indicated a good fit for all the splits as shown in Table 32. All coefficient alphas surpased the 0.70 level among items within the individual scales. All loadings of the paths were significant.

6.10 Chapter Review

Confirmatory factor analysis enables the researcher to test the theory developed through exploratory factor analysis. The theory developed in the previous chapter has been tested through CFA in this chapter. All the variables are tested along with dimensions. The variables which have not loaded properly on to the dimensions are deleted. Finally the RAILQUAL confirmatory model was developed and tested with theoretical model and across alternative models and as result a 18 item 6 factor RAILQUAL confirmatory model was evolved which will be further tested in the next chapter to prove the hypothesised relationships.

6.11 Chapter References

AMOS 16 User Manual

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7

CHAPTER 7: EVALUATING RAILQUAL STRUCTUAL MODEL

7.1 Introduction

Evaluating the RAILQUAL model determines whether hypothesized relationships exist between the constructs – and enables the researcher to accept or reject the theory. In this chapter the estimation of multiple and interrelated dependence relationships between the constructs confirmed in the RAILQUAL measurement model and the unobserved concepts in these relationships which account for measurement error in estimation process will be evaluated .Then the RAILQUAL structural model will be defined to explain the entire set of relationships. There after demographic characteristics and relationships were tested using MANOVA and finally the ranking of attributes were tested through Kendwal's test.

7.2 Reliability of RAILQUAL Model

The reliability for measures is established using construct reliability (composite reliability). To test the construct reliability, values of Cronbach's alpha for all constructs are reported. The value of Cronbach's alpha is estimated for each of six measures as shown in Table 7.1. The Cronbach's alpha for RAILQUAL instrument was 0.953 which is acceptable and shows that the instrument is reliable. Further evidence of reliability of the scale is checked through composite reliability and average variance and extracted scores of different factors obtained (Fornell and Lacker, 1981., Hair et al, 2006). Composite reliability (CR) of the latent variables is greater than the acceptable limit of 0.70 (Carmines and Zellar, 1988). The average variance extracted for all the factors is greater than or equal to 0.5, which is acceptable. This shows the internal consistency of the instrument used in the study.

7.3 Construct Validity of RAILQUAL Model

Construct validity is the extent to which a set of measured variables actually reflects the latent construct they are designed to measure (Hair et al., 2005). Construct validity is established in this research by establishing the face validity, convergent validity, discriminant validity and the nomological validity.

7.3.1 Face Validity

Face validity is established by adopting the measurement attributes used in the research from the existing literature and adopting the same to the present research context.

7.3.2 Convergent Validity

Convergent validity was assessed by examining the factor loadings and average variance extracted of the constructs as suggested by Fornell and Lacker (1981). All the indicators had significant loadings on to the respective constructs (p = 0.001) and values varying from 0.615 to 0.925. In addition convergent validity is assessed through measuring construct reliability (CR) and Average Variance Extracted (AVE) to check whether there is similarity between measures of theoretically related constructs (DeVellis, 1991). In addition, the average variance extracted (AVE) for each construct should be greater than or equal to 0.50, which further supports the convergent validity of the constructs. Composite reliability should be close or higher than 0.6 and it should be greater than AVE (Bagozzi and Yi, 1994; Fornell and Larcker, 1981).

The formula for construct reliability is, where $CR = \frac{(\sum_{i=1}^{n} \lambda_i)^2}{(\sum_{i=1}^{n} \lambda_i)^2 + (\sum_{i=1}^{n} \delta_i)}$ in which λ is the standardised loadings of the construct and δ is error variance of the construct.

The formula for measuring Average Variance Extracted is as follows: $AVE = \frac{\sum_{i=1}^{n} \lambda_i^2}{n}$ in which it is the sum of Squared Standardised loadings divided by total number of items in the construct.

After applying the above said formula the derived AVE and CR are shown in Table 7.1

Table 7.1 Convergent Validity of RAILQUAL

Constructs	Attributes	Standardised Estimate	Construct Reliability	AVE
Reservation ticketing	Convenience (x1)	.709	.939	.880
	Promptness(x2)	.951		
Platform Services	Provi infor (x3)	.800	.799	.737
	upkee repair (x4)	.783		
	clean station(x6)	.685		
	Connections(x18)	.682		
In train service	clean train(x23)	.762	.681	.756
	toilet facility(x24)	.678		
	journey comft(x29)	.742		
	Catering (x30)	.836		
Punctuality reliability	ontime depart(x8)	.760	.749	.807
	Speed(x9)	.778		
	accuracy (x10)	.884		
Employee service	attitude &help (x21)	.710	.662	.624
	request handling(x25)	.538		
safety security	secure journey(x33)	.690	.749	.767
	Safe journey(x34)	.764		
	luggage security(x36)	.846		

7.3.3 Discriminant Validity

Fornell and Lacker (1981) states that discriminant validity can be assessed by comparing the average variance extracted (AVE) with the corresponding inter-construct correlations estimates. Testing for discriminant validity checks whether two constructs differ. In this research AVE method was used. If the AVE of each construct is greater than its shared variance with any other construct, discriminant validity is supported. Shared variance is the amount of variance that a variable (construct) is able to explain in another variable (construct). It is represented between square of the correlation between any two variables (constructs) (Fornell and Larcker, 1981).

From the results of Table 7.2, it can be seen that the AVE values of all the service quality factors are greater than the inter construct correlations, which support the discriminant validity of the constructs.

Table 7.2 Discriminant Validity of RAILQUAL

Covariance		Estimate	Shared variance	AVE
rese	<--> secu	.105	.236	.880
rese	<--> emps	.296	.681	
rese	<--> pfser	.338	.741	.737
rese	<--> intrs	.229	.398	
rese	<--> punc	.261	.526	
secu	<--> emps	.220	.668	
secu	<--> pfser	.093	.267	.756
secu	<--> intrs	.300	.688	
secu	<--> punc	.061	.163	
emps	<--> pfser	.272	.806	,624
pfser	<--> intrs	.245	.549	
emps	<--> intrs	.436	1.027	.807
emps	<--> punc	.235	.642	
pfser	<--> punc	.282	.732	.767
intrs	<--> punc	.154	.317	

7.4 RAIILQUAL Basic Structural Model

This model incorporates all the hypothesised relationships to demonstrate a direct relationship between reservation ticketing, security, employee service, platform service, in train service and punctuality with moderating impact on railway passenger service quality as shown in Figure 7.1.

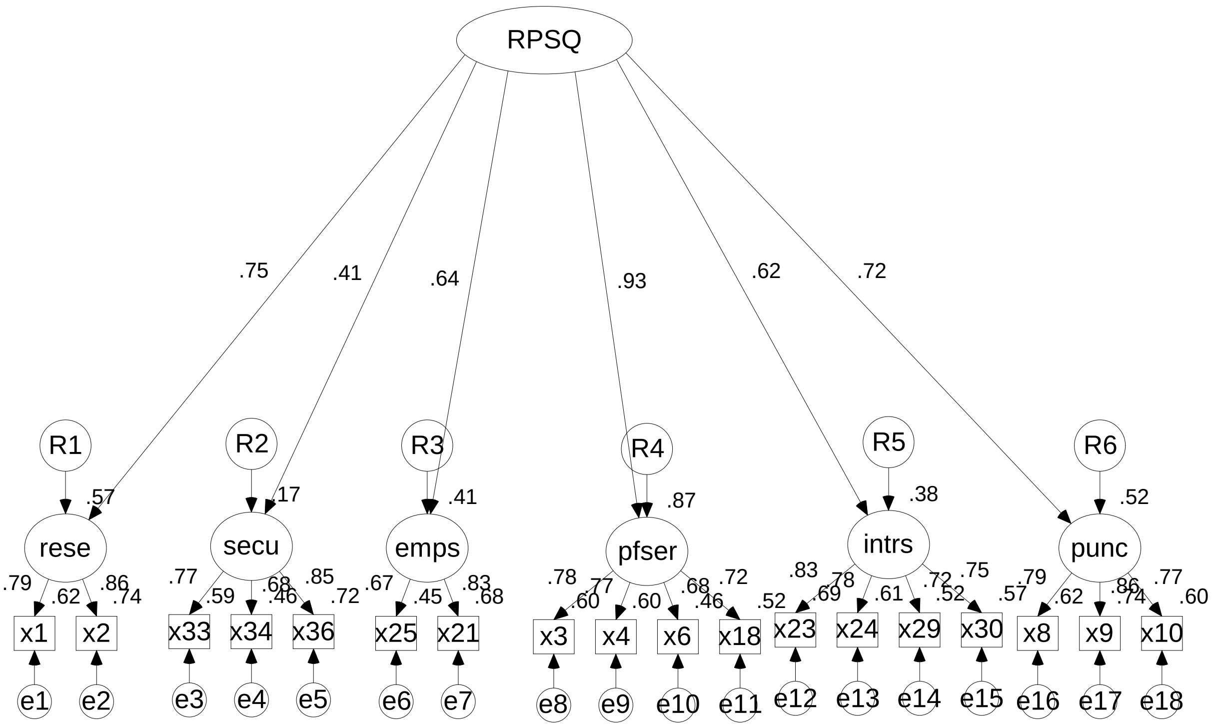

Figure 7.1 RAILQUAL basic structural model

The results of the structural equation of the research model are reported with the structural model showing fit indices as in Table 7.3. Table 7.4 shows the regression weights of service quality dimension and all standardised paths are presented as Figure 7.2.

Table 7.3 RAILQUAL Structural model fit indices

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
1841.390	129	0.856	0.809	0.840	0.849	0.850	0.821	0.083	0.105

Table 7.4 Regression Weights of service quality dimension with RPSQ

Path			Estimate	S.E.	C.R.	P	Standardized estimate	Squared multiple correlations
rese	---	RPSQ	1.000				.753	.567
secu	---	RPSQ	.452	.042	10.810	***	.413	.170
emps	---	RPSQ	.731	.047	15.691	***	.639	.408
pfser	---	RPSQ	.983	.050	19.662	***	.934	.872
intrs	---	RPSQ	.809	.051	15.776	***	.618	.382
punc	---	RPSQ	.816	.044	18.397	***	.723	.523

RPSQ – Railway Passenger Service Quality;

rese – Reservation and Ticketing; Secu – Safety and Security; emps – employee service ;

pfser – platform service ; intrs – intrain service ; punc – Punctuality

S.E is an estimate of the standard error of the covariance

C.R is the critical ratio obtained by dividing the estimate of the co variances by its standard error. The value of exceeding 1.96 represents a significant level of 0.05

*** p-value < 0.001

An examination of the hypothesised model results identified a Chi-square value within the recommended range with significant p value. The other fit indices also indicate a high level of fit between the data and the hypothesised model.

An examination of the regression weights provided within AMOS results shows that all the pathways of the constructs with railway passenger service quality are significant. Hence this base model can be retained to further improve after adding passenger satisfaction and behaviour loyalty dimensions to prove the relationship between service quality, satisfaction and behaviour loyalty intensions. The fit indices reflect a high level of fit. The absolute fit indices are all within the recommended tolerances and indicate a hypothesised model that fits the data.

7.5 RAILQUAL Model Cognitive attributes

While developing RAILQUAL theoretical model the dimensions related to the less cognitive aspects of customer perceptions (Satisfaction and Loyalty) were not included in the exploratory factor analysis as it is not recommended to mix cognitive and emotional aspects wit in an analysis (DeVellis,2003). But they will be analysed in the confirmatory factor analysis so that the final RAILQUAL structural model will be tested along with these structural paths for evaluating the hypothesis proposed. As the perceived service quality is perfect variable (Parasuraman et al., 1988; Boulding et al., 1993; Bolton and Drew, 1991; Cronin and Taylor, 1992), it was measured by one item. So in the analysis part the perceived service quality is not analysed.

7.5.1 Railway passenger Satisfaction:

A four item scale measured customer satisfaction. The items are: you feel satisfied with the decision to travel by Railways (y9), you enjoy the experience with rail travel (y10), you feel satisfied with service quality of Indian Railways (y11), your overall satisfaction towards the Indian Railways passenger services (y12) and from Figure 7.2 and Tables 7.5 and 7.6 it shows that the standardised estimates of all the five items greater than 0.6 indicate they all loaded well on to the dimension. The fit indices also indicate a good fitting model.

An examination of the AMOS output, including factor weights and recommended modification indices output led to the removal of two items y11and y12. This resulted in a good fitting model. The factor has Cronbach alpha of 0.816.

Table 7.5 passenger satisfaction factor loadings and error variances for revised model

Attribute	Standardised Factor Loading	Squared multiple correlations
you feel satisfied with the decision to travel by railways(y9)	0.680	0.462
you enjoy the experience with rail travel (y10)	0.830	0.689

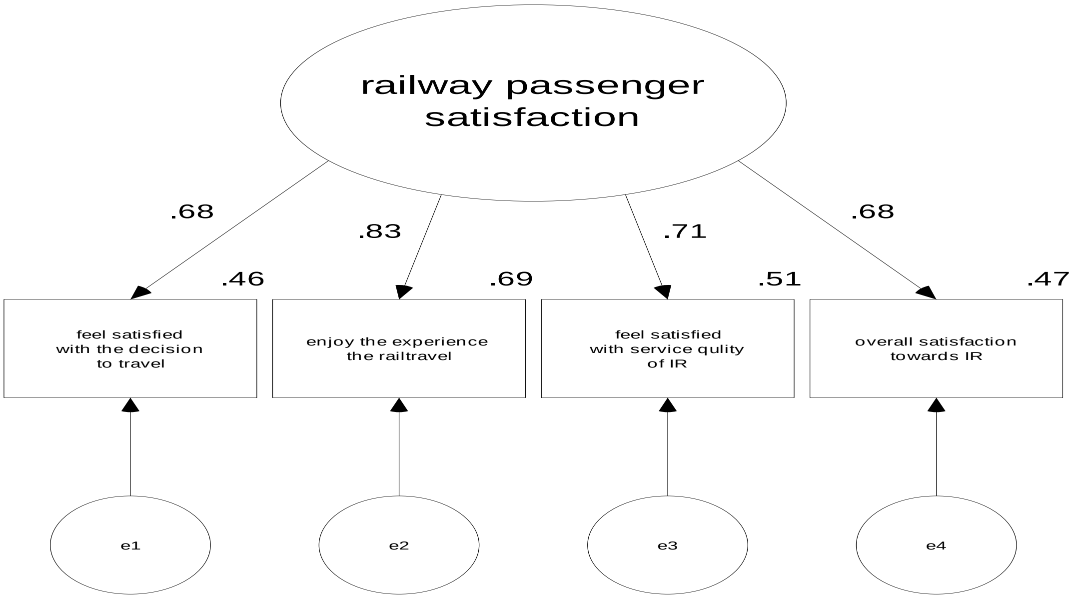

Figure 7.2 CFA model of railway passenger satisfaction

The fit indices also reflect a high level of fit. The absolute fit indices of the GFI (0.995), AGFI (0.977), the RMR (0.10) and RMSEA (0.062) all are within the recommended tolerances. The incremental or comparative fit indices also indicate a good fit with both NFI and CFI having a result of 0.993 and being above the recommended minimum value of 0.90. These fit indices confirm the factor structure. The solution with items and factor loadings is detailed in Table 7.6.

Table 7.6 Passenger satisfaction fit indices

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
11.218	2	0.995	0.977	0.993	0.994	0.994	0.983	0.10	0.062

7.5.2 Railway Passenger Behaviour Loyalty

A four item scale measured the behaviour loyalty where the items are: *you would recommend the train journey to your friends and others (y5), you would continue to come even when the prices are higher (y6), you consider railways as first choice for journey in your list (y7), you* *would like to travel in Indian Railways in the future (y8).* The results of the confirmatory analysis of these four items are shown in Figure 7.3.

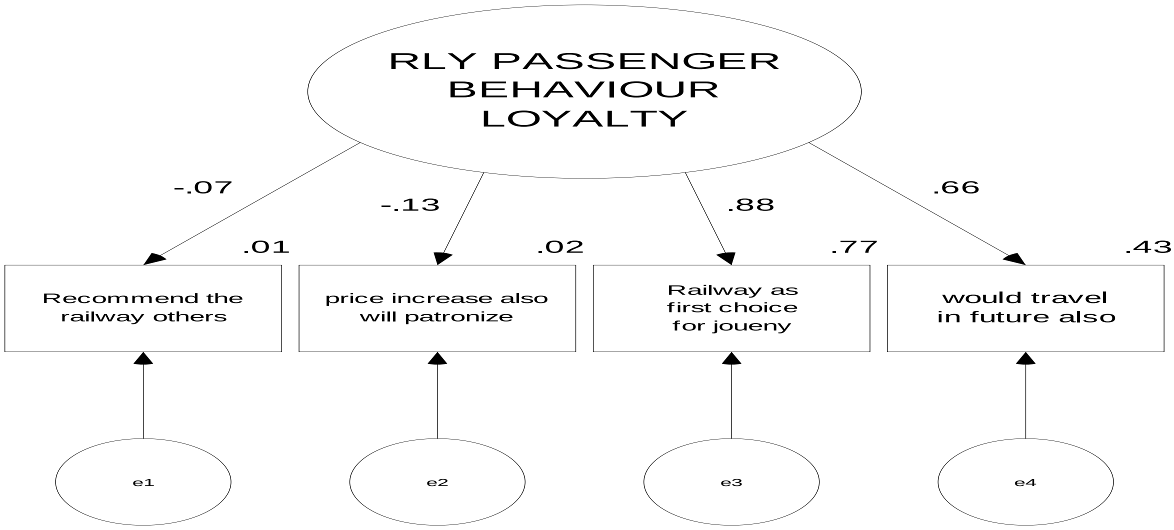

Figure 7.3 Railway passenger behaviour loyalty CFA model

The fit indices indicate a poorly fitted model. An examination of the AMOS output, including factor weights and recommended modification indices output led to removal of two items which have negative variances and negative factor loadings and this resulted in a good fitting model with two items. The revised model solution, including retained items and standardised factor loadings, is detailed in Table 7.7.

Table 7.7 Passenger behaviour loyalty factor loadings and error variances for revised model

Attribute	Standardised Factor Loading	Squared multiple correlations
you would like to travel in Indian Railways in the future(y6),	0.878	0.771
you consider railways as first choice for journey in your list(y7)	0.656	0.431

7.6 RAILQUAL FINAL STRUCTUAL MODEL

A full structural equation model is shown in Figure 7.4 where specification is done and parameters are estimated.

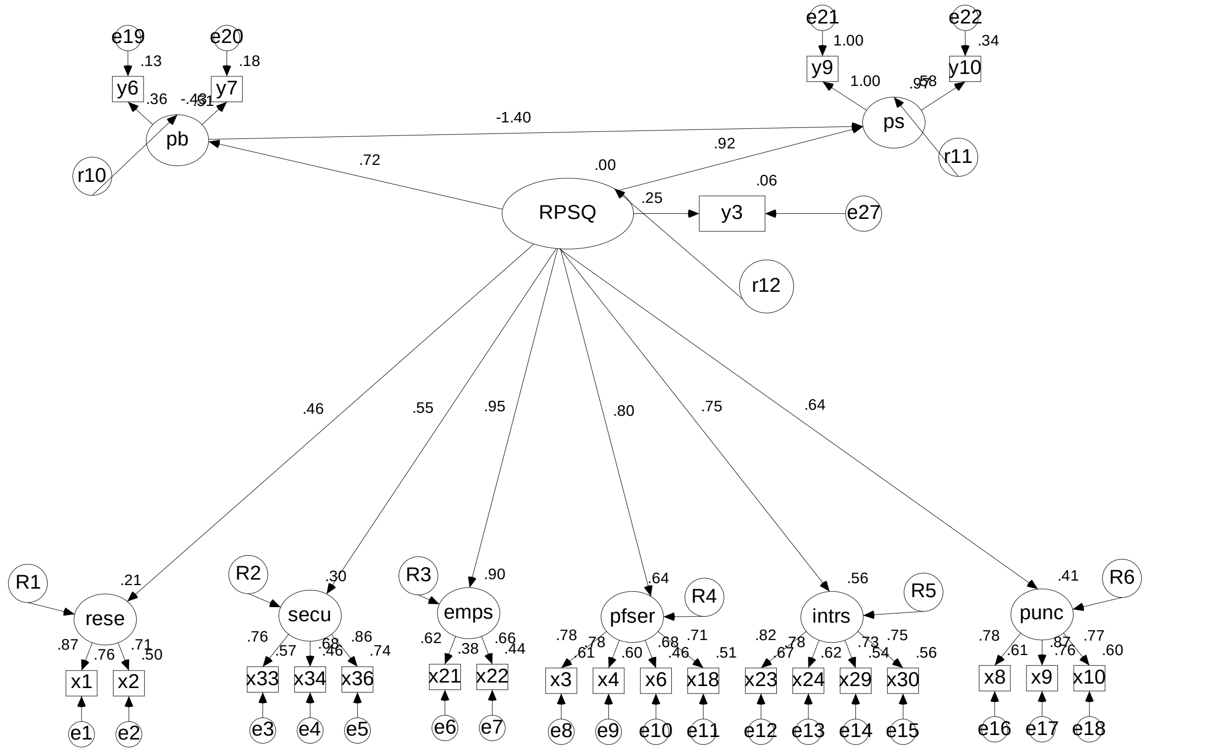

Figure 7.4 RAILQUAL final structural model

Rese - reservation and ticketing, secu – Safety and security, emps – employee service, pfser – platform services, intrs – in train service, punc – punctuality and reliability, RPSQ – railway passenger service quality, PS – passenger satisfaction, pb – passenger behaviour loyalty; x1 = convenience of reservation and ticketing, x2 = promptness and accuracy in reservation and ticketing, x3 = provision of information about train timings/platforms, x4=upkeep/repair of station buildings and platform, x6 = amenities at the station, x8 = train departure on time, x9 = duration of the journey (speed), x10 = train arrival on time without being late (i.e., itinerary accuracy), x18 = connectivity with other forms of public transport, x21 = handling of request to railway staff, x23 = cleanliness inside the train, x24 = toilet facilities, x25 = attitude and helpfulness of railway staff, x29 = comfort during the journey, x30= quality and price of catering services in train, x33 = personal security on train, x34 = safety during train journey, x36 = security of luggage on train; e1 to e27 – error variances; r1 to r12 – residuals.

The overall model as presented in Chapter 1 forms hypothesis 1 to hypothesis 9. This model incorporates all the hypothesised relationships to demonstrate a direct relationship between railway passenger service quality, railway passenger satisfaction and behaviour intention of the passengers. The impact of reservation ticketing, platform services, in train services, punctuality and reliability, employee service, safety and security on railway passenger service quality was tested in this model.

The overall model is examined using Structural Equation Modelling. Structural Equation Modelling has a number of advantages over other multivariate techniques (Anderson and Gerbing, 1988; Byrne, 2001; Mackenzie, 2001). In particular it can incorporate entire systems of hypothesised relationships to enable the modelling of a complex series of relationships that are more representational of complex environments (Macknzie, 2001). As such, it is possible that relationships supported by regression analysis may not be supported through the more stringent structural equation model testing, given the impact of other associated relationships.

The results of the Structural Equation Modelling of the research model proposed in the Chapter 1 are reported in Table 7.8 .The structural model showing all the standardised paths is presented in Table 7.9 and 7.10.

Table 7.8 Goodness of Fit of Full structural model

χ^2	DF	CMIN/df	GFI	AGFI	NFI	CFI	IFI	RMR	RESEA
1086.356	223	4.87	0.901	0.865	0.895	0.902	0.902	0.048	0.099

An examination of the hypothesised model indicates that the model has an acceptable fit. The absolute fit indices of GFI (0.901) and RMR (0.048) are all within the recommended tolerances. The incremental or comparative fit indices also indicate an acceptable level of fit with the IFI (0.902) and CFI (0.902) being above the recommended value. The normed Chi-

Square (4.87) is also within the broader recommended range. The fit indices reflects acceptable level of fit and all the indices are within recommended tolerances which indicates that the hypothesised model fits the data well with some fit indices indicating a good fit whilst others indicating an average fit with AGFI (0.865) and NFI (0.895). Basically, the structural model is considered to fit the sample data reasonably and can be accepted as a fitting model considering the complexity of the model and large sample size. More complex models with larger samples should not be held to the same strict standards and so when samples are large and the model contains a large number of measured variables and parameter estimates, cut off values of 0.90 on key GOF measures are unrealistic (Byrne, 2001; Hair et al., 1998; Tabachnick and Fidell, 2001). The standardised regression weights in each pathway are provided in Table 7.9. The total effect of railway passenger service quality on passenger satisfaction is 0.916.

7.7 Results of Hypothesis testing

The overall model as presented in Figure 7.4 forms hypothesis 1 to 9. This model incorporates all the hypothesized relationships to demonstrate a direct relationship between reservation and ticketing, platform services, intrain service, punctuality, employee service and safety and security with railway passenger service quality (RPSQ) and RPSQ with railway passenger satisfaction and passenger satisfaction with passenger behaviour intention and RPSQ with behaviour intention. The hypothesized relations are detailed below.

7.7.1 Hypothesis 1

The first hypothesis (H1) posits that "**Reservation and Ticketing have a significant effect on Railway passenger service quality"**

The results are shown in Figure 7.4 and Table 7.9 and 7.10. The pathway from reservation ticketing to railway passenger service quality is significant ($p < 0.001$) and the standardised regression weight is 0.457. Therefore the hypothesis that the reservation and ticketing influences railway passenger service quality is supported.

Table 7.9 Standardised Regression Weights for Path Relationships

Constuct Relationship	Standardised Regression Weight	Significance
H1 - Reservation and Ticketing have a significant effect on Railway passenger service quality	0.457	0.000
H2 - Platform services have a significant effect on Railway passenger service quality	0.800	0.000
H3 – In Train services have a significant effect on Railway passenger service quality	0.746	0.000
H4 – Punctuality have a significant effect on Railway passenger service quality	0.640	0.000
H5 - Employee services have a significant effect on Railway passenger service quality	0.951	0.000
H6- Safety and Security have a significant effect on Railway passenger service quality	0.546	0.041
H7 - Railway passenger service quality has a significant effect on passenger satisfaction	0.916	0.003
H8-Railway passenger satisfaction has a significant effect on behaviour intentions	-1.404	0.007
H9 – Railway passenger service quality has significant effect on passenger behaviour intentions	0.716	0.000

RPSQ – Railway Passenger Service Quality

7.7.2 Hypothesis 2

The second hypothesis (H2) posits that "**Platform services have a significant effect on Railway passenger service quality"**

The results are shown in Figure 7.4 and Tables 7.9 and 7.10. The results indicate that the pathway from platform services to railway passenger service quality is significant ($p<0.001$)

with a standardised regression weight of 0.800. Therefore the hypothesis that platform services affect the level of railway passenger service quality is supported.

7.7.3 Hypothesis 3

The third hypothesis (H3) posits that "**In Train services have a significant effect on Railway passenger service quality"**

The results are shown in Figure 7.4 and Tables 7.9 and 7.10. The results indicate that the pathway from in train services to railway passenger service quality is significant ($p<0.001$) with a standardised regression weight of 0.746. Therefore the hypothesis that in train services affects the level of railway passenger service quality is supported.

7.6.4 Hypothesis 4

The fourth hypothesis (H4) posits that "**Punctuality have a significant effect on Railway passenger service quality"**

The results are shown in Figure 7.4 and Tables 7.9 and 7.10. The results indicate that the pathway from punctuality and reliability to railway passenger service quality is significant ($p<0.001$) with a standardised regression weight of 0.640. Therefore the hypothesis that punctuality and reliability affects the level of railway passenger service quality is supported.

7.7.5 Hypothesis 5

The fifth hypothesis (H5) posits that "**Employee services have a significant effect on Railway passenger service quality"**

The results are shown in Figure 7.4 and Tables 7.9 and 7.10. The results indicate that the pathway from employee services to railway passenger service quality is significant ($p < .001$) with a standardised regression weight of 0.951. Therefore the hypothesis that employee service affects the level of railway passenger service quality is supported.

7.7.6 Hypothesis 6

The sixth (H6) hypothesis posits **that "Safety and Security have a significant effect on Railway passenger service quality"**

The results are shown in Figure 7.4 and Tables 7.9 and 7.10. The results indicate that the pathway from safety and security to railway passenger service quality is significant ($p < 0.041$) with a standardised regression weight of 0.546. Therefore the hypothesis that safety and security affects the level of railway passenger service quality is supported.

7.6.7 Hypothesis 7

The seventh hypothesis (H7) posits that **"Railway passenger service quality has a significant effect on passenger satisfaction"**

The results are shown in Figure 7.4 and Tables 7.9 and 7.10. The results indicate that the pathway from railway passenger service quality to railway passenger satisfaction is significant ($p<0.007$) with a standardised regression weight of 0.916. Therefore the hypothesis that railway passenger service quality affects the level of railway passenger satisfaction is supported.

7.7.8 Hypothesis 8

The eighth hypothesis (H8) posits that "**Railway passenger satisfaction has a significant effect on passenger behaviour intentions"**

The results are shown in Figure 7.4 and Tables 7.9 and 7.10. The results indicate that the pathway from railway passenger satisfaction to passenger behaviour intentions is significant ($p<0.003$) with a standardised regression weight of -1.404 which is a negative path and hence the relationship can be treated as insignificant. Therefore the hypothesis that railway passenger satisfaction affects the level of railway passenger behaviour loyalty is not supported.

7.7.9 Hypothesis 9

The ninth hypothesis (H9) posits that “**Railway passenger service quality has a significant effect on passenger behaviour intentions”**

The results are shown in Figure 7.4 and Tables 7.9 and 7.10. The results indicate that the pathway from railway passenger service quality to railway passenger behaviour is significant (p<0.001) with a standardised regression weight of 0.716. Therefore the hypothesis that railway passenger service quality affects the level of railway passenger behaviour intention is supported.

Talble 7.10 Results of Hypothesis Testing through RAILQUAL Structural Model

Hypothesis	Relationship	Un Stand Estimate	P value	Standardised path Estimate	Testing of Hypotheis
H1	Rese - RPSQ	1.000	< 0.001	0.457	Accepted
H2	Pf Ser- RPSQ	1.288	< 0.001	0.800	Accepted
H3	Intrain - RPSQ	1.951	< 0.001	0.746	Accepted
H4	Punc-RPSQ	1.822	< 0.001	0.640	Accepted
H5	emp ser -RPSQ	2.107	< 0.001	0.951	Accepted
H6	Safety-RPSQ	1.572	< 0.001	0.546	Accepted
H7	PassSat - RPSQ	2.954	< 0.007	0.916	Accepted
H8	PassSat -PassBeha	-3.240	<0.003	-1.404	Rejected
H9	PassBeha-RPSQ	1.000	< 0.006	0.716	Accepted

7.8 Replication and generalizability of hypothesis testing across demographic variables

To test the extent to which the RAILQUAL strictural model is stable across different demographic traits the findings were replicated with the same sample splitting into grouping varibles on the basis of demographies in an attempt to reduce the error due to capitalization of chance (MacCallum, Roznowski and Necowitz 1992). For cross validation a total of seven spilts were generated from the survey responses including travel class, gender, income group and travel frequency. The 9 hypothesised paths were tested on all the sample splits.

7.8.1 Path estimates Across Gender

When a comparison was made between gender variable across all the structural relationships the following results emerged as shown in Table 7.11. The relation between reservation and ticketing to railway passenger service quality is having a standardized path estimate of 0.428 across males and 0.394 across females. The path way is significant ($p<0.001$). The standardised path estimate between security and railway passenger service quality is 0.653 across males and 0.559 across females with significant path ($p< 0.001$). The relation between employee services to railway passenger service quality is 0.718 across males and 0.899 across females with a significant path of $p< 0.001$.

Table 7.11 Comparison of hypothesized relationship of RAILQUAL across Gender

Hypothesis	Relationship	Standardised Path Estimate	
		Male (n= 723)	Female (n= 492)
H1	Rese - RPSQ	0.428	0.394
H2	Secur- RPSQ	0.653	0.559
H3	Emps - RPSQ	0.718	0.899
H4	Pf Ser- RPSQ	0.629	0.804
H5	Intrain - RPSQ	0.783	0.690
H6	Punc-RPSQ	0.433	0.577
H7	PS- RPSQ	0.501	0.396
H8	PS-PB	-1.569	-1.018
H9	PB-RPSQ	0.558	0.512

The platform service quality pathway with railway passenger service quality is having significant path ($p < 0.001$) with a standardised regression weight of 0.629 with males and 0.804 with female group. In Train service has standardised regression weight of 0.783 across males and 0.680 across females having significant $p< 0.001$. In a similar way punctuality and railway passenger service quality has a path way of 0.433 across males and 0.577 across females with a pathway which is significant at $p< 0.001$. Passenger satisfaction is having a standardised regression weight of 0.501 across males where it is 0.396 with significant path of $p<0.02$. The relationship between passenger satisfaction and behaviour intension has a negative standardised regression weight of -1.569 across males and -1.018 across females with a non-significant path way of $p>0.05$. The results indicate that the pathway between railway passenger service quality to behaviour intention has a standardised regression weight of 0.558 across males and 0.552 across female with significant path of $p< 0.001$.

In comparison with the main model, in gender based bifurcation model there is not much difference in the final hypothesised results. Overall the results indicate that out of 9 hypothesis relationship except for the eighth one all the others were proved across both male and female groups with some minor differences in standardised regression weights. The eighth hypothesis is rejected across both groups with negative standardised regression weights and insignificant p values.

7.8.2 Path estimates Across Travel Class

When a comparison is made between travel class variable across all the structural relationships the following results emerged as shown in Table 7.12. The relation between reservation and ticketing to railway passenger service quality is having a standardized path estimate of 0.439 across lower class and 0.502 across upper class. The path way is significant ($p<0.001$). The standardised path estimate between security and railway passenger service quality is 0.548 across lower class and 0.559 across upper class with significant path ($p<0.001$). The relation between employee services to railway passenger service quality is 1.007 across lower class and 0.831 across upper class with a significant path of $p < 0.001$. The platform service quality pathway with railway passenger service quality is having significant path ($p < 0.001$) with a standardised regression weight of 0.752 with lower class and 0.930 with upper class group.

Table 7.12 Comparison of hypothesized relationship of RAILQUAL across travel class

Hypothesis	Relationship	Standardised Path Estimate	
		Lower class (n=881)	Upper Class (n=334)
H1	Rese - RPSQ	0.439	0.503
H2	Secur- RPSQ	0.548	0.559
H3	Emps - RPSQ	1.007	0.831
H4	Pf Ser- RPSQ	0.752	0.930
H5	Intrain - RPSQ	0.766	0.688
H6	Punc-RPSQ	0.614	0.704
H7	PS- RPSQ	0.687	2.044
H8	PS-PB	-1.147	0.2.575
H9	PB-RPSQ	0.683	0.334

In Train service has standardised regression weight of 0.766 across lower class and 0.688 across upper class having significant $p<0.001$. In a similar way punctuality and railway passenger service quality has a path way of 0.614 across lower class and 0.704 across upper class with a pathway which is significant at $p<0.001$. Passenger satisfaction is having a standardised regression weight of 0.687 across lower class whereas it is 2.044 across upper class with significant path of $p < 0.02$. The relationship between passenger satisfaction and behaviour intension has a negative standardised regression weight of -1.147 across lower class and -1.018 across upper class with non-significant path way of $p>0.05$ whereas the results indicate that the pathway between railway passenger service quality to behaviour intention has a standardised regression weight of 0.558 across lower class and 0.552 across upper class with significant path of $p<0.001$. In comparison with the main model, in travel class based bifurcation model there is not much difference in the final hypothesised results.

Overall the results indicate that out of 9 hypothesis relationship except for the eighth one all the other were proved across both lower and upper class groups with some minor differences in standardised regression weights. The eighth hypothesis is rejected across both groups with negative standardised regression weights and insignificant p values.

7.8.3 Path estimates Across Travel Frequency

The third variable travel frequency has been compared with all the 9 hypothesised relationships of the RAILQUAL main model. This variable has 5 groups like less frequent traveller, some what frequent (i.e., twice a year travellers), frequent travellers who travels up to 4 to 5 times a year and very frequent travellers who travel at least once in a month and the last group being daily commuters. The model could not be tested with the last group because of less sample (n = 23) in that group. Hence the model is compared across the remaining groups. The results are as shown in Table 7.13.

Table 7.13 Comparison of hypothesized relationship of RAILQUAL across travel frequency

Hypothesis	Relationship	Standardised Path Estimate				
		Less Frequent (n 70)	Twice a Year (n 239)	Frequent 4to5 Times (n 641)	Very Frequent(montlhly once) (n 242)	Daily (n 23)
H1	Rese - RPSQ	0.470	0.442	0.405	0.349	Could not run the model
H2	Secur- RPSQ	0.368	0.546	0.484	0.597	
H3	Emps - RPSQ	1.251	0.817	0.945	0.933	
H4	Pf Ser- RPSQ	0.965	0.798	0.822	0.756	
H5	Intrain - RPSQ	0.453	0.657	0.700	0.817	
H6	Punc-RPSQ	0.717	0.745	0.670	0.623	
H7	PS- RPSQ	0.902	0.649	0.782	0.448	

H8	PS-PB	-1.628	-1.235	-1.312	-0.948	
H9	PB-RPSQ	0.715	0.804	0.685	0.532	

The results indicate that the first group (i.e., occasional travellers) has standardised regression weights of 0.470, 0.368, 1.251, 0.965, 0.453, 0.453, 0.717, 0.902, 0.715 across H1, H2, H3, H4, H5, H6, H7, H9 relationships with significant (p = 0.001) respectively except for H8 relationship which has a negative standardised regression weight of -1.628 with non siginifcant p value > 0.5. Hence all the hypothesis from H1 to H9 are supported and H8 is not supported for occasional travellers groups.

In a simliar way when a comparison is made for group 2 i.e., some what frequent travellers (i.e., twice a year) the results shown in Table 7.13 indicate that the path estimates of H1, H2, H3, H4, H5, H6, H7, H9 are 0.442, 0.546, 0.817, 0.798, 0.657, 0.745, 0.649, 0.804 respectively with a significant p of <0.001 except for H8 which is having a p of >0.5 and also a negative path estimate of -1.235. Hence except for H8 all the other relatioships are supprorted for the second group of somewhat frequent travellers.

The third group is frequent travellers with 4 to 5 journeys a year. As per the results shown in Table 7.13, it indicates that the third group (i.e., frequent travellers) has standardised regression weights of 0.405, 0.484, 0.945, 0.822, 0.700, 0.670, 0.782, 0.685 across H1, H2, H3, H4, H5, H6, H7, H9 relationships with significant (p = 0.001) respectively except for H8 relationship which has a negative standardised regression weight of -1.312 with non siginifcant p value > 0.5. Hence all the hypothesis from H1 to H9 are supported except for H8 for frequent travellers group.

In a simliar way when a comparison is made for group 4 i.e., very frequent travellers (i.e., twice a year) the results shown in Table 7.13 indicate that the path estimates of H1, H2, H3, H4, H5, H6, H7, H9 are 0.349, 0.597, 0.933, 0.756, 0.817, 0.623, 0.448, 0.532 respectively with a significant p of < 0.001 except for H8 which is having a p of > 0.5 and also a negative path estimate of -0.948 . Therfore except for H8 all the other relatioships are supprorted for this fourth group of very frequent travellers.

For the fifth group of daily travellers as the sample is very small (ie n = 23), the relationship could not be checked as the variables to be tested are more than the sample size in the group it encounted an error.

7.8.4 Path estimates Across Income

The fourth variable income has been compared with all the 9 hypothesised relationships of the RAILQUAL main model. This variable has 5 groups like less than 1,50,000 income per annum, between 1,50,000 to 3,00,000 per annum, 3,00,000 to five lakhs per annum, between 5,00,000 to 10,00,000 income per annum and the group with more than 10,00,000 income per annum with sample sizes 40, 172, 392, 333, 278 respectively. The results are shown in Table 7.14.

Table 7.14 Comparison of hypothesized relationship of RAILQUAL across Income

<table>
<tr><th rowspan="2">Hypothesis</th><th rowspan="2">Relationship</th><th colspan="3">Standardised Path Estimate</th><th></th><th></th></tr>
<tr><th>Less Than 1.5 Lakh (n 40)</th><th>Between 1.5 to 3 Lakh (n 172)</th><th>Between 3 to 5 Lakhs (n 392)</th><th>Betwee n 5to 10 Lakhs (n 333)</th><th>More than 10 Lakhs (n 278)</th></tr>
<tr><td>H1</td><td>Rese - RPSQ</td><td>0.634</td><td>0.257</td><td>0.557</td><td rowspan="6">The model is unidntified as iteration limit reached</td><td rowspan="6">The model is unidntified as iteration limit reached</td></tr>
<tr><td>H2</td><td>Secur- RPSQ</td><td>0.514</td><td>0.152</td><td>0.276</td></tr>
<tr><td>H3</td><td>Emps - RPSQ</td><td>0.935</td><td>1.035</td><td>0.759</td></tr>
<tr><td>H4</td><td>Pf Ser- RPSQ</td><td>1.031</td><td>0.932</td><td>0.943</td></tr>
<tr><td>H5</td><td>Intrain - RPSQ</td><td>0.501</td><td>0.396</td><td>0.589</td></tr>
<tr><td>H6</td><td>Punc-RPSQ</td><td>0.697</td><td>0.832</td><td>0.728</td></tr>
</table>

H7	PS- RPSQ	0.179	0.356	0.222		
H8	PS-PB	****	-0.949	-0.520		
H9	PB-RPSQ	****	0.584	0.579		

The results indicate that the first group (i.e., annual income < 1.5 Lakhs) has standardised regression weights of 0.634, 0.514, 0.935, 1.031, 0.501, 0.697 across H1, H2, H3, H4, H5, H6 relationships with significant ($p<0.001$) and ($p<0.5$) . But for H7 relationship the standardised regression weight is 0.179 with insignificant $p > 0.5$ and for the relationship of H8 and H9 the relationship could not be established. Hence the relationships H1 to H6 are accepted and H7, H8 and H9 are rejected for less than 1.5 lakh per annum income group.

In a simliar way when a comparison is made for group 2 (i.e., annual income between 1.5 to 3 lakhs per annum) the results shown in Table 7.14 indicate that the path estimates of H1, H2, H3, H4, H5, H6, H7, H9 are 0.257, 0.152, 1.035, 0.932, 0.396, 0.832, 0.356, -0.949, 0.584 respectively. The results indicate that the pathway of relationships H1,H2, H4, H5, H6 are only having significant paths ($p<0.001$) where as for paths of H3, H7, H8, H9 the pathway is non significant with($p>0.5$). Therefore the relationship paths of H1, H2, H4, H5, H6 are accepted and relationships paths of H3, H7, H8, H9 are rejected for this group of income between 1.5 lakhs to 3 lakhs per annum.

The third group is respondents with income between 3 to 5 lakhs per annum. As per the results shown in Table 7.14, it indicates that the third group has standardised regression weights of 0.557,0.276,0.759,0.943,0.589,0.728,0.222,-0.520,0.579 for H1,H2,H3,H4,H5,H6,H7,H8,H9 relationship paths. But the pathway of H1 to H6 are only significant with $p<0.001$ whereas for pathway of H7, H8, H9 the path way is insignificant with $p>0.5$. Therefore the relationship of H1,H2,H3,H4,H5,H6 are supported and H7, H8 and H9 are not supported for this group of income variable whose income are between 3 to 5 lakh per annum.

The fourth group of respondents is with income between 5 to 10 laks per annum. As per the results shown in Table 7.14, the model could not be run as it is unidentified and the iteration limit reached. The results that follow are therefore incorrect. Therfore comparison could not be done with this group for the relationship paths of H1 to H9.

The fifth group of respondents is with income above 10 laks per annum. As per the results shown in Table 7.14, the model could not be run as it is unidentified and iteration limit reached. The results that follow are therefore incorrect. Therefore comparison could not be done with this group for the relationship paths of H1 to H9.

7.8.5 Path Estimates across Travel Purpose

The fifth variable is travel purpose and it has been compared with all the 9 hypothesised relationships of the RAILQUAL main model. This variable has 5 groups like travellers with official/business work, on personal work, travellers on pilgrimage/holidaying, to visit friends and relatives, other reasons with sample sizes 47, 201, 639, 294 and 34 respectively. The results are shown in Table 7.15.

Table 7.15 Comparison of hypothesized relationship of RAILQUAL across travel purpose

<table>
<tr><th rowspan="2">Hypothesis</th><th rowspan="2">Relationship</th><th colspan="3">Standardised Path Estimate</th><th></th><th></th></tr>
<tr><th>On businsess official work (n 47)</th><th>On personal Work (n 201)</th><th>Piligrimage/holidaying (n 639)</th><th>To visit friends and relatives (n 294)</th><th>Other reasons (n 34)</th></tr>
<tr><td>H1</td><td>Rese – RPSQ</td><td>0.386</td><td rowspan="6">The model is unidntified as iteration limit reached</td><td>0.507</td><td>0.344</td><td rowspan="6">Could not run the model</td></tr>
<tr><td>H2</td><td>Secur- RPSQ</td><td>0.907</td><td>0.566</td><td>0.471</td></tr>
<tr><td>H3</td><td>Emps – RPSQ</td><td>1.172</td><td>0.966</td><td>0.903</td></tr>
<tr><td>H4</td><td>Pf Ser- RPSQ</td><td>0.614</td><td>0.777</td><td>0.828</td></tr>
<tr><td>H5</td><td>Intrain – RPSQ</td><td>0.924</td><td>0.728</td><td>0.808</td></tr>
<tr><td>H6</td><td>Punc-RPSQ</td><td>0.271</td><td>0.643</td><td>0.608</td></tr>
</table>

H7	PS- RPSQ	4.118		1.832	0.483	
H8	PS-PB	-4.814		-2.277	-1.027	
H9	PB-RPSQ	0.386		0.852	0.509	

when a comparison is made for group 1 (ie travalling for business and official work) the results shown in Table 7.15 indicate that the path estimates of H1,H2,H3.H4,H5,H6,H7,H9 are 0.386, 0.907, 1.172, 0.614, 0.924, 0.271, 4.118, -4.814 and 0.899 respectively. The results indicate that the pathway of relationships H2, H3, H4, H5 are only having significant paths ($p < 0.001$) where as for paths of H1, H6, H7, H8, H9 the pathway is non significant with ($p > 0.5$). Therefore the relationship paths of H2, H3, H4, H5 are accepted and relationships paths of H1, H6, H7, H8, H9 are rejected for this group.

The second group of respondents are travellers with personal work. As per the results shown in Table 7.15, the model could not be run as it is unidentified and iteration limit reached. The results that follow are therefore incorrect. Therfore comparison could not be done with this group for the relationship paths of H1 to H9.

The third group of respondents are travellers who are on piligrimage and holidaying. As per the results shown in the Table 7.15, the path estimates of H1,H2,H3.H4,H5,H6,H7,H8,H9 are 0.507,0.566,0.966,0.777,0.728,0.643,1.832,-2.277 and 0.852 respectively. The pathway of relationships results indicate H1, H2, H3, H4, H5, H6 are only having significant paths ($p < 0.001$) where as for paths of H7, H8, H9 the pathway is non significant with ($p > 0.5$). Therefore the relationship paths of H1,H2,H3, H4,H5,H6 are accepted and relationships paths of H7, H8, H9 are rejected for this group.

The fourth group of respondents are travellers who are on visit to friend and relatives . As per the results shown in the Table 7.15 the path estimates of H1,H2,H3.H4,H5,H6,H7,H8 and H9 are 0.344, 0.471, 0.903, 0.828, 0.808, 0.608, 0.483,-1.027 and 0.509 respectively. The pathway of relationships results indicate that all the relationships are significant having significant paths ($p < 0.001$) where as only for H8 the path is non significant with $p > 0.5$ and the path estimate is also negative. Therefore all the relationship paths except H8 are accepted for this group.

For the fifth group of respondents, they are travellers with other reasons and as the sample is very small (i.e., n = 34), the relationship could not be checked, as the variables to be tested are more than the sample size in the group and hence it encountered an error.

7.9 Demographic Characteristics and Relationships

A Multi Analysis of Variance (MANOVA) was used to analyse the relationship between demographic variables such as gender, income, travel class, travel frequency and study variables such as reservation ticketing, platform services, in train service, punctuality reliability, safety and security and employee service which are the significant predictors of railway passenger service quality. The result of MANOVA (Table 7.16) shows significant relationships between gender and in-train service (p=0.15), income and in train service (p=.001), travel class and platform services (p=.025),travel class and in train service (p=.002), travel class and punctuality and reliability (p=.001), travel class and employee service (p =.029), travel frequency and intrain service (p=.005), travel frequency and punctuality and reliability (p =.019).

Table 7.16 Demographic Multi Analysis of Variance (MANOVA)

Demographic Vs Dimensions	Gender		Income		Travel Class		Travel Frequency	
Reservation and Ticketing[a]	F	2.786	F	2.086	F	4.470	F	.117
	P	.151	P	.630	P	0.15	P	.976
Platform services[b]	F	.618	F	.830	F	4.472	F	1.285
	P	.404	P	.800	P	0.025*	P	.274
In Train Service[c]	F	2.352	F	1.937	F	2.081	F	1.959
	P	.015*	P	0.001*	P	.002**	P	.005**
Punctuality[d]	F	.647	F	3.526	F	4.805	F	.930
	P	.633	P	.569	P	.001**	P	.019*
Employee	F	1.231	F	1.308	F	1.081	F	1.104

Service[e]	P	.224	P	.206	P	.029*	P	.353
Safety and Security[f]	F	1.525	F	.713	F	6.518	F	.053
	P	.156	P	.075	P	.11	P	.995

$a^R = .540$ $\Delta r^2 = .085$; $b^R = .465$ $\Delta r^2 = .043$; $c^R = .500$ $\Delta r^2 = .004$; $d^R = .538$ $\Delta r^2 = .050$
$e^R = .609$ $\Delta r^2 = .022$; $f^R = .563$ $\Delta r^2 = .071$;
*** p = < .05 **p < .01**

7.10 Analysis of Railway passenger's satisfaction

This research evaluated the importance of various attributes having an impact on the perceived quality of South Central Railway and hence overall satisfaction level of passengers. With the objective of ranking hierarchically the major attributes of Railway passenger services, the non-parametric Kendall's W test was used. An asymptotic significance of 0.000 clearly revealed that the passengers attach different relative weights to the varied attributes of services of railways – with the provision of information about train timings/platforms being ranked as the number one in perceived quality of South Central Railway and safety of train journey ranked last which indicates that South Central Railway has to take care of the aspects which are ranked low so that the overall service quality improves and there by passenger satisfaction also improves. The ranks are given below in Table 7.17. The top five attributes with good quality in the sequence are train arrival on time without being late (i.e., itinerary accuracy), duration of the journey (speed), upkeep/repair of station buildings and platforms, train departure on time, provision of information about train timings/platforms. As per perceptions of railway passengers the worst five service quality attributes are comfort during the journey, personal security on train, promptness and accuracy in reservation and ticketing, attitude and helpfulness of railway staff, safety during train journey.

Table 7.17 Ranks of attributes according to service quality perceived by Railway passengers

N	1215
Kendall's W[a]	.088
Chi-Square	1808.787
Df	17
Asymp. Sig.	.000

a. Kendall's Coefficient of Concordance

Attributes	Ranks
safety during train journey	6.8
attitude and helpfulness of railway staff	7.05
promptness and accuracy in reservation and ticketing	8
personal security on train	8.08
comfort during the journey	9.19
security of luggage on train	9.24
convenience of reservation and ticketing	9.44
toilet facilities	9.5
quality and price of catering services in train	9.76
connectivity with other forms of public transport	9.79
cleanliness inside the train	9.82
handling of request to railway staff	9.9
amenities at the station	10.12
train arrival on time without being late (ie itinerary accuracy)	10.27
duration of the journey (speed)	10.62
upkeep/repair of station buildings and platforms	10.7
train departure on time	11.12
provision of information about train timings/platforms	11.6

7.11 Chapter Review

The evaluation of RAILQUAL structural model has been done. All the hypothesised relationships are tested in general to the whole sample and also group wise category wise to test the robustness of the model. Except for the hypothesis H8 (i.e. the relationship between passenger satisfaction and behaviour intentions all the other hypotheses were accepted. The model fit also tested and found that the structural model is considered to fit the sample data reasonably and accepted as a fitting model considering the complexity of model and large sample size. Reliability and validity of the model were also tested and found accepted. The relationship between study variables and demographic variables were tested with MANOVA and the passengers' perceptions of attributes were ranked as per their significance using Kendall's W test. *The next chapter concludes the thesis with the summary of conclusions and recommendations.*

7.12 Chapter References

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CHAPTER 8: SUMMARY, CONCLUSION AND RECOMMENDATIONS

8

8.1 Introduction

Research on the railway passenger service quality was stimulated by new interest evinces due to the fact that passenger transport is the more visible face of the railways as it touches directly the lives of millions who avail of the passenger transport services. Increased attention on competition, loss of market share to roadways and low cost airlines and decreasing revenues in passenger segment and passengers increased expectations on service quality led to this study.

The scope of this study was to identify service quality attributes and dimensions relevant to railway passenger services. Based on different review of literature and focus group discussions and expert opinions an integrated theoretical framework was developed which has been empirically tested across South Central Railway. Alongside the theoretical framework, a set of hypotheses have been developed.

The study applied a positivist approach methodology in which a survey questionnaire was used to obtain quantitative data to test hypotheses. The data for this study was obtained from various train passengers over South Central Railway zone of Indian Railways in India. The sample consists of 1215 railway passengers from 47 trains across South Central Railway of both lower and upper classes with a mix of all demographic profiles. Structural equation modelling including analysis of moment structures (AMOS) software applied to test the hypothesised relationships. In this chapter, first the theoretical contribution of the thesis in terms of gaps in the field is discussed. Second, the practical or managerial implications of the study's findings are described. This is followed by a discussion of the methodological and theoretical limitations of the research. Finally, some future research avenues suggested.

8.2 Qualitative Research

As stated earlier the attributes were identified through four focus groups, one from lower class passengers and one from upper class passengers with other two from railway officers of which one from subordinates and other from officers. This process allowed some clear identification of those elements found reflecting similarities in expectation between the groups and those elements found reflecting differences. It is interesting to note that there are substantially more elements reflecting similarities than differences. Many of the elements reflecting similarities also reflect elements of difference. For example all respondents commented on the expectation that the toilets should be clean and well maintained. However there was also a difference evident in that the lower class passengers expected this to occur where as the upper class passengers assumed it would occur, as otherwise it would not be an upper class. Also of equal importance to both groups of passengers were good catering facilities, safety and security in the journey. Other elements included punctuality in train operations, friendly and courteous employees, handling of delays and unusual circumstances effectively, on demand ticket availability and value for money. When it becomes more viable to group them under a range of headings they turned out to be reservation and ticketing, employee service, platform amenities, safety and security, in train service and punctuality.

8.3 Conclusion about Focus Group Analysis

The principle objective of the focus groups was to identify items relating to railway passenger services quality that could be used in a survey instrument to be distributed to railway passengers in upper class and lower class trains in express as well as passenger train services. From the data collected it was evident there was a definite and clear distinction between the perceptions of upper class and lower class passengers. The lower class travellers mostly of the opinion that Indian Railways Passenger services offer the cheap and convenient mode of transport and there is no alternative to substitute it – in a sense where they felt they belonged. They did not want something that was out of ordinary as they, implicitly, saw themselves as normal people and did not want any luxury except the trains maintaining punctuality and availability of tickets on demand.

In contrast the upper class passengers expected that train services was exclusive , that treats them special that having good catering facilities, personal attention from staff throughout journey, some form of entertainment to make journey interesting , and by implication they are looking for something out of ordinary. These findings were translated into items for inclusion in the survey instrument. For all dimensions an approximately equivalent mix of items between upper class and lower class passengers' opinion was included.

8.4 Research Contribution

The research reported in this thesis will make a number of contributions to advancing knowledge from both an industry perspective and a theoretical perspective. The research integrates, with in the quality Railway passenger services context, a number of additional attributes and dimensions derived from literature review and focus group discussions to the relationship between pre core railway passenger services, core passenger services and peripheral services with railway passenger service quality, railway passenger satisfaction and behaviour intentions as well as providing an extension and replication of previous research in the Indian Context. The research contribution is now briefly discussed in relation to the industry and conceptual contributions.

8.4.1 Contribution to Academic Theory (i.e., Service quality Management)

The research contributes to academic theory by developing the RAILQUAL model, which identified attributes and dimensions in Railway passenger service quality measurement and their impact on overall railway passenger quality and passenger satisfaction. The contribution to theory development falls mainly within the confine of Indian Railways passenger's services research, the context of the specific research focus. The dimensions derived out of this research will contribute to a greater understanding at the generic level of the role played by these constructs in determining passenger service quality.

8.4.2 Contribution to Academic Practice

The research contributes methodologically to existing service quality measurement research. By testing and validating the RAILQUAL model with data from diversified samples through vigorous psychometric scale development procedures and methodologies in each phase, the study shows that the development of RAILQUAL instrument is robust across contexts.

8.4.3 Contribution to Transportation Industry Theory (i.e., Indian Railways)

The research is the first of its kind in Indian Railways which provides new understanding on railway passenger service quality. There are a number of industry related contributions that will derive from this research. The changing nature of the Railway passenger services and the resultant increase in competitive intensity necessitates higher performance levels in the Indian Railways. These can only be achieved through a better understanding of the expectations of railway passengers and the importance placed by them on aspects such as reservation and ticketing, platform services, in train service, punctuality and reliability, employee service, safety and security. The research outcomes will inform managers through the establishment of an empirical relationship between service quality, satisfaction, loyalty and their antecedents

8.4.4 Contribution to Transportation Industry Practice

This research conceptualized, constructed, refined and tested a multiple item instrument RAILQUAL to measure railway passenger service quality which is very useful in the present day competitive environment.

8 .5 Research Findings:

This section discusses the objectives pertaining to research questions presented in the Chapter one in detail. The aim of this section is to explore the extent to which the objectives were achieved in the study to comprehend the specific outcome of each objective.

Objective (i): to identify railway passenger service quality attributes and dimensions and to construct RAILQUAL instrument for measuring railway passenger service quality

The objective was investigated by conducting a review of literature, contextual research review, the results of which are discussed in Chapter two and Chapter Three. This investigation also involved an in-depth search of literature to ascertain attributes of service quality. Then the identified attributes were refined with focus group discussions pilot which yielded a final list of 45 attributes pertaining to railway passenger service quality which were further pruned to 36 attributes with expert opinions followed by pilot study which was presented in Chapter 4. This resulted in the conceptualization, construction and development of RAILQUAL instrument. The instrument is incorporated as Appendix I of the thesis.

Objective (ii): to develop RAILQUAL theoretical model to find service quality dimensions which are significant predictors of overall service quality in railway passenger services and to identify individual service quality attributes which are significant predictors of their respective service quality dimensions.

The method used to answer this objective was presented in chapter five of the thesis. The Exploratory Factor Analysis technique is used to examine the service quality attributes among the passengers in South Central Railway in Indian Railways. As factor analysis is a multivariate analysis technique that determines underlying factors (domains) in a set of correlated attributes (Hair et al.2003; Nannually & Bernstein 1994), EFA was the most appropriate method to identify the quality domains and pertinent correlated attributes. The process of EFA in this research involved five key steps, which are pre-analysis checks, sampling adequacy, factor extraction, factor rotation and factor interpretation. Finally a six factor 27 attributes RAILQUAL theoretical model emerged out of this objective.

Objective (iii): to confirm the identified railway passenger service quality attributes and railway passenger service quality dimensions by developing RAILQUAL measurement model

This objective was met by measuring all the service quality dimensions along with the service quality attributes though Confirmatory Factor Analysis (CFA). Chapter Six of this thesis demonstrated all the provisional models developed for analysis. First, CFA model is performed for all the six dimensions of railway passenger service quality, to determine the reliability and validity of the model's constructs and to evaluate the fit between observed and estimated covariance matrices. Secondly three alternatives - RAILQUAL models of first order, second order and third order were developed and tested with fit indices to identify the best fitted model and the variables which have not loaded properly on to the dimensions are deleted which resulted in the evolvement of a Six Factor and 18 attributes RAILQUAL measurement model.

Objective (iv): to test the relationship between attributes and dimensions of railway passenger service quality through RAILQUAL Structural Model and to determine the role of each attribute and dimension in predicting service quality and passenger satisfaction.

The relationship between the six quality domains and overall satisfaction was examined by evaluating RAILQUAL Structural model which was presented in detail in Chapter Seven. All the hypothesised relationships are tested in general to the whole sample and also group wise category wise to test the robustness of the model. Except for the hypothesis H8 (i.e. the relationship between passenger satisfaction and behaviour intentions all the other hypotheses were accepted. The model fit also tested and found that the structural model is considered to fit the sample data reasonably and accepted as a fitting model. Reliability and validity of the model were also tested and found accepted. The relationship between study variables and demographic variables were tested with MANOVA. The study proved that reservation ticketing, platform services, in train service, punctuality, employee service and safety and security are the six dimensions which have significant contribution towards Railway Passenger Service Quality (RPSQ) and RPSQ is the significant predictor of Passenger Satisfaction and Behaviour Intentions of the passengers.

8.6 Overall Implications of the Research

The new source of empirical evidence form this analysis offers some significant implications. The study contributes to the body of knowledge in three main areas – Theoretical, Practical and Methodological aspects as discussed below.

8.6.1 Theoretical Implications

After reviewing extant literature in the domain of service quality management, a conceptual frame work was developed on the basis of focus group discussions, expert opinions and pilot study. This study was conducted in South Central Railway zone of Indian Railways in India. In the frame work, the direct influence of railway pre core services (i.e., reservation ticketing and platform services), core services (i.e. in train service, punctuality) and peripheral services (i.e. employee service and safety security) on railway passenger service quality (RPSQ). This understanding was conceptualised on the basis of prior studies on service quality (Parasuraman, Zeithmal and Berry 1988; Groonors, 1984, Cronin and Taylor, 1992). A new set of 18 attributes were identified which are loaded on to six service quality dimensions which are significant predictors of railway passenger service quality and passenger satisfaction.

Statistical results showed that all hypotheses except two were accepted. Overall, all the service quality dimensions were to be found significantly and positively correlated to railway passenger service quality. The significance of railway passenger quality on passenger satisfaction was found to be positive. However, two hypotheses i.e. railway passenger service quality with behaviour intentions and passenger satisfaction with behaviour intentions were not found to be significant.

The novelty of this research is based on the development of comprehensive model that examines the factors that influence the railway passenger service quality. Previous studies that have been conducted in the area of service quality did not focus much on railway passenger services quality. Thus it can be claimed that this is the first time that this theoretical framework tested empirically and theoretically. Several theoretical contributions emerge from this research.

First, to the knowledge of researcher this research is the first empirical work that synthesised concepts from three main theories of service quality such that Parasuraman's SERVQUAL, Cronin and Taylor’s SERVPERF and Grönroos service quality model to assess individual attributes of railway passenger service quality and in a more holistic manner, and in an Indian context. In the present study, an integrated model was developed that combines the factors associated with railway passenger service quality factors. SERVQUAL is much more service oriented. Those commonly used in public transport industry are more industry-based. SERVQUAL is much more humanistic, or customer related, while most of the measures used in public transport industry are much more mechanistic, or have a technical focus, or use more objective measures. This has led to the criticism that SERVQUAL could not tell the whole story. This study suggest an integrative model that combines the attributes used in SERVQUAL, the public transport industry, and the railway service sector to be grouped together to form a pool of items for measurement.

Second, another contribution to knowledge is that, it is the first study of its kind collecting valuable data across passengers dynamically while they were on their journey so that actual perceptions can be collected. In this regard, the researcher has addressed the question which is those factors that influence passenger service quality and passenger satisfaction in Indian Railway passenger services. The researcher combined all the key factors like pre core services, core services and peripheral services which take care of pre journey, at the time of journey and post journey attributes in relation to passenger service quality.

Third, this research was conducted in the sector of Railways which is another contribution to knowledge that, it is first study to report that has valuable insights from passengers. In addition the study contributed to knowledge on how railway passengers perceive various aspects regarding railway passenger services. Although studies have been found in various other sectors in service quality the setting of this study was service quality in Indian Railways, which is significant because it's the only major mode of transport in India catering to a huge population 100 billion and connecting all over India with a geography distribution of 23 states with different cultures with 65,000 kms route length.

Finally, a key contribution relates to the fact that it brings empirical evidence from a relatively new cultural and administrative context, taking into account that most of the prior studies have taken place in USA,UK, New Zeland, Canada which are operating railways in private sector whereas India is the only country apart from China which is operating Railways under the Government sector where social obligations takes priority over pricing and service to all the sections of people across India rather than profits takes centre stage in running trains to non-profitable routes or pricing tickets etc

8.5.2 Practical Implications

The examination of factors that influence railway passenger service quality is an important endeavour. Eventually improved service quality leads to passenger satisfaction which leads to continued patronage and to ultimately improved profitability .The findings of this study have several practical implications however, few important implications for managers and academics are followed.

First this study highlighted the importance of pre core services, core services and peripheral services. Each of the dimensions along with their respective attributes is studied in detail. Results assessed the relative influence of reservation and ticketing, platform amenities, in train service, punctuality, employee service and safety and security on the railway passenger service quality. Findings indicated a positive influence to the dependant variable such that railway passenger service quality (RPSQ). Moreover, these findings confirm and expand existing knowledge for service quality in general. The conceptualisation suggest that when the when these dimensions are improved only the overall service quality will improve.

Second, this study found that the core services like in train service and punctuality and reliability play an important role in improving the overall railway passenger service quality. This suggest that other things being equal, the more importance given to maintaining punctuality and reliability makes a difference on the perceptions of the passengers. Results assessed that on the basis of improving the attributes of that dimension the respective score of the dimension will improve and there by overall RPSQ.

Third, the employee behavioural aspects with the passengers can lead to satisfaction or dissatisfaction among the passengers. Generally the results suggest that the railways are not maintaining personal rapport with the railway passengers as done in airways. The results advocate that attention must be given to all the passengers irrespective of the class they are travelling and irrespective of the train they are travelling.

Finally, regarding availability of ticket on demand, there is a general complaint from across all the sections of the passengers that the tickets availability is really a major problem all of them are facing. The results of the study suggest that attention must be given to top priority by the railway administration.

The major inference of the present research is that in train service and punctuality and reliability followed with employee service are the three significant predictors of railway passenger service quality.

8.5.3 Methodological Implications

The contribution of this study in terms of methodology is that this research is one of the few studies that test railway passenger service quality aspects in Indian Context. This research has filled gaps in railway passenger service quality domain by identifying the significant predictors of railway passenger service quality in Indian conditions. In addition, the conceptual framework explains the individual attributes which are strong predictors of respective service quality dimensions that may be used in management research in other countries as well.

Additionally, this study verifies existing measurement scales and develops its own scale to measure railway passenger service quality. The scale is validated and reliability is tested thoroughly. The central relationship between service qualities, customer satisfaction and consumer loyalty has been well established with in the service industry context. This research extends the understanding of those relationships with in the context of Railway passenger Services.

8.7 Research Limitations

This research has some limitations which fall into two major categories the theoretical limitations and the practical limitations which are discussed below.

8.7.1 Theoretical Limitations

Despite the promising results, some limitations of the study should be noted that could be addressed in future research. Examining the service quality attributes which are the significant predictors of the railway passenger service quality the case of situational attributes are not taken care in this research. Thus these situational attributes needs to be tested in the further study. Thus more tests are necessary to strengthen its generalizability

The second limitation of this research is that the present research did not consider different cultural context of the passengers. In future research, the researcher could examine that aspect.

The third limitation is that, since this study is one of the few studies which developed an instrument to measure the railway passenger service quality in railways with sample taken from a single zone of Indian Railways (i.e. South Central Railway), whereas Indian Railways is a gigantic organisation with 17 zones across India,. Hence a large sample with representation of all the zones would strengthen and support the research findings.

8.7.2 Methodological Limitations

The research design used in this study is not without methodological limitations. It did not allow examining the passengers' perceptions of railway service quality over a period of time. Several limitations of the study should be noted. First, the fact that the data is reliant on using a single questionnaire at a single point of time is problematic. To avoid common method bias the same respondent should be administered with the questionnaire before the journey, at the time of the journey and after the journey.

A second limitation is the cross sectional design of the study. Because the data was collected at a single point of time, one is unable to establish cause-and –effect relationship among the variables of the interest. Future research that looks to develop a longitudinal design in order to collect predictor and criterion variables before and after the journey would be much stronger.

Third, the research analyses were based on Indian Railway passenger services in India, which is government organisation therefore, limiting the generalizability of the research findings. Hence there is a limitation of the research for generalisation particularly for railways in other countries where most of them are in private sector.

The fourth limitation of this study is the contextual effect in the responses because this study was undertaken on a voluntary participation basis among the passengers and the respondents were given a choice of completing the questionnaire any time in their total journey. Thus, it is possible that respondents could have been affected by the environment or other factors when they complete the survey.

The fifth limitation may be that this study was based on the use of questionnaire method, which implies that common method bias might have occurred as in other research using the same method(Blau,1985).Data obtaining from a single source may be problematic for casual prediction based on survey since the measures are taken on one occasion only. Thus multiple methods may be helpful to further clarify the plan of this research. This limitation proposes that in-depth interviews with passengers along with data would be more useful.

Finally, there might be reliability and validity issues with the information obtained from the questionnaires used in this study because they were self – reported by the respondents. According to (Park and Kim, 2009, p-34) self survey data may produce high correlations among measures. In part, because the data shared common method variance and thus errors in measurement are correlated with each other.

8.8 Scope for Future Research

The study findings contribute to literature on service quality, transportation and Railway passenger services. By providing an in depth account of individual attributes and dimensions which are significant predictors of railway passenger service quality which are very much helpful for railways to improve the passenger service quality and there by satisfaction.

There are so many avenues for future research. This study examined direct relationships between independent variables such that reservation ticketing, platform services, in train service, punctuality and reliability, employee service, safety and security to dependant variable railway passenger service quality. One of the key issues for the future researchers to address concerns the examination of the more sophisticated relationship between these variables. In this regard, future research could also develop a theoretical model concerning the role of situational attributes. This study investigated the direct relationship between railway passenger service quality and a variety of antecedent factors. How ever, it is reasonable to suggest that a variety of more complicated relationship may exist.

The conceptual framework developed for the study should be investigated across different zones of Indian Railways which may support it generalizability. Thus the predictor variables should be tested in other zones of Indian Railways in same culture may present confounding effects. Thus, more tests are necessary to strengthen its generalizability.

For future research, this study also suggests using indepth interviews alongside survey questionnaires which may infer more about individual perceptions about service quality attributes.

Future research beckons, since many questions are still unanswered. Longitudinal studies may help determine if the relationships studied here differ depending up on the time of the evaluation process. In future, researcher(s) could examine the difference in passengers' perceptions of railway service quality before the journey, at the time of journey and after the journey

And finally, a large sample including diverse cultures may provide more strength and support future findings. Therefore, more studies are required to better understand passengers' perception of significant predictors of service quality attributes.

8.9 Conclusion

The various dimensions of service quality identified in this research should be viewed as levers of improving railway passenger service quality in the minds of passengers. However the degree of emphasis placed on these dimensions depends on the objective of the Raiwlays. Apart from quantitative findings discussed above through qualitative study, the following observations were made during data collection and instrument development stage. From the data collected it was evident there was a definite and clear distinction between the perceptions of upper class and lower class passengers. The lower class travellers were mostly of the opinion that the Indian Railways passenger services offers the cheapest and most convenient mode of transport and there is no alternative to substitute it – in a sense where they felt they belonged. They did not want something that was out of the ordinary as they, implicitly, saw themselves as normal people and did not want any luxury except the trains maintaining punctuality and availability of tickets on demand. In contrast, the upper class passengers expected that train services were exclusive that treats them special like having good catering facilities, personal attention from staff throughout journey, some form of entertainment to make journey interesting and thus by implication were looking for something out of the ordinary. The following is the list of 10 major areas in Railway passenger services quality which needs immediate attention from the Indian Railways.

- ❖ Punctuality and re-scheduling of trains.
- ❖ Congestion at station platforms/concourses/circulating areas/FOBs in spite of expansion/modernization of stations.
- ❖ Constraint of platform length and width particularly of the old stations.
- ❖ Slow progress of increasing platform height and cover over platforms.
- ❖ Unsatisfactory on-board catering services and lack of good quality bed-roll/linen
- ❖ Lack of cleanliness of trains, platforms and station racks and toilets.
- ❖ Availability of ticket on demand.
- ❖ Overcrowding of trains especially suburban.
- ❖ Security of Passengers on trains and nuisance beggars.
- ❖ Slow speed of trains and excess journey time.

Finally the researcher feels that the Indian Railways is first and foremost a service and it ought to function like any other service sector facility was lost on them. The Railway administration feels that the passenger is pleased with if a few new trains are announced at regular intervals and fares are kept low. But there must be at least be basic facilities at stations and trains. The chaos at our railway station is due to the lack of attention paid to their running. The platforms at major stations are arguably among the dirtiest in the world. They lack proper signage, seating facilities and communication mechanisms. Lifts and escalators are non existent in most stations though the Railways is the most preferred option for long distance travel in India. More personnel need to be deployed not just to manage crowds but also to help passengers with precise information. Proper communication between officials and passengers itself could streamline passenger flow and facilitate better patronage. But these are possible only if policies and priorities are set with the passenger in focus. A public utility like the Railways has to be judged not merely on the bottom line, but on the quality of service it provides. The unfortunate part is even when the Railways have claimed operational profits, its record on passenger amenities was nothing to crow about. The Railways has to revolve around the passenger. The passenger must be seen as consumer with privileges and not as a captive user with limited choices.

8.10 Chapter Review

This research conceptualized, constructed, refined and tested a multiple item instrument RAILQUAL to measure railway passenger service quality which is very useful in the present day competitive environment. RAILQUAL model was tested for reliability and validity. The Structural model was evaluated for testing the hypothesized relationships between the constructs. In this Chapter a full discussion was made regarding the research contribution of this study to academic theory and practices and how to apply them to Industry theory and Industry Practice. The theoretical, methodological and practical implications of the research were discussed. Then theoretical and methodological limitations were pointed out and after that future research avenue was highlighted. Finally in the conclusion the outcome of this research was highlighted.

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APPENDIX A1

RAILQUAL

Questionnaire for Railway passengers

(A Survey on Indian Railway Passenger Services)

The survey deals with passenger's experience of rail travel. The objective of this study is to know how the passenger personally feels about Indian Railways. The responses will be very much useful for the improvement of the quality of services on Indian Railways. To help in this aspect, please spare a little time to complete the questionnaire. To answer the questions please tick the box next to the options that apply or write in your response in the space provided. By filling the questionnaire you are helping to evaluate and improve the quality of services in Indian Railways. Please answer the questionnaire given below, only if you have travelled by train during the last one year period otherwise pass on this questionnaire to your friend. The data collected will be used for academic purpose .

DEMOGRAPHIC FACTORS

Q1a) Your Name (Optional): _________________________ Contact Number (optional) : ________________

Q1b)Your age:

- Up to 20 -- ☐
- 31-40 --------------------------------------- ☐
- 51-60 --------------------------------------- ☐
- 71-80 --------------------------------------- ☐
- 21-30 ------------------------------------- ☐
- 41-50 --------------------------------------- ☐
- 61-70 -------------------------------------- ☐
- 81 and above-------------------------------- ☐

Q2). Gender : Male ---------------------------- ☐ Female ------------------------------------ ☐

Q 3).Your educational qualification :

- Illiterate -- ☐
- Up to High School ------------------------------ ☐
- Graduate/Post Graduate --------------- ☐
- Docoral Degree -------------------------- ☐
- Semi Literate (read and write) ---------- ☐
- SSC/Intermediate -------------------------- ☐
- Professional Degree/PG ------------------- ☐

Q 4). Your profession :

- Student --- ☐
- Employee (Cental Govt)------------------------- ☐
- Employee (State Govt)------------------------- ☐
- Employee (Pvt) ------------------------------- ☐
- Others -- ☐
- Employee (PSU) ------------------------ ☐
- Business ----------------------------------- ☐
- Retired ---------------------------------- ☐
- Self Employed --------------------------- ☐

Q 5).Monthly income of your family (approximately) : ` ___________

Q 6). How often do you travel ?

- Seldom (very rarely) ------------- ☐
- Once in six months ---------------------- ☐
- 1or 2 times a month ------------------------ ☐
- Daily -- ☐
- Less often (Once in a year) ------- ☐
- Once every 2-3 months --------------- ☐
- 3 or more times a week --------------- ☐

Q 7).The most important reasons for selecting train services are (tick as many as)

- Affordable price ------------------------------ ☐
- Comfortable Journey ------------------------ ☐
- Journey is reliable -------------------------- ☐
- Pleasure/joy ------------------------------------- ☐
- Time Saving -------------------------- ☐
- Connectivity ----------------------------- ☐
- safety & security -------------------------------- ☐
- No other alternative--------------------------- ☐

Q 8) State of Domicile : ____________________

Q 9). In which class you will be travelling often ?

First Class AC ------------------------------ ☐ II AC --- ☐
III AC ----------------------- ☐ AC Chair Car ------------------------------- ☐
Sleeper/ Chair Car --------------------- ☐ General ------------------------------- ☐

Q10).Where do you reside :

City ------------------ ☐ Town -------------- ☐ Village ----------------- ☐

Q11)	What is your perception of passenger services provided by Railways over the years?					
	a) Improved significantly	b)improving	c) worsening	d) can't say		
	FACILITIES AT RAILWAY STATIONS					
Q12)	How do you find the following facilities?					
		In all stations	In most stations	In some stations only	Not in any station	N/A
	i) Approach to station free of encroachment					
	ii) Circulating area spacious and ambient					
	iii) Platform spacious for movement of both passengers and luggage					
	iv) Location of prepaid taxi/auto booths convenient					
Q13)	Booking/Reservation office and Enquiry counters					
		Always	Mostly	sometimes	Never	N/A
	i) Are all booking counters manned?					
	ii) Are the booking clerks conversant /trained					
	iii) Are enquiry counters manned?					
	iv) Location of prepaid taxi/auto booths convenient					
	v) Time taken to obtain ticket from booking counters	Always less than half an hour	Usually between Half to one Hour	Usually between One to two hours	Always more than two hours	Can't say
	vi) Any suggestions on what improvements could be made?					
Q14)	i) Have you used the waiting rooms at any time?			Yes	No	
	ii) if used , how do you find the following ?	Always working/ usable	Mostly working/ usable	Working /Usable sometimes	Never working /Usable	Can't say
	a) Furniture					
	b) Fittings					
	c) Toilets/bathrooms					
Q15)	i) Have you used the retiring rooms at any time?			Yes	No	
	ii) if used , how do you find the following ?	Always working/ usable	Mostly working/ usable	Working /Usable sometimes	Never working /Usable	Can't say
	a) Furniture					
	b) Fittings					
	c) Toilets/bathrooms					

	iii) Were retiring rooms provided on demand	Always	Mostly	Sometimes	Never	Can't say
Q16)	How do you find the following?					
I)	Electronic train indicator and coach guidance system (ie electronic boards on platforms that display train number and position of coaches)					
		Always	Mostly	sometimes	Never	Can't say
a)	Are they in working condition ?					
b)	Do they display accurate information ?					
II)	Public address system					
		Always	Mostly	sometimes	Never	Can't say
a)	Is the sound clear ?					
b)	Are the announcements timely ?					
Q17)	How do you find the behavior of the Railway staff?					
		Always courteous	Mostly courteous	Courteous only sometimes	Never courteous	Can't say
	i) In booking /reservation offices					
	ii) In parcel offices					
	iii) In enquiry counters					
	iv) TC/TTEs					
	v) Railway porters					

Q 18).What is the main purpose of your Journey mostly?(tick as many as found appropriate)

Daily commuting for work/education/business -- ☐
On Official/business Work -- ☐
On personal Work -- ☐
To Visit friends and relatives -- ☐
Shopping trip -- ☐
Travel to/from holiday --- ☐
To Pilgrimage -- ☐
To medical treatment --- ☐
Others -- ☐

Q 19) How did you book your ticket mostly(tick as many as found appropriate) ?

In advance – booked over internet --- ☐
In advance at Reservation counter -- ☐
In advance via travel agent --- ☐
Through Tatkal booking --- ☐
Using a season ticket -- ☐
Ticket is not purchased by me -- ☐

Q 20) How would you rate the following regarding ticket booking :

1 = Very poor, 2 = poor, 3 = Neither good nor poor 4 = good 5 = Very good N/A = Not Applicable							
The information provided about availability of Tickets	1	2	3	4	5		N.A
Ease and convenience of ticket purchase	1	2	3	4	5		N.A
Clarity of information given in time tables	1	2	3	4	5		N.A
Clarity of information given at Reservation counters	1	2	3	4	5		N.A
Promptness and accuracy of Staff at Reservation counter	1	2	3	4	5		N.A

Q21) In which station you will be boarding train mostly ____________________

Q22) Taking into account all the different aspects at the boarding station,how did you rate it oveall?

Very good	Good	Neither good nor poor	Poor	Very poor
☐	☐	☐	☐	☐

Q 23 How did you rate the above station ?

1 = Very poor, 2 poor, 3 = Neither good nor poor 4 = good 5 = Very good N.A= Not applicable							
Tickets buying facilities(if you bought at the station)	1	2	3	4	5		N.A
Provision of information about train Timings	1	2	3	4	5		N.A
The upkeep/repair of Platforms	1	2	3	4	5		N.A
Cleanliness of the station	1	2	3	4	5		N.A
The facilities and services at the station (ie toilets)	1	2	3	4	5		N.A
The facilities and services at the station (ie cafes)	1	2	3	4	5		N.A
Availability of carriers (ie coolies) at station	1	2	3	4	5		N.A
Helpfulness of the Railway staff	1	2	3	4	5		N.A
Connections with other forms of public Transport	1	2	3	4	5		N.A
Bogie placement information on platform	1	2	3	4	5		N.A
Your personal safety and security at station	1	2	3	4	5		N.A
Your baggage security at station	1	2	3	4	5		N.A
The ease of being able to get on and off the train at station platform	1	2	3	4	5		N.A

Q 24) While waiting at the Station have you asked Railway Staff for help or information ?

Yes – asked for help -------------------- ☐ Could not find anyone to ask ☐

Yes – asked for information ------------ ☐ No-didn't need help/information ☐

Q 25) Overall, how satisfied were you with the way your request was handled ?

Highly Satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Highly dissatisfied
☐	☐	☐	☐	☐

Q 26). Based on your experience of your train journey how satisfied were you with the train services ?

1 = Very Dissatisfied, 2 = Dissatisfied, 3 = Neither Satisfied nor dissatisfied 4 = satisfied 5 = Very satisfied N.A = Not applicalbe							
The frequency of the trains on the route	1	2	3	4	5		N.A
Regarding the punctuality of train	1	2	3	4	5		N.A
The pricing of ticket	1	2	3	4	5		N.A
Medical facility in the train	1	2	3	4	5		N.A
Providing you with information about any changes in iternary	1	2	3	4	5		N.A
Availability of coach attendant / helper in the train	1	2	3	4	5		N.A
Sufficiency of Boarding time to train at station	1	2	3	4	5		N.A

Q27. Specifically thinking about the cleanliness of the train you boarded for the journey recently , how would you rate it for :

1 = Very poor, 2 = Poor, 3 = Neither good nor poor 4 = Good 5 = Very good N.A =Not Applicalbe							
The cleanliness of the inside of the train	1	2	3	4	5		N.A

Q28A) How would you rate the trains in terms of journey comfort:

1 = Very poor, 2 = Poor, 3 = Neither good nor poor 4 = Good 5 = Very good N.A = Not Applicalbe							
Cleanliness	1	2	3	4	5		N.A
Up keep and repair (condition of seats, walls, floor etc)	1	2	3	4	5		N.A
The provision of information during journey	1	2	3	4	5		N.A
The availability of staff on the train	1	2	3	4	5		N.A
The helpfulness and attitude of staff on train	1	2	3	4	5		N.A
The Space for luggage	1	2	3	4	5		N.A
Sufficient room for passengers to sleep	1	2	3	4	5		N.A
The comfort of the seating area (ie Berths and seats)	1	2	3	4	5		N.A
The ease of being able to move to other compartments(ie Vestibutes)	1	2	3	4	5		N.A
Your personal security while on board the train	1	2	3	4	5		N.A
The toilet facilities	1	2	3	4	5		N.A
Trust worthiness of the Staff	1	2	3	4	5		N.A
Journey comfort (ie unusual jerks in train movement etc)	1	2	3	4	5		N.A
Condition of Fans and Air conditioner and plug sockets	1	2	3	4	5		N.A
Adequacy of Lighting in the train	1	2	3	4	5		N.A
Water facility in the train	1	2	3	4	5		N.A
Windows condition	1	2	3	4	5		N.A
Cleanliness of Blankets etc provided to you	1	2	3	4	5		N.A
Functionality of Laptop and cell chargers	1	2	3	4	5		N.A
Emergency alarm chain condition	1	2	3	4	5		N.A

Only answer Q 28b if you say fairly poor or very poor regarding the train toilet facilities (in Q28A)
Q 28b. Please describe the nature of the problem and suggestions to improve the facilities :

Q29). Specifically thinking about the overall comfort in the train you boarded for the journey recently , how would you rate the overall comfort of the journey :

Very good	Good	Neither good nor poor	Poor	Very poor	Don't know/ No opinion
☐	☐	☐	☐	☐	☐

Q30)	Catering services in trains					
		Always	Mostly	sometimes	Never	Not used
	i)Are the paced items sold at MRP/Notified rate?					
	ii)Are beverages sold at notified rates					
	iii)Is the quality of food maintained					
	iv) Do the catering staff maintain					

	personal hygiene					
	v) Tariff					

Cheap	Reasonable	High	Not used	No opinion

Q31). How did you rate the all the catering facilities used by you in your journey in terms of :

1 = Very poor, 2 = poor, 3 = Neither good nor poor 4 = good 5 = Very good
N.A = Not Applicalbe

Cleanliness	1	2	3	4	5		N.A
Quality	1	2	3	4	5		N.A
Quantity	1	2	3	4	5		N.A
Pricing	1	2	3	4	5		N.A
Freshness	1	2	3	4	5		N.A
Behavior of the Catering staff (ie politeness and courtesy)	1	2	3	4	5		N.A
Time Taken to deliver	1	2	3	4	5		N.A

Q32) Overall, how satisfied are you with catering service quality/quantity on the train ?

Highly Satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Highly dissatisfied	Don't know/ No opinion
☐	☐	☐	☐	☐	☐

Q33)	Punctuality of trains					
		Always on time	Mostly on time	Sometimes on time	Never on time	Can't say
	(i) Departure from boarding station					
	(ii) Arrival at destination station					

Q34) If there is a delay in the train which you have travelled , How well do you think the Railways dealt with the delay ?

Very well	Well	Neither well nor poorly	Poorly	Very poorly	Don't know/ No opinion
☐	☐	☐	☐	☐	☐

Q35) How well do you rate the Railways for each of the following, in relation to delay that occurred

1 = Very Well, 2 = Well, 3 = Neither well nor Poor 4 = Poor 5 = Very poor N.A= Not Applicable

Information provided about the delay	1	2	3	4	5		N.A
The accuracy of information given about the delay	1	2	3	4	5		N.A
The usefulness of the information	1	2	3	4	5		N.A
The speed at which information was provided	1	2	3	4	5		N.A
The time taken to solve the problem	1	2	3	4	5		N.A
The availability of alternative transport if the train service could not continue	1	2	3	4	5		N.A

Q36) Have you ever traveled in a train which is late yes ☐ No ☐

Q37) How much late arrival is tolerable to you

up to 15 mts ---------------- ☐ up to 1 hour ---------------- ☐ not tolerable --------☐
up to ½ hour --------------- ☐ up to 2 hours ---------------- ☐

Q38) Which of these potential improvements do you think would be most likely to assist you when planning future rail journeys? (tick all that apply)

Better telephone enquiry/ booking service ---------- ☐ Better route maps of rail networks------------- ☐
Better Internet enquiry/booking service ------------- ☐ Make timetables easier to read --------------- ☐
Better information facilities at stations ---------------- ☐ Better Ticket buying facilities at stations ------- ☐
None of these --- ☐ Others (please specify) _________________ ☐

Q39) Have you ever made a compensation claim for a delayed journey or about inferior service ?

No ______________________ ☐ Yes ______________ ☐

If yes please answer the following question :

Q40) How satisfied were you with the way your complaint/claim was handled

Very Satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Very dissatisfied	Don't know/ No opinion

Q41) Why were you dissatisfied? (Tick all that apply)

Insufficient compensation ---------------------- ☐ poor explanation given ___________________ ☐
Inappropriate form of compensation _____ ☐ Have not yet received a response _________ ☐
Time taken to respond _________________ ☐

Others : (please write in)						
Q42)	Security arrangements in trains					
		Always	Mostly	sometimes	Never	Can't say
	i)How often have you seen traveling escort security in trains					
	ii)Are they adequate to prevent crimes/thefts in trains					
	iii)Any suggestions for improvements					

Q43) Whether concerns about your personal security ever prevented you from traveling by train, either forcing you to use another method of transport or not to make the journey at all?

No -- ☐
Yes – I have traveled by another mode of transport --- ☐
Yes – I have not made the journey I wanted to --- ☐

Q44) Would you say the amount of crime and anti-social behavior at station premises and train compartments has changed over the past few years ? Do you think ------

There's a a lot more	There's a little more	There is about the same	There's a little less	There's a lot less	Don't know
☐	☐	☐	☐	☐	☐

Q45) Please specify how good job you think the Railway Protection Force (ie Railway police) and General Reserve Police (ie Civil police) do in carrying our each of the following at the station and in train

1 = Very poor job, 2 = Poor job, 3 = Fair job 4 = Good Job 5 = Excellent job 6 = Did not know							
Provide a visible patrolling presence	1	2	3	4	5		N.A
Deal with people being drunk	1	2	3	4	5		N.A
Dealing with eve teasers	1	2	3	4	5		N.A
Tackling Retail salesman	1	2	3	4	5		N.A
Tackling thieves	1	2	3	4	5		N.A
Tackling Beggar nuisance	1	2	3	4	5		N.A
Protecting your privacy in journey	1	2	3	4	5		N.A

Q46) Thinking about your personal security when using railways, what were the top two priorities the RPF and GRP should focus their resources on ?
Priority 1 ___________________ Priority 2 ____

Q47). Considering the services Railways offers, are they worth what you paid for

Not Worthy	some what worthy	Neither worthy /nor disworthy	worthy	Fully Worthy	Don't know/ No opinion
☐	☐	☐	☐	☐	☐

	Overall experience and other issues				
Q48)	How do you rate your overall experience of the services provided by Railways in a scale of 1 to 10 ?(1- Lowest grade and 10 – highest grade)				
Q49)	How do you rate the value of services provided by the Railways for the price that you pay in a scale of 1 to 10(1- Lowest grade and 10 – highest grade)				
Q50)	Do you feel that update/accurate train running information is transmitted?				
	Always	Mostly	Sometimes	Never	Can't say

Q51) Listed below are seven features pertaining to Indian Railways Services quality dimensions which is offered to the passengers. We would like to know how important each of these features is to you when you evaluate the Railways quality of service. Please rank them out of 100 points.
(ie minimum is 0 and maximum is 100 points)

1.The appearance of the Indian Railways physical facilities, equipment Personnel and communication materials	
2.The Indian Railways ability to perform promised service dependably and accurately	
3. The Indian Railways willingness to help passengers and provide prompt service	
4.The Knowledge and courtesy of employees and their ability to convey trust and confidence	
5.The caring ,individualized attention the Indian Railways provides to its passengers	
6. The image of Indian Railways	
7. The technical quality (ie itinerary accuracy and success to complete a trip)	

Which one feature among the above seven features is most important to you ? (please enter the feature's number)	
Which feature is second most important to you?	
Which feature is least important you ?	

Q52) Have you ever traveled in a train in abroad
Yes -------------------------------- ☐ No ---------------------------------☐

Q 53). How did you rate Indian Railway Services in comparison, with Railways abroad?
Indian Railways is Better than the Railways Abroad
Abroad Railways are better than Indian Railways.
Indian Railways is equal to Railways abroad.
If your answer is 1 or 2 above, please mention the differences briefly

Q54)	If you have to choose an alternative for train journey, what other mode you will chose?				
	Bus	Car	Airways	Others	No alternative

Q55)	If you compare your journey in train with bus journey what is your opinion				
	Better than bus	About the same	Worse than bus	Don't know	Can't say

Q56) How satisfied are you with the Indian Railway Services :

Very Satisfied	Fairly Satisfied	Neither satisfied nor dissatisfied	Fairly dissatisfied	Very dissatisfied	Don't know/ No opinion
☐	☐	☐	☐	☐	☐

Q57) Finally in addition to this questionnaire I would like you to have your opinion of the overall service quality of Indian Railways .

Very good	Good	Neither good nor poor	Poor	Very poor	Don't know/ No opinion
☐	☐	☐	☐	☐	☐

Q58)	How do you rate the overall satisfaction you have received from Indian Railway passenger services in a scale of 1 to 10(1- Lowest grade and 10 – highest grade)	

Q59) please offer 3 best suggestions in order of priority which will improve the service quality of Indian Railways considerably

Priority 1 ____

____

Priority 2 ____

____

Q 60) Indian Railways makes a lot of contribution to the society and it is playing a key role in the socio economic development of the country : Yes ☐ No ☐

Q61) Have you noticed any difference of quality among different trains of Indian Railways in which you have travelled till now Yes ☐ No ☐

Q62) If yes , what is the number or name of the train which is maintaining good quality that can be taken as a bench mark for other trains to follow ________________.

Q63) Your PNR Number / Ticket Number please (if your are traveling right now): ___________________

Thank you very much for your cooperation.

If you have any suggestions or require any clarifications please send an email to the following id : *railqual@gmail.com*

1. Devi Prasad, M and Raja Shekhar, B. (2011). "Evaluation of service quality in Indian Railway Passenger Services through development of RAILQUAL", *Journal of Public Transportation. Florida Under Review**

2. Devi Prasad, M and Raja Shekhar, B. (2011). "The Effects of Individual Dimensions of Railway Service Quality: Finding from Indian Railway Passenger Services through developing RAILQUAL", *International Journal of Innovation, Management and Technology*, *In press*[#]

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Synopsis

of the Ph.D. thesis on

EVALUATION OF SERVICE QUALITY AND PASSENGER SATISFACTION IN INDIAN RAILWAYS BY DEVELOPING RAILQUAL

Submitted by

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for the degree of
Doctor of Philosophy

Under the Guidance of
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SCHOOL OF MANAGEMENT STUDIES
UNIVERSITY OF HYDERABAD
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Abstract

Service organizations are continually confronting challenges to remain competitive and successful, which compels them to regularly revaluate their strategies to improve services. Customer satisfaction, from the service quality perspective, has emerged as a new modus operandi for assessing customers' perceptions and/or expectations of services in order to reorient and regulate existing services. Services are becoming increasingly ubiquitous and this growth is accompanied by increased business interest in measuring and managing service quality. This interest is also reflected in a large number of academic studies. Despite this there is very little consensus about the dimensions and antecedents of Railway Passenger Service Quality (RPSQ).There are two possible reasons for this: first the phenomenon of railway passenger service quality is changing as affordability is increasing among customers. Second, the theoretical approach and the assumptions on which the public transport service quality is usually founded, is flawed in the Indian context.

The research issues are: 1) What is the structure of Railway Passenger Service Quality? 2) What are the antecedents of the Railway Passenger Service Quality? 3) What are the most appropriate modelling and measurement methods for measuring Railway Passenger Service Quality quantitatively? 4) What is the relationship between Railway Passenger Service Quality and passenger satisfaction and behaviour loyalty of passengers?

It was found that leading models and instruments tend to be based on exploratory factor analysis and have not been informed by advances in measurement theory, particularly co-variance-based structural equation models. The diverse nature of requirements of stake holders makes it extremely difficult to decide upon what constitutes quality in Railway passenger services. Hence, identification of common minimum quality items suitable for all passengers will help design the system and there by improve passenger satisfaction. To address this issue, recent advances in measurement theory to dataset were applied and compared two different modelling methods namely exploratory factor analysis and confirmatory factor analysis. Based on psychometric scale development approaches, this research conceptualized, constructed, refined, and tested a multi-item scale 'RAILQUAL' that examined key factors influencing railway passenger service quality. Through qualitative and quantitative studies in three phases a 18 item six dimensions 'RAILQUAL' model was developed, which is a measuring instrument for service quality and passenger satisfaction in Indian Railways. The resultant dimensions showed good psychometric properties based on findings from various reliability and validity tests as well. Nine hypotheses were proposed in the thesis and examined using structural equation modelling. Although one hypothesis was rejected the resultant structural model showed strong relationships between the dimensions included.

The research identified that service quality is a strong contributor to behaviour loyalty. The strong pathway from service quality to behaviour loyalty was through passenger satisfaction. Both passenger satisfaction and service quality had significant effect on profitability. The research provides an empirical evaluation of relationship between identified attributes towards dimensions of service quality and also the importance of each dimension towards the overall service quality of passenger services in Indian Railways. A number of recommendations for further research were made. These included the replication of this study in all the zones of Indian Railways so that the instrument 'RAILQUAL' can be standardized across Indian Railway.

1.0 INTRODUCTION

Managing services effectively is a main challenge in the service management domain because of intangibility, heterogeneity, perishability, inseparability of services and massive human involvement in service delivery. Delivering superior service and ensuring higher customer satisfaction have become strategic necessities for organizations to survive and prosper. The Indian Railways (IR) is the principal mode of transportation for the long haul freight movement in bulk, long distance passenger traffic and mass rapid transit in suburban areas and it networks the nation providing economic and reliable transport to Indians. While the freight traffic generates bulk of the revenue for railways, passenger transport is the more visible face of the railways as it touches directly the lives of millions who avail the passenger transport services. Accordingly, Indian Railways have been making efforts over the past few years to enhance the services being provided to their passengers.

However Indian Railways market share in passenger segment has come down from 68% in 1951 to a mere 13% now in total passenger transportation sector in India. Indian Railways has to learn quintessentially that market share has to be fought and won in the market place. For winning this battle consistently, the customer should be offered superior and compelling value on a continuing basis. The ultimate measure of value for Railways' services is customer satisfaction. To create this value, the Indian Railways has to transform itself from an introspective organisation where the emphasis was on process and procedure, to one that is externally oriented with emphasis on the market and the customer.

Gauging passenger satisfaction through service quality studies has become one of the most popular marketing strategies, and it is an approach that infiltrates many academic disciplines, such as psychology, mechanical engineering, business and management science. As a result, many commercial service studies have been commissioned by numerous service providers (Azhar 2007; Badri, Abdulla & Al-Madani 2005; Mazzeo 2004; Prewitt-Baker2000), as it is critical for such service providers to prove their strength in business performance in a competitive environment (Chowdhary & prakash 2007:238, Mehta, Lalwani & Soon 2000:62; Park2007:238; Shemwell, Yavas & Bilgin 1998:155)

Moreover, defining quality is also a difficult task due to its generic nature. Significant body of research has focussed on measurement of service quality in conventional services (Bolton and Drew, 1991; Parasuraman et al., 1985; Parasuraman et al., 1988). SERVQUAL (Parasuraman et al., 1988) and SERVPERF (Cronin and Taylor, 1992) are the examples of scales which have been developed to measure service quality in such contexts. However, further research has identified additional dimensions of service quality besides those extracted in SERVQUAL and SERVPERF (Brady and Cronin, 2001; Levseque and McDoughall, 1996). With the rise of technology enabled services, research has also captured the technology related dimensions of service quality (Collier and Bienstock, 2006; Parasuraman et al., 2005).

Although the Railways is large and economically important for most countries, there has been surprisingly little research in the industry on service quality. As an example a search on Google scholar (20 November 2009) revealed that only fifteen of the nearly eighteen hundred articles in scholarly journals on the topic of service quality relate to Railways service quality. A closer examination shows that out of these fifteen articles, only nine related to service quality in passenger services in Railways (e.g Disney,1998,1999;Hanna and Drea,1998; Dria and Hanna, 2000; Tripp and Drea, 2002). There is very little published literature that reports the use of SERVQUAL in assessment of railway passenger service quality. As such, it remains the least researched subject area open to intense research. As very little is known about service quality dimensions of railway passenger services and appropriate measures of such dimensions, there is a need to empirically identify these dimensions. Hence this study addresses this issue by developing a comprehensive instrument RAILQUAL by using structural equation modelling approach.

2.0 REVIEW OF LITERATURE IN BRIEF:

Allen and DiCesare (1976) considered that quality of service for public transport industry contained two categories: user and non-user categories. Under the user category it consists of speed, reliability, comfort, convenience, safety, special services and innovations. For the non-user category, it is composed of system efficiency, pollution and demand. Silcock (1981) conceptualized service quality for public transport industry as the measures of accessibility, reliability, comfort, convenience and safety. Pullen (1993, p261) defined quality of service for local public transport industry as a concept that involves "those attributes of the service which affect its fitness for purpose" and "the attributes, and indeed fitness for purpose, required detailed definition in relation to local objectives and circumstances".

Tripp and Drea (2002) also used a survey of Amtrak passengers to assess the direct and indirect relationship between pre-core/ peripheral and core service performance components and their impact on the likelihood of repeat purchase (p.433). They found that the core experiences on-board that determined the customer’s attitudes to the service provider and subsequently their intention to use the train again. These attributes included announcements, seat comfort, ride, cleanliness of seating area, courtesy of on board staff, rest rooms and café car conditions.

The gap model of service quality and the concept of transport service quality showed consistency that service quality should be measured on a multidimensional basis. On the other hand, inconsistency is also found when comparing these two. They have different dimensions in conceptualization of the service quality. SERVQUAL is much more service oriented. Those commonly used in public transport industry are more industry-based. SERVQUAL is much more humanistic, or customer related, while most of the measures used in public transport industry are much more mechanistic, or have a technical focus, or use more objective measures. This has led to the criticism that SERVQUAL could not tell the whole story. In summary, in order to measure the quality of service thoroughly, the attributes used in SERQUAL, the public transport industry, and the railway service sector should be grouped together to form a pool of items for measurement.

3.0 CONTEXTUAL REVIEW

3.1 Brief overview of Indian Railways

The Indian Railways is a unique state-owned enterprise because of its size, ownership structure and one-hundred-and-fifty-year-old history. These attributes among others, make it a complex, intriguing and thus fascinating subject to do research. The Indian Railways is one of the world’s largest state-owned enterprises, a utility under a single management, second only to China’s .With around 1.4 million employees and 1.1 million pensioners, one of the world’s largest railway networks – over 63,000 Kilometres of routes – running approximately 13,000 trains each day, including 9000 passenger trains, the railways is a Ministry within the Government of India. Indian Railways carry over two million tons of freight and some 17 million passengers between 7000 railway stations each day. A fleet of 2,00,000 wagons, 40,000 coaches, and 8000 locomotives achieves this. To fathom the scale, consider the fact that each day Indian trains travel four times the distance to moon and back.

3.2 Indian Railway Passenger Sector Performance

Railway freight is measured in ton-km (tkm) and passenger traffic measured in passenger km (pkm), each increased at an annual rate of around 4 % over the past 50 years. Growth in railway traffic has been much lower than growth in total transport demand. During FY 1980-2010 the total freight traffic grew at an average annual rate of 6.8% and passenger traffic at 8.5%. Over this period the traffic carried by road increased at an average annual rate of 10.2 % for freight and 9.6% for passengers. Indian Railways' total share of freight and passenger traffic has steadily declined. Fifty years ago IR carried more than two thirds of both freight and passenger traffic. Twenty years ago it still accounted for two thirds of freight, but its passengers share had fallen to one third. By FY 2007, IR's share of freight traffic had fallen to less than one third and its passenger traffic share was only 13%. (ADB report IND 36317, Nov 2002). Trends in road and rail traffic shares are in Table 1.

Table 1. Operational performance of different modes of transport

Historical Overview of Operational Performance of different modes of Transport Mode-wise Traffic in Million Tonnes and percentage Share in Total Traffic							
Year	Total originating Inter regional traffic	Railways	Highways	Coastal Shipping	Airlines	Pipe lines	Inland Water transport
1950-51	82.3	73.2 (89%)	9.0 (11%)	NA	NA	NA	NA
1978-79	283.4	184.7 (65%)	95.6 (34%)	3.1 (1%)	NA	NA	NA
1986-87	484.9	255.4 (53%)	224.0 (46%)	5.5(1%)	NA	NA	NA
2007-08	2555.35	768.7 (30.08%)	1558.9 (61%)	59.1 (2.31%)	0.28 (0.01%)	113.5 (4.4%)	54.9 (2.15%)

Source: RITES Draft final report 2009: "Total Transport System Study on Traffic Flows and Modal Costs"

It is seen that the market share of rail transport has reduced drastically from 89 % in 1950-51 to 30 % in 2007-08. The road sector has been the biggest gainer and pipelines also have gained share by 4.5 %.Along with People's Republic of China (PRC) and United States (US), India is one of the few countries in the world with annual railway traffic in excess of 500 billion converted ton-km (ctkm). The passenger share of railway traffic in India is high compared with other countries with large railway operations. In FY 2010 passenger-km represented 60% of IR's total ctkm, compared with 24% in PRC and 1 % in the US.

4.0 RESEARCH QUESTIONS

The gap identified in the review of conceptual and contextual literature and management practices of passenger transportation service sector in Indian Railways have led to the formulation of five research questions that motivated the present study.

(i) What is the structure of Railway Passenger Service Quality?

(ii) What are the antecedents of the Railway Passenger Service Quality?

(iii) What are the most appropriate modelling and measurement methods for measuring Railway Passenger Service Quality quantitatively?

(iv) What is the relationship between Railway Passenger Service Quality and passenger satisfaction and behaviour loyalty of passengers?

4.1 Research Objectives

Based on the research questions the broad objective has been framed to evaluate service quality and passenger satisfaction in Indian Railways by developing RAILQUAL. The broad objective was further divided into the following sub-objectives. They are

(i) to identify railway passenger service quality attributes and dimensions and to construct RAILQUAL instrument for measuring railway passenger service quality;

(ii) to develop RAILQUAL theoretical model to find service quality dimensions which are significant predictors of overall service quality in railway passenger services and to identify individual service quality attributes which are significant predictors of their respective service quality dimensions ;

(iii) to confirm the identified railway passenger service quality attributes and railway passenger service quality dimensions by developing RAILQUAL measurement model and

(iv) to test the relationship between attributes and dimensions of railway passenger service quality through RAILQUAL Structural Model and to determine the role of each attribute and dimension in predicting service quality and passenger satisfaction.

4.2 Research Hypotheses

H_1 Reservation and Ticketing have a significant effect on Railway passenger service quality

H_2 Platform services have a significant effect on Railway passenger service quality

H_3 In-Train services have a significant effect on Railway passenger service quality

H_4 Punctuality and Reliability have a positive effect on Railway passenger service quality

H_5 Employee services have a significant effect on Railway passenger service quality

H_6 Safety and Security have a significant effect on Railway passenger service quality

H_7 Railway passenger service quality has a significant effect on passenger satisfaction

H_8 Railway passenger satisfaction has a significant effect on passenger behaviour intentions

H_9 Railway passenger service quality has a significant effect on passenger behaviour intentions

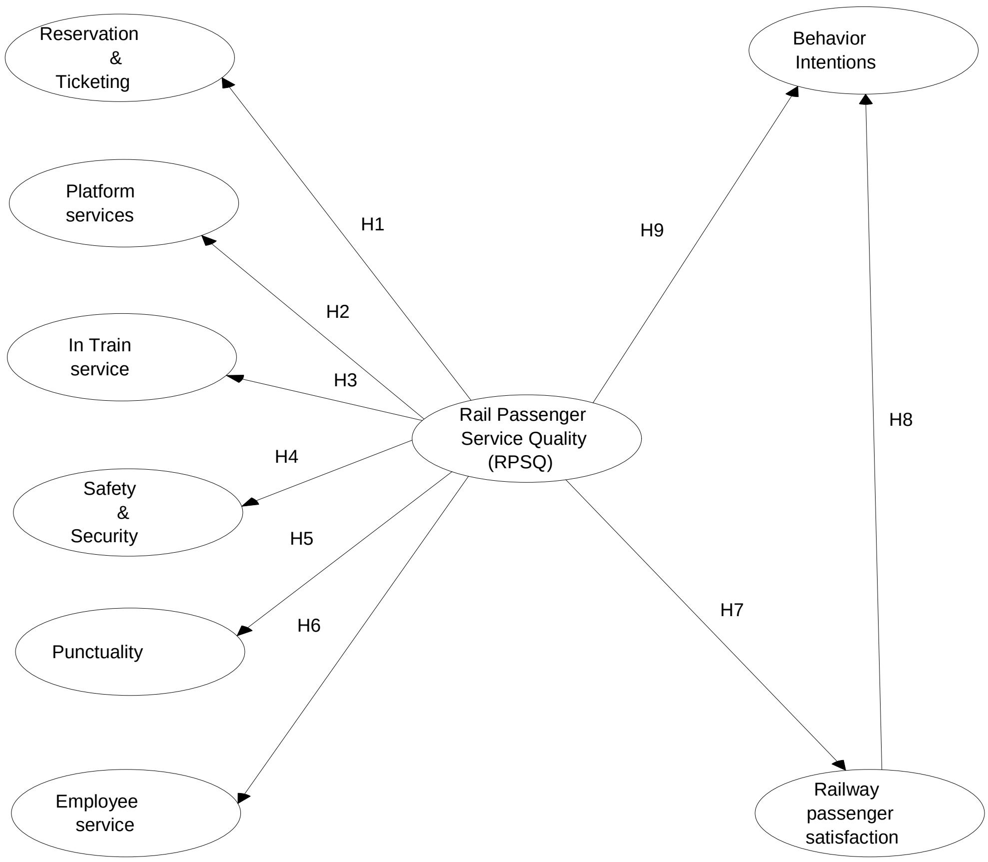

Fig 1. Hypothesised RAILQUAL Research Model

5.0 RESEARCH METHODOLOGY

5.1 RAILQUAL Instrument Development Stages

In this research, a seven stage process has been adopted that is derived from Churchill (1979) as shown below.

Stage	Instrument development Component
1	Construct Framework and Definition
2	Attribute Generation
3	Attribute pool review
4	Pilot Study
5	Scale purification
6	Data Collection
7	Reliability and validity Assessment

5.2 Methodological Design tor the attributes and domain identification

STEPS IN RESEARCH STAGE ONE : EXPLORATORY STUDY ATTRIBUTES AND DOMAIN IDENTIFICATION
Step 1: Specifying the area of service quality and passenger satisfaction Step 2: Generating a list of service attributes that can be utilised for the prediction of passenger satisfaction (literature survey, focus groups and experts opinions) Step 3: Developing a questionnaire to identify degree of importance of attributes Step4: Refining the service quality attributes and service quality domains through an exploratory study **PILOT SURVEY** ➢ **Sample and sampling technique:** • The method of "five subjects per attribute" was used for the determination of sample size and 185 subjects were selected through the purposive sampling technique from Secunderabad Railway Station of South Central Railway, India. The stratum was a mix of upper class passengers and lower class passengers. ➢ **Data gathering technique:** • A structured questionnaire was used based upon multidimensional scaling, in combination of Likert, numerical and categorical scales (Cooper & Schindler 2006: 373; Kotler 2000:110).

- **Data analysis:**
    - Refinement of attributes and domain identification were done through exploratory factor analysis (EFA), the Kaiser-Meyer-Olking measure of sample adequacy and Bartletl's Measure of Sphericity.
    - Cronbach's alpha was used for reliability testing.

The problem area of the study was initially investigated through a comprehensive literature survey of a variety of areas, including transportation engineering and service quality and customer satisfaction in the service operations area. The selection of quality of attributes for the study was initially based on literature survey. The identified attributes were then discussed at focus group meetings to select more appropriate attributes in the context of the Indian Railway Passengers in India. Subsequently, a questionnaire was designed based upon the attributes identified by the focus groups, to gather data for refining the attributes and to identify pertinent quality domains for the main study described in stage two.

5.3 Methodological Design for RAILQUAL Model building and testing

STEPS IN RESEARCH STAGE TWO: MAIN STUDY
RAIL QUAL MODEL BULDING AND TESTING

Step 5: Developing provisional models based on the identified attributes, quality domains and the conceptual model.

Step 6: Conducting a survey to gather data on passenger satisfaction and service quality.

Step 7: Data analysis proceeds in two steps. First the exploratory factor analysis is used to identify the underlying dimensions of service quality for railway passenger services. For this the sample was split into two approximately equal sub-samples, sample 1 (n=607) and sample 2 (n=608). This was done by randomly selecting ~ 50 per cent of the cases using a filtering algorithm in SPSS16. Next an exploratory factor analysis was performed on the 36 attributes of the measurement scale using principal component analysis using varimax rotation.

Step 8: Next, Confirmatory factor analysis was done on sample 2 to confirm the factor structure of the railway service quality factor dimensions.

Step 9: The framed hypotheses were tested using structured model.

MAIN STUDY

- **Sample and sampling technique:**

  Sample size was determined through selection of sample size method developed by Krejcie & Morgan (1970: 608) and 1215 subjects were chosen by means of purposive sampling dynamically across 47 express and passenger trains of South Central Railway.

- **Data gathering technique:**
    - A structured questionnaire was used based on multidimensional scaling, which is a combination of Likert, numerical, categorical and dichotomous scales (Cooper & Schindler 2006: 373; Kotler 2000:110).

- **Data analysis :**
    - Structured equation modelling was employed for identification of relationships between service quality domains and service quality attributes.

5.4 Sample plan and Data Collection for the Main Study with sample frame

The main data collection was done dynamically across South Central Railways. The researcher travelled along with the passengers in the trains and collected data from the passengers. A purposive sampling approach was used. In this research the selected trains were considered to be approximately representative of the whole South Central Railway. In total 1215 completed survey responses were collected. The sampling frame is as shown in Table 2.

Table 2. Sampling Frame

Total Population (Indian Railways)					**Fig in millions**
Trains	Trains	Yrly Passen	Pass/Day	Revenue	Revenue(%)
Pass	2999			34590	17
Mail/Express	2077	3120	8.5	147550	75
Suburban	4648	3800	10.4	15690	8
Total	9724	6920	18.9	197830	100
Working Population (South Central Railways)					**Fig in millions**
Trains	Trains	Yrly Passen	Pass/Day	Revenue	Revenue(%)
Pass	254			3050	17
Mail/Express	170			13470	75
Suburban	47			1440	8
Total	471	290	0.795	17960	100
Sampling Frame					
Trains	Trains	Pass/Train		Total Sample	
Pass	8	26		208	
Mail/Express	35	26		911	
Suburban	4	24		96	
Total	47			1215	(ie 0 .15% or one out of 650)
Detailed Sampling Frame					
Trains	Trains	Pass/Train		Total Sample	
Pass	8	26		208	
Mail/Express(UC)	35	9		315	
Mail/Express(LC)	35	17		596	
Suburban	4	24		96	

Source: 2007-08 Indian Railways year book

6 .0 RESEARCH FINDINGS:

6.1 Research Finding one (Development of the RAILQUAL Instrument)

6.1.1 Inductive attribute generation through Focus Group Discussion

In this research focus groups were used to explore perceptions of railway passenger services with the resultant data being analysed and used for the development of scales to be used in the quantitative stage of the research. In this research four focus groups were held comprising one of railway officers of senior supervisor cadre and junior management cadre of Indian Railways and the second group with railway officers of middle management and top management grade, third group with rail passengers with experience in upper class travel and fourth group with rail passengers with experience in lower class travel in Indian Railways. This number of focus groups is consistent with normal practice that suggests a focus group will normally consist of between four and six focus groups (Krueger, 1994; Morgan, 1996). Each focus group consisted of between six and ten people. The first and second focus groups of Indian railway officers were chosen from all the functional departments of railways with varied experience levels. The researcher acted as moderator for the focus group discussion and took extensive notes of the proceedings. The key themes and words were identified and used to develop a range of attributes in relation to the rail passenger quality. In addition the focus groups discussed aspects of the service quality relationship that affected passenger satisfaction and the aspects of the passenger satisfaction that influence loyalty. As a result of focus group discussion and review of transport quality literature a scale has been developed with 45 attributes after taking expert opinions.

6.1.2 RAILQUAL instrument by development through Pilot Study

The attributes selected for retention were then formed into a questionnaire. A Likert scale ranked from one to five was chosen, as this range of values is familiar to most respondents (Graziano & Raulin, 2000) and provides sufficient range of response points to enable respondents to respond. The Likert scale format was adopted for these attributes for these attributes as a five point response was considered adequate.The resultant survey instrument was distributed to a convenience sample of train passengers at Secunderabad station of South Central Railways over a period of one week in different timings of the day. Participants in the focus group were also given the survey instrument to fill it .Approximately 200 survey forms were distributed, with 185 completed and usable responses being received.

6.1.3 RAILQUAL Instrument Purification

The data were entered into SPSS. The data were cleaned to remove any entry errors or invalid responses, and checked for normality through an examination of skewness and kurtosis (Hair et al, 1998). Following the data cleaning, the data were subject to an exploratory R type factor analysis using principal components analysis and an orthogonal (Varimax) rotation. Principal components analysis was used as it explains common, specific and random error variances (Hair et al., 1998; Hinkin et al., 1997). For each scale, factors demonstrating an Eigenvalue greater than one were extracted, although scree plot was also obtained to clarify if any other factors might be present. (Hair et al., 1998; Tabachnick &Fidell, 2001). The resultant component analysis was examined and items that were complex, that is, showed substantial and similar loadings on more than one factor (Hair et al., 1998) removed. Items that demonstrated a factor loading of 0.35 or below were examined and unless there was a specific theoretical reason for retention, these items were also deleted. The use of a loading of 0.35 at this stage in this research is considered to be a conservative guideline, and thus an acceptable level of certainty of the item validity is attained (Hair et al., 1998). A Cronbach alpha value of 0.70 or above is generally accepted and to determine a high level of homogeneity with in the scale, and to accept that items do reflect a single dimension (Churchill, 1979; Hair et al., 1998; Hinkin et al., 1997). The resultant scale comprised 36 items and was divided into six sections with items grouped conceptually for ease of response. The revised questionnaire was then, after a further evaluation by the researcher and expert colleagues, deemed finalised for the main data collection.

6.2 Research Finding Two

6.2.1 Development of RAILQUAL Theoretical Model through Exploratory Factor Analysis

After exploratory factor analysis only 27 of the 36 attributes identified in the pilot study have been loaded on to the following six dimensions when factor loading of 0.50 and above was taken into consideration.

Reservation and Ticketing: Reservation and ticketing comes under the pre core services category of railway passenger services. Convenience of reservation and ticketing, promptness and accuracy in reservation and ticketing and ticket purchasing facilities are the three attributes which are loaded on to this dimension.

Platform Services: Platform services come under the pre core services of railway passenger services. Provision of information on train times/ platforms, the upkeep and repair of station building and platform, amenities at the station, catering and other facilities at station, connection with other forms of public transport and the ease of being able to get on and off the train at station platform are the six attributes loaded on to this dimension. All the six attributes are the significant contributors of platform services quality.

In-train Service: In-train service comes under core services of railway passenger service. Cleanliness of the train, toilet facilities, comfort of seating area, provision of information during journey, journey comfort and quality and price of catering in the train are the six attributes which significantly contribute towards in-train service dimension.

Punctuality : Punctuality comes under core services of railway passenger services. Train departure on time, length of time the journey scheduled to take (speed), train arrival on time (i.e., intermarry accuracy) and connections with other train services are the four attributes which are the significant contributors of punctuality and reliability dimension.

Employee Service: Employee service comes under peripheral service dimension. Enquiry handling at the ticket counter, courtesy of railway employee, availability of railway staff on train and the way the request to railway staff was handled are the four attributes which are the significant contributors for employee service dimension.

Safety and Security: Safety and security comes under peripheral service dimension. Personal security at station, personal security on train, safety of the train journey and security of luggage on train are the four attributes which have a significant loading on to this dimension.

The Cronbach alpha of each factor is 0.791, 0.858, 0.857, 0.832, 0.738 and 0.812 respectively. The principal component analysis identified six dimensions with an Eigen value greater than one that together explained over 64 per cent of the variance. An examination of the screen plot also indicated that six components was an appropriate solution. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.922 and Bartlett Test of Sphericity was significant ($p < 0.001$). The Chi Square value was 27734.768 with 630 degrees of freedom. These measures provide support for the factorisation.

6.3 Research Finding Three

6.3.1 Developing RAILQUAL measurement model with Confirmatory Factor Analysis

After identifying six clear factors through exploratory factor analysis, the next stage is to confirm the factor structure on sample 2. Structural Equation Modelling (SEM) using AMOS 16.0 was used to perform the confirmatory factor analysis. The CFA results revealed some fit indices below acceptable thresholds. Then verified the standard estimates of the all the attributes and the attributes with standard estimates of less than 0.6 were deleted. This process was repeated with all the 6 dimensions and a total of 9 attributes were deleted. Therefore in an effort to achieve a better fit for CFA, 9 attributes were deleted and remaining 18 attributes were loaded significantly on to 6 dimensions. Same has been rechecked with EFA by taking attributes with factor loading of 0.6 and above.

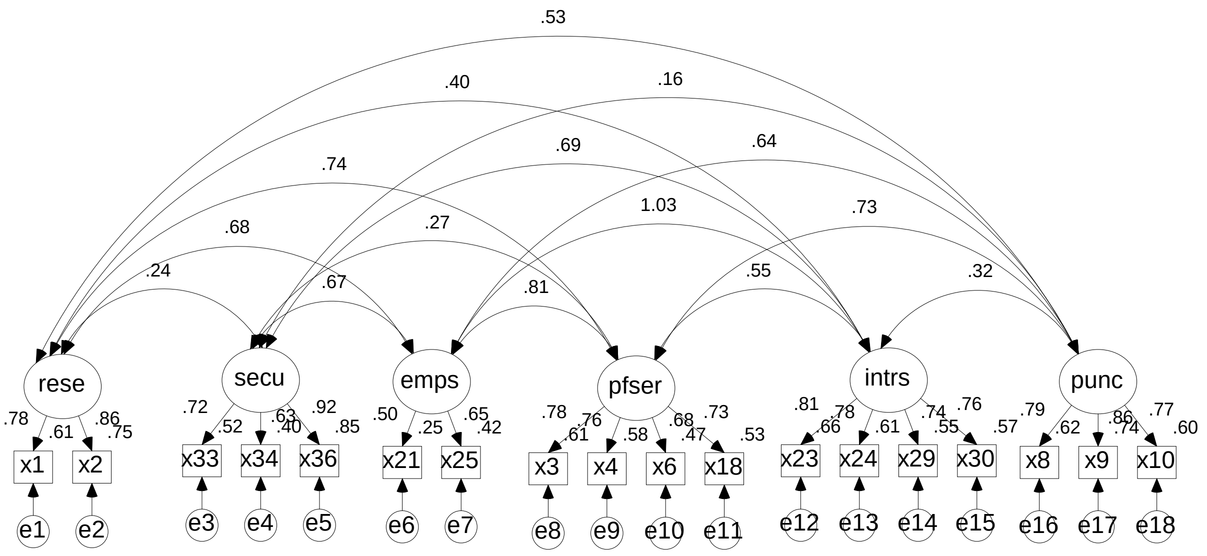

Fig 2: RAILQUAL CFA Measurement Model

6.3.2 RAILQUAL Measurement Model fit:

The resutls for RAILQUAL model as shown in table 3 and figure 2 demostrate a range of fit characterstics that indicate an acceptable level of fit. The absolute fit indices of GFI (0.906), AGFI (0.866) and RMR (0.043) are all within the recommended tolerances.The incremental or comparitive fit indices also indicate an acceptable level of fit with NFI (0.899) and CFI (0.908) being above the recommended minimum value. The normed Chi-square (1177.470) is also within the broader recommended range.

Table3 RAILQUAL model fit indices

χ^2	DF	GFI	AGFI	NFI	CFI	IFI	TLI	RMR	RESEA
1177.470	51	0.906	0.866	0.899	0.908	0.908	0.882	0.043	0.085

6.3.3 Reliability of the RAILQUAL Model:

The Cronbach' alpha for the RAILQUAL instrument was 0.953 which is acceptable and shows that the instrument is reliable. Further evidence of the reliability of the scale is checked through composite reliability and average variance extracted scores of the different factors obtained (Fornell and Lacker, 1981, Hair et al, 2006). Composite reliability (CR) of the latent variables is greater than the acceptable limit of 0.70 (Carmines and Zeller, 1988). The average variance extracted for all the factors is greater than or equal to 0.5, which is acceptable. This shows the internal consistency of the instrument used in the study.

6.3.4 Validity of RAILQUAL Model

6.3.4.1 Construct Validity:

Construct validity is the extent to which a set of measured variables actually reflects the latent construct they are designed to measure (Hair et al., 2005). Construct validity is established in this research by establishing the face validity, convergent validity and discriminant validity

6.3.4.2 Face validity

Face validity was established by adopting the measurement attributes used in the research from the existing literature and adopting the same to the present research context.

6.3.4.3 Convergent validity

Convergent validity was assessed by examining the factor loadings and average variance extracted of the constructs as suggested by Fornell and Lacker (1981). All the indicators had significant loadings on to the respective constructs (p = 0.001) and values varying from 0.538 to 0.951 . In addition convergent validity is assessed through measuring construct reliability (CR) and Average Variance Extracted (AVE) to check whether there is similarity between measures of theoretically related constructs (DeVellis, 1991). In addition, the average variance extracted (AVE) for each construct should be greater than or equal to 0.50, which further supports the convergent validity of the constructs. Construct reliability should be close or higher than 0.6 and it should be greater than AVE (Bagozzi and Yi, 1994; Fornell and Larcker, 1981).The derived AVE and CR are shown in Table 4.

Table 4 Convergent Validity of RAILQUAL

Constructs	Attributes	Standardised Estimate	Construct Reliability	AVE
Reservation ticketing	Convenience (x1)	.709	.939	.880
	Promptness(x2)	.951		
Platform Services	Provi infor (x3)	.800	.799	.737
	upkee repair (x4)	.783		
	clean station(x6)	.685		
	Connections(x18)	.682		
In train service	clean train(x23)	.762	.681	.756
	toilet facility(x24)	.678		
	journey comft(x29)	.742		
	Catering (x30)	.836		
Punctuality reliability	ontime depart(x8)	.760	.749	.807
	Speed(x9)	.778		
	accuracy (x10)	.884		
Employee service	attitude &help (x21)	.710	.662	.624
	request handling(x25)	.538		
safety security	secure journey(x33)	.690	.749	.767
	Safe journey(x34)	.764		
	luggage security(x36)	.846		

6.3.4.4 Discriminant Validity

Fornell and Lacker (1981) states that discriminant validity can be assessed by comparing the average variance extracted (AVE) with the corresponding inter-construct correlations estimates. Testing for discriminant validity checks whether two constructs differ. In this research AVE method was used. If the AVE of each construct is greater than its shared variance with any other construct, discriminant validity is supported. Shared variance is the amount of variance that a variable (construct) is able to explain in another variable (construct). It is represented between square of the correlation between any two variables (constructs) (Fornell and Larcker, 1981).

From the results of Table 5, it can be seen that the AVE values of all the service quality factors are greater than the inter construct correlations, which support the discriminant validity of the constructs.

Table 5 Discriminant Validity of RAILQUAL

Covariance		Estimate	Shared variance	AVE
rese	<--> secu	.105	.236	.880
rese	<--> emps	.296	.681	
rese	<--> pfser	.338	.741	.737
rese	<--> intrs	.229	.398	
rese	<--> punc	.261	.526	
secu	<--> emps	.220	.668	
secu	<--> pfser	.093	.267	.756
secu	<--> intrs	.300	.688	
secu	<--> punc	.061	.163	
emps	<--> pfser	.272	.806	,624
pfser	<--> intrs	.245	.549	
emps	<--> intrs	.436	1.027	.807
emps	<--> punc	.235	.642	
pfser	<--> punc	.282	.732	.767
intrs	<--> punc	.154	.317	

6.4 Research Finding Four Developing and testing RAILQUAL Structual Model:

6.4.1 RAILQUAL Structural model fit

This model incorporates all the hypothesised relationships to demonstrate a direct relationship between railway passenger service quality, railway passenger satisfaction and behaviour intention of the passengers. The impact of reservation ticketing, platform services, in train services, punctuality and reliability, employee service, safety and security on railway passenger service quality was tested in this model. The overall model is examined using Structural Equation Modelling.

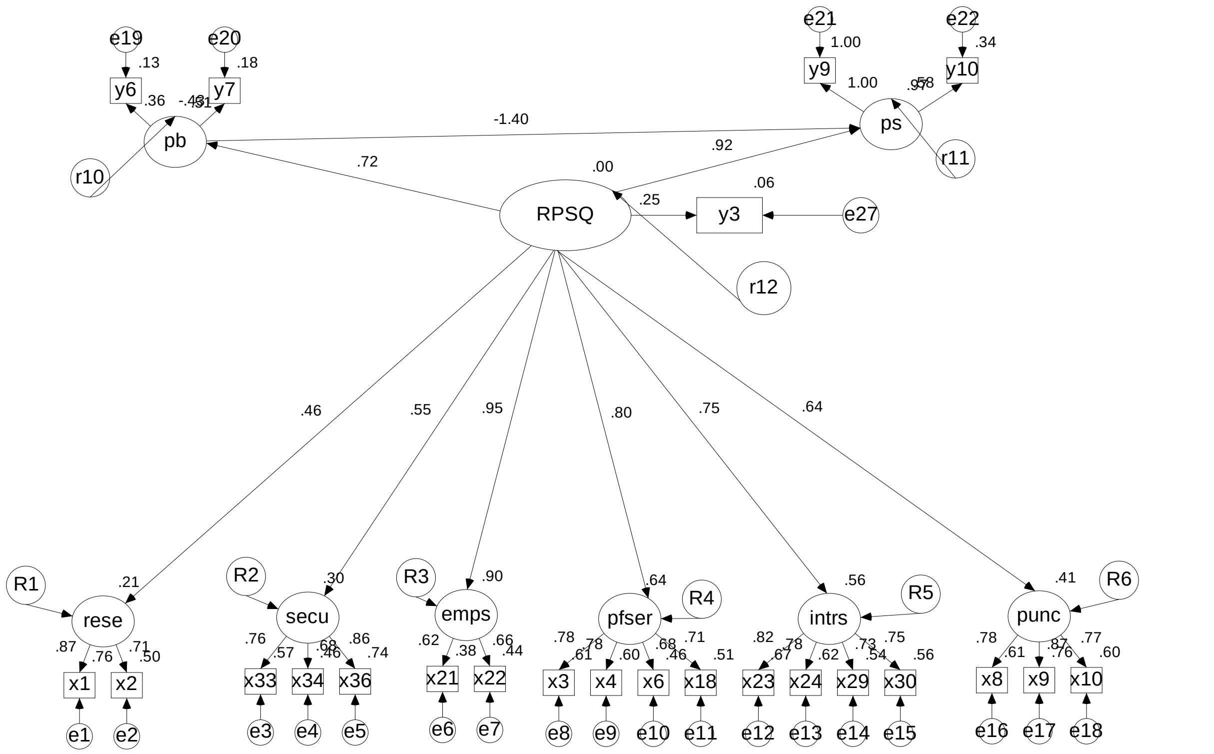

Figure 3 RAILQUAL final structural model

Table 6 Goodness of Fit of Full structural model

χ^2	DF	CMIN/df	GFI	AGFI	NFI	CFI	IFI	RMR	RESEA
1086.356	223	4.87	0.901	0.865	0.895	0.902	0.902	0.048	0.099

An examination of the hypothesised model indicates that the model has an acceptable fit as shown in table 6. The absolute fit indices of GFI (0.901) and RMR (0.048) are all within the recommended tolerances. The incremental or comparative fit indices also indicate an acceptable level of fit with the IFI (0.902) and CFI (0.902) being above the recommended value. The normed Chi-Square (4.87) is also within the broader recommended range. The fit indices reflects acceptable level of fit and all the indices are within recommended tolerances which indicates that the hypothesised model fits the data well with some fit indices indicating a good fit whilst others indicating an average fit with AGFI (0.865) and NFI (0.895). Basically, the structural model is considered to fit the sample data reasonably and can be accepted as a fitting model considering the complexity of the model and large sample size. More complex models with larger samples should not be held to the same strict standards and so when samples are large and the model contains a large number of measured variables and parameter estimates, cut off values of 0.90 on key GOF measures are unrealistic

(Byrne, 2001; Hair et al., 1998; Tabachnick and Fidell, 2001). The standardised regression weights in each pathway are provided in Table 7. The total effect of railway passenger service quality on passenger satisfaction is 0.916.

Table 7. Standardised Regression Weights for Path Relationships

Constuct Relationship	Standardised Regression Weight	Significance
H1 - Reservation and Ticketing have a significant effect on Railway passenger service quality	0.457	0.000
H2 - Platform services have a significant effect on Railway passenger service quality	0.800	0.000
H3 – In Train services have a significant effect on Railway passenger service quality	0.746	0.000
H4 – Punctuality have a significant effect on Railway passenger service quality	0.640	0.000
H5 - Employee services have a significant effect on Railway passenger service quality	0.951	0.000
H6- Safety and Security have a significant effect on Railway passenger service quality	0.546	0.041
H7 - Railway passenger service quality has a significant effect on passenger satisfaction	0.916	0.003
H8-Railway passenger satisfaction has a significant effect on behaviour intentions	-1.404	0.007
H9 – Railway passenger service quality has significant effect on passenger behaviour intentions	0.716	0.000

RPSQ – Railway Passenger Service Quality

6.4.2 Results of Hypothesis testing:

As per the results shown in table 7 ,Table 8 and Figure 3 only hypothesis H8 is rejected. All the remaining hypothesis are accepted.

Talble8: Results of Hypothesis Testing through RAILQUAL Structural Model

Hypothesis	Relationship	Un Stand Estimate	P value	Standardised path Estimate	Testing of Hypotheis
H1	Rese - RPSQ	1.000	< 0.001	0.457	Accepted
H2	Pf Ser- RPSQ	1.288	< 0.001	0.800	Accepted
H3	Intrain - RPSQ	1.951	< 0.001	0.746	Accepted
H4	Punc-RPSQ	1.822	< 0.001	0.640	Accepted
H5	emp ser -RPSQ	2.107	< 0.001	0.951	Accepted
H6	Safety-RPSQ	1.572	< 0.001	0.546	Accepted
H7	PassSat - RPSQ	2.954	< 0.007	0.916	Accepted
H8	PassSat -PassBeha	-3.240	<0.003	-1.404	Rejected
H9	PassBeha-RPSQ	1.000	< 0.006	0.716	Accepted

6.4.3 Testing RAILQUAL Model Replication and generalizability

To test the extent to which the RAILQUAL measurement model is stable across different demographic traits the findings were replicated with the same sample splitting into grouping varibles on the basis of demographies in an attempt to reduce error due to capitalization of chance (MacCallum, Roznowski and Necowitz 1992). For cross validation a total of seven spilts were were generated from the survey responses including travel class, gender, income group and travel frequency. The 18 item six dimension RAILQUAL model was estimated by CFA for all the sample splits. The results indicated a good fit for all the splits as shown in Table 9. All coefficient alphas surpased the 0.70 level among items within the individual scales. All loadings of the paths were significant.

Table 9: Fit Indices of various demographic profiles

Sample Split	Group	n	X^2	Df	GFI	AGFI	CFI	RMR	RMSEA
Travel Class	Lower Class	881	894.200	120	.903	.862	.906	.043	.086
	Upper Class	334	514.183	120	.855	.793	.875	.047	.099
Gender	Male	724	853.894	120	.888	.840	.895	.051	.092
	Female	491	546.619	120	.889	.842	.902	.040	.085
Travel Frequecy	Less Frequently	239	375.293	120	.859	.799	.888	.050	.095
	Frequently	641	712.314	120	.894	.849	.903	.045	.088
	Very frequently	242	372.334	120	.854	.792	.884	.051	.092

7.0 RESEARCH CONTRIBUTION

7.1. Contribution to Academic Theory (i.e., Service quality Management)

The research contributes to academic theory by developing the RAILQUAL model, which identified attributes and dimensions in Railway passenger service quality measurement and their impact on overall railway passenger quality and passenger satisfaction.

7.2. Contribution to Academic Practice

The research contributes methodologically to existing service quality measurement research. By testing and validating the RAILQUAL model with data from diversified samples through vigorous psychometric scale development procedures and methodologies in each phase, the study shows that the development of RAILQUAL instrument is robust across contexts.

7.3. Contribution to Transportation Industry Theory (i.e., Indian Railways)

The research is the first of its kind in Indian Railways which provides new understanding on railway passenger service quality.

7.4. Contribution to Transportation Industry Practice

This research conceptualized, constructed, refined and tested a multiple item instrument RAILQUAL to measure railway passenger service quality which is very useful in the present day competitive environment.

8.0 LIMITATIONS AND FUTURE SCOPE

This study was conducted on only one of the zones of the Indain Railways i.e., the South Central Railway. This research needs to be taken up on all the other zones of Indian Railways (i.e., 16 nos.) so that the model can be tested thorougly. Recent mathematical modelling techniques like Fuzzy Logic, Data Envelopment Analysis (DEA), Quality Function Deployment (QFD) and Neural Networks may be applied to this research to make it more robust and innovative.

9.0 CONCLUSION

The various dimensions of service quality identified in this research should be viewed as levers of improving railway passenger service quality in the minds of passengers. However the degree of emphasis placed on these dimensions depends on the objective of the Raiwlays. Apart from quantitative findings discussed above through qualitative study, the following observations were made during data collection and instrument development stage. From the data collected it was evident there was a definite and clear distinction between the perceptions of upper class and lower class passengers. The lower class travellers were mostly of the opinion that the Indian Railways passenger services offers the cheapest and most convenient mode of transport and there is no alternative to substitute it – in a sense where they felt they belonged. They did not want something that was out of the ordinary as they, implicitly, saw themselves as normal people and did not want any luxury except the trains maintaining punctuality and availability of tickets on demand. In contrast, the upper class passengers expected that train services were exclusive that treats them special like having good catering facilities, personal attention from staff throughout journey, some form of entertainment to make journey interesting and thus by implication were looking for something out of the ordinary. Finally the researcher feels that the Indian Railways is first and foremost a service and it ought to function like any other service sector facility was lost on them. The Railway administration feels that the passenger is pleased with if a few new trains are announced at regular intervals and fares are kept low. But there must be at least be basic facilities at stations and trains, A public utility like the Railways has to be judged not merely on the bottom line, but on the quality of service it provides. The unfortunate part is even when the Railways have claimed operational profits, its record on passenger amenities was nothing to crow about. The Railways has to revolve around the passenger. The passenger must be seen as consumer with privileges and not as a captive user with limited choices.

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2. Devi Prasad, M and Raja Shekhar, B. (2011). "The Effects of Individual Dimensions of Railway Service Quality: Finding from Indian Railway Passenger Services through developing RAILQUAL", *International Journal of Innovation, Management and Technology*, *In press*[#]

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