CRM Implementation in Indian Telecom Industry – Evaluating the Effectiveness of Mobile Service Providers Using Data Envelopment Analysis

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Abstract

With the liberalization and internationalization in telecommunication, service quality has become an important means of differentiation and path to achieve business success. Faced with a growing market and increasing competition, companies in the telecom business are adopting to new technological imperatives in order to outperform their competitors. These companies adapt continuously to the dynamic environment so as to survive competition. The emphasis here lies in identifying critical value adding processes and redesigning them to become customer centric. One such approach in the adoption of an IT to move towards customers is the Customer Relationship Management (CRM). The Indian Mobile Service Providers are using CRM extensively to identify the needs of the customers and stretching out ways and means to satisfy them. In this context, it is absolutely essential to study the effectiveness of the CRM being practiced by the mobile service providers. This study specifically analyses the extent to which CRM is being practiced by the mobile service providers, and identifies the effect of the service quality of the mobile service providers on the Customer Loyalty. As CRM focuses on being customer centric, it becomes essential to measure the effectiveness of CRM in terms of the degree to which the customers are advocates of the mobile service provider as well as to measure the degree to which they participate in the cross selling and up selling of the various products and services of the provider. To evaluate the effectiveness, there are lots of quantitative techniques available and some work in this area has already been done. But there is a dearth of literature focusing on the relative efficiency. One advanced operations research technique which evaluates the relative efficiency is the Frontier Analysis or Data Envelopment Analysis (DEA).

This paper attempts to use Data Envelopment Analysis to assess the effectiveness of Mobile Service Providers, specifically a set of the providers offering services in Chennai, Tamil Nadu, India. The research has identified a set of input and output parameters for each Service Provider, from which the efficient frontiers (DMUs) are determined. The relative efficiency of the Service Providers are measured with respect to the efficient frontier and then analyzed. Detailed recommendations are set forth, for appropriate interventions to address the specific gaps identified through the gaps analysis. The analysis further provides useful information and opens up new avenues for future research.

Keywords: Data Envelopment Analysis, Effectiveness, CRM, Loyalty, Relative Efficiency, Frontier Analysis, DMU

1. INTRODUCTION

The telecom industry in India has witnessed a transformation from a monolithic regime, through an age of de-regulation and privatization; it has seen the rapid rise of market players who offer innovative products and services. This change has been commensurate with the growth of the industry, now ranked the fifth largest in the world and soon expected to be second largest. Faced with a growing market and increasing competition, companies in the telecom business are adopting to new technological imperatives in order to outperform their competitors. These companies adapt continuously to the dynamic environment so as to survive competition. The emphasis here lies in identifying critical value adding processes and redesigning them to become customer centric. IT is being adopted to redefine the customer service parameters and for retaining customers. The ultimate objective of technology consists in its applicability in targeting to right customers and catering efficiently to their needs. One such practice which is being followed by the telecom companies is the Customer Relationship Management (CRM) to help them compete in the ever changing environment..

CRM signifies identifying the needs of the customers and stretching out ways and means to satisfy them. In this perspective CRM cannot be treated merely as a technology; it also has implications in the strategy formulation for companies. It focuses on the customers looking for value in all their transactions and is willing to pay for that value. In a way technology has brought the customers closer to the marketer. Knowledge about markets, segments and product usage can be made easily available to the organizations. Many companies thrive on this knowledge as it enables them to design the right kind of marketing and promotional strategies to capture the attention of the customers. Even capturing the attention of the customer has become challenging as media proliferation has led to increase in competition. A better equipped customer with knowledge about various alternatives available in the market is difficult to be convinced. Companies have to be alert in their approach to understand the customer's definition of 'value' and accordingly position themselves on quality, service, performance, and efficiency perspective. It becomes imperative to create value for their customers; a value that is able to bind them to the company and stop them from switching to another company's product. Advertising and promotions can be instrumental in influencing the purchase decision concerning the product launched in the market; but if the company has built a long-term relationship with its customers, advertising and promotion can become more effective in delivering returns. Reducing costs, aggressive promotion and advertising necessarily did not bring revenues and loyal customers. The whole idea is to develop business models that would enhance the quality and improve interaction with their customers leading to more satisfied and loyal customers.

In the light of this context, this paper attempts to study the CRM practices that are being followed extensively by Mobile Service Providers and to assess the effectiveness of CRM on Customer Loyalty using Data Envelopment Analysis (DEA). Though the telecom service providers use CRM comprehensively, the key performance indicator of CRM practices on their services per se is the service quality. Service quality is considered to be an important means of differentiation and path to achieve business success. Since CRM focuses on being customer centric, this study identifies and uses one main outcome of customer orientation, viz., Customer Loyalty, measured in the form of indices. In this paper, customer loyalty is identified in two indices namely, Advocacy Loyalty Index and Purchase Loyalty Index. The paper uses the mathematical technique called Data Envelopment Analysis (DEA) to assess the effectiveness of the CRM practices by Mobile Service Providers, specifically a set of GSM mobile service providers in Chennai, India. The extended SERVQUAL parameters defined by Seth et al are identified to be the input parameters for DEA and using regression we analyze which of these parameters are predictors of the Customer Loyalty which form the output parameters for DEA. From the identified input parameters of SERVQUAL and output parameters of Loyalty, efficient frontiers (DMUs) are determined. The relative effectiveness of the usage of CRM practices by the service providers are measured with respect to the efficient frontier and then analyzed. Detailed recommendations are set forth, for appropriate interventions to address the specific gaps identified through the gaps analysis. The analysis further provides useful information and opens up new avenues for future research.

2. LITERATURE REVIEW

The Indian Telecom Industry with an overall teledensity of 72.09 in April 2011 and the mobile segment teledensity of 69.19, finds it difficult to build sustainable and successful relationships with a large customer base. It is not easy to accomplish and has a direct impact on many core operational processes. It is about the interactions of the entire business with customers. Customer Relationship Management (CRM) is about creating a competitive advantage by being the best at understanding, communicating, delivering service and developing existing customer relationships in addition to creating and keeping new customers.

A good CRM strategy will take the business vision and apply it to the customer base by asking the following questions:
· What products and services are we offering now and will in the future?
· In what markets?
· What customer groups will these products and services appeal to?
· Which of these are of most value to the organization?
· What additional needs do the most valuable customer groups have?
· In what different ways can we be managing our business to deliver better to customers?

Customer Relationship Management (CRM) is rapidly becoming an integral part of many organizations. The concept itself is relatively simple. Rather than market to a mass of people or firms, market to each customer individually. In this one-to-one approach, information about a customer (e.g., previous purchases, needs, and wants) is used to frame offers that are more likely to be accepted. This approach is made possible by advances in information technology.

CRM thus requires organizational and business level approaches – which are customer centric – to doing business rather than a simple marketing strategy. CRM involves all of the corporate functions (marketing, manufacturing, customer services, field sales, and field service) required to contact customers directly or indirectly. The term "touch points" is used in CRM to refer to the many ways in which customers and firms interact.

Most notable among these are the beliefs that existing customers are more profitable because the acquiring and attracting of new customers is expensive, and that it is less costly to up- sell or cross-sell products or services to current customers (Berry, 1995; Peppard, 2000; Sheth and Paravatiyar, 1995). One of the most important studies conducted in this field is by Reichheld and Sasser (1990), which showed the large impact on profitability of small increases in customer retention rates, which made the marketing community more conscious of the need to manage customer relationships in the long term as well as prior to the first sale. In addition, more studies have shown that the cost of retaining current customers is lower than the cost of acquiring new ones (Blattberg and Deighton 1996, Filiatrault and Lapierre 1997) and that economic benefits of high loyalty are important, and in many industries it is this which determines the differences between companies (Reichheld 1996).

The objective of customer relationship management is to unite and join information technology and business processes in a fashion that enables the firm to acquire new customers, to retain existing customers, and maximize the lifetime value of its customers (Peppard, 2000). Most importantly, CRM allows firms to differentiate customer treatments based on specific customer needs and preferences. Additionally, financial metrics that are centered on customers allow firms to segregate those customers that the firm should be keeping from those it should be willing to lose (Dyche, 2001), enabling micro-management of profitability.

An analysis of the above different definitions shows, they all have common concepts of: customer focus (customer satisfaction, loyalty and retention), technology, knowledge management, change management and leadership. According to Newell (2000) there are often three distinct types of relationship customers: the top, middle and lower groups. The top group (top 10 %) consists of customers with excellent loyalty and high profitability for the organization. CRM is needed to retain and offer them the best possible services in order to avoid them defecting to hungry

competitors. Middle group customers (next 40% to 50%) are ones delivering good profits and who show good potential for future growth and loyalty. These are the customers who are probably giving some of their business to competitors. The idea is to use CRM to target middle group customers effectively as they are the greatest source of potential growth. Lower group relational (bottom 40 to 50 %) customers are those who are only marginally profitable. Some may have potential for growth but the expense and effort involved in targeting such numbers, hinders the effectiveness of servicing existing relational customers in the top and middle groups.

Some of these benefits can be measured and others cannot. CRM is composed of four continuous processes, and each process provides distinctive benefits to the organization. To obtain all of these benefits, sales, marketing, and service functions need to work together.

Benefits of CRM project
Identification
Source of benefits -Clean data about customer, Single Customer View
Benefits - Help sales force, Cross selling

Differentiation
Source of benefits -Understand customer
Benefits - Cost effective marketing campaign, Reduce direct mailing cost

Interaction
Source of benefits -Customer satisfaction and loyalty
Benefits -Cost effective customer service

Customization
Source of benefits -Customer satisfaction and loyalty
Benefits - Lower cost of acquisition and retention of customer, Maximize share of wallet

In India, rapid diffusion of telecom, at least in the urban areas, has been progressing, thanks to the hyper-competitive telecom markets with the post-liberalization entry of several Indian and global players. In such a competitive milieu, survival and success of the Indian players will depend on competitiveness. For service providers, the pursuit of service quality is essential for competitiveness and is gaining momentum. As a result, service quality has become an important means of differentiation and is critical for achieving corporate success. The proven positive relationship of service quality with customer satisfaction (Danaher and Mattsson, 1994; Leisen and Vance, 2001), customer loyalty and retention (Ranaweera and Neely, 2003), profitability (Thompson, DeSouza and Gale, 1985; Bloemer, Ruyter and Wetzels, 1999) and competitive advantage (Hampton, 1993) provides a base to explore the subject in the mobile context.

Previous studies in this area primarily focused on functional quality aspects (i.e., pertaining to service delivery process or how the services are delivered) and inadequately addressed technical quality aspects (i.e., issues concerning what is actually delivered). However, researchers in mobile communication (Wang and Lo, 2002; Johnson and Sirikit, 2002) have emphasized that technical quality attributes play an important role in forming service quality perceptions of customers. In light of this, this extended SERQUAL (Seth et al, 2008) instrument determines service quality structure by combining both functional as well as technical quality (i.e., network quality in cellular mobile context) attributes.

Service business success has been associated with the ability to deliver superior service (Gale, 1990; Rudie & Wansley, 1984). Delivering superior service by maintaining high quality is a prerequisite for success (Parasuraman et al., 1988). Leading service organizations strive to maintain a superior quality of service in an effort to gain customer loyalty (Zeithaml & Bitner, 1996); thus, a service organization's long-term success in a market is essentially determined by its ability to expand and maintain a large and loyal customer base. Moreover, the yardstick by which an exceptional service organization may be measured is its retaining customer ratio: the

loyal customer base. Evaluating the impact of service quality through customer retention will help companies to gauge financial impact of service quality (Zeithaml et al., 1996).

While service organizations aim to gain customers' loyalty, customers, on the other hand, seek an organization's service loyalty (the assurance of a consistent and superior quality of service) as proof of the organization's commitment to offering superior service, for both the present and the long term. Berry (1987) proposed the idea of earning loyalty by being loyal.

Numerous studies have been conducted in an attempt to determine the essential nature and development of loyalty, i.e. how organizations can create and enhance customer loyalty through products and services. Recognizing its importance, previous researchers examined the many facets of loyalty: brand loyalty (Bloom, 1981; Carman, 1970; Cooper & Inoue, 1996; Cunningham, 1967; Day, 1969; Frank, 1967; Jacoby, 1971; Olson & Jacoby, 1971; Zeithaml, 1981); store loyalty (Langrehr & Rinne, 1987; Samli & Sirgy, 1981); customer loyalty (Fredericks & Salter, 1995; Lowenstein, 1993; Maruca & Halliday, 1993; O'Brien & Jones, 1995; Ostrowski et al., 1993; Reichheld, 1993); repeat business (Collis, 1990; Crowford, 1993; Lynch, 1995; Sellers, 1989; Wiersema & Thompson, 1991).

Research addressing loyalty within the context of the service industry has traditionally focused on the means by which loyalty may be acquired. Snyder (1986) studied how customers' loyalty to a service organization may be measured accurately. Czepiel and Gilmore (1987) proposed a model showing the development of customer loyalty in services. Gremler and Brown (1996) argued that the loyalty of the service customer is a multi-dimensional construct, comprising three dimensions: behavioural loyalty, attitudinal loyalty and cognitive loyalty.

The challenge for today's organizations is not merely to reach the top, but to stay there. If that is an organization's aim, its primary focus should be not merely to attract customers, but to obtain their loyalty and, thus, their patronage, not only for the present, but also for the long term. This loyalty, however, is the end result of an on-going, long-term relationship. Such relationships are founded on an organization's ability to maintain and extend its relationships with customers (Gummesson, 1994).

(Bob E. Hayes,2007) identifies key drivers of loyalty for service providers and introduces new customer loyalty metrics designed to help companies increase revenue through new and existing customers:.
1. Advocacy Loyalty Index (ALI): Will your customers recommend your products and services to their friends?
2. Purchasing Loyalty Index (PLI): Will your customers purchase different products and/or increase the amount they purchase from you?
These two are the indices which go in with the CRM practices, as CRM practice should result in the customers being satisfied and loyal which can be measured with the extent to which they are advocates of the service provider and they also participate in the up-selling and cross-selling with respect to their purchase intention.

DEA is a mathematical programming technique with a number of practical applications for measuring the performance of a set of similar units. In principle, DEA is concerned with a number of alternative decision making units (DMU). Each of them is analyzed separately via a mathematical programming model which checks whether the DMU under consideration could improve its performance by decreasing its input and increasing its output. The improvement is pursued until the boundary of the convex hull of the other DMUs is reached. A DMU which cannot improve its performance is efficient or non-dominated. Otherwise, it is dominated by a convex combination of other DMUs. Thus, possible improvements for a particular DMU are indicated, not in an arbitrary direction, but on the basis of the performance of the more successful and efficient DMUs.

Identification of inputs and outputs in a service sector is really a challenging task as they are not well defined. In this context, Mahapatra and Khan (2007) have suggested a methodology to find out the factors responsible for quality improvement in education sector via neural network approach. Elangovan et al. (2007) have used an Executive Support System (ESS) approach for improving the quality and productivity in maintenance engineering model. However, DEA approach enables the management to frame right kind of policy for improvement of quality through identification of inefficiencies in certain dimensions in an organisation, both in manufacturing and service industries (Anatiliy, 2007; Parkan, 2006). Pacheco and Fernandes (2003) analysed efficiency of 35 Brazilian domestic airports using DEA and suggested the best quality implementation strategy. Lin et al. (2005) determined the efficiency for a shipping industry using financial indicators through DEA so that Quality Improvement Programme (QIP) can be implemented. Recent studies reveal that DEA has been successfully applied to education sector but each study differs in its scope, meaning and definition.

In one such study, the policy for Italian universities has been derived based on computation of Technical Efficiency (TE) using DEA with various input and output specifications (Agasisti and Bianco, 2006). A comparative study on efficiency of private universities and public universities in the USA using DEA has been carried out by Rhodes and Southwick (1986) considering each individual university as a DMU. Tomkins and Green (1988) have used DEA to test the performance of individual departments of a university considering both teaching and research activities and compared the results with the ranking obtained by means of elemental analysis of staff/student ratio. McMillen (1997) applied DEA in order to assess the relative desirability of Association to Advance Collegiate Schools of Business (AACSB) accredited MBA programmes . McMillan and Datta (1998) used DEA to assess the relative efficiency of 45 Canadian universities and found that a subset of universities comprising of three categories such as comprehensive with medical school, comprehensive without medical school and primarily undergraduate universities are regularly found to be efficient. In an attempt to compare the performance of selected schools in the Netherlands, Ramanathan (2001) studied the effect of several non-discretionary input variables which are not under direct control of management on efficiency scores. Calhoun (2003) employed DEA to compare relative efficiencies of private and public Institutions of Higher Learning (IHL) using a sample of 1323 four-year old institutions and introduced a new way for clustering institutions based on revenue management.

 Data envelopment analysis (DEA), occasionally called frontier analysis, was first put forward by Charnes, Cooper and Rhodes in 1978. It is a performance measurement technique which, can be used for evaluating the relative efficiency of decision-making units (DMU's) in organisations. Examples of such units to which DEA has been applied are: banks, police stations, hospitals, tax offices, prisons, defence bases (army, navy, air force), schools and university departments. One advantage of DEA is that it can be applied to non-profit making organizations. Since the technique was first proposed much theoretical and empirical work has been done. Many studies have been published dealing with applying DEA in real-world situations. Obviously there are many more unpublished studies, e.g. done internally by companies or by external consultants. Though DEA is being used by many Service Organizations, there is no such study using DEA to assess the effectiveness of a leading-edge technology like CRM being used by the telecom operators on the Customer Loyalty.

3. RESEARCH METHODOLOGY
The questionnaires including covering letter, were personally distributed to customers of mobile services, during Apr-Jun, 2011. Convenience sampling method was used to collect the data from customers. Further, the data was specifically collected from residential mobile customers, who had been using the services for at least six months. Finally, of the 550 surveys individually administered, 523 questionnaires were received at a response rate of 95 per cent. On further filtering, 490 responses were found to be completely filled which results in the response rate of 89%. The high rate of responsiveness is the result of the constant follow ups and reminders sent to the respondents considering the higher level of subscribers in the mobile segment. The demographic characteristics of the customers are summarized in Table 1. Most of the

respondents (about 60%) were pre-paid, while rest (40%) of the respondents accounted for post-paid services. Respondents in the age group 21-30 yrs (32%), 31-40 yrs (26%) and 41-50 yrs (21%) were the major contributors.

Age

No.	Name	Frequency	%
1	18-20	51	10.4
2	21-30	157	32
3	31-40	160	26.5
4	41-50	103	21
5	>50	49	10

Monthly Expenditure

No.	Name	Frequency	%
1	upto 500	314	64.1
2	501-1000	124	25.3
3	1001-2000	34	6.9
4	>2000	18	3.7

Education

No.	Name	Frequency	%
1	Grad	100	20.4
2	UG	131	26.7
3	PG	189	38.6
4	Others	70	14.3

Occupation

No.	Name	Frequency	%
1	Business	64	13.1
2	Professionals	129	26.3
3	Educator	28	5.7
4	Home Maker	62	12.7
5	Student	161	32.9
6	Others	46	9.4

Table1: Demographic Characteristics of Respondents

4. ANALYSIS AND RESULTS

Data collected was analysed through a series of validated tools and procedures. The reliability of items was assessed by computing the coefficient alpha (Cronbach, 1951), that measures the internal consistency of the items. For a measure to be acceptable, coefficient alpha should be above 0.7 (Nunnally, 1978). Owing to multidimensionality of service quality construct, coefficient alpha was computed separately for all the dimensions identified. In the present study, all alpha coefficients ranged from 0.687 (close to the cut-off value of 0.70) to 0.9 indicating good consistency among the items within each dimension. The results are shown in Table 2.

SERVQUAL Parameters

No.	Parameter	No.of Items	Apha
1	Reliability	5	0.846
2	Responsiveness	4	0.863
3	Assurance	4	0.802
4	Empathy	5	0.816
5	Tangibles	3	0.775
6	Convenience	4	0.778
7	CupenQlty	5	0.781

Loyalty Parameters

No.	Parameter	No.of Items	Apha
1	Advocacy	4	0.908
2	Purchase	3	0.687

TABLE 2: Reliability Scores (Cronbach's Alpha)

Factor Analysis
Before proceeding for the factor analysis, appropriateness of factor analysis needs to be assessed. This can be done by examining sampling adequacy through Kaiser- Meyer-Olkin (KMO) statistic. Table 3 provides the SPSS output of data for factor analysis. KMO value greater than 0.6 can be considered as adequate. (Kaiser and Rice, 1974).

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.876
Bartlett's Test of Sphericity	Approx. Chi-Square	7404.626
	Df	406
	Sig.	.000

TABLE 3: KMO and Bartlett's Test

From the Table, it can be seen that KMO value is acceptable; Bratlett test results also show that the values are significant and thus acceptable. The items in the respective category were individually subjected to PCA with varimax rotation and Kaiser Normalization

The items having factor loadings less than 0.5 were eliminated (Hair et al., 2005). Finally, seven factors comprising twenty-eight items, all having eigen values of unity and above were extracted and the results are shown in Table 4. Further, in order to assess the appropriateness of the data for factor analysis, the communalities derived from the factor analysis were reviewed. These were all relatively large (greater than 0.5), suggesting that the data set is appropriate (Stewart, 1981). The individual dimensions of the proposed instrument explained total variance exceeding 60 per cent, suggesting the appropriateness of the process.

	Component						
	Reliability	Responsiveness	N/w Qlty	Assurance	Convenience	Empathy	Tangibles
	1	2	3	4	5	6	7
Rel4	.835						
Rel5	.758						
Rel2	.677						
Rel1	.643						
Rel3	.639						
Resp3		.764					
Resp1		.749					
Resp4		.729					
Resp2		.696					
cupeneqlty3			.790				
cupeneqlty4			.752				
cupeneqlty1			.652				
cupeneqlty5			.642				
cupeneqlty2			.614				
Assu4				.767			
Assu1				.718			
Assu3				.679			
Assu2				.645			
Conv1					.779		
Conv3					.779		
Conv2					.637		
Conv4					.587		
Emp2						.657	
Emp4						.557	
Emp1						.544	
Emp3						.522	
Tang3							.759
Tang1							.729
Tang2							.727

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 7 iterations.

TABLE 4: Factor Extraction Results of Service Quality Measurement Items

According to Ahire, Golhar and Waller, (1996), confirmatory factor analysis (CFA) provides enhanced control for assessing unidimensionality (i.e., the extent to which items on a factor measure one single construct) than exploratory factor analysis (EFA) and is more in line with the overall process of construct validation. In this study, confirmatory factor analysis model is run through SPSS Amos 19 and the key model statistics are shown in Table 5.

FACTORS	COMPARATIVE FIT INDEX (CFI)	GOODNESS OF FIT INDEX (GFI)
Reliability	.971	.972
Responsiveness	.991	.99
Assurance	.973	.982
Empathy	.935	.951
Tangibles	.925	.931
Convenience	.966	.981
Customer Perceived N/w Quality	.956	.973

TABLE5: Unidimensonality for the Seven Dimensions

The same process of Factor Analysis is repeated for the Loyalty Indices. The results are found from Table 6 through 8

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.820
Bartlett's Test of Sphericity	Approx. Chi-Square	1517.395
	Df	15
	Sig.	.000

TABLE 6: Loyalty Indices -KMO and Bartlett's Test

	Component	
	Advocacy	Purchase
	1	2
Loyltyindex2	.917	
Loyltyindex3	.915	
Loyltyindex4	.866	
Loyltyindex1	.818	
Loyltyindex5		.846
Loyltyindex6		.704

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 3 iterations.
TABLE 7: Factor Extraction Results of Loyalty Indices Measurement Items

FACTORS	COMPARATIVE FIT INDEX (CFI)	GOODNESS OF FIT INDEX (GFI)
Advocacy Loyalty Index	.995	.991
Purchase Loyalty index	.971	.977

TABLE 8 : Unidimensonality for the Two Loyalty Indices

To analyse the effectives of CRM on Loyalty, the first step is to perform a Multiple Regression Analysis of Service Quality Parameters Advocacy Loyalty Index and Purchase Loyalty Index as the dependent variables. From the Regression analysis we determine the predictors of Advocacy and Purchase Loyalty.

The results of the Regression Analysis are given below in equations

Advocacy Loyalty Index (ALI) = 3.568 + 0.256 Reliability + 0.327 Responsiveness + 0.279
Customer Perceived Network Quality + 0.19 Assurance
+ 0.241 Empathy
Purchase Loyalty Index (PLI) = 3.261 + 0.150 Reliability + (-0.124) Customer Perceived Network
Quality + 0.122 Assurance + 0.212 Convenience
+ 0.103 Empathy

5. ASSESSING THE EFFECTIVENESS OF CRM USING DATA ENVELOPMENT ANALYSIS

The predictors from the regression analysis are used as input parameters and the two loyalty indices are used as output parameters for the study. The mean values of the service quality parameters are taken as input for each of the Service Providers. Data pertaining to 7 Service providers are used for the study.

Mobile Service Provider	Reliability	Responsiveness	Empathy	Assurance	Network Qlty	Advocacy
SP1	3.48	.41	3.19	3.56	3.52	3.44
SP2	3.65	3.49	3.29	3.14	3.56	3.67
SP3	3.53	3.35	3.19	3.54	3.53	3.51
SP4	3.47	3.47	3.34	3.75	3.49	3.55
SP5	3.59	3.64	3.45	3.84	3.49	3.57
SP6	3.55	3.58	3.25	3.66	3.65	3.72
SP7	3.63	3.64	3.53	3.73	3.48	3.45

TABLE 9: Mobile Service Providers Details with Input and Output Parameters – Advocacy

For example, for the Service Provider SP3, the Reliability averages to 3.53, Responsiveness averages to 3.35, Empathy averages to 3.19, Assurance averages to 3.54, Customer Perceived Network Quality averages to 3.53 and the output parameter Advocacy averages to 3.51.

To compare these service providers and measure their performance a commonly used method is ratios which takes output measure and divides it by the corresponding input measure. In this case, we analyze the effectiveness of providers by taking inputs and converting them (with varying degrees of efficiency) into outputs. Since we have only one output parameter namely, Advocacy and 5 input parameters it is not advisable to perform such ratio as it would give a skewed result.

One problem with comparison using ratios is that different ratios can give a different picture and it is difficult to combine the entire set of ratios into a single numeric judgment. To combine these figures into a single judgment is very difficult. This problem of different ratios giving different pictures would be especially true if there is an increase in the number of service providers (and/or increase the number of input/output measures). Thus it is very difficult to interpret the values corresponding to service provider S5 from these ratios. This is where it is essential to get into a better technique called Data Envelopment Analysis which interprets the ratios and provides the efficient frontier.

It is important to note that DEA can only give relative efficiencies - efficiencies relative to the data considered. It does not, and cannot give absolute efficiencies. In words, DEA while evaluating any number of Decision making units (DMU's), and with any number of inputs and outputs requires the inputs and outputs for each DMU to be specified. It defines efficiency for each DMU as a weighted sum of outputs [total output] divided by a weighted sum of inputs [total input]; where all efficiencies are restricted to lie between zero and one (i.e. between 0% and 100%). It uses the numerical value for calculating the efficiency of a particular DMU. Weights are chosen to maximise its efficiency, thereby presenting the DMU in the best possible light.

Thus DEA provides the details of the best performing DMU which is usually 100% efficient. The other DMUs are not performing upto this efficient frontier. The Table 10 gives the DEA Solver Oputpt for the Effect on Advocacy.

Mobile Service Provider	Reliability	Responsiveness	Empathy	Assurance	Network Qlty	Advocacy	Weighted O/p	Weighted I/p	Efficiency	Working
SP1	3.48	3.41	3.19	3.56	3.52	3.44	0.96	1.00	0.96	-0.04
SP2	3.65	3.49	3.29	3.14	3.56	3.67	1.03	1.03	1.00	0.00
SP3	3.53	3.35	3.19	3.54	3.53	3.51	0.98	0.99	0.99	-0.01
SP4	3.47	3.47	3.34	3.75	3.49	3.55	0.99	1.03	0.97	-0.03
SP5	3.59	3.64	3.45	3.84	3.49	3.57	1.00	1.07	0.93	-0.07
SP6	3.55	3.58	3.25	3.66	3.65	3.72	1.04	1.04	1.00	0.00
SP7	3.63	3.64	3.53	3.73	3.48	3.45	0.96	1.08	0.89	-0.12
Weight	0.00000	0.199739	0.099966	0.000000	0.000000	0.279557				

TABLE 10: Effectiveness of the Service providers on Advocacy Loyalty using DEA

From the analysis using DEA, it can be seen that SP2 and SP6 are the two mobile service providers who are on the efficient frontier as the efficiency is 1.00. The other service providers SP1, SP3, SP4 and SP7 are less performing. For instance, SP7 is only 89% efficient when compared to SP2 and SP6. That means, given the current scenario, SP7 needs to improve by 11% to reach the efficient provider.

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The Service Providers SP2 and SP6 are 100% efficient. For the other service providers to improve their performance they need to analyse the input and out parameters of the efficient frontiers. Thus, for instance let us consider the Service Provider SP5. Their current levels of efficiency with respect to the service quality parameters as inputs are only 93%. They need to improve by 7% to reach the efficient frontier. For improving their performance, the service provider SP5 needs to look into how their service quality parameters influence the advocacy loyalty index. They also could analyze the predictors of Advocacy loyalty of the efficient frontier, i.e., SP2 or SP6.

For instance from the data set, the regression equation for SP5 is as given below:

Advocacy Loyalty Index (ALI) = 0.395 + 0.615 Customer Perceived Network Quality

To compare, let us consider the regression equation of SP2 and SP6.

For SP2,

Advocacy Loyalty Index (ALI) = 1.402 + 0.255 Responsiveness + 0.224 Assurance + 0.258 Empathy + (-0.344) Tangibles + 0.259 Customer Perceived Network Quality

For SP6,
Advocacy Loyalty Index (ALI) = 0.970 + 0.334 Reliability + 0.260 Assurance + (-0.259) Tangibles.

From the above regression equations, SP7 could consider either the predictors of SP2 or SP6 in order to improve its efficiency.

Similarly, the same procedure is repeated for Purchase loyalty. The regression equation for the same is as given below:

Mobile Service Provider	Reliability	Assurance	Convenience	Network Qlty	Empathy	Purchase
SP1	3.48	3.56	3.35	3.52	3.19	3.3
SP2	3.65	3.14	3.47	3.56	3.29	3.29
SP3	3.53	3.54	3.4	3.53	3.19	3.21
SP4	3.47	3.75	3.51	3.49	3.34	3.27
SP5	3.59	3.84	3.49	3.49	3.45	3.24
SP6	3.55	3.66	3.45	3.65	3.25	3.22
SP7	3.63	3.73	3.51	3.48	3.53	3.26

TABLE 11: Mobile Service Providers Details with Input and Output Parameters – Purchase

The Solver Screenshot to determine the effectiveness of CRM on Purchase Loyalty Index is given below:

Mobile Service Provider	Reliability	Assurance	Convenience	Network Qlty	Empathy	Purchase	Weighted O/p	Weighted I/p	Efficiency	Working
SP1	3.48	3.56	3.35	3.52	3.19	3.3	1.00	1.00	1.00	0.00
SP2	3.65	3.14	3.47	3.56	3.29	3.29	1.00	1.02	0.98	-0.02
SP3	3.53	3.54	3.4	3.53	3.19	3.21	0.97	0.97	1.00	0.00
SP4	3.47	3.75	3.51	3.49	3.34	3.27	0.99	1.00	0.99	-0.01
SP5	3.59	3.84	3.49	3.49	3.45	3.24	0.98	0.98	1.00	0.00
SP6	3.55	3.66	3.45	3.65	3.25	3.22	0.98	0.98	1.00	0.00
SP7	3.63	3.73	3.51	3.48	3.53	3.26	0.99	1.00	0.99	-0.01
Weight	-0.06985	-0.05545	0.04346	0.02101	0.06925	0.30303				

TABLE 12: Effectiveness of the Service providers on Purchase Loyalty using DEA

From the analysis for purchase loyalty using DEA, it can be seen that SP1, SP3,SP5 and SP6 are the mobile service providers who are on the efficient frontier as the efficiency is 1.00. The other service providers SP2, SP4 and SP7 are less performing. Thus the same insight could be extended to the purchase loyalty index too.

As compared to the previous research work using Data Envelopment Analysis, this paper is an attempt to contribute its findings to the most competitive industry, i.e the telecom industry. The application of DEA is used only in the last stage to evaluate the effectiveness of CRM adopted by

the telecom industry in India. This study attempts to links many facets of business viz., CRM approach which is adopted by the telecom industry; comparison of its effectiveness using a Quantitative approach like Data Envelopment Analysis. The output of this simulated model provides an insight to the industry practitioners an effective method of evaluating a technology which is being adopted by them. Though this study concentrates only on 7 service providers in Chennai, it can further be extended with more parameters so that a holistic picture on the actual happenings and the scope of improvement of each players in different areas can be further improved.

6. CONCLUSION

This paper set out as a contribution to current practices of CRM by the mobile service providers for assessing the effectiveness on Customer Loyalty. Data pertaining to 7 Service Providers were collected from a sample of 490 mobile users in Chennai, Tamil Nadu, and India to analyze the effectiveness of CRM practices using Data Envelopment Analysis (DEA) /Frontier analysis. The efficient frontiers were identified and the relative efficiency of the other service providers were established using DEA which formulates the situation as a Linear Programming Problem and was solved using Excel Solver. This research was an attempt to analyze the effectiveness of an IT i.e. CRM technology, being extensively used for a specific purpose of moving closer to the customer. The study analyzed the effectiveness of CRM on two Loyalty Indices which relate to the concept of Word of Mouth, Cross-selling and Up-selling. As this research is confined only to two models, namely a model for Advocacy Loyalty and Purchase Loyalty, it cannot be generalized unless it is extended to more concepts on Loyalty. This study provides scope for further research using multiple input and output measures to assess the effectiveness of various IT tools in other service sector and other industrial sectors.

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