
Selection of Best Mobile Service Provider Company Using Multi Criterion Decision Approach

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Abstract

Mobile service providers gain back their massive investment in their infra-structures as the emergence of new technological innovations in networks, platforms, and applications has enabled. The problems which are facing by the users in selecting mobile service providers are insufficient details of the criteria and the companies. Several factors are responsible for the adoption of different mobile services. The present study involves six companies providing mobile services viz. Bharat Sanchar Nigam Limited (BSNL), AIRTEL, Vodafone, Tata Docomo, Idea and Reliance. Important factors for assessing the mobile service providers are identified. Analytic Hierarchy Process (AHP) is used to find out most preferable mobile service provider. The results indicate that network is most important criteria for the expert. The study also ranked Vodafone as the top ranked service provider. Mobile network operators, service and application providers can take advantage of this research to develop and implement specific mobile services.

Keywords: Mobile Services, Service Adoption, Adoption Factors, Analytic Hierarchy Process.

Introduction: Smart phones and tablets are now become the basic needs of life. These two are now diffused into the daily life of the consumers. We are using the basic mobile services like- SMS, recording, camera, and voice call services to the advanced services like- e-mail, locator, what's app and we chat. In recent years new mobile services and innovation are developing continuously in India and its potential to attract the consumers day by day is significant for mobile service providers, network operators and application developers. In contrast to the high expectations, the acceptance, adoption and use of many of these new mobile services have not proliferated (Constantiou, Damsgaard, and Knutsen, 2006). More advanced services are still waiting to influence the lives of consumers (Carlsson and Walden, 2008).

Mobile services can be classified into five categories, (1) communication services, (2) entertainment services, (3) information services, (4) transactional services and (5) Web services (Bouwman, Bejar, and Nikou, 2012; Kuo and Chen, 2006; Nysveen, Pedersen, and Thorbjørnsen, 2005; Varshney, 2005). While making decision to opt for mobile services, consumer's perceptions depend on many factors. These are- mobile service functioning, mode of payment, added value, and perception of quality, cost and performance.

Including India, Brazil, South Africa and Nigeria, are expected to be very important cursers in the development of global mobile value-added-service (Informa Telecoms

and Media,2010). Mobile communication or information services (Siau and Shen, 2003). Process of mobile service adoption was analysed by Kargin, Basoglu and Daim,2009. Smura, Kivi, and Toyli, 2011, investigated the subset of the mobile services/applications, such as mobile data service usage in Finland. Study has been done by Chong, Chan and Ooi, 2011, on m-commerce. Mobile gaming services were analysed by Liang and Yeh, 2011.

All the above studies have been performed by authors to identify the key success factors of the mobile service adoption based on the user requirement or mobile service provider. So a study on mobile service categories and companies is necessary to identify the factors influencing the adoption or identifying that which is most preferred by consumers.

This study aims to use Analytic Hierarchy Process (AHP) (Saaty, 1980), to identify the most preferred service category based on user's preferences and the most influencing factors for mobile service adoption. AHP allows quantitative evaluation and is applicable when there is difficulty in formulating the evaluations criteria (Haas and Meixner, 2005). This study contributes to theory by making clear why users intend to adopt mobile services and creating in sight for mobile service developers and providers to take crucial service related factors into consideration and how operators can counter the threat from overlooking consumer's preferences when designing new mobile services.

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Review of Literature:

Studies were conducted to diagnose the problem of the Indian mobile service market most of which are based on the use of traditional acceptance theories. But some researchers indicated that these theories may not be effective to be used in studying the mobile service innovations (Carlsson et al., 2006; Hyvönen and Repo, 2005). Service accessibility and simplicity with regard to service functionality have been found to be crucial factors. Mattila (2003) argued that service accessibility is one of the most important issues affecting adoption of current and future mobile services. Accessibility of a service is not limited to cognitive aspects of adoption, but also includes availability and access to service in physical senses. Yet, service accessibility and quality of Internet connection can potentially impact the use of particular services such as mobile TV.

There are different ways for charging mobile service users and these pricing methods are explored by Munnukka (2006) and concluded that, customer's price perceptions differ significantly depending on the charging methods they had in use. The choice preferences of consumer's are influenced by different payment methods significantly. Yan (2001) found an unfair method of charging in which interconnection between the mobile and fixed network was charged per-unit. Mobile subscribers were charged per-minutes but where there is no network interconnection, fix network subscribers were charged per-unit (each unit is 3 min).

Kultima (2009) pointed out that other attributes of service functionality such as usability and flexibility are important casual design values. Zhao, Lu, Zhang, and Chau, 2011 found that gaining value by using mobile services is also seen as an important factor so a clear understanding of what makes mobile services valuable is helping us to understand the concept of value in mobile communications domain

Kim, Park, and Jeong (2004) indicated that user's satisfactions with service quality and service cost are among important factors that affect users intention to use mobile services and they argued that mobile carriers should maximize user's perceptions by taking those factors into account. In addition, user's perceptions toward their performance in daily routines by using a particular service can affect the use of mobile services. Petrova and MacDonell (2010) argued that users may not adopt a innovative and advanced technology, if it does not help them in routine life..

Human assessment of qualitative attributes is always subjective and imprecise. Hence, conventional AHP seems to be an adequate method to capture the importance of the user's requirement for the purpose of

the current study. Determination of the importance of these factors also enables service providers and mobile application developers to design and develop services that fit user requirement. Tetard and Collan (2009) argued that users are in principle lazy and they are reluctant to make extra effort in complex situation like choosing service that fits their needs.

Trust in system quality and understand ability in contents quality have been found to be part of success factors of mobile commerce (Gioug, Dooyeon, and Sungyul, 2006). Is Iklar and B"uy"uk"ozkan (2007) have also used AHP in their research to analysed user's preferences towards different mobile phone brands. AHP is an appropriate approach for the current study, because AHP combines all of the mentioned factors into a model and quantitatively measure the importance of user requirements. AHP is often conducted with a small group of experts who are capable of performing subjective pairwise comparisons of decision criteria (Saaty, 1980).

Thus, the objective of this study to use the Analytic Hierarchy Process (AHP) (Saaty, 1980) is twofold. First to investigate which criterion is comparatively more important for all mobile service users. Second, to identify the most preferred telecommunication company based on user's preferences. By the above discussion, it is confirmed that this study contributes to the adoption and acceptance research by prioritizing factors which influence mobile service adoption.

Design of AHP Instrument: Six important companies under consideration are - Bharat Sanchar Nigam Limited (BSNL), AIRTEL, Vodafone, Tata Docomo, Idea and Reliance and the seven criteria (Communication services, network density, plans, entertainment services, information services, web services, transaction services) has been selected for the study for comparison. Several studies by authors were taken for consideration for present work. Research on Web mobile service has been done by Bouwman et al., 2012, communication services was studied by Kuo and Chen, 2006; Nikou, Mezei, and Bouwman, 2011 and Hyvönen and Repo, 2005 analysed the information, entertainment and transaction services.

The following section explains each criterion and its attributes in more details.

Mobile Communication Services: SMS, MMS, mobile video call and mobile email are mobile communication services. These are the most used mobile applications by Ishii, 2004; Kim et al. 2004.

Mobile Entertainment Services: Services such as, ringtones, games, gambling, music, mobile, TV etc comes under mobile entertainment services. These services are for entertainment purpose and consumers take advantage of entertainment services and have fun at

the same time when wired entertainment applications are not available. Entertainment services are very important for a consumer's mentality for having a mobile (Shih, 2011; Tan and Chou, 2008).

Mobile Information Services: Instant information services comes under these service category such as internet surfing, maps, locator, weather information, news information and searching options. The use of mobile information services is possible when there is interaction between customers and service employees, or systems of a service provider through internet channel and when the customer is mobile. Tourism businesses gain more information by the developments in information technology and the use of Internet. It also reduces the tourist's anxiety when searching for travel information (Mallat, Rossi, Tuunainen and O'orni, 2009). Mobile Google map, mobile search services, mobile weather, mobile news and mobile surfing of the internet are the examples of this service category.

Web Services: Web is not a new technology. A study by Koskela, Kostamo, Kassinen, Ohtonen, and Ylianttila, 2007, proved its use in designing software and creating business solutions. It offers the next generation of internet services that use the social web (Kamel Boulos and Wheeler, 2007). Social web provides collaboration or sharing information between mobile service users. Facebook, twitter, LinkedIn, what's app and we chat are examples of social networking sites.

Methodology:

AHP is a multiple criteria decision-making method originally developed by Prof. Thomas L. Saaty (1977) provides measures of judgement consistency derives

priorities among criteria and alternatives simplifies preference ratings among decision criteria using pair wise comparisons. This study uses AHP to identify the most preferred mobile service company and the most important criteria influencing the adoption of mobile services based on consumer's preferences. Using the relationships of the criteria, alternatives, objectives and overall priority, it is also helpful for practitioners to create the hierarchical structure of a complex problem. The final outcome is a ranking of the decision alternatives.

AHP has been done in four main steps: (1) to decompose the problem into sub-problems; (2) to do pair wise comparison of the elements; (3) evaluate and (4) to synthesize results and obtain a final ranking. In the decomposition step, organisation of the components of the problem has been done in a hierarchical structure. To create the hierarchy, method allows dependencies only among elements in the same cluster and the direction of impact is only towards the top of the constructed structure. For example, according to the main goal of determining the most influential factor of mobile service adoption can be solved by investigating the mutually independent concepts of payment mode, functionality, added value and PQCP (this is the first level of the hierarchy). These objectives can be decomposed individually in the second level of the tree: for example functionality can be described in terms of simplicity, usability, accessibility and flexibility. The elements of the different clusters on the second level are assumed to be independent from each other (i.e. there is no connection between simplicity and bundled pricing strategy). Generally speaking, an AHP model and its hierarchy tree can have as many levels as a designer of the model wants.

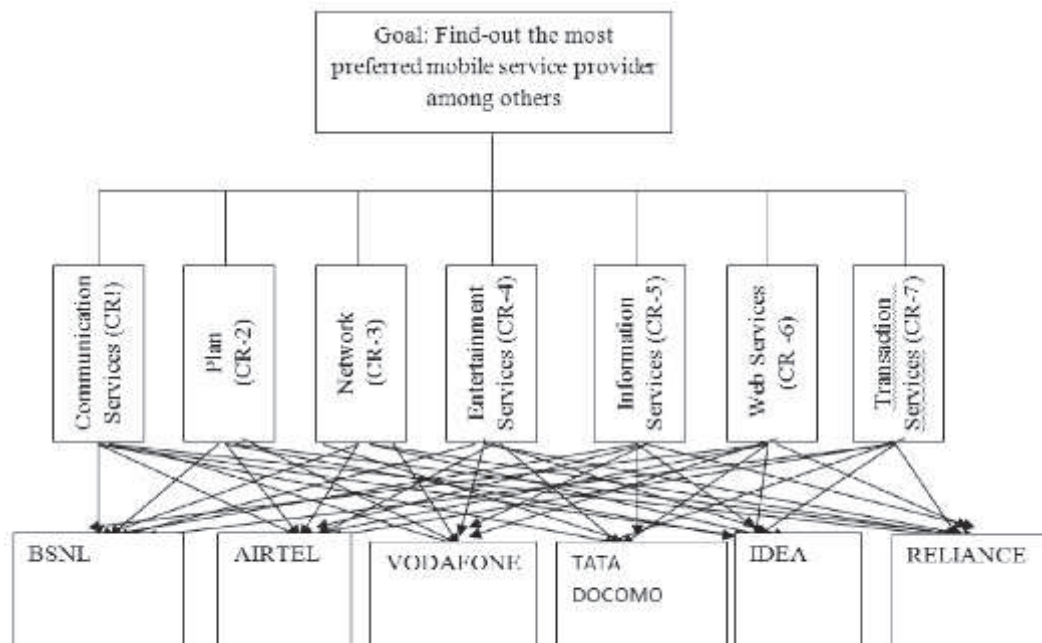


Fig: Hierarchical model for the best mobile service provider company selection

However, in the author's AHP models, disregard to the first level of the tree which is the objective of the study, there are two levels. The first level is called attributes and the second level is called the alternatives. In the present study, the relative importance for each hierarchy level was determined by pair wise comparison. Then, the weights for each criterion were determined by combining the comparisons into a comparison matrix (in the following section these will be explained in more details). Collected data can be analyzed by making use of computer software called "Expert Choice". However, in current study Excel Spread sheet with AHP Excel Add-in has been used to calculate and generate the results. After the hierarchical tree is constructed, pair wise comparisons are made in terms of importance for all combinations of elements within a sub-problem with respect to the parent.

Table 1: The linguistic description of the numerical scale in AHP

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities considered equally important
3	Moderate importance of one over another	One activity is marginally favoured over another
5	Essential or strong importance	One activity is strongly favoured over another
7	Very strong importance	One activity is very strongly favoured and its dominance is demonstrated in practice
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order
2,4,6,8		Intermediate values between two adjacent judgments

Using the pair wise comparisons, a matrix of judgements can be constructed. The basic assumption of AHP is the reciprocity of the pair wise comparisons:

The reliability of this estimation can be measured by the

Consistency Ratio (CR): this measure indicate show consistent the comparisons are relative to large number of purely random judgements. Perfectly consistent judgments result in a consistency ratio of 0; CR =1 indicates that judgments were made randomly. As a general rule, a consistency ratio which does not exceed (0.10) is considered acceptable. In the last step of the analysis the synthesis of the local weights is performed to obtain the global weights of the attributes by multiplying the local priorities by the priority of the antecedent elements. The unique and most important feature of AHP lies in the fact that it can provide a numerical evaluation and comparison of concepts which are in commensurable with other methods. It is important to mention that this numerical evaluation and the priorities of attributes highly depend on the main goal of the decision making situation: different overall priorities can result in significantly different results. The final results of the method would be most likely different if one considers the same set of attributes from the point of view of mobile service designers rather than consumers. Since in the analysis the opinion of a group of respondents is considered and not a single decision maker, an additional step is required: the aggregation of the individual priorities in to an overall result. When applying AHP in group decision making usually a set of three important properties is considered when choosing the appropriate aggregation function:

1. Unanimity: if A is prioritized over B then the overall priority of A must be higher than the priority of B.
2. Homogeneity: if all individuals judge a ratio t times as large as another ratio, then the aggregated judgment should also be t times as large.
3. Reciprocity: the synthesized value of the reciprocal of the individual judgments should be the reciprocal of the synthesized value of the original judgment. Acze'l and Saaty (1983) proved that the arithmetic mean and the geometric mean satisfy the first two properties when aggregating individual judgements but the geometric mean is the only choice if the objective is to ensure that reciprocity is also satisfied.

Questionnaire: Questionnaire has been performed by paper-and-pencil. The questionnaire was designed through informal interviews with mobile consumers of all selected mobile companies on AHP. After completion of the draft, the questionnaire was pre-tested by experts and administered by respondent familiar with the mobile domain and Analytic Hierarchy Process (AHP) to check the accuracy of the questionnaire and to check for ambiguous expressions. Next an adjusted questionnaire was distributed to a convenient sample of a single consumer. The age of the respondent is 30 years old. Unit

of analysis are decisions made and not who made the decisions so in AHP it is not relevant to use a representative sample. Shrestha, Alavalapati, and Kalmbacher (2004) found that AHP is usually used to survey people who have knowledge about the topic under investigation and large number of sample is not needed. Nonetheless, they recommended a large sample if the intention is to make generalizations and to capture greater heterogeneity.

Result and Analysis: Now the pair wise comparison matrix is drawn by using the pair wise comparison of criteria. Pair wise comparisons are establishing the priorities for the all criteria. So one of the pair wise comparison matrixes is shown below-

Factors	C1	C2	C3	C4	C5	C6	C7	Priorities
C1	1	1	1/2	4	6	2	8	0.192
C2	1	1	2	8	9	7	9	0.336
C3	2	1/2	1	7	8	2	8	0.240
C4	1/4	1/8	1/7	1	7	1	7	0.087
C5	1/6	1/9	1/8	1/7	1	1/4	1/2	0.023
C6	1/2	1/7	1/2	1	4	1	7	0.095
C7	1/8	1/9	1/8	1/7	2	1/7	1	0.027

The consistency ratio 0.097 is computed which is less than (0.10), so it is consistent. The overall priorities of each criterion for different companies that we considered are given in below table:

Company	C-1	C-2	C-3	C-4	C-5	C-6
CR-1	0.053855	0.101116	0.279071	0.024459	0.434193	0.107306
CR-2	0.030103	0.261052	0.165099	0.015992	0.313085	0.214668
CR-3	0.205954	0.03255	0.46321	0.102687	0.139875	0.055724
CR-4	0.102524	0.238774	0.35089	0.033167	0.155673	0.118971
CR-5	0.089613	0.25741	0.289932	0.034193	0.273582	0.055271
CR-6	0.046304	0.293427	0.281472	0.02903	0.274893	0.074874
CR-7	0.274917	0.190263	0.190245	0.045159	0.237257	0.062158
Overall Priority	6.144743	10.57855	15.75811	2.227677	14.25746	5.445031
Rank	4	3	1	6	2	5

After the ranking of the criteria and decision alternative, the obtained results confirmed that consumer's preference was VODAFONE among all six companies and criteria preferred is network density.

Conclusion: The present study confirms that analytic Hierarchy Process (AHP) approach in mobile telecommunication domain is an applicable method to enhance the common knowledge with regard to consumer's intention towards mobile service adoption and continuous usage. The results indicate that for

majority of the respondents the adoption of mobile services strongly depends on service functionality. This means, if services can fulfil consumer's expectation such as service quality and usability. Moreover, accessibility of mobile services plays as significant role in consumer's decisions and if services are accessible to consumers when/ wherever they need then service costs and the way their usage is charged are less of a concern and pricing schemes together with type of subscription are considered to be less relevant.

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