AN MCDM APPROACH TOWARDS M-PAYMENT BUSINESS MODELS EVALUATION

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ABSTRACT

There are many challenges in the adaptation of m-payment technology such as improved service quality, missing standards, lack of content quality, low customer satisfaction, and lack of a business model. The business model plays a critical role in the success of m-payment technology, and there are different m-payment business models, each with their own advantages and disadvantages. Project managers have little understanding about the different components of these specific business models. This study surveyed different business model's evaluation criteria from the literature and industry, and used the Analytic Hierarchy Process to evaluate m-payment business models on the basis of these criteria. The scalability and user centric architecture in the case of service related factors and collaboration & partnership, and response to market trends were the most important factors for sustainability of business models. According to the given criteria, the collaboration model was the most dominant model in the m-commerce domain. A sensitivity analysis was performed in order to find out different views about the final prioritized list under varying conditions.

Keywords: M-commerce, M- Payment business models, Analytic Hierarchy Process.

1. Introduction

M-commerce (mobile commerce) is a process where mobile devices like mobile phones, PDAs, smart phones and other emerging devices can be used to initiate any transaction. The fast adaptation and tremendous growth of mobile and wireless technologies assures the realization of different types of innovative applications. The most important categories among these applications are financial services, location based information, wireless business re-engineering and mobile games etc. New forms of mobile technologies are rapidly transforming the marketplace. Today's business market is extremely dynamic and most organizations are searching for new and innovative ways to optimize their business processes and other parameters for added value. In this regard, m-payment and m-shopping are useful tools for many organizations to achieve their objectives in the current digital world. The use of m-payment has been proposed for online payment services as a way to deal with security and trust problems in electronic transactions (Thair, Suhuai et al., 2010). There are different stakeholders involved in implementing m-payment systems, and each has a different role and different interests. Introduction of m- payment systems is a complex economic game with multiple stakeholders, and has in-depth concerns in different factors. Research shows that the immaturity of the market and the consequent unresolved technical, strategic and demand

issues make the adoption of mobile payments highly uncertain (Agnieszka,, Elaine, & Robert 2005). Due to many actor's involvement i.e. operators, banks and independent service providers which play different roles in implementing m-payment services, it is necessary to select a suitable business model to optimize different parameters. The essence of the problem of selecting the best business model is a multi-criterion problem. Therefore, the process of creating or selecting a business model has inherited complexity due to the need to balance multiple or even conflicting stakeholder requirements. Observing the nature of the problem, we investigated two questions. The first was, "Which m-payment business models are adequate for m-payment implementation on the basis of multi and conflicting criteria?", and the second was, "what is the relative importance of each criterion?" We hypothesize that there is a need for a comprehensive evaluation of existing m-payment business models. This work has two important parts i.e selection of alternatives (business models) and criteria for evaluation of these models.

This paper begins by surveying five m-payment business models and ten different evaluation criteria which typify these models. It then delineates the presumptions and procedures to conduct the Analytic Hierarchy Process (AHP). To test our hypothesis, AHP is used to obtain the relative weights among the factors, sub factors and the total values of each m-payment business model based on these weights**.**

This paper is organized as follows: Section 2 provides a literature review for prospective analysis while Section 3 provides the overview of m-payment business models. Section 4 advocates the criteria for evaluation purposes, and Section 5 presents a hierarchy of the research method. Section 6 touches on the proposed approach while Section 7 discusses the sensitivity analysis which is an important part of the proposed approach. Lastly, Section 8 summarizes the conclusion and future directions.

2. Literature review

Many attempts were made to explore the m-payment process from different perspectives. The literature emphasizes the following two parameters:

2.1Business model evaluation

Different approaches were followed to analyze the m-payment process. The core component of this analysis was business model evaluation. Pousttchi, Schiessler & Wiedemann (2007) proposed a framework for mobile payment business models. This framework facilitates the categorization of m-payment business models. The framework consists of six partial models: Market model, Value proposition model, Implementation model, Capital model, Distribution and Communication model, and Threat model. Qiang, Yan, and Tingjie (2008) have named mobile payment as ubiquitous payment and categorized mobile payment business models into four modes: i.e. carrier's operator independently, mobile network operator centric, financial institutions centric and third party operating. They discussed the disadvantages of these models and recommended some strategies to solve them. Research performed by the Smart Card Alliance Contactless Payment Council (Smart Card Alliance, 2008) considered four different business models for mobile payments deployment and discussed their advantages and disadvantages. Schierz, Schilke, et al., (2010) proposed a conceptual model which focused on factors determining consumer's acceptance of mobile payment services. The parameters of compatibility, subjective norm and individual mobility are strongly

supported by empirical results. This study provides useful directions for managers regarding market mobile payment solutions to rectify consumer intention. Pousttchi and Hufenbach (2012) exercised the extension of mobile payment business model framework with three new variables: mobile marketing service provider, trusted service manager and mobile customer relationship management service provider.

Cabanillas, Leiva, et al. (2013) modified the classical technological acceptance model by including risk as a variable given its relevance in the field. The empirical results showed a particular support for the effects of external influences, of usefulness and, to a lesser extent, of risk. This research showed several directions for companies to focus on consumer intention for using m-payment services. Slade, Williams et al. (2014) explore the potential of a new model of consumer technology adoption, and its extension from risk and trust perspective in explaining non-users adoption of proximity Mobile Payment. Data analysis shows that the extended model explains more variance in behavioral intention, but performance expectancy remains the strongest predictor across both models. The strong theoretical and practical implications can be derived from findings for strategic development and marketing proximity of m-payment in the UK.

2.2 MCDM applications in m-commerce

The wide range applications of MCDM mechanisms have been reported from the existing literature. Chou, Lee, et al. (2004) evaluated the performance of different payment systems using the Analytic Hierarchy Process which provides the foundation for this study. Ondrus (2008) utilized the MCDM method to evaluate the potential of NFC (Near Field Communication) in comparison to other technologies for payment purposes. Asghari, Amidian, et al. (2010) performed an empirical evaluation of m-payment business models using ELECTRE, which is one of the MCDM methods. Sharma and Gutierrez (2010) provide a framework which characterizes m-commerce business models.

3. M-payment business models

A thorough literature review was performed and comprehensive discussions were carried out with industry experts in order to investigate different business models and their advantages and disadvantages. This section discusses some conclusive remarks from the literature review and industry survey. There are five m-payment business models and each model has some advantages and disadvantages. Despite several efforts, there is no dominant m-payment business model in the market today. The fundamental components that make business models viable systems are the ability to improve, without ambiguity, the transaction technology in different economic environments.

3.1 Operator centric business model

In this model, the operator manages the whole business scenario and the decision making. Other organizations such as financial institutions are not concerned with the payment process. There are two payment methods used in this model which are prepaid cards and telecommunication phone bills. The main disadvantage of this model is that it cannot support macro payment (Smart Card Alliance, 2008).
Example: NTT DOCOMO is well known m-payment company which follows the operator centric model for their m-payment services

3.2 Bank centric model

In this case, the whole production and management of the m-payment process can be controlled by banks, while operators do not have any concerns (Smart Card Alliance, 2008). Operators charge the banks due to the use of SIM-based application technology for their m-payment purposes, and operators receive a rental fee from the banks because operators have ownership of the SIM toolkit. Payments are made through bank accounts, so both micro and macro payments are supported in this model (Smart card alliance, 2008). An example of this model is Pay box.

3.3 Operator centric with bank interface model

In this case, operators manage and control the whole business process, but at the same time banks also take part in the payment process. Normally, this model solves the issues of the two previous models. It supports both micro and macro payments. For micro payments M-wallet, telecommunication bills or prepaid cards etc. are used while for macro payments bank accounts are used. In comparison with the two previous models, this model provides a unique user interface for communicating with several accounts in different banks (Asghari, Amidian et al., 2010).

3.4. Peer-to-peer model

This model adopts a different approach from the previous models. Here, a third party provides the m-payment service while using the infrastructure provided by operators and banks. Actually, bank accounts and mobile devices are necessary components for the use of this model. This model supports both micro and macro payments (Smart Card Alliance, 2008). An example of this model is PayPal.

3.5 Collaboration model

In this model there are different actors which perform different roles in accomplishing the task of m-payment. The collaboration model is based on collaboration among operators, banks and service managers who manage and control the whole business process and any decision making. It organizes the collaboration among the responsible parties. In this model, banks and operators focus on their main functions; in addition, they have transaction fee income (Smart Card Alliance, 2008). An example of this model is SEMOPS.

4. Evaluation criteria

The most logical part of this research is to find evaluation criteria, which give an abstract and context free evaluation of existing m-payment business models. For this purpose, a through literature review was conducted and collaboration with industry experts was done in order to identify the success factors of m-payment business models which act as evaluation criteria. These success factors were considered to provide a comprehensive analysis of the existing m-payment business models independent of any specific perspective and context. Criteria are used to identify the opinions of decision makers for reference in their selection process. Sharma and Gutierrez (2010) provide a framework, which surveyed the success factors for m-commerce business models evaluation. These factors support sustainability of m-payment business models and categorized them into Service and Organization related factors.

4.1 Service related factors

4.1.1 Interface

The interaction layer between a specific business model and its customer can be represented using Interface. The ease of use, expediency and accessibility are relative characteristics of any business model which produce a better customer experience and its success. The customer Interface covers all customer related aspects, especially the selection of the target customers, the channels through which it contacts them and the kind of relationships the company wants to establish with its customers (Pousttchi, Schiessler et al., 2009). The business model is more feasible if its Interface is more usable. Literature strongly claims that in cases where there is good interface design, value propositions are increased several times. A good, easy to use, accessible interface is a deciding factor for the success of a business model (Sharma and Gutierrez, 2010).

4.1.2 Service offering

A major determining factor for the success of m-commerce is service affordability—such as low access, subscription, and usage fees (Grami and Schell, 2004). Service offering means a combination of services which establishes end to end connectivity between various functional blocks of a business model's value chain (Sharma and Gutierrez, 2010). There are a number of services for the proper functioning of any business model. The set of services which allow any business model to create market and capture value is represented by Service Offering characteristics. Services become a crucial element for the business of many companies (Zolnowski,Wei et al., 2014).

Guideline: Analyze all the key processes required by the business model to function effectively and determine whether there is an incorporating service component for each of the functions required.

4.1.3 Value proposition

The sketch of products and services which are offered by a specific business to its valuable customers can be explained by Value Proposition, and also justify the investment of customers in products or services which are offered by the company. A Value Proposition is an overall view of an m-payment service provider's bundle of offers that are of value to the customer (Pousttchi, Schiessler et al., 2009). The broad business logic and product offerings are represented by it, which provides value to the customers as compared to other competitors. It also tries to explain the questions like:

- What are the products and services offered to the customers?
- And how do these offerings provide worth to the customers? (Sharma and Gutierrez, 2010).

This factor depends on different services such as macro payment, micro payment, transfer and account statement etc. For example, in the Operator Centric Model, the extensibility has been limited to services which the operator can exhibit. In the Collaboration Model it has been extended to banks, operators and service manager's capabilities (Asghari, Amidian et al., 2010). The value is the core concept in the service domain. It represents inclusive logic for creating value which the business delivers. In order to deliver the value proposition to diverse customers, the firm should have required capabilities to employ available resources and put forward services to market.

Guideline: A Value Proposition can be explained by answering the following questions.

- How much value should the customer expect from the relevant business?

- What is the customer's intention to select a specific company?
- How much does the end product or service cost?
- What is the suitability of the proposed cost?

Finding answers for these questions and forming the suitable solution with respect to each, facilitates the shaping of the Value Proposition in a specific business model. The amount of value generation depends upon viability which further depends on better value proposition. More exactly, based on the segments resulting from the application of the moderating effect of gender, companies will be able to define strategies adapted to the influence patterns, producing differentiated value propositions (market segmentation), so that these propositions properly satisfy customers, improving their loyalty, and thus contributing to the achievement of the goals of the companies themselves (Cabanillas, Fernández et al., 2014)

4.1.4 Dynamicity

Business models change and evolve with time due to changes in external variables; this is called dynamicity. The global business environment is extremely dynamic and ongoing changes in this environment compel companies to regularly review and adapt their business models to carry on their market presence. The literature justifies the idea that static business models are not viable and thus reluctance to change to market needs make them even less viable.

Guideline: The capability to alter a model in reaction to a dynamic exterior environment (customer expectations, changing business environment, technology innovations, and market needs) and willingness of the organization to alter their business model.

4.1.5 Scalability

Scalability refers to the capability of a business model to extend its services or resources to increase throughput. The scalability of mobile service payment depends on mobile network operators, banks and third party scalability which participated in the payment service (Asghari, Amidian et al., 2010). It indicates its potential to either handle growing amounts of revenue with ease, or to be readily enlarged. Literature shows that in the future friendly or supple value networks will be more desirable and substitute linear and traditional value chains. Attention given to Mobile Payment likewise was mainly focused on specific themes (Tan, Ooi, K. et al., 2014).

Guideline: Friendly, modular and supple nature of the business model to facilitate the accumulation of resources and services.

4.1.6 User centric architecture

The emerging mobile applications are often enthused by new technologies or by new devices. A number of technology architectures/solutions have been proposed to improve cost, functionalities, scalability and security (Kim, Mirusmonov et al., 2010).We must produce more user-centric business models in order to exploit the synergies of mobile technologies which give prospective customers top priority. There are strong indications from the literature review that a user centric approach towards designing services leads to enhanced user participation and engagement. User centricity is implied by understanding the behavior of expected end-users and using feedback in designing the service.

Guideline: The objectives of businesses are meeting customer necessities, reforming the services and products according to the mindset of the customer, meeting customer hopes and improving the quality of the customer's experience.

4.2 Organization related factors

4.2.1 Organizing model

An Organizing Model provides a sketch of how service providers, or the internal departments which offer a single service, organize value chains, business processes, business or organizational strategies, collaborations and partnerships with other value partners to deliver services and products to the end customer. The arrangement of participating entities which aim to effectively deliver different services across the value chain can be described by the Organizing Model. In any business model different roles and responsibilities are assigned to each participant. In a feasible business model, the Organizing Model is complete which means that appropriate actors exist who perform tasks specific to their core responsibilities.

Guidelines: In depth analysis of the roles and responsibilities with respect to each actor in a value chain, and recognition of the proper match between a suitable actor for an exact role or responsibility.

4.2.2 ROI (Return on Investment)

ROI means Good Return on Investment (ROI) to each of the participating partners. The detailed view about the desirable investment in the organization and the related cost models explain the costing structure for variable services and products. Both of these components assist in explaining one of the extremely important drivers of a business case. It describes the investments, risks and the revenue streams split across different participating actors in the value chain. There should be proper mechanisms to describe the entire business model and value chain which is generated by it, sufficient ROI for all the involved partners that keeps them busy in the value chain. The literature highlights that ROI is an important factor for any business and its partners. It is very important to analyze that each participant in the business model is receiving enough ROI to stay involved.

Guideline: It is necessary to investigate whether each participant is receiving sufficient ROI to stay engaged in the value chain by developing a complete revenue-cost map for the business model.

4.2.3 Collaboration & partnership

The lack of cooperation between the key players is a significant barrier to the success of m-payments. All key players have their strengths and weaknesses; the most successful business models could be those based on strong partnership (Pousttchi, Schiessler et al., 2009). The ability to **e**nable m-commerce success substantially depends on partnerships and external collaborations, which also extends the considerations of the associated roles and responsibilities of various actors and the rate of their participation. It is clear that currently the mobile marketplace is a carrier-dominated one rather than an open market and it requires more severe partnerships with tightly coupled arrangements rather than loose cooperation. A partnership is a voluntarily initiated cooperative agreement between the m-payment service provider and other companies in order to create value (Pousttchi, Schiessler et al., 2009). In the highly competitive mobile business domain, different

actors need to collaborate with each other to complement their shortcomings and create valuable propositions for their customers. In fact, for nearly each player, partnerships with a number of other actors are an important part of their business models, as they are required to overcome the complexity of providing a complete end-to-end solution, which requires many complementary competencies (Camponovo, 2002).

Guideline: Existence of value based collaborations and partnerships which ultimately bring additional revenue to the entire value chain.

4.2.4 Response to market trend

For global m-payment services to succeed, a wide range of criteria will have to be met i.e. requirements are not only technology-based or business-based, also economics-based, and requirements that have their origin in the social/cognitive sciences. Market needs can be considered the critical success factors for a mobile commerce proposal which have taken first priority from technological factors. An organization's proper responsiveness towards change in market trends gives it superiority in a highly spirited environment. Organizations face new challenges due to dynamic market trends and redirect them towards initiatives uptake. No business model can survive in isolation, and it must consider external market forces. Market trends are dynamic in nature and are controlled by many factors such as technology innovations, increases in customer expectations and so forth. These factors further force organizations to change their business models and evolve accordingly.

Guidelines: Analyze the tendencies of a business model and regulate it according to changing market trends. Examine how likely or how capable a business model is to change in response to market trends. More responsiveness implies more sustainability.

5. Research methodology

This research is based on the assumption of interprevitism which posits that reality is socially constructed, multiple interpretations and realities exist and scientific research is time and context dependent (Sharma and Gutierrez, 2010). Alternate value chain models with benefits and drawbacks for each player could be analyzed with economic modeling and design research, and can be backed by interviews and expert panels (Dahlberg, Mallat et al., 2008). An online survey and interview method were used in order to identify the relative importance of each factor in comparison to other factors. A survey provides a comprehensive system for collecting information to describe, compare or explain knowledge, attitudes and behaviors over large populations.

5.1 Sample selection

The AHP is a decision making method where users can have less understanding about m-payment business models which may lead to inconsistency of data. In order to avoid inconsistencies during data analysis, we used an expert pool. Different and well known m-payment companies, service providers and financial institutions were located using the Internet. Then proper profiling was done in order to find the most relevant people from industry. Cabanillas, Fernandez et al. (2014) stated that an individual's positive experience with a given item in the past will have a decisive impact on current behavior toward that item. Individual emailing was done to obtain participant's consent.

5.2 Questionnaire design

There were a total of 21+100 comparisons in the study. In order to achieve the maximum response rate, the transitive property was used to resize the questionnaire. We compared each criterion with their consecutive criterion only one time and the rest of the comparisons were determined using the transitive property. The survey was done in two phases. In the first phase, a relative comparison was done of each criterion, and in the second phase the supporting intensity level of each criterion with respect to each m-payment model was determined. Figure 1 shows the format of the question used for AHP. Table 1 shows Saaty's scale which measures relative importance of one factor over another.

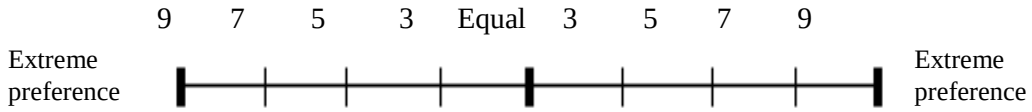

Figure 1. AHP questionnaire format

Table 1
Saaty's scale

Intensity level	**Definition**	**Explanation**
1	Equal preference	Two factors equally preferred. The objective
3	Somewhat more preference	One is slightly favored over other on the basis of judgment and experience
5	Much more preference	one is strongly favored over other
7	Very much more preference	Very strongly preference
9	Absolutely more preference	Extreme preference
2,4,6,8	Intermediate values	When compromise is done.

Source: Coyle, 2004

5.3 Research Questions

In this study the following research questions were investigated:

Q.1.What is the relative importance of reported m-payment service and organizational related factors in the selection of an m-payment business model?

Q.2. Which business model is more appropriate on the basis of the factors reported in Q1?

Q.3. Which factors are more sensitive in term of relative importance with respect to each m-payment business models?

6. M-payment business models evaluation: An MCDM approach

There are several stakeholders in the system; a viable and sound business model needs to be developed that will provide a framework for revenue sharing. MCDM is a multi-criteria decision making method including several techniques which allow rating a range of criteria, and then ranking them with the opinions of industry experts. The MCDM methods have a high potential to reduce the cost and time and increase the accuracy of decisions and can be an appropriate framework for solving problems. With this characteristic, decision makers have the possibility to easily examine the problem and scale it in accordance with their requirements (Asghari, Amidian et al., 2010). This section will introduce one of the MCDM methods named AHP, and then use this method and apply it to the expert's opinions in order to make a comparison between the mentioned business models.

6.1 AHP technique

The Analytic Hierarchy Process (AHP) is the most commonly used MCDM (Multi Criteria Decision Making) method that was developed by Thomas L. Saaty. The most innovative aspect of this technique is the modelling of the hierarchy. The nature of the problem may be a highly complex, multi-criteria situation causing conflict. A pair wise comparison of the different elements can be constructed where the values in each cell show the dominancy of each element over another with respect to some given criterion. The largest eigenvalue problem can result from this scaling formulation for each hierarchy. The AHP uses dominance matrices and goes beyond probabilistic measurement. It develops the tradeoff in the course of structuring and analyzing a series of simple reciprocal pair wise comparison matrices.

The AHP is based on three major components:

1. Decomposition of complex problem into a hierarchy where each level contains some manageable elements and each element is decomposed from another set of elements. The process of decomposition is continued to more specific elements.

2. A measuring methodology is used for prioritizing the elements within each stream of hierarchy. The pair wise approach is used to evaluate each set of elements with respect to other elements of a higher layer.

3. The input to this method is the actual measurement of some parameter or subjective opinion such as preference or satisfaction and the output is a quantified value of each alternative, therefore objective as well as more subjective problems can be quantified.

The AHP follows three steps in order to get the final results i.e. qualify decision making framework, pair-wise comparison, and calculating the relative value of each alternative. It provides some space for small inconsistencies in judgment because human beings are not always consistent. The principal Eigen Vectors give ratio scales and Principal Eigen value give a consistency index (CI). Currently, the AHP is used in many applications such as management sciences and decision making sciences. First proposed by T.L. Saaty in the 1970s, the AHP is undoubtedly one of the best decision methods available. AHP mathematically transforms conceptually subjective or fuzzy factors into quantitative variables to evaluate alternatives. We use AHP to quantify the qualitative factors

considered in this paper and thereby evaluate the performance of the five m-payment business model alternatives.

The following procedure can be performed in evaluation using the AHP. First, the construction of a hierarchical structure is carried out, by which the causalities between the factors, sub factors, and alternatives are established. Second, the priority weights among the factors are calculated through the pair wise comparison matrix. Third, the total value for each payment alternative is calculated based on the priority weights multiplying the data from the expert poll.

The following steps are followed using AHP:

- Pair wise comparison of existing factors which acts as evaluation criteria
- Finding supporting intensity of each criterion with respect to each alternative
- Synthesis of the results obtained from the above two steps in order to get final priorities
- Sensitivity analysis to check sustainability of final results under different conditions

Figure 2 shows an AHP decision tree which consists of four layers. The top layer shows the objective i.e. evaluation of m-payment models, and the second layer shows the evaluation criteria which consist of service related and organization related factors. Similarly, the third layer shows the sub criteria, and fourth layer lists the different alternates which have to be prioritized.

6.2 Applying AHP to collected data

In this case we have five alternatives and ten evaluation criteria. The evaluation criteria can be categorized as:
1) Service related factors
2) Organization related factors

6.2.1 Pair wise comparison matrix

There are ten factors and five alternatives. To calculate the total number of comparisons, we use the formula n (n-1)/2, where n represents the total number of factors. We have six service related factors and four organization related factors, so the total number of comparisons is 6(6-1)/2+4(4-1)/2=15+6=21. Similarly, to find the supporting intensity level of each factor with respect to each model, there will be 10*4 =40 comparisons.
The all diagonal elements are 1 which indicates that each factor has equal importance to itself. The transitive and reciprocal properties were used e.g. if $a_{12}=7$ then $a_{21}=1/7$ and so on. Figures 3 & 4 graphically show the relative importance of each factor. In service related factors, scalability and user centric architecture have the top most relative importance. In organization related factors, collaboration & partnerships and response to market trend have top most relative importance.

6.2.2 Consistency index (CI)

The law of transitivity must be perfectly satisfied in the pair wise comparison matrix. If this is not the case then there will be inconsistencies among the values obtained from expert judgments and the law of transitivity.

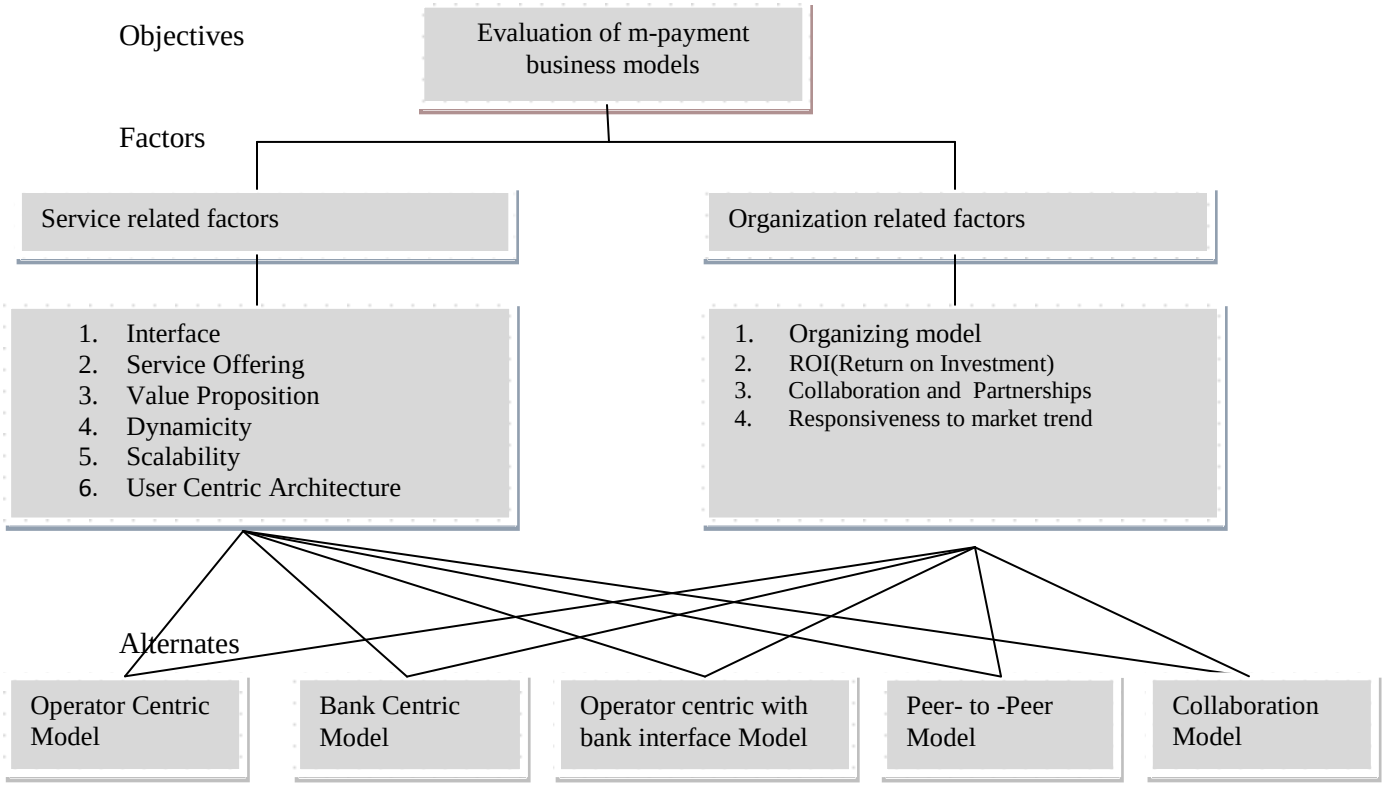

Figure 2. AHP decision tree

If the law of transitivity perfectly holds then λ_{max} = n. But unfortunately, the estimate of λ_{max} is not equal to n in most cases. Therefore, we calculate the CI to determine whether or not the law of transitivity is violated. The formula of the CI is CI= $(\lambda_{max}-1)/ (n-1)$. When CI = 0, the matrix is entirely consistent, whereas if CI > 0 the matrix is inconsistent. Saaty (1980) suggests a range of consistency i.e. if CI > 0.1 then the calculated values are inconsistent and the test will fail.

6.2.3 The priority weights within the hierarchy

The priority weights between the factors (and sub factors) are obtained by calculating the Eigen vectors in pair wise comparison matrix sets. First, we compared the factors and sub factors to get an Overall Preference Matrix (OPM).Then, we calculate RVV (Relative Value Weight) by standards methods. The final stage is to construct OPM (Option Performance Matrix) and using the equation to get VFM (Value For Money) i.e.
VFM= OPM * RVV

6.2.4 Data collection

We collected data from an expert pool, which included experts from the m-payment domain, for sample data used in AHP. The AHP is primarily a method of decision-making in organizations. We therefore conducted an online survey of experts which have considerable experience in the m-payment domain in different multinational organizations. The survey was done in two phases. In first phase, the relative importance

of each factor was identified on the basis of expert opinions and their personal judgment and experience. In the second phase, the supporting intensity level of each factor with respect to each model was determined. In the survey, we asked the interviewees to measure the degree to which each m-payment business model corresponded to the sub factors on a nine-level ordinal scale. The total value for each payment alternative was then derived by taking the geometric mean for each expert and filling in the corresponding tables. The K-value assignment method was used for collecting data from the experts.

6.2.5 Results

The Eigen vector of the service related factors in Table 2 shows that Scalability and User Centric architecture have more relative importance as compared to other factors. Similarly, the Eigen value of Organization related factors in Table 3 shows that Collaboration & Partnership and Response to market trends have more relative importance as compared to other factors

Table 2
Pair wise comparison of service related factors

	Int[1]	SO[2]	VP[3]	DY[4]	SC[5]	UCA[6]	E.V[7]
Int	1	2	1	1/7	1/2	½	0.092
SO	1/2	1	1/2	1/2	1/9	1/9	0.047
VP	1	2	1	1	1/2	½	0.118
DY	7	2	1	1	1/2	½	0.201
SC	2	9	2	2	1	1	0.271
UCA	2	2	2	2	1	1	0.271

1) Interface, 2) service offering, 3) value proposition, 4) dynamicity, 5) scalability, 6) user centric architecture, 7) Eigen value

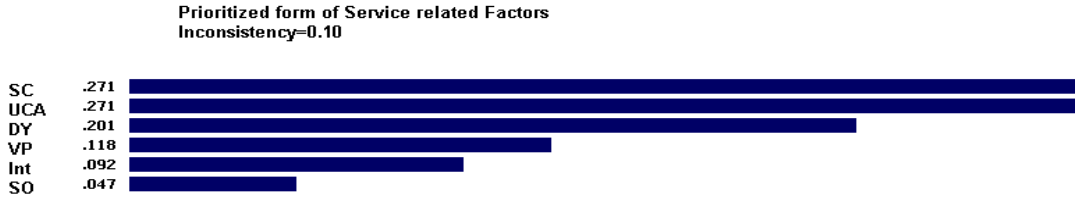

Figure 3. Prioritized form of service related factors

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Table 4 displays the OPM (Option Performance Matrix) which shows the supporting intensity level of each factor with respect to each model. Table 5 shows the final prioritized form in which the Collaboration model is the best model.

Table 3
Pair wise comparison of Organization related factors

	OM[8]	ROI[9]	C&P[10]	RTMT[11]	Eigen-vector
OM	1	1/2	1/9	1/9	0.055
ROI	2	1	1/2	½	0.161
C&P	9	2	1	1	0.392
RTMT	9	2	1	1	0.392
					1.000

8) organizing model, 9) return on investment, 10) collaboration and partnership, 11) response to market trend

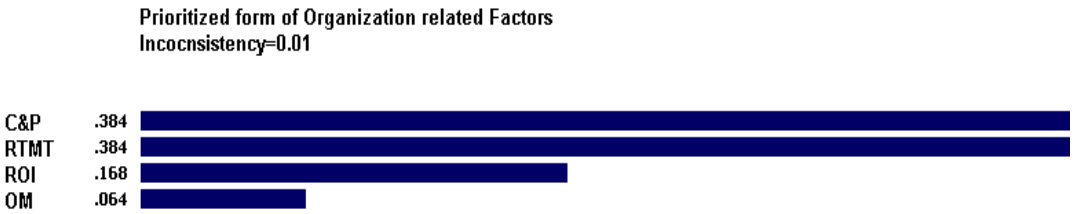

Figure 4. Prioritized form of organization related factors

Figure 5 shows the alternatives priorities with respect to service related factors where the CM model has the top priority. Figure 6 shows alternative priorities with respect to Organization related factors where the OPBI model has the top priority. Our results are consistent with previous research conducted by (Asghari, Amidian et al., 2010).

Table 4
OPM (Option Performance Matrix)

	Int	**SO**	**VP**	**DY**	**SC**	**UCA**	**OM**	**ROI**	**C&P**	**RMT**
Bank centric Model	0.212	0.038	0.14	0.102	0.12	0.11	0.26	0.19	0.26	0.046
Operator Centric Model	0.111	0.089	0.13	0.102	0.12	0.11	0.18	0.19	0.14	0.17
Operator centric using bank interface	0.315	0.25	0.28	0.198	0.23	0.33	0.26	0.36	0.26	0.307
Peer to Peer model	0.212	0.217	0.13	0.115	0.12	0.11	0.08	0.06	0.08	0.15
Collaboration model	0.152	0.40	0.33	0.49	0.40	0.33	0.23	0.19	0.26	0.34

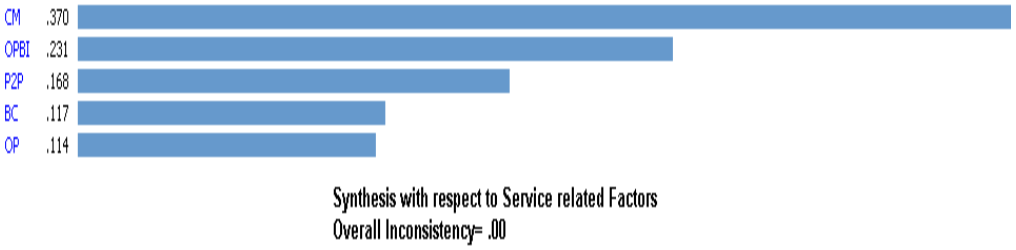

Figure 5. Synthesis with respect to service related factors

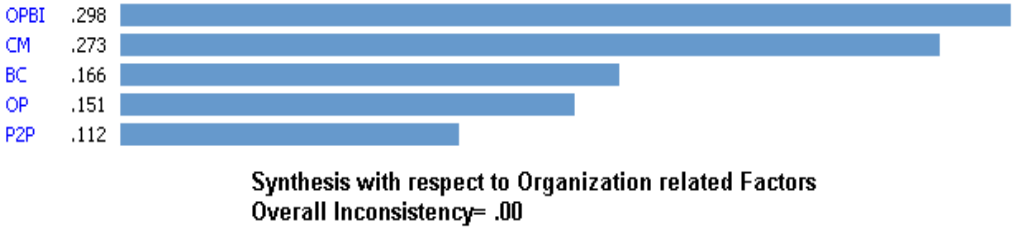

Figure 6. Synthesis with respect to Organization related factors

Table 5
Final Prioritized Form

Priority	M-payment Business Models
1	Collaboration model (CM)
2	Operator centric using bank interface(OPBI)
3	Operator Centric Model (OP)
4	Bank centric Model (BC)
5	Peer to Peer model (P2P)

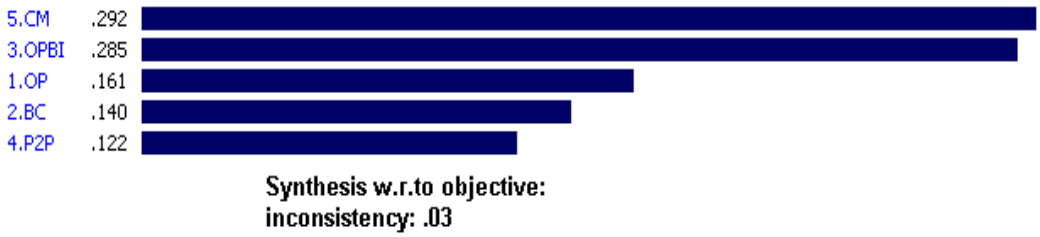

Figure 7. Synthesis with respect to objective

7. Sensitivity Analysis

The results of the priorities of different alternatives are very dependent on the relative weights given to the main evaluation criteria. Major changes in the final results are possible in case of minor changes in relative values of the main criteria. Obviously, the subjectivity factor is involved in human judgment, so it is necessary to test the stability of

the final results under different conditions. We applied a sensitivity analysis based on those scenarios that replicate alternative future developments or different views on the relative values of the different criteria.

Through decreasing or increasing the importance of individual criteria, we observed the consequential changes of the priorities and the position of the alternatives. Sensitivity analysis is a technique which provides information on the stability of the final ranking. If the alternative ranking is highly sensitive to minute changes in the criteria weights, a careful review of the relative importance is recommended. Similarly, extra decision criteria should be incorporated as extremely sensitive levels to a weak bias of the at hand set of criteria. In order to achieve this task the weights of the significant criteria are separately distorted, simulating relative values between 0% and 100%. Expert Choice 2000 2nd Edition software was used to change the local priority values of the chosen subjective factors. Figures 8, 9, 10, 11, 12 and Table 6 show the sensitivity analysis of different factors and their sensitivity range. In Figure 8 we see that the collaboration model at the top position with respect to service related factors, and Figure 9 shows that the operator centric model using bank interface is at the top position with respect to organization related factors. Figure 10 shows the final synthesis of the results which shows that the collaboration model has top priority.

Figures 11 and 12 show the % sensitivity (peak relative value) of service and organization related factors which is 30% and 8.3 % beyond which the final prioritized list can be altered. Table 6 shows the % sensitivity of all the evaluation factors.

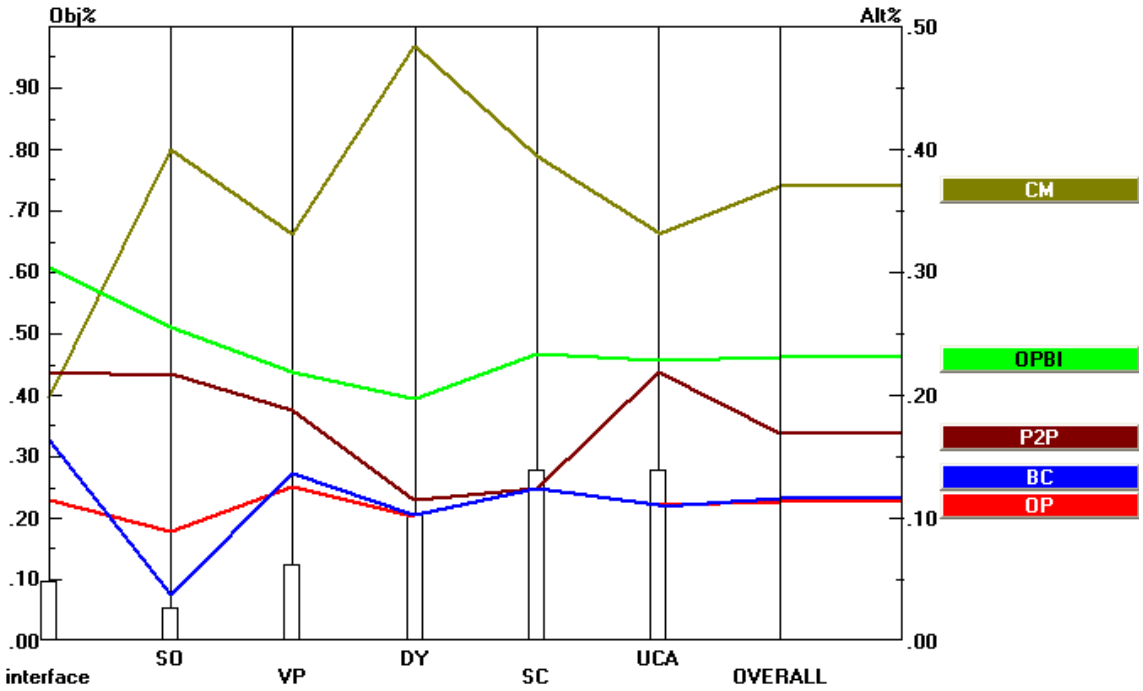

Figure 8. Synthesis with respect to Service related factors

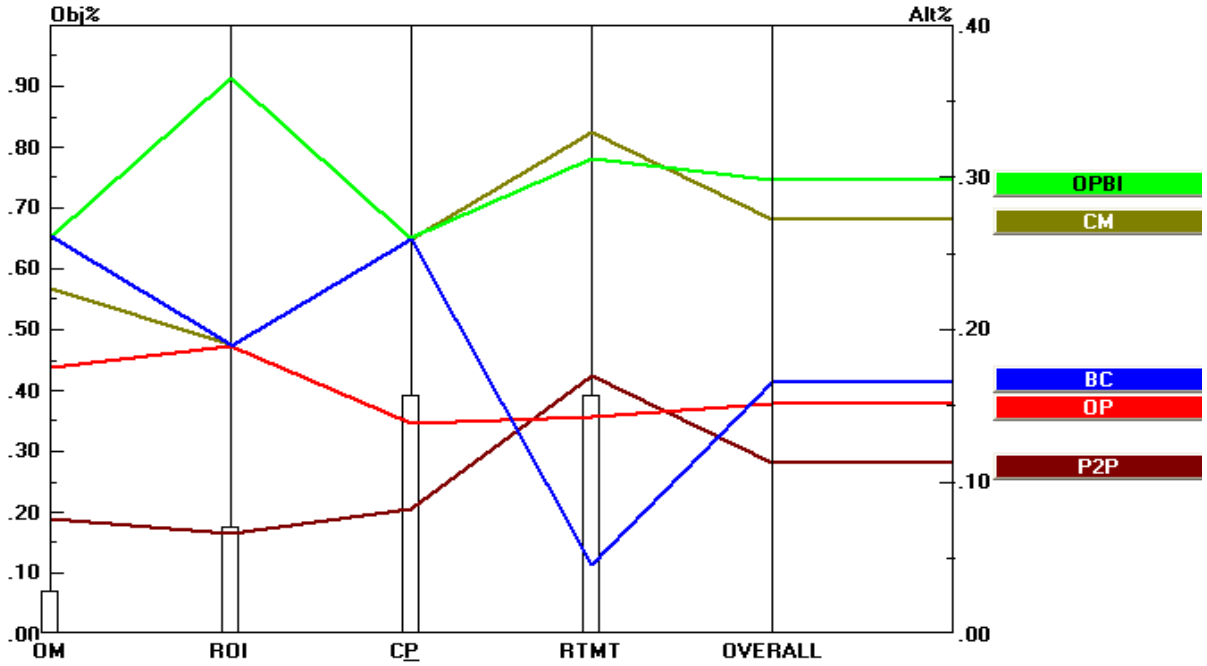

Figure 9. Synthesis with respect Organization related factors

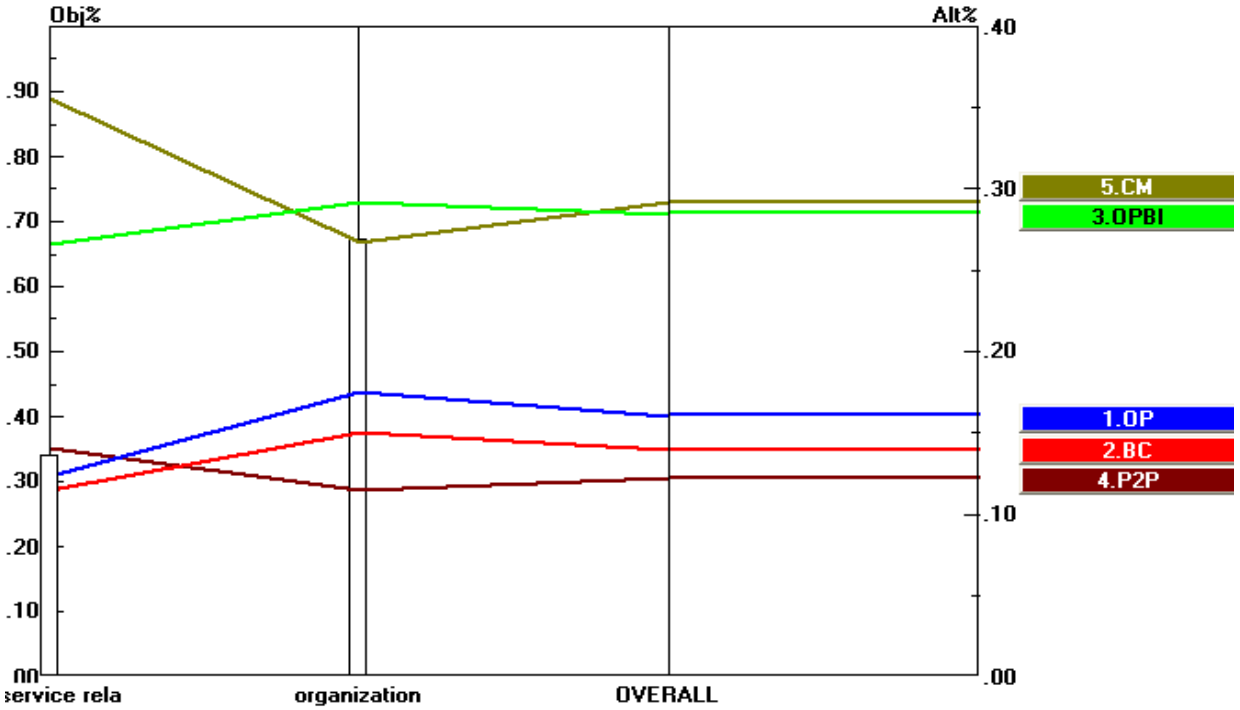

Figure10. Synthesis with respect to objective (Final result)

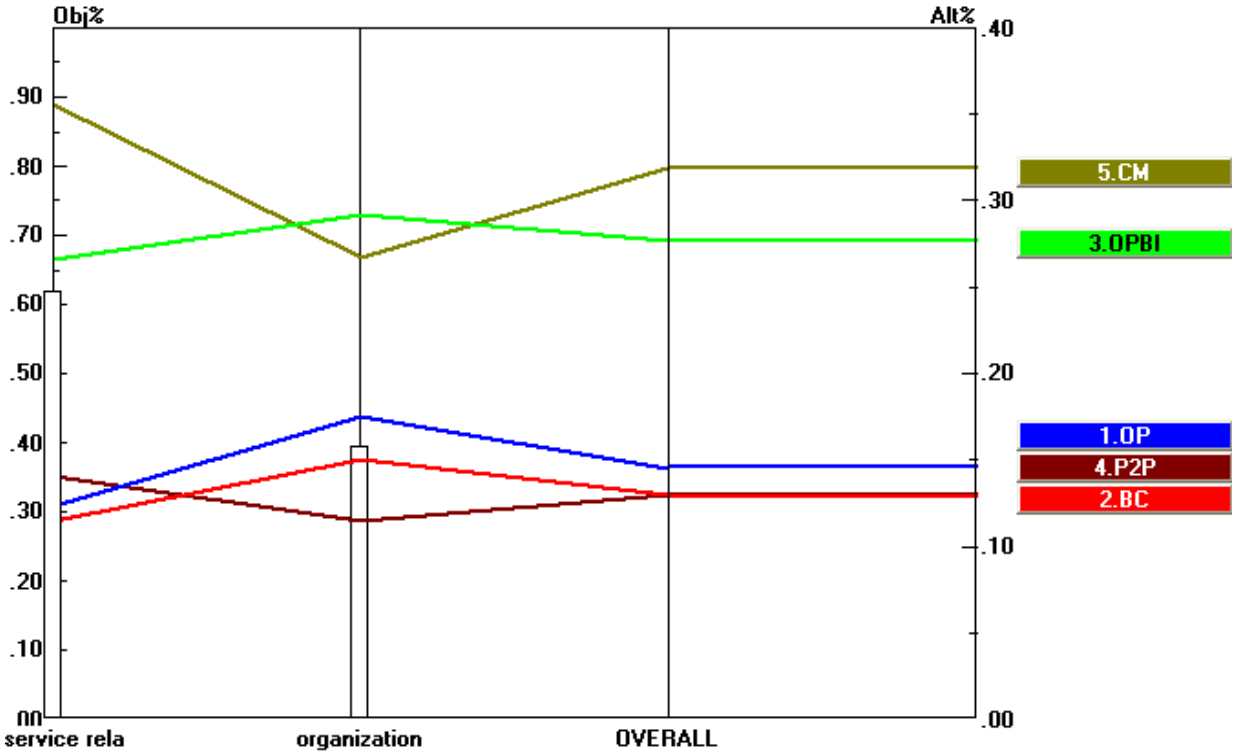

Figure 11. Service related factors are changed to 30%

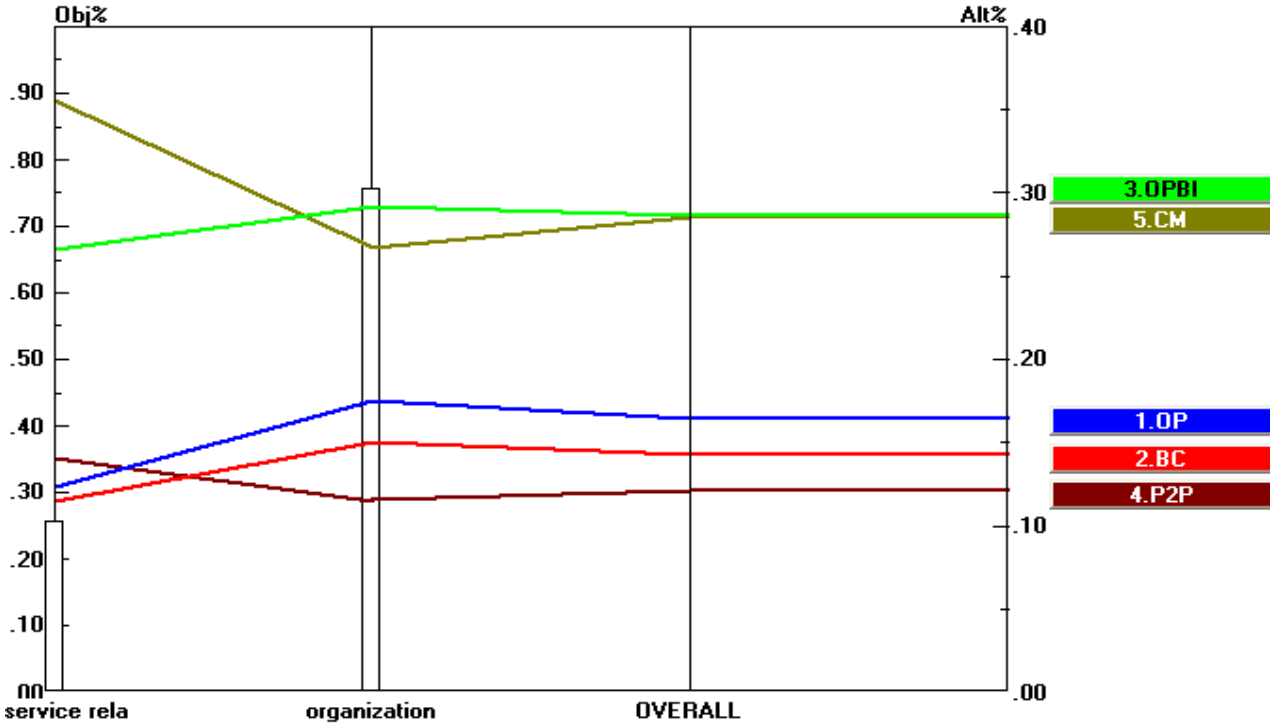

Figure 12. Organization related factors are changes to 8.3 %

Table 6
% change with respect to individual factors

S.No	Factors	% change
3	Interface	35.4
4	Service offering	17.2
5	Value proposition	90
6	Dynamicity	80
7	Scalability	73
8	User centric architecture	73
9	Organizing model	55.6
10	ROI	83
11	Collaboration & Partnership	41.5
12	Response to market trend	38.2

8. Conclusion and future work

In this research work, five different mobile payment business models were surveyed. Similarly, 10 distinct factors which act as evaluation criteria were surveyed in the field of mobile payment from the relevant literature. A comparison between these five models was made using one of the MCDM techniques. The results show that the Collaboration model is the best model on the basis of general criterion taken from the literature, and whose significance was specified using the experts from different multinational organizations through an online survey. A sensitivity analysis was done in order to check the sustainability of the resulting priorities in case of varying conditions. The findings and the proposed generic framework presented in this work provide worth to organizations, customers and other stakeholders which participate in the value chain. The results from this study may also give value to the relevant practitioners, mainly for organizations aspiring to roll out mobile commerce initiatives in the near future including software developers, mobile operators, wireless hardware vendors, and other IT industry representatives. This study will also be valuable to organizations looking for innovative and successful business models, whose business is based on m-commerce approaches in order to help them add value. This research work supports managers in the assessment of their business and m-commerce plans by providing substantial understanding about different components of the business models. This framework provides a valuable decision making tool for project managers. In the future, this framework can be validated using different case studies in the m-payment domain. Similarly, other MCDM techniques like ANP, Linear programming etc. can be used in future projects to strengthen these results. This is a generic framework i.e. the evaluation criteria were taken from the literature and their relative importance was measured by experts. In future work, this framework can be tailored to specific contexts.

REFERENCES

Agnieszka,Z., Elaine,L., & Robert,S. (2005). Classifying m-payments – A user-centric model. *Proceedings of the Third International Conference on Mobile Business, ICMB*, 3-8.

Asghari, F., Amidian,A.A., Muhammadi,J & Rabiee.H.R. (2010). A fuzzy ELETRE Approach for Evaluating Mobile Payment Business Models. *International Conference on Management of E-Commerce and E-Government*, IEEE.

Cabanillas, F. J. L., Fernandez, J. S., & Leiva, F.M. (2014). Role of gender on acceptance of mobile payment, *Journal of Industrial Management & Data Systems. 114(2)*, 220-240.

Cabanillas, F.L., Fernández, J.S.,& Leiva, F.M.(2014). Antecedents of the adoption of the new mobile payment systems: The moderating effect of age. *Computers in Human Behavior, 3*, 464–478.

Cabanillas, F.L., Fernández, J.S., Leiva,F.M. (2014). The moderating effect of experience in the adoption of mobile-payment tools in Virtual Social Networks: The m-payment acceptance model in virtual social networks (MPAM-VSN), *International Journal of Information Management, 34*, 151–166.

Cabanillas, F.L., Leiva, F.M., & Fernandez, J.S. (2013). The impact of risk on the technological acceptance of mobile payment services. *International Network of Business and Management, 1*, 309–328.

Camponovo, G. (2002). Mobile commerce business models. *2nd M-business Conference*, Austria.

Chou,Y., Lee,C,W,. & Chung, J. (2004). Understanding m-commerce payment systems through the Analytic Hierarchy Process. *Journal of Business Research, 57(12)*, 1423–1430.

Coyle, G. (2004). *The Analytic Hierarchy Process (AHP). Practical Strategy: Structured Tools and Techniques*. Open Access Material, Glasgow: Pearson Education Ltd. ISBN 0-273-68220-2, http://www.booksites.net/download/coyle/student files/AHP_Technique.pdf.

Dahlberg, T., Mallat,N , Ondrus,J., & Zmijewska,A. (2008). Past, present and future of mobile payments research: A literature review. *Journal of Electronic Commerce Research and Applications, 7*, 165–181.

Grami, A., & Schell, B. (2004). Future trends in mobile commerce: Service offerings, technological advances and security challenges. *Conference of Privacy, Security and Trust, Fredericton*, 1-14.

José, R., Rodrigues,H.,Melro, A., Coelho, A., & Ferreira, M.C. (2013). Design lessons from deploying NFC mobile payments. *LNCS Springer*, 86–93.

Kim, C., Mirusmonov, M., Lee, I. (2010). An empirical examination of factors influencing the intention to use mobile payment. *Journal of Computers in Human Behavior, 26,* 310–322.

Ondrus, J. (2008). Near field communication: An assessment for future payment systems. *Journal of Information Systems and E-Business Management, 7(3),* 347-361. DOI: 10.1007/s10257-008-0093-1

Pousttchi, K., Schiessler, M., & Wiedemann, D.G. (2009). Proposing a comprehensive framework for analysis and engineering of mobile payment business models. *Journal of Information Systems and e-Business Management, 7(3),* 363-393.

Pousttchi, K., Schiessler, M., & Wiedemann, D.G. (2007). Analyzing the elements of the business model for mobile payment service provision. *Sixth International Conference on the Management of Mobile Business, ICMB.*

Pousttchi, K., & Hufenbach, Y. (2012). Mobile payment in the Smartphone age extending the mobile payment reference model with non-traditional revenue streams. *MoMM2012,* Bali, Indonesia, 31-38.

Qiang, Yan, & Tingjie, L. (2008). A study of mobile payment mode in u-commerce. *Economics and Management School, Beijing University of Posts and Telecommunications,* Beijing, China.

Reilly, P.O., Duane, A., & Andreev, P. (2012). To m-pay or not to m-pay—realizing the potential of smart phones: conceptual modeling and empirical validation. *Electron Markets, 22,* 229–241.

Slade, E., Williams, Dwivedi,Y. & Piercy, N. (2014). Exploring consumer adoption of proximity mobile payments, *Journal of Strategic Marketing, 23(3),* 1-15. *DOI: 10.1080/0965254X.2014.914075*

Schierz, P. G., Schilke, O., & Wirtz, B. W. (2010). Understanding consumer acceptance of mobile payment services: An empirical analysis, J*ournal of Electronic Commerce Research and Applications,* 9, 209–216.

Sharma, S. & Gutierrez, J.A. (2010). An evaluation framework for viable business models for m-commerce in the information technology sector, *Electronic Markets, 20(2),* 33-52.

Smart Card Alliance. (2008). Proximity mobile payments business scenarios: Research report on stakeholder perspective. *A Smart Card Alliance Contactless Payments Council White Paper*. Princeton Junction, NJ.

Thair A.D, Suhuai, L., Peter. S. (2010). Consumer acceptance of mobile payments: An empirical study. *New Trends in Information Science and Service Science (NISS).* 533 – 537.

Tan, G.W., Ooi, K.B., Chong, S.C., & Hew,T.S. (2014). NFC mobile credit card: The next frontier of mobile payment? *Journal of Telematics and Informatics, 31*, 292–307.

Zolnowski, A., Wei, C., Böhmann, T. (2014). Representing service business models with the service business model canvas - The case of a mobile payment service in the retail industry. *47th Hawaii International Conference on System Science, IEEE,* 718-727.