

[DOI: 10.20472/IAC.2015.020.069](https://doi.org/10.20472/IAC.2015.020.069)

BEHROOZ NOORI

Department of Industrial Engineering, West Tehran Branch, Islamic Azad University, Iran

AN ANALYSIS OF MOBILE BANKING CUSTOMERS FOR A BANK STRATEGY AND POLICY PLANNING

Abstract:

Online banking is increasingly common. Financial institutions deliver online services via various electronic channels, subsequently diminishing the importance of conventional branch networks. This study proposed an integrated data mining and customer behavior scoring model to manage existing mobile banking users in an Iranian bank. This segmentation model was developed to identify groups of customers based on transaction history, recency, frequency, monetary background. It classified mobile banking users into six groups. This study demonstrated that identifying customers by a behavioral scoring facilitates marketing strategy assignment. Then the bank can develop its marketing actions. Thus, the bank can attract more customers, maintain its customers, and keep high customers' satisfaction.

Keywords:

Data mining; mobile data, mobile banking; customer segmentation

JEL Classification: C54, C52, C88

Introduction

The newly emerging channels of online banking and rapidly increasing penetration rates of mobile phones motivate this study (Chen, 2013).

The internet has had a significant impact on financial institutions, allowing consumers to access many bank facilities 24 hours a day, while allowing banks to significantly cut their costs. Research has shown that online banking is the cheapest delivery channel for many banking services (Koenig-Lewis, Palmer, & Moll, 2010; Robinson, 2000). A number of studies have identified advantages to bank customers, including cost and time savings as well as spatial independence benefits (Koenig-Lewis et al., 2010).

According to Gartner's prediction of leading trends of 2012 in mobile applications, mobile commerce (m-commerce) remains the most important one. Gartner further forecasts that mobile devices will replace PCs as the main device to access the internet. As for the third quarter of 2012, IPSOS indicated that "The era of Multi-Screen has come, and smartphones account for the purchasing behavior of 65% of mobile device users." According to that report, 66 percent of the smartphone holders in Taiwan access the internet via a smartphone at least once daily; approximately 57 percent of the customers perform mobile searches; and 40 percent of the customers shop via mobile phones (IPSOS, 2012). These statistics reflect vigorous growth in the scale of m-commerce. However, mobile banking remains in its infancy, and international adoption rates demonstrate the strong potential of m-commerce (FRB, 2012). Therefore, data mining for mobile banking is of priority concern for further developing mobile banking services (MBSs) (C. S. Chen, 2013).

Moreover, recent developments in Internet connectivity have led to a renewed interest in Internet banking among specific groups of working individuals. Moreover, with the rapid development of mobile and smart phones, Internet banking has become more conducive to many more individuals, since they can carry out their banking transactions anywhere and anytime (Govender & Sihlali, 2014; Lee & Chung, 2009). Mobile banking, an extension of Internet banking, provides time independence, convenience, prompt response to customers and cost savings. These benefits serve as an opportunity for banks to increase consumer market through mobile services. Furthermore, mobile technologies, such as smart phones, PDAs, cell phones, and iPads have not only become ubiquitous, but also trendy among young adults (Govender & Sihlali, 2014).

Moreover, in recent years the market orientation has changed to customer centric view. After realizing the importance of simultaneous use of various channels, banking and financial companies are now paying attention to mobile banking especially when it comes to maintenance of customer relationships (Sangle & Awasthi, 2011). The ability to identify customer's most pressing need at a given moment of time is one of the promising propositions of mobile banking. Advanced mobile technologies help banks in offering new services like viewing account details, fund transfer, balance enquiry, loan details, bill payments, enquiry about credit card and demat account and add value to existing ones by disseminating the information at user defined time and place (Sangle & Awasthi, 2011).

Besides, banking was at the forefront of the service sectors that migrate customers from face-to-face transactions to computer-mediated transactions. With the development of m-commerce, similar expectations have been held out that much banking activity that is

currently carried out online through fixed line internet terminals will migrate to mobile devices. The range of services that can be undertaken while mobile is likely to increase, and mobile phones are likely to evolve as ubiquitous payment devices (Koenig-Lewis et al., 2010; Wilcox, 2009).

Market segmentation is one of the most important areas of knowledge-based marketing. In banks, it is really a challenging task, as data bases are large and multidimensional (Zakrzewska & Murlewski, 2005).

Though a number of aspects have been studied for m-commerce, very little is reported regarding the customer segmentation of mobile banking from customer relationship management (CRM) perspective (Wong & Hsu, 2008). The knowledge of the key mobile user segments in financial sector is still lacking. This study attempts to add to the body of literature by data mining in mobile banking services (Sangle & Awasthi, 2011).

In relation to customer-centric business intelligence, banks are usually concerned with the following common Marketing and sales concerns (Chen, Sain, & Guo, 2012):

- Who are the most / least valuable customers to the bank? What are the distinct characteristics of them?
- Who are the most / least loyal customers, and how are they characterized?
- What are customers' transaction behavior patterns? Which services have customers purchased together often? Which types of mobile banking users are more likely to respond to a certain promotion mailing?
- What are the sales patterns in terms of various perspectives such as services, regions and time (weekly, monthly, quarterly, yearly and seasonally), and so on?
- What are the user segments in terms of various perspectives

In order to address these marketing concerns, data mining techniques have been widely adopted, coupled with a set of well-known business metrics about customers' profitability and values, for instance, the recency, frequency and monetary (RFM) model, and the customer life value model (Chen et al., 2012).

In this article a case study of using data mining techniques in customer-centric business intelligence for a bank was presented. The main purpose of this analysis is to help the bank better understand its mobile banking customers and therefore conduct customer-centric marketing more effectively. On the basis of a new segmentation model, customers of the bank have been segmented into various meaningful groups. Accordingly, a set of recommendations was provided to the bank on customer-centric marketing (Chen et al., 2012).

Literature survey

Banks operate in a competitive environment facing challenges in customer acquisition and service costs. In such an environment, the understanding and prediction of customer behavior in usage of services is becoming an important subject. The banks' intention is to shift customers to technology enabled self-service channels like ATMs, internet banking and more recently onto mobile banking services. Customers, these days are more and more pressed for time and they seek a channel that offers them convenience

of anytime, anywhere banking and mobile banking services fits the bill very well. In Iran, mobile banking services seem to be high on priority for banks (Thakur, 2014).

Particularly in Iran, banking services on mobile banking were launched few years ago yet the usage of such services has not reached the desired level. Therefore, it becomes more important to look for the customer segments. The studies conducted on bank information technology adoption render insufficient information about customer segmentation (Sangle & Awasthi, 2011). In this regard the current study tends to emphasize customer data mining framework and identify the mobile user segments.

While the use of branch-based banking is still very popular, banks have other ways of providing customers with financial management services and one of them is mobile banking (Govender & Sihlali, 2014). The mobile phone as a channel for service consumption offers enormous potential since today, a mobile phone is an integral part of customers' life and a growing number of these devices are also equipped with internet connection. Currently mobile banking services enable consumers, for example, to request their account balance and the latest transactions of their accounts, to transfer funds between accounts, to make buy and sell orders for the stock exchange and to receive portfolio and price information (Laukkanen, 2007). Hence it is necessary to investigate mobile banking customer segments.

The rationale for cross-selling, defined in the introduction as "the strategy of selling other products to a customer who has already purchased a product from the vendor" is not only to "increase the customer's reliance on the company and decrease the likelihood of switching to another provider" but also to exert a generally positive influence on the relationship with the customer, strengthening the link between provider and user (Kamakura, Wedel, De Rosa, & Mazzon, 2003). Increasing product holding leads to an increased number of connection points with customers, as well as increasing the switching costs they would face if they decided to take their custom elsewhere. Increased product holding also creates a situation in which the company can get to know its customers better through a greater understanding of buying patterns and preferences. This, in turn, puts it in a better position to develop offerings that meet customer needs. Consequently, it is argued that cross-selling increases the total value of a customer over the lifetime of the relationship (Ansell, Harrison, & Archibald, 2007; Kamakura et al., 2003).

Cross-selling, and consequently cross-buying, is receiving considerable attention in both research and management in the financial services industry. Denoting to terms such as "bancassurance" and "allfinanz", i.e. the sales of insurance products by banks, and on the other hand "assurfinance", i.e. the sales of financial products by insurance companies, changes in the market such as deregulation and increasing competition have driven the once traditional financial service providers towards increasing provision of integrated financial services, that is, offering their customers a seamless service of banking, investment and insurance products (Mäenpää, 2012; Van den Berghe & Verweire, 2001).

Market segmentation has become one of the most dominant concepts in both marketing theory and practice. In banking industry, like any other service industries, segmentation is considered as a major way of operationalizing the marketing concept, and providing guidelines for a bank's marketing (Edris, 1997). As theory, market segmentation is the process of dividing a market into distinct groups of individuals, or organizations, who

share one or more similar responses to some elements of the marketing mix. The segmentation process calls for dividing the total market into homogeneous segments, selecting the target segments, and creating separate marketing programs to meet the needs and wants of these selected segments (Edris, 1997).

The identification of segments allows the evaluation and refinement of a bank's marketing strategy. The effectiveness of the segmentation process and strategy depends on identifying segments that are measurable, accessible, stable, substantial, and actionable (Edris, 1997).

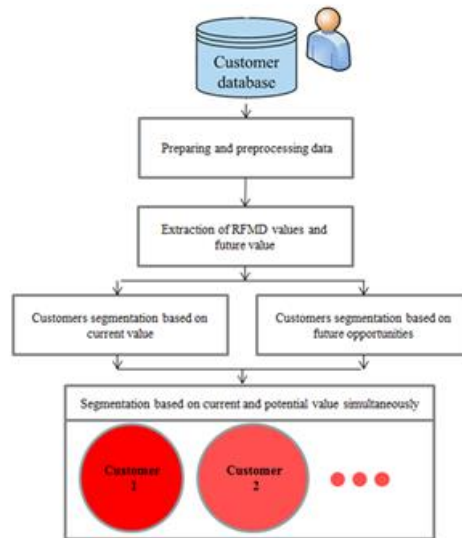
Customer segmentation is used in different settings, for instance, using customer segmentation for estimating customer future value as a part of customer lifetime value (CLV) in banking scope (Khobzi, Akhondzadeh-Noughabi, & Minaei-Bidgoli, 2014). Generally, customer segmentation is often used to obtain more details about different customers in banking scope. Actually, according to these studies diverse groups of banks' customers are identified by segmenting based on customers' financial transactions (Khobzi et al., 2014).

RFM analysis is a widely used method that identifies customer behavior and represents customer behavior characteristics, and it stands for the words: Recency, Frequency, and Monetary. Generally, these parameters are defined as follows (Khobzi et al., 2014):

- Recency: The interval between the purchase and the time of analysis.
- Frequency: The number of purchases within a certain period.
- Monetary: The amount of money spent during a certain period.

These definitions are adaptable and can vary in different cases. In recent years, several researchers tried to extend the concept of RFM analysis, but there is lack of studies that analyze the customer segments and RFM analysis focusing banks over the mobile banking platform. Thus, although the increasing competitiveness in mobile banking is motivating an exponential growth in the number of studies, there is a call for studies that will help us to understand how customer behavior are formed in the mobile banking business in greater detail.

Fig. 1. Research methodology using RFMD variables and potential value.



Moreover, the rapid development of data mining methods enables using large data bases of customer data to extract the knowledge, supporting marketing decision process. As the ability to acquire new customers and retain existing is crucial, especially in the finance marketplace, the possibility of customer segmentation by obtaining the information on unknown hidden patterns has a major significance. Until now only few papers present using of data mining techniques in banks. In our work, we consider application of a new RFM segmentation algorithm in this area (Zakrzewska & Murlewski, 2005).

Methodology

In this study, numbers of mobile banking users of a major bank in Iran were studied. These user demographics were shown in table I. Additionally, bank customer table was shown in table II. The proposed methodology utilized a new segmentation methodology, as shown in Fig. 1. In this work, customer priority number (CPN) or RFMD as a new model of RFM, was introduced for first time. It is the product of the recency (R), frequency (F), average transaction amount or monetary (M) and customer deposit (D) ratings:

$$\text{RFMD} = R \times F \times M \times D \quad (1)$$

The rationale of the proposed approach is that if customers have had similar purchasing behavior, then they are very likely also to have similar RFMD values. RFMD values were used to cluster customers into groups with similar RFMD values. The scaling of R–F–M–D attributes was shown in table III.

TABLE I. Demographics of mobile banking users

Education	Percent (%)	Occupation	Percent (%)	Gender	Percent (%)	Age	Percent (%)
High school	0.56	Employee	0.364	Male	0.804	Young	0.36
College	0.34	Business	0.397	Female	0.196	Middle	0.578
Master and above	0.1	Engineer	0.054			Old	0.062
		Manager	0.016				
		Student	0.07				
		Physician	0.07				
		Faculty	0.01				
		Others	0.019				

TABLE II. Customer table.

Field Name	Data Type	Description	Value set
ID	Text	Customer ID code	-
Acct-NO	Text	Customer account number	-
Birth-Date	Text	Below 30; 30-40; 40-60; 60 and above	{Y, M, O}
Sex-code	Text	Gender	{F, M}
Marital_Status	Yes/No	-	{Y, N}
Education	Text	High school and below; college; master and above	-
Occupation	Text	Manager; employee of company; student; others	-
Operator-Network	Text	IR-TCI; MTN-Irancell; Talya	{I, M, T}
Service Type	Text	e.g. Payments, Transfers, Payments & Transfers	-
Open-Date	Date/Time	Account opening date	-
Amount	Number	-	-
Transaction-Date	Date/Time	-	-
Balance	Number	Account status	-

Fig. 2. Customer segmentation result based on CLV

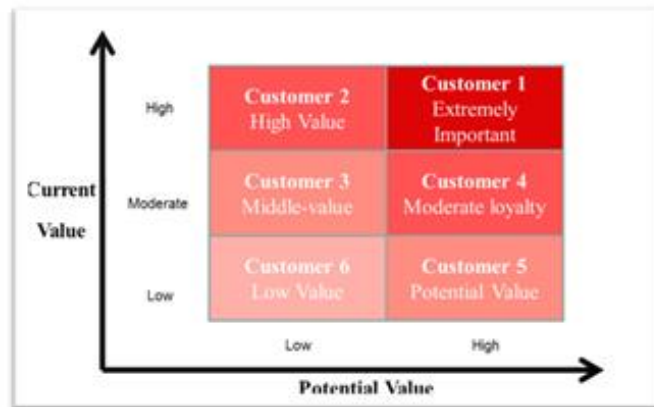


Fig. 3. The partial data of C-Bank dataset

TABLE VI. Segmentation results

ID	RFMD	Current Value	Potential Value	Customer Type or Segment	Segment	Marketing Strategy
0017805	108	High	High	Customer 1	Extremely important	Relationship management
0017760	12	Low	High	Customer 5	Potential value	Retention
0017832	24	Low	Low	Customer 6	Low value	Growing

TABLE III. The scaling of R-F-M-D attributes

Field Name	Description	Value set
ID	-	-
Recency	Below 15; 16~30; 31 and above (day)	{3, 2, 1}
Transaction Frequency	Below 5; 5~20; 21 and above (in a fiscal year)	{1, 2, 3}
Transaction amount average	NT\$100 and below; 100~1,000; 1,001~3,000; 3,001 and above	{1, 2, 3, 4}
Deposit Average	NT\$1,000 and below; 1,001~7,000; 7,001~20,000; 20,001 and above	{1, 2, 3, 4}

TABLE V. RFMD values for each customer

ID	Acct-NO	Recency	Transaction Frequency	Transaction amount average	Deposit Average	R	F	M	D
.
0017805	0027864	10	30	1200	41000	3	3	3	4
0017760	0027866	8	4	450	5120	3	1	2	2
0017832	0027942	25	12	150	15000	2	2	2	3
.
.

RFMD refers to the customer current value. It calculated for each stored customer data (Table II). RFMD or CPN ranking was illustrated in table IV. The rankings given are normally scored on a scale of 1-4. Therefore, CPN would be between 1 and 144. After the case priority number (CPN) was computed, customer current value could be determined. After RFMD computation, potential value of customer based on future opportunities should be estimated. The CPN and potential value of customer are main

TABLE IV. Suggested CPN table for customer current value

Segment	Value
High value	81~144
Moderate	36~80
Low	1~35

elements for customer segmentation (Fig. 2).

Case study

This work considered a bank customer records to conduct empirical research (Fig. 3). Three customers were selected to show methodology effectiveness. The real data of selected customers and related R, F, M, and Ds were shown in table V. RFMDs were computed and customer potential values were illustrated in table V. Meanwhile customer type and its marketing strategy were derived (Table VI).

Managerial implications

The bank's marketing and business manager, bank branch manager, or analysts can employ the segments to:

- Better understand customers. The bank can track changes to customers' life styles. Better customer knowledge and understanding are the cornerstones of effective and profitable customer management (Zuccaro & Savard, 2010).
- Enhance the value of segmentation systems. Proactive segmentation systems are enhanced when they are updated regularly. This means that both demographic and transaction data are integrated into an ongoing process of customer segment management. Customer segments possess the built-in capacity to integrate demographic and transaction data. Up-to-date and relevant segmentation system provide the bank with invaluable data to plan new service offerings, predict customer reaction and determine profit levels on a segment-by-segment basis. Segmentation system enhances the bank's capacity to employ customer knowledge in a more strategically effective manner (Zuccaro & Savard, 2010).
- Improve marketing effectiveness. Without a sound segmentation system a bank would not be able to perform valid and reliable customer prospecting which in turn would seriously undermine the effectiveness and profitability of customer targeting. The starting point for serious customer prospecting and targeting is the bank's customer data and transaction database. It provides the analyst with invaluable behavioral information (use of mobile banking by each customer). In addition, the database will contain rudimentary socio-demographic data such as the customer's age, sex, marital status and some employment information. Customer prospecting and targeting could be undertaken employing such data. Customers would be

placed in groups. Many organizations have realized that by enhancing their customer database they can significantly improve their customer prospecting and increase the lift of customer targeting strategies. Thus, segmentation is designed to exploit the potential of the bank's customer database. Once a specific customer segment generated by RFMD segmentation has been identified, it becomes relatively simple to identify the customer prospects and target them with the appropriate strategy and promotional tools (Zuccaro & Savard, 2010).

- Develop effective communications. In the age of segmentation, developing an effective communication strategy is not a simple task. The nature and variety of potential communication messages and media to transmit the messages has grown exponentially during the last two decades. In addition, most organizations, including banks, are abandoning traditional communication media such as television and radio and opting for more specialized vehicles such as the web. Segmentation provides the bank with a richer set of segments that can be described with an impressive level of detail. The refined segments along with detailed financial life style of its members allow the bank to design tailor-made communication strategies (Zuccaro & Savard, 2010).

Conclusion

Mobile phone handsets, which were initially used almost exclusively for voice calls are now often used to transmit data and undertake commercial transactions. In recent years, mobile phones have become very popular with a penetration rate in many of states of Iran. The term m-commerce has been widely used to describe a subset of e-commerce and refers to transactions with monetary value that are conducted via mobile devices (Koenig-Lewis et al., 2010).

Iranian banks today face intense competition inside and outside Iran. This in turn has forced these banks to be more oriented towards their customers. The main focus of this study was on the customer segmentation. Banks which are marketing-oriented are not only required to be aware of the needs of their customers, but they should be able to satisfy effectively the needs of each identified customer segment. This study provides evidence that segmentation of the customers is of great importance to banks in order to identify the behavior of each segment and provide certain marketing actions that best suit these behaviors. The results of this study provide a practical approach to Iranian banks that would help in determining the true segments of mobile banking customers (Edris, 1997).

Furthermore, one of the important factors for the success of a bank industry is to monitor their customers' behavior. The bank needs to know its customers' behavior to find interesting ones to attract more transactions which results in the growth of its income and assets.

The RFM analysis is an approach for extracting behavior of customers and is a basis for marketing and CRM, but it is not aligned enough for banking context (Bizhani & Tarokh, 2011). So, this study introduced new RFM model to improve understanding of bank customers.

Furthermore, this paper presented a framework of segmentation by applying it to the customers of one of Iran's major banks. Also, this paper presented a synthesized example of segmentation in the banking sector. The proposed model improved current understanding of mobile banking customers. Meanwhile, from a practical perspective, insights provided by the study can help mobile banking managers to manage mobile users' behavior.

REFERENCES

- ANSELL, J., HARRISON, T., & ARCHIBALD, T. (2007). Identifying cross-selling opportunities, using lifestyle segmentation and survival analysis. *Marketing Intelligence & Planning*, 25(4), 394-410.
- BIZHANI, M., & TAROKH, M. (2011). Behavioral rules of bank's point-of-sale for segments description and scoring prediction. *International Journal of Industrial Engineering Computations*, 2(2), 337-350.
- CHEN, C.S. (2013). Perceived risk, usage frequency of mobile banking services. *Managing Service Quality*, 23(5), 410-436.
- CHEN, D., SAIN, S.L., & Guo, K. (2012). Data mining for the online retail industry: A case study of RFM model-based customer segmentation using data mining. *Journal of Database Marketing & Customer Strategy Management*, 19(3), 197-208.
- EDRIS, T. (1997). Services considered important to business customers and determinants of bank selection in Kuwait: a segmentation analysis. *International Journal of Bank Marketing*, 15(4), 126-133.
- FRB. (2012). Current use of mobile banking and payments. www.federalreserve.gov/econresdata/mobile-devices/2012-current-use-mobile-banking-payments.htm.
- Govender, I., & Sihlali, W. (2014). A Study of Mobile Banking Adoption among University Students Using an Extended TAM. *Mediterranean Journal of Social Sciences*, 5(7), 451.
- IPSOS. (2012). Mobile internet and smartphone adoption statistics. available at: www.digitimes.com.tw/tw/dt/n/shwnws.asp?CnIID%410andCat%435andCat1%4andid%4310528.
- KAMAKURA, W.A., Wedel, M., De Rosa, F., & Mazzon, J.A. (2003). Cross-selling through database marketing: a mixed data factor analyzer for data augmentation and prediction. *International Journal of Research in marketing*, 20(1), 45-65.
- KHOBZI, H., Akhondzadeh-Noughabi, E., & Minaei-Bidgoli, B. (2014). A New Application of RFM Clustering for Guild Segmentation to Mine the Pattern of Using Banks'e-Payment Services. *Journal of Global Marketing*, 27(3), 178-190.
- Koenig-Lewis, N., Palmer, A., & Moll, A. (2010). Predicting young consumers' take up of mobile banking services. *International Journal of Bank Marketing*, 28(5), 410-432.
- LAUKNEAN, T. (2007). Internet vs mobile banking: comparing customer value perceptions. *Business Process Management Journal*, 13(6), 788-797.
- LEE, K., & Chung, N. (2009). Understanding factors affecting trust in and satisfaction with mobile banking in Korea: A modified DeLone and McLean's model perspective. *Interacting with computers*, 21(5), 385-392.
- MAENPA, I. (2012). Drivers of cross-sectoral cross-buying behaviour among business customers. *International Journal of Bank Marketing*, 30(3), 193-217.
- ROBINSON, T. (2000). Internet banking: still not a perfect marriage. *Informationweek. com*, 4(17), 104-106.
- SANGLE, P.S., & Awasthi, P. (2011). Consumer's expectations from mobile CRM services: a banking context. *Business Process Management Journal*, 17(6), 898-918.

- THAKUR, R. (2014). What keeps mobile banking customers loyal? *International Journal of Bank Marketing*, 32(7).
- VAN den Berghe, L., & Verweire, K. (2001). Convergence in the financial services industry. *Geneva Papers on Risk and Insurance. Issues and Practice*, 173-183.
- WILOX, H. (2009). Banking on the mobile. *white paper, Juniper Research, Basingstoke*, available at www.juniperresearch.com (accessed 23 October 2009).
- WONG, Y.K., & Hsu, C.J. (2008). A confidence-based framework for business to consumer (B2C) mobile commerce adoption. *Personal and Ubiquitous Computing*, 12(1), 77-84.
- ZAKRZEWSKA, D., & Murlewski, J. (2005). *Clustering algorithms for bank customer segmentation*. Paper presented at the Intelligent Systems Design and Applications, 2005. ISDA'05. Proceedings. 5th International Conference on.
- ZUCARRO, C., & Savard, M. (2010). Hybrid segmentation of internet banking users. *International Journal of Bank Marketing*, 28(6), 448-464.