


# **COMPREHENSIVE FRAMEWORK FOR MARKETING INFORMATION SYSTEM: A SYSTEMATIC PERSPECTIVE WITH DESIGN SCIENCE APPROACH**

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## **Abstract**

*Firm's which employed better marketing activities could perform better in a competitive market. However, if marketing activities are not in one direction, firm could lose its market. In this article, a comprehensive and systemic outlook on the marketing system would be done. Therefore integrated outlook to marketing system in this article could be applied by the firms, in order to perform marketing activities in a better manner. Furthermore, today's agile markets need agile firms. Consequently, firms need more agile activities, especially in marketing. In order to respond to this requirement for different firms, the systemic outlook to marketing has been combined in this article by the design science methodology. Therefore, a comprehensive marketing information system (MkIS) has been developed. This marketing information system*

*which has sales system, product system, churn and retention system, data bases, customers section, marketing research activities, market segmentation, marketing dashboards, would be introduced in this article.*

*Keywords: Marketing information system; Recommender system; Churn and retention system; Sales system; Design science*

## **INTRODUCTION**

In today's competitive world, marketing is a critical issue in business. Besides, marketing data and information are being grown every day. As a result, managing marketing information is going to be more difficult and necessity of an auxiliary tool for managing it is being felt. This tool is a marketing information system. Nowadays, successful companies are applying different information systems for marketing activities, but a comprehensive model for the marketing information system is not proposed yet. In literature, marketing information system has defined in different forms. Some of these definitions would be shown in the literature section. Furthermore, some of the other applications of information technology in marketing would be described in this section. In the research method section, design science and content analysis which have been used for developing marketing information technology conceptual framework would be described. Besides, a prototype marketing information system conceptual framework would be illustrated in the beginning of finding section. This prototype conceptual framework has been developed by applying content analysis to literature review. Moreover in the findings section, the results of our interviews, which is our proposed marketing information technology conceptual framework would be shown.

## **LITERATURE REVIEW**

Cox and Good in 1967 used marketing information system terminology for the first time (Cox & Good, 1967). However, applying computers in marketing was first proposed by Kotler in 1966. Marketing nerve system is the name of the first marketing system which was proposed by Kotler. He has explained how a firm can use a computer system for supporting marketing activities (Kotler P. , 1966). Afterwards this concept gain lots of respect from other researchers which studied about marketing information systems. All studies about marketing information systems concluded a model in which the concept of system referred to a tool for changing input to output. In these models, marketing management has been a controlling and feedback unit

and used the output for organization's marketing activities and sell operations. Some of these conceptual models are explained in continuing.

Regarding Montgomery and Urban in 1970 and Crissy and Mossman in 1977, marketing information systems is a decision support system which must have marketing mix sub-systems. These sub-systems can be used by marketing managers for answering critical questions about marketing plans (Montgomery & Urban, 1970) and (Crissy & Mossman, 1977). King and Cleland in 1974 have identified the marketing strategic planning as the most important marketing information system value (King & Cleland, 1974). Planning and developing product, pricing, distributing and promotion strategies are sub-systems for a marketing information system which proposed by Brien and Stafford in 1968. Moreover, they explained the usefulness of a marketing information system for planning and developing marketing plans (Brien & Stafford, 1968). Tull and Hawkins in 1993 have defined marketing information system as a producer, keeper and distributor of information for marketing managers (Tull & Hawkins, 1993). Furthermore a marketing information system can be defined as a structural composition of people, machines and processes, which are applied for an information flow from internal and external sources. This information flow would be applied for decision making (O'Brien, 1998).

Boone and Kurtz in 2007 have introduced a marketing information system as a computer based system which has a steady flow of information for marketing managers (Boone & Kurtz, 2007). Furthermore, Jobber in 2007 defines marketing information system as a system in which marketing data is formally gathered, stored, analyzed and distributed to managers in accordance with their informational needs on a regular basis (Jobber, 2007). Moreover Kotler and Keller 2006 have defined marketing information systems more broadly as people, equipment, and procedures to gather, sort, analyze, evaluate, and distribute needed, timely, and accurate information to marketing decision makers (Kotler & Keller, 2006).

Up to now, marketing information systems have been the only tools which used other information system's data for supporting decision making in marketing field (Li, Raymond McLeod, & Rogers, 2001), (Ying & Peters, 2011) and (Hess, Rubin, & West, 2004). Moreover, these decisions are usually for designing marketing campaigns and promoting (Lin & Hong, 2009) and (Lee, Lee, & Park, 2009).

In summary a marketing information system is a system which is applied for decision making in marketing field (Hakhu, Kiran, & Goyal, 2012). Therefore a comprehensive and systematic framework for marketing information system, especially for some of the most important marketing objectives (like attracting new customers, retaining old customers, uprising market penetration and new market penetration), is not proposed yet. In this article, we would propose a conceptual framework for marketing information system.

Information technology has been applied to different aspects of marketing like advertisement, new product development, customer retention, and also recommending products to customers. Some of the researches of these applications are as it would describe in the proceeds of this section.

Today customers face lots of products. Recommender system in some of internet shops does an important role for recommending customers' needs to them. One of recommender system's advantages is personalizing recommendations for each customer with regard to their characteristic and behavior. This procedure helps customers to choose their favorite products and also help shops to sell their products. Furthermore this could lead shops to identify customers' needs for developing new products and also creating suitable campaigns for different products (Han, Kamber, & Pei, 2012). Recommender systems are supportive tools in different industries and web shops. They have been applied for recommending different products from different sources to customers (Schafer, Konstan, & Riedl, 1999). They have been used in different shops, from web-based to brick and mortar, from book sellers to banks (Costa-Montenegro, Barragáns-Martínez, & Rey-López, 2012),(Dehghani, Afshar, Jamali, & Nematbakhsh, 2012). Likewise recommending internet pages, planning to-do list for busy men (Kim, 2011), new product development (Christensen & Schiaffino, 2011), knowledge management (Thai-Nghe, Drumond, Krohn-Grimberghe, & Schmidt-Thieme, 2010), and also medical industry (López-Nores, Blanco-Fernández, Pazos-Arias, & Gil-Solla, 2012).

It is widely accepted that in order to move a new product idea through to production and final launch into the market, a number of activities need to be performed (Utterback, 1971). Recently there has been an effusive corporate and academic interest in the notion of customer involvement. Companies are rushing into the customer involvement bandwagon, viewing it as a way to achieve a more favorable cost/time product development curve (Anders Lundkvist, Ali Yakhlef, 2004). The first step in the successful development of the new products involves the determination of customer requirements and their subsequent translation into product quality characteristics. Initiated by the identification of the need or the adoption of an idea, a number of technical, financial and business preliminary evaluations are carried out. Further detailed technical development follow, and finally the finished product, after a series of company and market tests, is launched into the market (Michail Kagioglou, Rachel Cooper, Ghassan Aouad, Martin Sexton, John Hinks, Darryl Sheath, 1998).

Advertisement is one of the challenges which different firms face it. Developing appropriate campaign could help firms benefit from better advertisement. Furthermore identifying different customer clusters and classifying customers with respect to different campaigns could help them in directed marketing. Consequently, directed marketing lowers

advertisement costs and improves marketing activities. Information technology could be applied for this purpose and help to the firms in developing better marketing campaign and advertisement (Han, Kamber, & Pei, 2012) (Chellappa & Shivendu, 2006).

Acquiring and retaining customers are important issues in competitive market (Zare-Hoseini, Tarokh, & Nooghabi, 2011). Retaining existing customers is much less expensive and difficult than acquiring new customers, especially in a mature market (Seo, Ranganathan, & Babad, 2008). Avoidance of a subscriber churn is a core issue of marketing. Minimizing customer churn could help a company to maximize its profit (Chu, Tsai, & Ho, 2007). Furthermore customer acquisition, maintenance and retention are good measurements for CRM implementation and marketing activities (Becker, Greve, & Albers, 2009). Computer assisted approach have been applied in different customer retention campaigns (Yu, Guo, Guo, & Huang, 2011),(Bock & Poel, 2011) and (Chen, Fan, & Sun, 2012).

## RESEARCH METHOD

In this section, two research methods of this article would be described. These two research methods are design sciences which are applied for a developing framework of information systems and content analysis, which is used for analyzing content and deriving knowledge from it.

### Design Science

Developing a comprehensive conceptual framework for marketing information system requires a systematic methodology and qualitative methods. There are two paradigms which characterize lots of researches in the information systems field: behavioral science and design science. The behavioral science paradigm is to develop and verify theories which could be used for explaining or predicting human or organizational behavior. The design-science paradigm is applied to extending boundaries of human and organizational capabilities. This paradigm is developed by creating new and innovative artifacts. Both paradigms are foundational to the information systems field, located as it is at the convergence of people, organizations, and technology (Hevner, March, Park, & Ram, 2004). Consequently, this article's methodology would be design science. Design science has seven guidelines which we used them as mentioned below (Hevner, March, Park, & Ram, 2004):

1. Design as an Artifact: Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation. We have designed a conceptual framework as our research goal in this article.

2. **Problem Relevance:** The purpose of design-science research is to develop technology-based solutions to important and relevant business problems. This model, which would be shown in the proceeds of this article, has been developed with regards to information technology requirements in the marketing field.
3. **Design Evaluation:** The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
4. **Research Contributions:** Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies. As it can be seen from marketing information system's literature, this concept is a novel concept and could be applied as a supportive tool by marketing experts.
5. **Research Rigor:** Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact. We have studied marketing and information system's literature to develop a rigorous conceptual framework for marketing information system.
6. **Design as a Search Process:** The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment. Our method for developing this conceptual framework is applying content analysis. We have analyzed literature and marketing and information technology expert's opinion for designing a marketing information technology conceptual framework (content analysis is also described as our auxiliary research method).
7. **Communication of Research:** Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences. Academic and non-academic, information technology and marketing experts have been interviewed for confirming the marketing information system theoretical framework.

### **Content analysis**

As we decided to analyze prior research, surveys, studies and case studies in applying information technology in marketing, we must apply a qualitative analysis method. Thus the content analysis has been considered as the most appropriate qualitative analysis method for this research.

Alfred R. Lindesmith developed a new method. His method is content analysis (Berelson, 1971). In the content analysis, six key questions must be answered (Krippendorff, 2004):

1. Which data are analyzed?
2. How are they defined?
3. What is the population from which they are drawn?
4. What is the context relative to which the data are analyzed?
5. What are the boundaries of the analysis?
6. What is the target of the inferences?

The content analysis is begun by identifying important phrases. As a result of identifying important phrases, keywords are also recognized. Then researcher must distinguish content of these key words by dictionary-based or qualitative approaches (Krippendorff, 2004). Because this paper is based on the purpose of knowledge in literature review, qualitative approaches have been used in this research.

In common, there are different approaches for content analysis as mentioned by Hsieh and Shannon: conventional, directed, and summative. They added, "Differences among the approaches are coding schemes, origins of codes, and threats to trustworthiness. In conventional content analysis, coding categories are derived directly from the text data. In a directed approach, analysis starts with a theory or relevant research findings as guidance for initial codes. A summative content analysis involves counting and comparisons, usually of keywords or content, followed by the interpretation of the underlying context. The authors delineate analytic procedures specific to each approach and techniques addressing trustworthiness with hypothetical examples drawn from the area of end-of-life care." (Hsieh & Shannon, 2005).

## **FINDINGS**

Up to now, we have brought forward literature review of marketing information system and also applications of computer assisted systems in the marketing activities. Moreover, this article's methodology and research method have been explained in the latest section. In this section the application of design science in this article would be described.

For the first guideline of the design science, we developed a prototype framework for the marketing information system from literature review by content analysis method. As a result, analyzing the marketing information system literature leads us to the Figure 1 framework. This prototype framework consists of a database and an information base. In the database, demographic and behavioral data of the customer and also product features are stored and

information such as market and marketing research data and information and competitor information are stored in the information base. Furthermore, idea generation in literature is described as the company's research and development department activities which comprised of competitors activities, ethnographic discovery methods and brain storming groups. In design (consist of idea screening, concept testing, focus group procedures, and prototype analysis) and market testing phases in this framework, new product would be designed and be tested in market. The results of market testing are going to the information base of the firm so as to be applied in new product development process. If the test shows suitable results, product can be launched. After that, the firm would sell its new product to its customers with its internal process. Data and information coming from selling are going to the customer database and the firm's information base. C&RS is churn and retention system. As it can be inferred from literature, customers churning and retaining customers are two important parallel issues in marketing. In this system churning customers must be identified and an appropriate proposition with RS (recommender system) would be recommended to them. Recommender system is an important supportive system for the marketing information system. By means of the recommender system, a firm could recognize its customer's preferences for creating a suitable product recommendation.

This framework is a basic framework and it can't satisfy all of marketing requirements. Therefore, we interviewed academic and non-academic experts in the fields of marketing and information technology. These interviews are in response to sixth and seven guideline of design science. For measuring reliability of these interviews, Holsti's percentage of agreement observations index has been applied (for third guideline). It is the percentage of all coding decisions made by two different coders on which they agree.

Holsti's formula is (Holsti, 1969):

$$PAO = \frac{2N}{n_1 + n_2}$$

Where,

N is the total number of coding decisions which coders agreed

N<sub>1</sub> and N<sub>2</sub> are the numbers of coding decisions by the each of the coders.



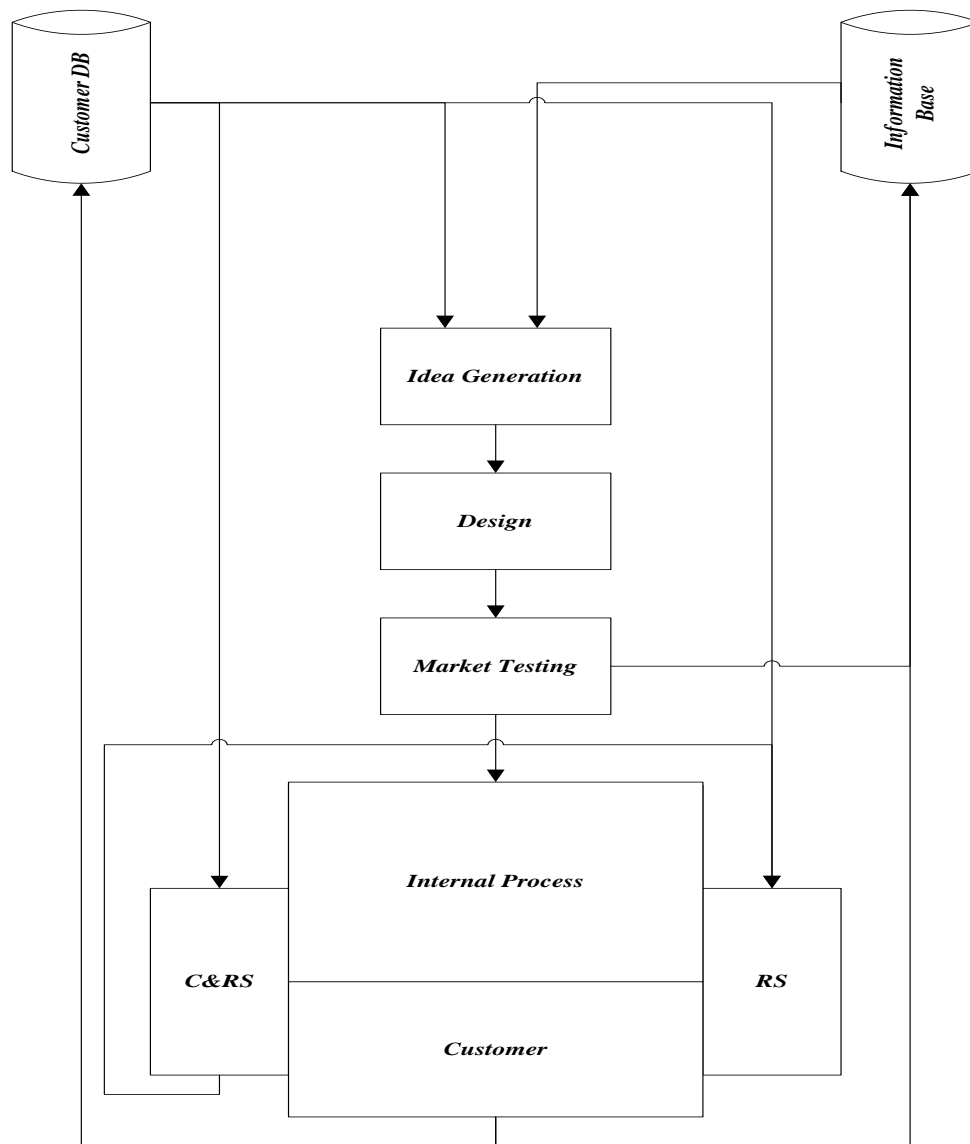


Figure 1: Marketing information system framework form literature review

Consequently, seven interviews with four marketing and three information technology experts have been done. All of these interviews were done with respect to business to customer marketing requirements. Then opinions of these experts being applied to our proposed model with Holsti's percentage of agreement observations index average of 90.2% (average of 23 agreements between 51 coding decisions), which shows good reliability of coding decisions and as a result, this article's developed marketing information system. Developed marketing information system for this article is shown in Figure 2. As it can be seen in Figure 2, proposed marketing information system in this article has some systems and also some features must be considered for each of them. Systems which develop marketing are product system, sales system and churn and retention system. Furthermore for developing a comprehensive framework for

marketing information system, other sections must be considered. These sections are database, customers, marketing research activities, market segmentation and marketing dashboards. Each of these systems and sections would be described in the proceeding of this article.

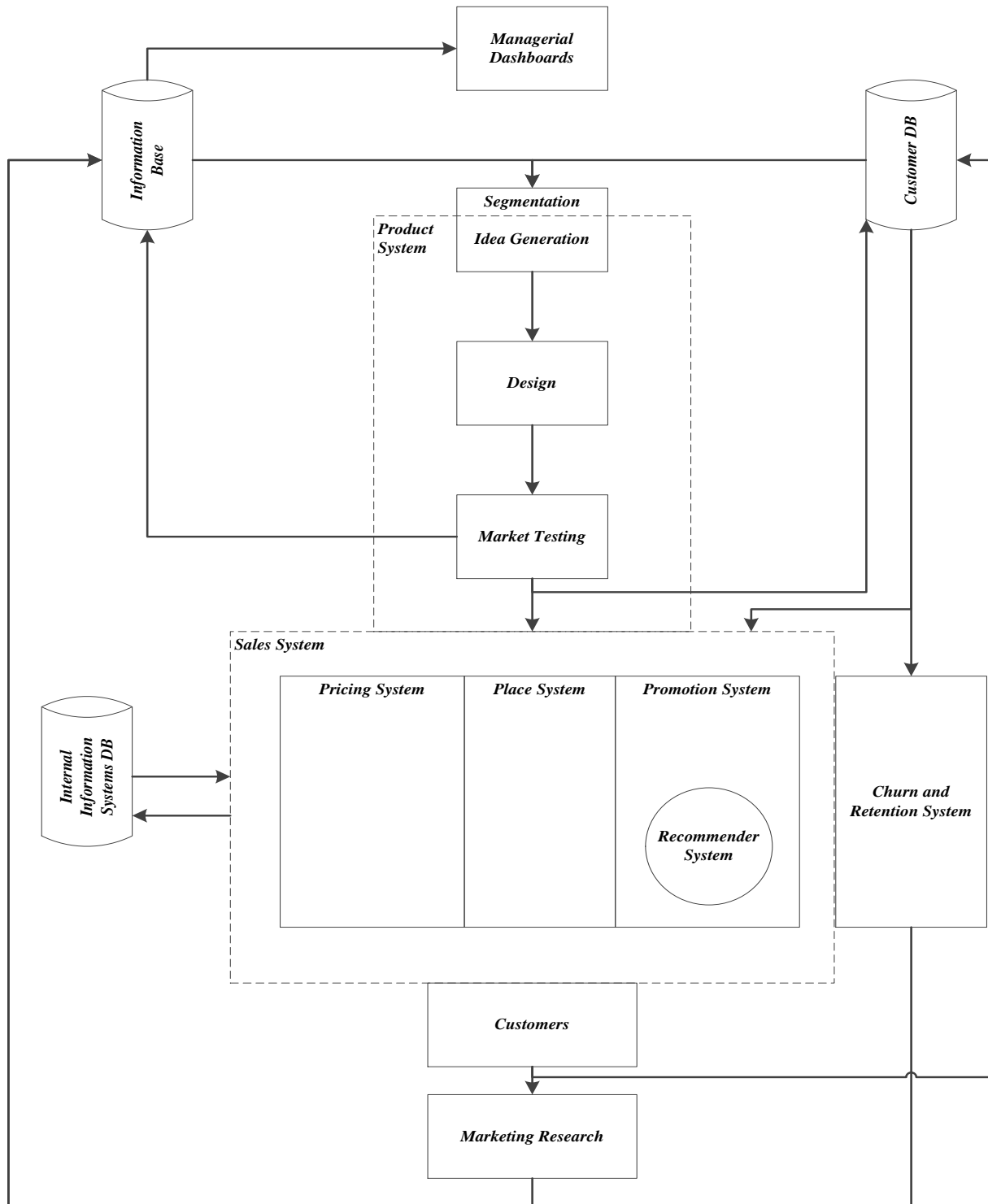


Figure 2: Marketing Information System (MkIS).

**Data bases:** After analyzing the literature, as it has been stated; two different data sources are recommended. One of them, which known as customer database consists of customer behavioral and demographic data and product features. Interviews have shown us that the media, which has been applied for establishing relationship with customers, is another requirement of this database. Moreover, it has been declared that information base consists of market and marketing research data and information (for example: attitude of customers), supply chain information, and competitors information. But with interviews, factors like marketing strategies, positioning information, benchmarking knowledge, crowd sourcing data, technological trends, market and marketing research data (customers opinion about products, firm's brand, features which are most suited to them and so on), market testing data, causes of customers churning, causes of satisfaction and dissatisfaction of customers, customers reviews about products, and also company's last designed products' information are other sources of information in a firm. Furthermore, each company has some internal data which could limit marketing activities. These data are stored in an internal information system data base of a firm that can be applied for marketing activities like pricing or placing.

**Market segmentation:** Interviewees declared that, market segmentation is a gap between marketing information system prototype framework and its complete framework. Market segmentation is a critical issue with a production system. It can play an important role in product system and consequently in a marketing information system. Market segmentation could be an automatic procedure with respect to customer data and also environmental information which comprises customer data base and information base. If a firm doesn't manufacture a product, then the production system becomes a plain system. However, as well as manufacturer, market segmentation has its position in a marketing system for these firms. Therefore, market segmentation has been proposed as an independent part of a product system. Consequently market segmentation could provide critical information for product system.

**Product system:** This system is applying for developing new products in a company. Inputs of this system are market information, competitors' products' features, crowd sourcing activities, brain storming groups, ethnographic discovery methods, technological trends in the market, and benchmarking companies in the current markets of the firm or companies in its future markets. These inputs are blend with market segmentation information, which is critical information for all companies, and applied for developing new ideas. These ideas must be screened and then tested conceptually. After that financial and business analysis must be done on the idea and if this idea is feasible, it can be applied for designing new products. Some of these designed products are globally new products and some of them are only new in a local market. Therefore a market testing must be done with respect to these concepts and the results of the market

testing (success or failure) are stored in information base for another new product development. If a market testing results show potentially successful product, the products and its features are stored in customer data base. Then new product would be manufactured and also would be entered to market and sales system.

**Sales system:** Most of today's information systems which are named marketing information system are sales systems. All of these marketing information systems could be used in the sales information system as a firm's internal selling processes. Before our interviews sales system was an ambiguous concept which was defined as only selling products. However after interviews, it has been identified that price, promotion and place (three Ps of four Ps) are critical issues in a sales system. Pricing system applied for pricing different products. This system use different pricing methods like competitor price (use competitor information from information base), economical pricing (by information base's information) and cost accounting (with data that comprise from internal information system data base). Placing system apply data of internal information system data base for placing new shops with GIS. Furthermore customer behavioral data and internal data (from internal information system data base) could be used for placing products. Besides, automatic supply chain and warehouse management are other values of a placing system which could be given to its clients. And at last promotion system has two important aspects. One of them is online offering and the other is designing advertisement campaigns. These two aspects can be achieved with a comprehensive recommender system which can use customer data base's data for recommending products in an online or offline form (in offline form, an advertisement campaign can be developed with products which are recommended to a cluster of customers and different segments of a market). Furthermore, recommender system could be used for recommending price to customers and proposing a suggestion to potential churning customers. In order to greater success of a firm's marketing activities, features like special advertise, media influence and advertisement time planning must be considered in promotion system.

**Churn and retention system:** Churn and retention system is a supportive system to sales system. This system use historical customer behavioral data and combine it with their demographical data for identifying the patterns of churning customers. Then churn probability and retention probability of each customer would be identified. After that, most probable churning customers are introduced to the promotion system (recommender system) in order to retaining them. Furthermore, causes of customer churning, in addition to customers' satisfaction and dissatisfaction causes, would be identified with this system and be stored in the information base. This information would be applied for developing new products with regards to customer needs.

**Customers:** The target of marketing activities is selling the firm's products to customers. Therefore, 'customers' is a critical issue in marketing system which must be considered. Customers buy firm's products and their demographic and behavioral data must be stored in the customer database. Furthermore, their intentions and attitudes about the firm and its products must be measured in marketing researches.

**Marketing research activities:** Marketing without considering marketing research is a blindfold process. Interviewees noted about measuring marketing activities effectiveness with marketing research. Therefore marketing research is added to marketing information system framework to complete systemic perspective of MkIS. In this part of marketing information framework, attitudes, intentions and opinions of the customers about the firm, its products and other things about that (like its brand) would be collected. This information is stored in the information base, in order to be applied in developing new products, marketing strategies, market segmentation, and other marketing activities which stated in this article.

**Marketing dashboard:** Information gathered in different part of marketing activities could be applied for marketing reports to managers. These information could be firm's sold products, customers satisfaction, competitors strategies, firm's strategies effectiveness, different media effectiveness, and other information which managers need for decision making.

## CONCLUSION

Competition in different markets is growing very fast. Therefore firms search for a solution which could be used for gaining more market share. The best solution for this situation is marketing. However a winning firm must integrate its marketing activities. Furthermore, agility could be a good response to this dynamic environment. With the intention of an agile and integrated marketing, some firms apply different marketing information systems. In this article a comprehensive framework for an integrated marketing information system has been developed by means of science design. This framework could be used by firms, in order to integrate their marketing activities or developing an integrated marketing information system (MkIS). The proposed marketing information system consists of sales system, product system, churn and retention system, data bases, customers section, marketing research activities, market segmentation, marketing dashboards, which have been introduced in this article. As it can be seen in this framework, 4Ps have been considered and the framework is suited for business to customer (B2C) firms (manufacturer or distributor). In the future research, each of these sub-system could be studied in detailed and also the other Ps could be entered to the framework (people which is a critical and supportive issue in marketing, process which some of its aspects are considered in this article and even physical evidence, that entering it to an information

system framework is so difficult, because of its intangible nature). Moreover, integrating a complete and detailed marketing information system framework with enterprise resource planning II (ERP II) framework could be generating ERP III.

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