Marketing Recommender Systems: A New Approach in Digital Economy

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Marketing information systems are those systems which make the gathering, processing, selection, storage, transmission and display of coordinated and continuous internal and external information. Includes systematic and formal methods used for managing all of an organization's information market. Recommendation systems are those systems that are widely used in online systems to suggest items that users might find interesting. These recommendations are generated using in particular two techniques: content-based and collaborative filtering. This paper aims to define a new system, namely Marketing Recommender System, a system that serves marketing and uses techniques and methods of the digital economy.

Keywords: *Marketing Recommender Systems, Information Systems, Database, Consumer Environment*

1 Introduction

Marketing Information System is a set that makes the gathering, processing, selection, storage, and transmission, coordinated and continuous display of internal and external information.

It consists of specialists, equipment and procedures for collecting, sorting, analysis, evaluation and distribution of necessary information, correctly and on time, to the decision makers in marketing.

One of the most important international conferences in recommendation systems, organized by the ACM, presents as a summary of all research definitions, the definition of recommendation systems:

"Recommender systems are software applications that aim to support users in their decision-making while interacting with large information spaces. They recommend items of interest to users based on preferences they have expressed, either explicitly or implicitly.

The ever-expanding volume and increasing complexity of information on the Web has therefore made such systems essential tools for users in a variety of information seeking or e-commerce activities. Recommender systems help overcome the information overload problem by exposing users to the most interesting items, and by offering novelty, surprise, and relevance" [11].

Through this paper we define a new concept namely Marketing Recommender System, as a system that links marketing information system and recommendation systems.

2 Consumer Environment and its Analysis

Why knowing the consumer environment?

Customer shall not be considered the last link of the chain of the movement of goods. The most important strong point of a business is continuous relationship with the client.

Marketers need to claim legitimately that they understand deeply, as it appears, developing and matures such a relationship.

Even if there is a tendency to delegate responsibility to the level of individual employee, relationship with the client, understanding and interpretation remains an attribute of marketing specialist.

Those who sell must focus on what they want to sell, on what customers want to buy, and must take into consideration that costumers desires are always changing.

So, what customers want? The answer is relatively simple.

They buy to satisfy a particular need or desire. The problem is, however, one of the most complex, because the needs are many and various, from the basic, essential for survival and common to all, and ending with the need to satisfy the need for respect of others or to obtain intellectually and spiritually satisfactions.

The active marketing requires start preparing for the new conditions and it's clear that a change in the consumer environment will have significant influence on the future resources of the company.

It is very important for marketers to adopt a system of evaluation of the consumer environment, based on:

- observation of the environment;
- significant changes in environmental inventory;
- forecasting and building scenarios for future action;

- analyze the potential effect of changing the company's ability to satisfy customers.

By identifying the priority of future actions, we can create and keep profitable customers.

Why must we know the consumer environment?

- the real marketing takes place through specific skills of consistently applying the principles of marketing and their orientation to the environment in which there is consumer purchases and operates normally even to each client;
- if you simply come to meet customer expectations, they will have not anything to say, neither good nor bad. But If you exceed customer expectations through performance in exchange relationships with your products, they (and those around them) will find this remarkable;
- the practice of effective marketing is done by satisfied customers. Of course, there may be limits to what can be done for them;
- the way to apply marketing in different situations is changing;
- competition for lower prices and higher quality products require a different perception of the consumer environment, is the new "battle field" in the current economic climate.

Changes in environment require marketers to adopt new strategies and tactics to ensure continuing relationship with their customers and develop effective long term company. Customer purchases benefits. Only this explains the fact that in the case of identical products offered at the same price, some consumers buy from a store, and some of the other. Or two clients in different places, at different times, at different prices, buy the same product?

The answer can be find, first, by investigating the experiences of consumers and second by the environment in which they take a series of decisions.

The task of marketing is to use appropriate tactics that maximize the demand for goods or services business. Marketing performance is to overlap "marketing mix" over "mix requirements" customer and get proper answers to questions like the following.

Who will buy the product offered by the firm?

To define, in the current competitive context, customers only as buyers of homes, drivers, smokers, machine tools and so on, is a risky approach. It's like the fact that we must be competitive in pricing and not needs.

You must have a relevant characterization of the categories of customers and their desires. 20/80 rule, called Paretto effect describes a phenomenon that is currently observed that about 20% of customers are responsible for about 80% of sales. The task is to identify marketing specialists this group 20% of potential customers and to focus efforts and resources to explore deeper business environment and their connections.

In order that we must look for answers to other questions:

- What kind of products we use to buy?
- What are frequently products they use to buy?
- Which are purchased most frequently bought?
- What is the frequency that purchases products from a certain category?

What do we understand in consumer environment?

A consequence of changes in demographic and cultural environment is changing attitudes and lifestyles of consumers. Consumers are more mature, more refined, have more discernment, are more cosmopolitan, more individualistic and more concerned about health and environmental problems.

Modern consumers are at the confluence of imagination and originality. They - or at least, those who have abundant income - started to claim a large variety of products (innovation, comfort, exclusivity, services) and, last but not least, small gifts from stores that used to attend them.

As the final consumer but is addressed to retail shops and retail is an area with high competitiveness, which is not patentable innovations are quickly identified, assessed, adjusted or denied by the competitors of the same panel of shops or other, appear extremely difficult problems for an effective marketing practice. In terms of today's consumer, the only thing is perpetual change.

It is normal responsibility of the marketing to supervise the marketing environment so we can anticipate future customer relationships. Knowledge of consumer and environmental analysis has become a specialized function which has at its disposal several tools and professional techniques. Tasks of the marketing specialists refer to inventory and evaluating all features and environmental characteristics and their impact on consumer business development.

So, what can and must make a firm is to monitor its progress and to intuit the nature and extent of any changes to prepare in order to maintain and develop its share of the market.

The market can be divided into categories of consumers, or, in other words, in different market segments.

Market segmentation is approach to determine, from a target – population, distinct groups of consumers according to the utility that they expect from a product.

For example, market segment toothpastes it contains all those who are concerned in particular the prevention of cavities, another segment is composed of those who aim primarily to have a bright white teeth.

There are many ways to divide the market into segments of customers, according to certain criteria such as age, sex, location in space, occupation or place of employment, income, leisure ways, how to use products.

Customer Profile can be a starting point to identify if a company's products are approved and other potential consumers from its environment. Such knowledge allows the firm to determine characteristics of new products, price and advertising level most appropriate for the market-target.

Very important is the question: *How much will buy?* It is a really crucial question because it refers to how big is the total market (in terms of a consumer together with those of his entourage).

The answer to this question is inextricably linked to the answers to the following questions:

- How many potential customers exist in each of an average consumer?
- What amount could buy respectively sell?
- What it means the competition on this plan?
- What are the strengths and weaknesses of the competitors?

At the first two questions we will try to reply with such a system.

If we try to dialogue with each consumer, even to outline a map of its options, we know that means its specific environment. Research task becomes easier if we have some demographic characteristics. We investigate some local statistics to find places where population is concentrated features that interest us. But, we must proceed carefully in estimating the potential market size, in correlation with business activity.

On the question: *How much will buy*, answer requires knowledge of purchasing power. Knowledge alone is not sufficient number of customers belonging to each target market, because it is not the same as knowing the quantities that they will buy.

The potential of a market purchase is obtained by multiplying the actual number of customers with their outlay on the same market in a given period. But we have to take into consideration to these incomes and expenditures of population, because purchasing behavior might be something larger than that considered by the company.

3 Related Work

Recommender systems have begun an important domain of research during the past years; they compare a user profile to some reference characteristics, and want to predict the rating or preference that a user would give to an item they had not yet considered. As we see in [1], the author details an evaluation of two different social networks used in a system to recommend individuals for possible collaboration.

The authors of paper [2], authors detail what Collaborative Filter is, what CF technologies can use, the theory and practice of CF algorithms, and design decisions regarding rating systems and acquisition of rating.

The authors of paper [3] describe a general recommendation architecture that is grounded in a field study of expertise locating. Their expertise recommendation system details the work necessary to fit expertise recommendation to a work setting.

Ziegler C.N. in his paper [4] made a research in Semantic web direction, deployment and integration of recommender system facilities for Semantic Web applications.

Konstas et al. in paper [5] created a collaborative recommendation system that effectively adapts to the personal information needs of each user. They adopt the generic framework of Random Walk with Restarts in order to provide with a more natural and efficient way to represent social networks. This work, we consider, is very complete.

Kautz et al. in paper [6], show us that one of the most effective channels for dissemination of information and expertise within an organization "is its informal network of collaborators, colleagues and friends". They reconstructed the social networks to make the search more focused and effective.

Empirical Applications in Recommender Systems was made in [7]. The authors applied random graph modeling methodology to analyze bipartite consumer-product graphs that represent

sales transactions to better understand consumer purchase behavior in e-commerce settings.

Taking into consideration all the works currently available on recommendation systems, we see that trying to define Recommender Systems existed, but we cannot say that to define a Marketing Recommender System, so our approach tries to propose a new model in Recommender Systems and in Recommender Systems in commerce.

4 The Definition of the Proposed Model

Recommender Systems are software tools and associated techniques that provide suggestions for elements which will be used by users.

Recommendation systems developers are experts in many fields, both as information and economic (as we see in Figure 1).

In the following we present our proposed definition.

The *Marketing Recommender System* is a recommender system that supports the level marketing of an organization, helping the company's marketing environment and marketing managers.

Computer Science	Economics
Artificial intelligence	Statistics,
Human Computer Interaction	Decision Support Systems
Information Technology	Marketing
Data Mining	Consumer
Adaptive User Interfaces	Behavior

Fig. 1. The developers of the recommender systems

It is a new layer that is intended to be superior either the marketing information system and also recommender system at the organizational level, is an independent layer but helping to develop marketing decisions and marketing relationships existing in the organization (see Figure 2).

Fig. 2. Marketing Recommender Systems, a new layer up to marketing informational Systems and Recommender Systems

MkRS objectives are reflected in three levels: input objectives, goals and objectives of data processing output, and as a set they are reflected in:

- Recommendation of consumers on the quality of organization output (product quality);
- Recommendation on improving the offer of customers organizations (development of questionnaires);
- Use search engines as a result of recommendations made by customers;

- Development of sales reports as a result of customer recommendations;
- Identifying the underlying causes of customer dissatisfaction due to un-recommendations of products.

As cybernetic systems, MkRS intends removing disturbances, maintaining stability in a continuous interconditioning in order to choose the most appropriate decision. Inputs, processing and outputs are shown in Figure 3.
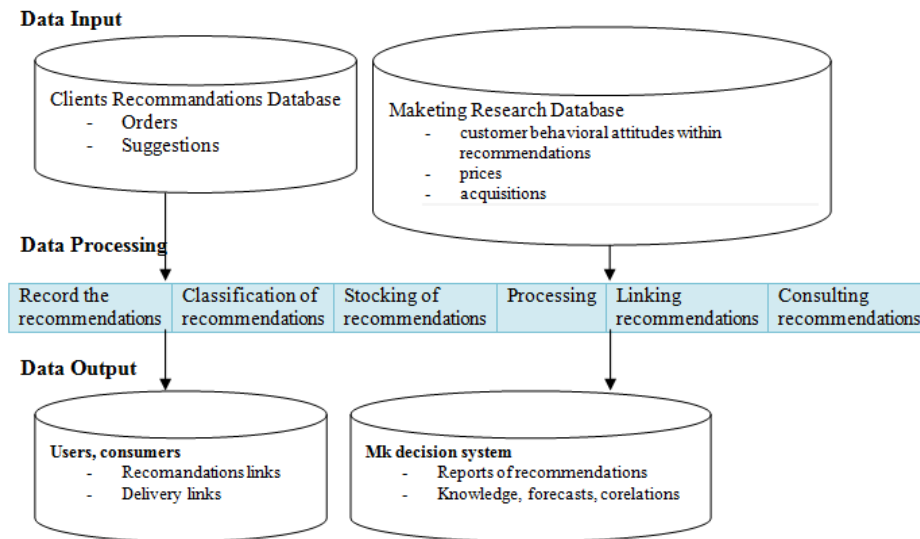
Fig. 3. MkRS as a cybernetic system

5 The Proposed Model
In designing a dedicated marketing system we must consider that this system is integrated, it must provide "single data entry and processing their multiple different depending on the requirements expressed by users" [8].
In the desire to propose a model of MkRS we must take into account the possibility to achieve such a system and operate such a system. System modeling team must take the following sequential process modeling:
Informational modeling defines functional requirements expressed by the following objectives:
- Which users are addressed
- What possibilities of order and payment exist
- What are the elements that are intended to be purchased (items, the users preferences and constraints)
- What are the most purchased products and services (what the most Suitable products and services are)

Conceptual modeling defines the structure and functional solution, independent of computing resources and software resources. It takes into account the role played by MkRS to the service provider and the role of MkRS provided to the service user. It has the following objectives:
- increase user satisfaction;
- increase user loyalty;
- increase of annual turnover.
Technical modeling transforms conceptual and informational modeling in front-end solution at level of computing resources at software and resources:
- the technique used in filtering information;
- the design of the system;
- the interface of the system;
- the evaluation;
- the interaction with other recommender systems.
At the conceptual level we propose to create a database framework containing at least the following related tables (see Figure 4).
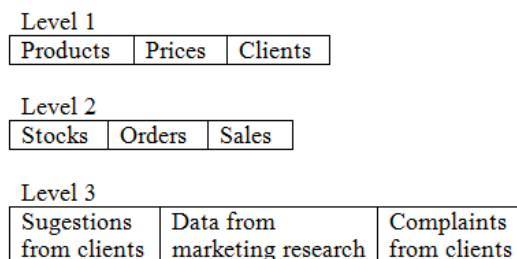

Fig. 4. The database framework

The next layer at this level, we propose to be databank which contains structured information

came from the precedent described levels, and which will be the base of develop of MkRS (as

we see Figure 5).

Reports for marketing research	Reports for marketing environment	Reports from marketing decisions	Reports from relationships wth different marketing environment

Fig.5. The databank

In the next step, within the precedent gathering of data, we can propose the technical modeling of the system. This is a step which consists in chose from several alternatives and finding the match model of a MkRS.

We want here, the existing of two levels presented in the next figure.

Level 1: the fundamental technique

Collaborative filtering	Content-based filtering	Datamining methods	Context-Aware methods	Web mining methods

Level 2: the evaluation of the quality of the recommendations

Utility	The quality of the users	Privacy	Adaptability

Fig. 6. The technical modeling of the system

6 The Initial Modeling of the System

The initial data consist of the set of users U and the set of items I. We have two steps in modeling the system.

We consider a single user and the set of items and then the set of users and a single item.

Then we will calculate the degree of utility of the user u for the item i as a function $R(u, i)$.

a. The case of a single user and a set of items

The recommendation of the products (a set of m elements) will be a vector with m elements $R(u, i_j)$, $j=1,m$. The elements of this vector are in range from 1-5, as we see below (figure 7).

Input data			**Output data**	
	i_1	$R(u, i_1)$	Min (R)	
	i_2	$R(u, i_2)$	Max (R)	
u	i_3	$R(u, i_3)$	Avg (R)	
	...		...	
	i_m	$R(u, i_m)$		

Fig.7. The elements of the vector of recommendation products

Min (R) will show us which is the less preference of the user u. Max (R) will show the most preferred item for the user u. The system will recommend the items with the largest predicted utility.

b. The case of a set of users and a single item.

We will have a set of n users and a single item. The recommendation of the products will be a vector with m elements $R1(u_k, i), k=1,n$. The elements of this vector are in range from 1-5.

Input data			**Output data**	
u_1			$R1(u_1, i)$	Min (R1)
u_2			$R1(u_2, i)$	Max (R1)
u_3		i	$R1(u_3, i)$	Avg (R1)
...			...	...
u_n			$R1(u_m, i)$	

Fig. 8. The case of a single item and n users

Min (R1) will show us which is the user who do not prefers or prefers less the item i. Max (R1) will show the user who prefers very much or most the item i. If we aggregate those

two functions, we will obtain an oriented graph, which must be represented in memory. We use the representation of adjacent arrays that can be easily adapted to representation of cost's graphs; each edge will be assigned a given cost, in our case R and R1 aggregate functions.
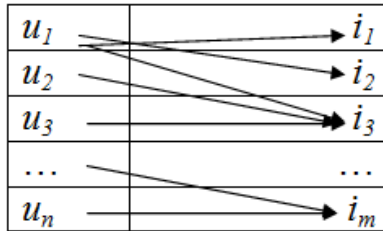

Fig. 9. The aggregation of two functions

The functions R, R1, respectively, will be stored as array elements in rows and columns, lines will store users and columns will store items. The

element (u, i) the matrix element will be the aggregate function to the user u and the item i.

7 Using Graphs to Represents the Marketing Relations

Marketing relations can be represented by using mathematical tools: graphs and matrices. Marketing relations can use graphs that consists of points (nodes) to represent actor and lines (or edges) to represent ties or relations. In the following example we take the case of an e-shop, in which we have 6 products and the e-shop was visited by 5 potential customers. Those 6 products have numerical rating such stars, from 1 to 5 stars, according the preference of the users. The users can also have a coefficient of importance from 1 to 3, such as 1 is not an important customer, 2 is important and 3 is very important. The graph is represented in the figure 10.
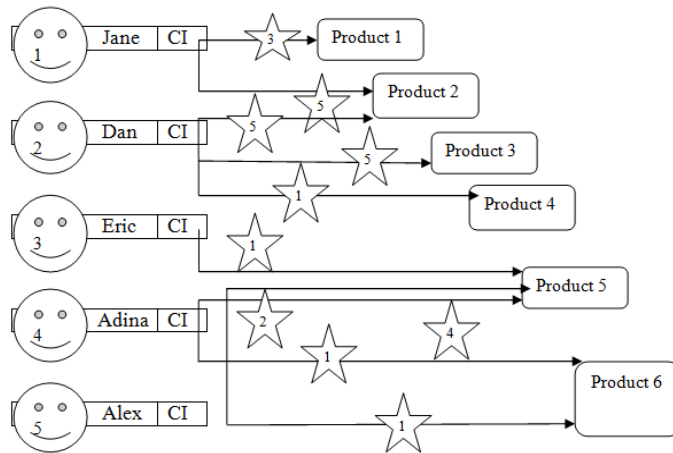

Fig.10. The representation of the example proposed

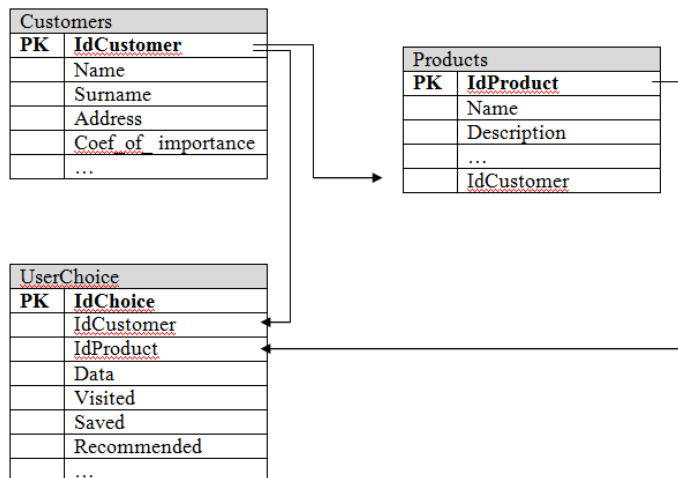The structure of a primary database we can see Figure 11.

Fig.11. The representation of the previous model in a DBMS

8 Conclusions
In this paper we introduced a new integrated concept in Recommender systems, namely Recommender Marketing Systems. By this we want to integrate marketing information systems with general information systems, to support both marketing and informatics. We described the system level, we took examples from graph theory and we made a brief representation of a database in a DBMS.

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