MODEL OF GAME INDUSTRY

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Abstract

The goal of the paper is to present a model of market where information goods are being sold. The model describes a system that contains many uncertainties. We use principles of fuzzy control and random processes. The model deals with social, economical and psychological aspects that influence decision making about purchasing goods. The source areas are microeconomics, marketing, competitive advantage and economics of information goods. We suggest a further extension of defined model and an importance of possible simulation results. The paper also includes directions for improvements that lead to validity of proposed model of market.

Keywords: Network Economics, Pricing, Piracy, Switching Costs, Price Discrimination.

Presenting Author's biography

ŠÁRKA KVĚTOŇOVÁ was born in 1981, Brno, Czech Republic. She has studied Economics and Management at the Brno University of Technology, Faculty of Business and Management, Brno, Czech Republic. In 2009, she finished Ph.D. study at Brno University of Technology, Faculty of Information Technology, Brno, Czech Republic. Her main research interests are software engineering, economics of information products, modeling of network economics, agent based systems, processes and project management with focus on Petri Net techniques and their application for software projects management.

1 Introduction

The importance of organizations dealing with information is growing rapidly. This fact implies the creation of new information products, institutions and services. In this dynamic sector of the economy- the economy of information goods- is necessary to research new patterns. In the market of information goods there are many factors that influence consumers' decisions of purchase.

We abstract the market to model interactions of economical, sociological and psychological factors with presence of specific characteristics of information goods. Pricing information goods must be analyzed because of the increasing influence of information technologies on all social areas. Pricing is one of the basic tools of the enforcement of products on the market and therefore the deployment of new technological knowledge in practice.

The main goal of the paper is to design a robust model of the market that will support the choice of an appropriate price strategy.

2 Preliminaries

The process of pricing needs to include many factors that are hard to describe numerically. The main fields that are required to cover main factors are microeconomics, marketing and economy of information goods. These can be studied from [1, 2, 5, 7, 9, 10]. There are no software tools that support pricing information goods because of the complexity of factors that must be dealing with. It is necessary to design a robust tool that covers the main fields and is open to further improvements.

There are some concepts that have to be mentioned before we present our proposed model. Further reading is possible from [2, 7, 9, 10, 14, 15].

Substitute product. This good's demand is increased when the price of another good is increased and conversely. If goods A and B are substitutes, an increase in the price of A will result in a leftward movement along the demand curve of A and cause the demand curve for B to shift out. Example: Windows and Mac OS.

Complementary product. Demand of this product is increased when the price of another product is decreased and conversely. It is a contrast to substitute product. Example: operating system and software applications.

Externalities. Costs or benefits not transmitted through prices, incurred by a party who did not agree to the action causing the cost or benefit. A benefit in this case is called a positive externality, while a cost is called a negative externality. Example: the more users will have Skype, the more utility will receive its users.

Versioning. Production of several versions of one product that can be easily by modification of basic product created. Versions differ in data processing speed, resolution, added value, graphics, innovation, etc. Example: Windows 7 Professional and Ultimate.

Switching costs. The costs incurred when a customer changes from one supplier or marketplace to another. The higher these costs are, the more difficult it is to execute the switch. Example: if a user of Linux wants to switch to Windows, he has to incur the costs of new operating system plus costs of needed changes due to usage of another operating system.

Transaction costs. This approach to the theory of the firm was created by Ronald Coase. Transaction costs refer to the cost of providing for some good or service through the market rather than having it provided from within the firm [14].

Transaction cost economics moves from the level of the individual/consumer behavior to that of the firm and, more generally, to that of governance [20].

Price discrimination/*price differentiation*. It exists when sales of identical goods or services are transacted at different prices from the same provider. In general, the practice of charging different customers different prices is called price discrimination. Price discrimination requires market segmentation and some means to discourage discount customers from becoming resellers and, by extension, competitors [13, 16, 17].

Market Segmentation. A market segment is a sub-set of a market made up of people or organizations sharing with one or more characteristics that cause them to demand similar product based on qualities of those products such as price or function. Example: students who have the common characteristic- high price elasticity of demand.

Experience good. It is a product or service where product characteristics such as quality or price are difficult to observe in advance, but these characteristics can be ascertained upon consumption. Example: a customer does not know the qualities of software he wants to buy and he searches for reviews or demo versions.

Fuzzy regulator. A technique, that deals with the uncertainty using the fuzzy sets. The uncertainty is caused by a lack of information that is needed to determine appropriate price strategy. It is possible to introduce the expert's decision making into the rules of fuzzy regulator.

Product's life cycle. A new product progresses though a sequence of stages from introduction to growth, maturity and decline. This sequence is associated with changes in the marketing situation, thus impacting the marketing strategy and the marketing mix.

Buyer's decision process. A general model consists of the following steps: problem recognition, information search, evaluation of alternative, purchase decision, purchase and post-purchase behaviour. Buyer must first be aware of a product, then be interested in it, choose the right version for him and finally consider the purchase.

3 Our Approach

In this section, we describe our proposed model and methods we used.

3.1 Proposed model

We consider the following abstraction: the market has several vendors who offer *N* products. Each product can have *N* versions. There are only substitutes being sold. Model time is in days and the length of simulation is one year[1]. This abstraction is needed to design the basic model that contains the main factors that influence pricing. The model is determined by input parameters. Used input parameters reflect the basic parameters that influence the buyer decision process.

The first step is to enter the model parameters that define the characteristics of products, their versions and consumers in the market. Some characteristics can be entered numerically or by choosing from preset values, but some of them express the ratio of characteristic.

An example is the interest of individual social classes in products where each group has the interest rated within a range -10 to 10 where 10 means the maximum interest. Maximal number of users is related with externality effects (externalities mean positive externalities) and this value represents a marginal number of users needed for full exteriorization of externality effects. Properties of each version are entered by ratio. The number of properties is not limited.

Consumers are segmented according to stratification into six groups [1].

We work with three possible distributions of social classes: normal, uniform and custom. Characteristics of consumer express a consumer's black box [1, p. 40] according to marketing practice.

For each social class is defined the ratio of the interest in product and its product requirements. The individuality of defined requirements for each social class is specified by weighting. It is possible to use normal or uniform probability distribution of social classes. Figure 1 shows the parameters that define three main objects: Product, Version and Consumer.

Product
-Name : string -Brand : string -Date of release : Date -Average price : int -Interest of each social class : ratio -Loyalty : % of all consumers -Image of brand : ratio -Has demo? : bool -Review : ratio -Lifetime : int -Curve of externalities : [none, exp, log, parabolic, S curve] -Max nr of users : int -Nr of versions : int
+Life Cycle() +Experience()

Fig. 1 (a) Stored properties and method assigning: Product

Version
-Name : string -Nr of sold units : int -Utility of illegal version : ratio -Costs of illegal version : int -Nr of pirates : int -Has externalities? : bool -Innovation : ratio -Graphics : ratio -Added value : ratio -Resolution : ratio -Speed of processing : ratio -Recency of data : ratio
+Properties() +Externalities()

Fig. 1 (b) Stored properties and method assigning: Version

Consumer
-Social class : [A, B, C1, C2, D, E] -Interest in each product : ratio -Loyalty to each brand : array of bool -Requirements : ratio -Weight of each requirement : ratio
+Set social class (chosen distribution)() +Set interest in each product (according to consumer´s social class)() +Set loyalty (randomly according to loyalty %)() +Set requirements (Weight of each requirement, social class)() +Price expectance() +Attitude() +Decision of purchase()

Fig. 1 (c) Stored properties and method assigning: Consumer

Fig. 1 also contains main methods of each class of mentioned objects.

The model is designed in a way that it is not necessary to type in all parameters. Parameters have implicit values that cause that missing inputs will have neutral values. For example: if the interest of social class A is not entered, the value of this parameter is 0 which means that a product interests social class *A* in neutral way.

[1] This time is not important in this state. It represents just a limitation for simulation experiments that should assure the validity of the model.

Input data cover only basic parameters and therefore it is necessary to enter all inputs for correct outputs.

3.2 Methods

Values of consumer properties are set after entering the model parameters. During simulation, the values of these methods are being updated:

Life cycle: using fuzzy inference [7] on innovation and brand image determines pricing strategy (skimming or penetration [2]). Position on the curve of product life cycle is calculated on the ground of lifetime, current model time and determined strategy (result is coefficient of lice cycle <0, 1>). The coefficient is a sum of contributions of each price strategy.

Experience: using fuzzy inference on brand image and review determines an auxiliary value that is modified by existence of demo version. Obtained value is modified by number of users (both legal and pirate) in the way that greater number of users increases more the value that after the modification gives the coefficient of quality awareness <0, 1>.

Properties: using fuzzy inference on six properties of version[2] determines the coefficient of properties <-10, 10>. In case that some property is irrelevant for given product, this fact will not affect the result value of the coefficient. The transformation used in this method can be implemented in three ways: as a weighted average, radar graph or as a network of fuzzy regulators. The coefficient's value is obtained as an area that is demarcated by particular properties when using the radar graph. We have experimented with the network of fuzzy regulators and achieved applicable results with added weights.

Externalities: normalizes current number of users into <0, 1> by maximal number of users if the version produces externalities. This method then defines position on the chosen curve of externalities that is expressed by the coefficient of externalities <0, 1>. The coefficient is equal zero if version does not produce externalities. We use four types of curves [3, 4, 8], [6, 7].

Price expectance: modifies the average price of product according to social class membership. This value is then modified by the coefficient of life cycle (if equals 0 then will not affect the price, if equals 1 then affects the price maximally with given %). Loyal consumers are willing to accept a higher price.

Attitude: expresses an internal decision of each consumer if he will find out more information about product. In case the consumer has not purchased the product yet, this method does fuzzy inference on interest in each product and the coefficient of quality awareness. The method is time dependant because the coefficient can vary according to the number of users and pirates of the product. The result can be positively modified by consumer's loyalty to brand. We suppose that product can be purchased also by the consumer who has been using a pirate version recently.

Decision of purchase: modifies the coefficient of properties by the coefficient of externalities (stronger externalities increase the value of coefficient of properties). This method chooses versions where value of modified coefficient of properties is equal or greater than the coefficient of requirements of consumer on product. These versions are then filtered by maximization of consumer's utility and then where price expectance is equal or greater than version's price. The method compares the version's price with costs of illegal version at the end. It decides if consumer will purchase the product or if he will use illegal version. The model considers lowered utility of pirate version [1, 9]. This method allows use the second or third degree of price discrimination. It specifies the set of version the consumer maximizes his benefit from.

The method Decision of purchase models the fifth step of buyer's decision process. Its output can be positive, negative or can say that buyer chooses pirating. The method involved all methods mentioned above and after its execution values of properties that are time dependent are updated and the model time is shifted one day forward[3]. The other methods are time independent and their calculation is realized once on the beginning of the simulation (e.g. setting of customers' parameters, determination of each version's qualities, etc.).

We summarize the methods in Figure 2. There are shown inputs and outputs of each method.

The simulation is aimed at optimization of each version's price so that the vendor's profit would be maximal. It is possible to make several analyses focusing on the factors that influence the purchase due to the complexity of model parameters.

Construction of fuzzy inference, modification of number of properties, modification of curves of externalities and price strategies, modification of characteristics of social classes and other modifications allow adaptation of this general model to specific environments and products.

[2] These six properties are the main characteristics that differentiate versions.

[3] Time management can be adapted according to application domain. One day shift could be too small step for simulation in one case and too large in other.

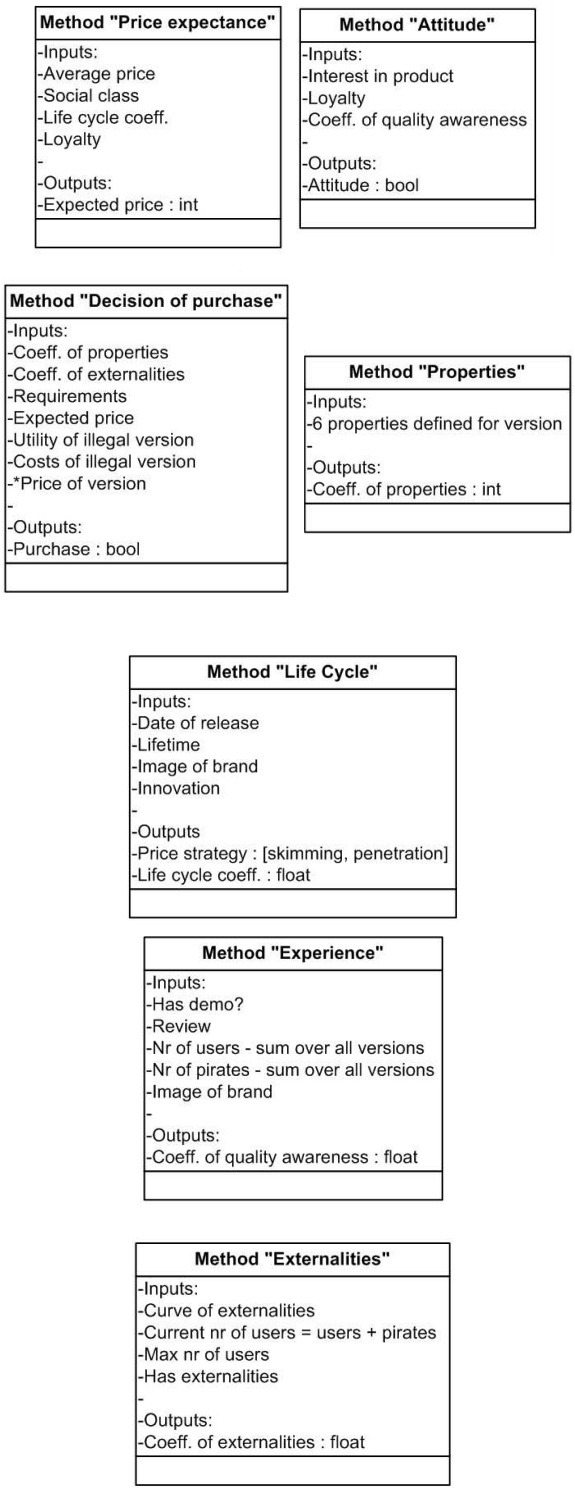

Fig. 2 (b) Methods, their inputs and outputs.

These methods model the buyer's decision process on the market.

4 Summary

Experimenting with model allows obtain a wider context of products, market subjects and factors that affect consumer's purchase decision making. During our experiments with the model we have obtained predicted progress of sale and piracy. It is useful also to monitor values of proposed coefficients in time.

The proposed market model can serve as a building block for further analysis. Proposed model could be also used for qualitative reasoning where basic laws of the environment are used to predict future state. Extending for the model could be for example an introduction of complements what implies the existence of switching costs and lock-in effect.

This model also does not consider changes of market mix of products, standardization or cooperation of vendors. The main question that must be answered is the validity of the proposed model. This could be achieved by cooperation with an expert from the practice, whose knowledge would be transformed into fuzzy logic and other parameter settings. The model is robust and does not limit the further improvements and extensions.

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