та джерел фінансування. Обґрунтовано пропозиції щодо розширення механізмів фінансування інвестиційних проектів в аграрному секторі за участю міжнародних інвесторів, у тому числі бізнес-ангелів. Розкрито економічну доцільність залучення венчурного капіталу та бізнес-ангелів для фінансування інноваційної діяльності аграрних підприємств. Охарактеризовано ключові вимоги та етапність отримання фінансування від міжнародної асоціації бізнес-ангелів.

Ключові слова: залучення іноземних інвестицій, аграрний сектор економіки України, інвестиційна привабливість, механізми фінансування інвестиційних проектів, венчурне фінансування, міжнародне інвестиційне співробітництво.

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МЕХАНИЗМЫ ФИНАНСИРОВАНИЯ ИНВЕСТИЦИОННЫХ ПРОЭКТОВ В АГРАРНОМ СЕКТОРЕ ЭКОНОМИКИ УКРАИНЫ ПРИ УЧАСТИИ БИЗНЕС-АНГЕЛОВ

Актуальность проблемы привлечения иностранных инвестиций в аграрный сектор экономики Украины и диверсификация форм международного инвестирования обусловлена необходимостью осуществления инновационного развития, технологической модернизации и повышения конкурентоспособности на мировом рынке украинских аграрных предприятий. Раскрыто состояние и проблемы привлечения иностранных инвестиций в аграрный сектор экономики Украины. Выявлено, что уровень привлечения прямых иностранных инвестиций в сельское хозяйство Украины и в целом в отечественный АПК не соответствует уровню его потребностей и инвестиционного потенциала. Сформулировано факторы инвестиционной привлекательности сферы АПК Украины, которые включают в себя следующие: высокая плодородность земли и благоприятные погодные условия для выращивания сельскохозяйственных культур; высокие экспортные возможности; высокая доходность украинских аграрных компаний и наличие резервов ее повышения; недооцененность активов и невысокая капитализация украинских компаний; благоприятный налоговый режим для агропроизводителей. Предложено отображать эти факторы в инвестиционных предложениях и проектах, которые отечественные аграрии представляют потенциальным иностранным инвесторам. Представлены направления государственной инвестиционной политики в аграрном секторе с целью консолидации ресурсной базы, а также источников финансирования. Разработаны и обоснованы рекомендации по расширению механизмов финансирования инвестиционных проектов в аграрном секторе при участии международных инвесторов, в том числе бизнес-ангелов. Раскрыто экономическую целесообразность привлечения венчурного капитала и бизнес-ангелов для финансирования инновационной деятельности аграрных предприятий. Охарактеризованы ключевые требования и этапность получения финансирования от международной ассоциации бизнес-ангелов.

Ключевые слова: привлечение иностранных инвестиций, аграрный сектор экономики Украины, инвестиционная привлекательность, механизмы финансирования инвестиционных проектов, венчурное финансирование, международное инвестиционное сотрудничество.

Bulletin of Taras Shevchenko National University of Kyiv. Economics, 2014, 6(159): 42-48
UDC 330.4:338.24: 519.86
JEL C65 D40 L95 Q25

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MODELING IN THE PROCESSES OF CHOICE OF THE COMPANY DELIVERING BOTTLED WATER BY THE CONSUMERS ON THE BACKGROUND OF REFLEXIVE MANAGEMENT

In this work the problem of high quality drinking water provision is described and analyzed. It is shown that a person may obtain such water by various ways one of which is bottled water delivery by specialized companies. The existence of numerous players on drinking water market stipulates the occurrence of the number of problems – in particular, the choice of the delivering water company by the consumer and fight of such companies for the consumer. The work proposes to apply a reflexive approach in order to influence the choice of the consumer, which allows the company to make him take the "right" decision. For solving the problem the classical and fuzzy model of reflexive management are described.

Keywords: drinking water, reflexive management, decision making.

Problem statement. The problem of water resources provision is actual in the whole world on the state level as well as on the level of each household. Water has a great utility meaning due to its usage in industry, agriculture, as drinking water etc. Although water is a renewable resource, today water pollution in the whole world has reached a critical level. It is subject to rivers, lakes, underground water and World ocean as a whole.

The most actual problem on the level of each state is the provision of its citizens by high quality drinking water. At the moment there are several ways of provision of the people by drinking water: central water supply, artesian water pump rooms, wells, bottled water etc. Water is an essential resource (as air) for the people whose quality of life depends on it. On the one side, everyone understands that in order to improve the quality of life (in the first hand health) of the people it is necessary that they drink clean water every day, especially using such water for making food and drinks. On the other hand, salvation of this problem needs considerable expenses which, as a rule, lie on the shoulders of the households. In such a way, the consumers stand before the problem of choice of the affordable and high quality drinking water. And the companies which provide people with drinking water have another problem: how the influence the choice of the consumers.

Analysis of the latest researches and publications. There are numerous works devoted to the provision of the population by high quality drinking water of scientific (theoretical and practical) as well as publicistic character written by the following authors: O. F. Balatskiy, A. K. Gorval, I. L. Golovinskiy, V. A. Golian, V. I. Danilov-Danilian, S. I. Doroguntsov, G. I. Korchak, L. G. Melnyk, M. A. Khvesyk, A. V. Yatsyk and others. Studying the works of scientists and practicians allows to make a conclusion that the problem of providing people with high quality drinking water is diverse, important and actual and requires constant monitoring and research of the bottled water market.

On one side the companies delivering bottled water perform social function – provide the population with drinking water, on the other – their activity is aimed at obtaining profit. At the moment there are many players on bottled water market among which are big (national) and small (city level) companies. There are two important problems which require constant salvation: consumer's choice of the company delivering bottled water and influence of such companies on that choice. Relevance and practical meaning of these problems have determined the aim of this investigation.

The aim of the investigation lies in the analysis of the accessible ways of providing people with drinking water, research of the bottled water market, grounding of the ne-

cessity of applying of the reflexive management in relations between the company delivering bottled water and the consumer, development of the corresponding economical-mathematical models.

Main results of the investigation. Major part of the population in the world and Ukraine consumes water due to central water supply. But even the clearest water that flows through the system of tens or hundreds of kilometers of tubes can lose its quality and even become harmful for the health. The reason is first of all – worn-out state of the tubes and the ability of water to solve practically everything. That is why such water should be additionally filtered before the consumption. For this purpose various filters can be used: filter cups, reverse osmosis systems, peripheral, flow through filters etc. The cost of such filters also differs and depends on many factors, in particular – on the capacity of the cartridge (how many liters of water the filter is capable to clean). Besides, the pollution of the filter should necessarily be observed. But even such cleared water needs to be boiled before consumption. Moreover, even scientists and specialists still do not have the unambiguous attitude towards various filters and their usage. For example, in [1] it is noted that "no water filters can clear water".

Bottled water can be a good alternative. Let us recall how a couple of years ago it was considered to be prestigious to have a cooler in the office with a bottle of water for own and clients' use, and today this attribute of "respectable life" has become a usual thing not only in the office, but even in private apartments as well. Bottled water is a safe and conveniently packed in hygienic container food product which corresponds the state standards and hygienic norms applied to drinking water which is sold and for the purpose of purchase by the people [2, 3]. Today there are the following types of bottled water [2, 4]: artesianwater or artesianwellwater; mineral water; purified water; ground water; spring water; sparkling water; sterilized water; well water.

Wide spread of bottled water is conditioned, in particular, by the fact that even after filters it still remains the pipe water, so its quality is under question. On the contrary, bottled water, as a rule, is produced in ecologically clean regions, does not require boiling, so its quality is higher. Still, nothing is unambiguous here too. In [1] it is stated that preservatives re added in such water which is not noted on the etiquettes. Besides, the use of plastic packing reduces the quality of water in a month after it was packed. In the process of such packing production bisphenol A is used which is very dangerous for the health even in small amounts [5] and gets into water as a result of heating plastic bottle with water. There are also other points of view as for the effect of bisphenol A on peoples' health [6]. It is also clear that plastic packing causes the pollution of environment as well [5].

As we can see, it is hard to say which water is the best and safest for human health. Each person decides what water to consume choosing some rational, from his/her point of view, balance of quality and price. Obviously, the cheapest is water from central water supply system (the cost of 1 liter is less than 1 copeck for Kyiv), the most expensive – bottled water (the cost of 1 liter of such water delivered by the companies may even reach 3 UAH in Kyiv). Despite this, each year we observe the increase of bottled water consumption in Ukraine [7]. The growth of bottled water demand is also conditioned by the growth of the number of enterprises producing, delivering and selling water of this type. For instance, there are more than 50 of such enterprises in Kyiv now which differ by the production volume, type and quality of water, terms of delivery, additional products and services etc.

It is the peculiarity of the bottled water market that enterprises actually offer the same product – water, and have no opportunity to change its characteristics or widen the assortment. On the contrary, the producers of bread (with the aim of satisfying the needs and wishes of the consumers) make bakery products of wide choice – from usual baton to various rolls with filling, the producers of dairy products offer milk of different fatness, yoghurts with various fruits and berries fillings etc. Thus, these producers aiming at increasing their income and competitive ability on the market can offer various products, change the assortment satisfying the needs and wishes of the consumer. We cannot say the same about the companies producing, delivering and selling drinking water. Although some companies offer water with various characteristics (softened water, silvered, iodinated etc.), the only means for them to compete for the consumer are low price and fast delivery. Still, even here there are some problems: the consumers associate low price with low quality of water, so it is hard to convince especially the new clients that water quality is good. One can of course deliver water right after the client's call, but this will hardly be economically justified. That is why such companies have to search for other means of influencing the consumers' choice.

Several factors influence the consumer's choice, among which are: quality and cost of water, terms of delivery and payment, quality and fastness of delivery, additional services and products.

Quality of drinking water is determined by its physical and characteristics (chlorides, mineralization, ferrum, trihalomethanes, residual chlorine, hardness, alkalinity) and microbiology (E.coli, antibiotics or preservatives) [8]. Some producers and companies delivering water also provide information as for physical and chemical characteristics on the packing, although antibiotics are never noted despite the fact that they may be in water. In this case the consumer should either fully trust the information on the packing or bring the sample of water to special laboratory for testing, or simply taste the water and follow the feelings and impressions after its consumption. For example, the formation of scale indicates that there is much calcium and magnesium salt and the more salt – the harder is water. Many people consider such water less "tasty". There are also presumptions, not confirmed enough by the doctors, that elements of scale may cause the formation of stones in kidneys.

The cost of water is available information for each consumer – it is indicated on the company's site or one can inquire it by the phone. None of the companies splits the price of a bottle and the price of delivery. The consumer only gets to know the cost of the bottle of water, but delivery is usually made under the condition that a consumer orders not less than two bottles. Besides, all the other additional goods or services become available for the consumer only in case of the order of the bottles of water. For example, the company "IDS Aqua Service" offers the consumers water of well-known brands in usual glass and plastic bottles (0.33 l, 0.5 l, 0.75 l, 1.5 l or 6 l), but one can order it only under the condition of ordering the bottles of water (18.9 l).

At the moment the consumers usually make phone calls to make the order. The client orders the necessary products while talking to the company's operator who issues the order, specifies its cost and appoints the time of delivery. While the order of the bottles of water does not bring about any questions (as their assortment is not wide, stable) the order of additional products can cause some problems. For example, the company "IDS Aqua Service" offers only two types of bottled water – "Alaska" and "Old Myrhorod" – and the consumer should only decide how many bottles and of which water he has to order. And the assortment of additional products is much wider (various kinds of water and types of the bottles, different volume

and choice of tea or coffee) which makes it more problematic for the consumer to make a decision. In and ordinary store the consumer sees what he buys, and in case of ordering the products by the phone he has no such opportunity. Still, if the consumer has access to the Internet, he can check these products on the company's site and get an idea about them. Today many companies have started to use their sites not only as sources of information, but as Internet shops as well, where the consumers can make orders. At the moment the majority of companies receive payment for water in course of its delivery, but there are a number of companies, for example, "Etalon", which allow making payments on their sites using bank cards.

Delivery is the main service the companies provide, and the future orders of the consumers depend on its quality and speed. The consumers on their side state the following requirements: delivery should be made at the appointed time (as a rule it is a certain period of time); bottles and additional products should be packed in a proper way; in case if the car is late the driver should let the consumer know about it and check the consumer's opportunity to wait for delivery. The problem of traffic jams in Kyiv sometimes makes it impossible to make a delivery on time. If delivery is late one or two times, it usually does not have any effect on the future orders of the consumer. But if delivery is late all the time, the consumer most likely will stop cooperating with such company. Thus, the companies should take into account the daily traffic on the roads while generating the routes in order to keep to the schedule of water delivery.

Additional products and services can be a competitive advantage as the consumer can order the necessary products without leaving home.

Actual is also the problem of bottles water fakes, especially of well-known brands. That is why almost all the big companies are looking for various ways of fake security. In particular, the company "IDS Aqua Service" uses 5 levels of security [9]: brand-named anti-dust cap, which prevents the dust from getting into the bottle, thermo cap with the name of the company; high-quality polycarbonate bottles; laser deposition of the production date; one-use two-piece plug.

In order to increase the competitive advantages and supersede the unscrupulous producers from the market two organization were formed – the Association "Bottled Waters of Ukraine" and the Association of the producers of mineral and drinking waters of Ukraine which is a member of European Bottled Water Association – EBWA (or its new name "Watercoolers Europe"). To be a certified member of Watercoolers Europe, the company should meet the high standards of sanitary norms which is available only for big companies with modern equipment. Thus, one of the criteria of choice of the company delivering water can be its certified membership in Watercoolers Europe which guarantees high quality of water. Still, high quality drinking water cannot be cheap, therefore, the producers and suppliers of such water should apply maximum effort to fight for the consumers, they should influence the consumers' choice – in particular, with the help of reflexive management instruments.

Within the framework of reflexive management the influence on the consumer's (the person who makes a decision) psyche is made by intentionally providing him with information that would make him take a decision the company (the managing side in reflexive management) needs. In order to make the consumer take the necessary decision, one should create in him the non-adequately inflated self-esteem at the moment of taking this decision [10]. The art of reflexive management lies in the fact that it should be applied in such a way that the side under influence does not feel it and the decision is foreseen.

In each process of decision making forms the corresponding model of self-actualization which includes [12]:

- destination model (hierarchical total of targets of the process of decision making, the rules of forming the attitude of domination on the multiplicity of targets and on multiplicity of the criteria of estimating the alternatives);
- model of the current state of decision making (the total of alternatives, the multiplicity of criteria, the meaning of criteria for the alternatives on multiplicity of criteria (the attitude of domination, the attitude of priority), the rules of choice);
- model of restrictions (model of relations between the targets of the process of decision making and the targets of other processes in decision making as well as the model of the current state of other processes of decision making).

However, it is hard for a common consumer to build such models. They usually simplify the problem of making choice by the way of comparison of small number of alternatives by definite requirements choosing at this the first alternative which meets all requirements. With this they confirm the statements of the concept of the bounded rationality by Herbert Simon [13, 14].

Besides, the multiplicity of the criteria of the consumer's choice of the company delivering bottled water can also vary. One consumer may use the above mentioned criteria, and the other – the following: the image of the company, other consumers' reviews of the company, the cost of one bottle of water. The first two criteria actually form the notion of the "quality of water" of some company in the consumer's consciousness. The consumer estimates the correlation between the quality of water and the cost of one bottle of this water. In this case we can talk about the psychologically comfortable price [15, 16]. In our case, it is the price for one bottle of water which the consumer is ready to pay for high quality water basing on his own experience and the experience of other consumers. If the real price appears to be lower than psychologically comfortable price the consumer may form the opinion that water is low quality and can reject the order (purchase) of such water. In case the real price is higher than psychologically comfortable price the consumer may also reject the order (purchase) of such water.

Thus, one of the tasks of the companies producing and delivering bottled water is setting such price for one bottle of water which would be as close to psychologically comfortable price of the consumer as possible. The price of the sale is set only by the company and the consumer cannot directly influence it. Although in the market scale the influence of the consumers is considerable – if there are no sales, the necessity occurs to lower the price which can lead to various consequences: either for increase of the income due to the increase of sales, or substantial losses if the consumers do not buy such water even for lower price. Still, the company producing and delivering bottled water can influence the forming of psychologically comfortable price by the consumer by means of advertising campaigns showing the dependence of health on quality of water; sponsorship of various sports activities; educational activity as for the quality of life, clean environment etc. In the consumer's consciousness the understanding should form that only high quality water can be the reason for good health, and this water is worth practically any price as health is a priceless gift. In such case we can talk about reflexive management.

Even when the real price fully coincides with the psychologically comfortable price or is close to it there are no guarantees that the consumer will make the necessary for the company producing and delivering bottled water choice in favor of this company. Although, in this case there is a possibility to at least estimate the consumer's readiness to take such decision, in particular, using the model of V. Lefevre. The model he proposes describes the readi-

ness of the person with reflection to make some action (in our case – to choose the company delivering water) [17]:

$$A1 = (a3 \to a2) \to a1, \quad (1)$$

where $A1$ – Boolean function which describes the readiness of the consumer to make the choice (truth, i.e. 1 – the consumer is ready to make the choice, lie, i.e. 0 – the consumer is not ready to make the choice); $a1$ – the assessment of pressure of the outside world on the consumer (the person taking a decision); $a2$ – the assessment of the consumer's mental set; $a3$ – the assessment of intentions (strivings and wishes) of the consumer. In the given formula $a3 \to a2$ – self-esteem of the consumer which consists of his mental set and intention in the situation of decision taking.

The assessment $a1$ represents the subconscious perception by the consumer of the outside world. Making his choice the consumer sometimes does not understand why he took this or that action. Such behavior of the consumer can be reached by means of competent advertising. If $a1$=1 it means that the environment (the company producing and delivering water) has an absolute influence on the consumer in the process of his making a necessary decision. If $a1$=0 it means that there is no such influence.

The assessment $a2$ reflects the obtained by the consumer his own knowledge and expectations on the basis of the received experience from using bottled water of the definite company. This assessment reflects psychological state of the consumer at the moment of his making choice. If there is no own experience other consumers' experience can be used which they share on various forums, in social networks etc. Analyzing these reviews the consumer is trying to reflect in his consciousness their perceptions and feelings in order to make a reasonable choice. In this case we can talk about mutual reflection. If $a2$=1 it means that the consumer obtained absolutely positive experience from using bottled water of the definite company. If $a2$=0 it means that consumer obtained absolutely negative experience.

The assessment $a3$ corresponds to expectation and needs of the consumer he wants to satisfy. In our case the consumer is trying to satisfy his natural need of high quality drinking water. He imagines what high quality water should be, i.e. definite expectations are formed. If $a3$=1, the consumer thinks his needs will be satisfied. If $a3$=0, the consumer thinks his needs will not be satisfied at all.

In our opinion, as an assessment $a3$ the module of the difference between the psychologically comfortable price and real price for the bottle of water can be used. We will consider that the less difference by the module is the more the consumer's expectations are satisfied. For transition to Boolean values we propose to set boundary value for difference by the module. If definite value of the module of the difference between psychologically comfortable price and real price appears within the set boundaries, then we can consider that assessment $a3$ takes value 1, other – 0.

Despite the existence of the even more considerable outer influence the consumer takes his own decisions if there is full freedom of choice among the alternatives. Such choice is called realistic and is defined as all the solutions of the following equation [11]:

$$A1 = (a3 \to a2) \to a1 = a3. \quad (2)$$

All of the noted assessments ($a1$, $a2$, $a3$, $A1$) are Boolean, i.e. take values 0 or 1. Sometimes it is quite hard to make a clear assessment. In this case it is proposed to use the instruments of the fuzzy sets theory and possibility theory. Having changed in (1) common to fuzzy implication, we will receive the following model:

$$\tilde{A}1 = (\tilde{a}3 \to \tilde{a}2) \to \tilde{a}1, \quad (3)$$

where $\tilde{A}1$ – fuzzy set which is formed by the linguistic variable which corresponds the resulting assessment of the consumer's readiness for making the choice, $\tilde{a}1$ – fuzzy set which is formed by the linguistic variable which corresponds the assessment of the outside world pressure, $\tilde{a}2$ – fuzzy set which is formed by the linguistic variable which corresponds the assessment of the mental set of the consumer, $\tilde{a}3$ – fuzzy set which is formed by the linguistic variable which corresponds the assessment of the consumer's intentions.

For fuzzy implication there are various ways of calculation of the resulting value of the membership function which were proposed by such scientists as L. Zadeh, K. Godel, E. Mamdani, J. Goggin, N. Vadi, L. Brauer and others [18]. Using the classical fuzzy implication of L. Zadeh, for (3) the following will be true:

$$\mu_{(\tilde{a}3\to\tilde{a}2)\to\tilde{a}1}(x,y,z) = \max\left\{\min\left\{\mu_{\tilde{a}3\to\tilde{a}2}(x,y), \mu_{\tilde{a}1}(z)\right\}, 1-\mu_{\tilde{a}3\to\tilde{a}2}(x,y)\right\}, \quad (4)$$

where $\mu_{\tilde{a}3\to\tilde{a}2}(x,y) = \max\left\{\min\left\{\mu_{\tilde{a}3}(x), \mu_{\tilde{a}2}(y)\right\}, 1-\mu_{\tilde{a}3}(x)\right\}$; $\mu_{\tilde{a}1}(z)$, $\mu_{\tilde{a}2}(y)$, $\mu_{\tilde{a}3}(x)$ – membership functions correspondingly to $\tilde{a}1$, $\tilde{a}2$, $\tilde{a}3$; x, y, z – description of the probable situation for the corresponding assessment (term).

Let's assume that each of the fuzzy sets ($\tilde{a}1$, $\tilde{a}2$, $\tilde{a}3$, $\tilde{A}1$) reflects the corresponding the most desirable result for the company delivering water. Then $\mu_{\tilde{a}1}(z) = 1$ will mean the absolute influence of the environment on the consumer in his taking the necessary decision, and $\mu_{\tilde{a}1}(z) = 0$ will mean the full absence of such influence. We will consider that the consumer obtained absolutely positive experience of using bottled water of the definite company if $\mu_{\tilde{a}2}(y) = 1$, and absolutely negative if $\mu_{\tilde{a}2}(y) = 0$. Analogically when $\mu_{\tilde{a}3}(x) = 1$ the consumer presupposes that all of his needs will be satisfied, otherwise $\mu_{\tilde{a}3}(x) = 0$. Found by the formula (3) value of the membership function for the resulting assessment $\tilde{A}1$ can be interpreted like this: if $\mu_{(\tilde{a}3\to\tilde{a}2)\to\tilde{a}1}(x,y,z) = 1$ then the consumer is absolutely ready to make the necessary decision, if $\mu_{(\tilde{a}3\to\tilde{a}2)\to\tilde{a}1}(x,y,z) = 0$ then the consumer is not ready to make such decision. The value of the membership function which lies within the boundaries from 0 to 1 will show the level of intensity of the corresponding assessment.

One of the problems of modeling in our case is the necessity of assessment of the behavior (psychoemotional state) of the person under various conditions. It is quite hard to provide such assessment with not just verbal but with exact numeric equivalent. In this case we propose to use Harrington scale which is a verbal-numerical scale containing comprehensive (verbal) description of the gradations and corresponding to these gradations numerical values: very high level (0,8–1,0); high level (0,64–0,8); medium level (0,37–0,64); low (0,2–0,37); very low (0,0–0,2).

Harrington scale is widely used as an instrument of artificial intellect, in particular, in intellectual systems of decision making. It refers to psychophysical scales and allows taking into account psychological peculiarities of the human. Thus, having described a definite assessment with

the words, we can define its level and pass to its numerical equivalent. But the given scale allows passing not only to the one number, but to the range of numbers. In this case we can take either average value of the range, or depending on the person's attitude to the problem – minimal or maximal value of the range. If the person has inclination to risks his/her assessments will be overestimated and correspondingly maximal value of the range can be taken. And, vice versa, if we consider that a person is conservative in taking decisions, is not inclined to risks, we can take the minimal value of the range.

For example, for the assessment $\tilde{a}3$ such possible gradations are formulated:

1) very low level – bottled water of the company absolutely cannot satisfy the needs of the consumer in high quality water. Then $\mu_{\tilde{a}3}(x) \in (0,0;\ 0,2]$ and for calculations can be taken $\mu_{\tilde{a}3}(x) \approx 0$, or $\mu_{\tilde{a}3}(x) = 0,1$, or $\mu_{\tilde{a}3}(x) = 0,2$;

2) low level – bottled water of the company can satisfy only some needs and requirements of the consumer. Then $\mu_{\tilde{a}3}(x) \in (0,2;\ 0,37]$ and for calculations can be taken $\mu_{\tilde{a}3}(x) \approx 0,2$, or $\mu_{\tilde{a}3}(x) = 0,285$, or $\mu_{\tilde{a}3}(x) = 0,37$;

3) medium level – bottled water of the company satisfies half of the needs and wishes of the consumer (for example, the quality of water by physical and chemical properties is satisfying for the consumer, but packing and term of delivery doesn't). Тут $\mu_{\tilde{a}3}(x) \in (0,37;\ 0,64]$, and for calculations can be taken $\mu_{\tilde{a}3}(x) \approx 0,37$, or $\mu_{\tilde{a}3}(x) = 0,505$, or $\mu_{\tilde{a}3}(x) = 0,64$;

4) high level – bottled water of the company can satisfy the majority of the needs and wishes of the consumer. Then $\mu_{\tilde{a}3}(x) \in (0,64;\ 0,8]$ and for calculations can be taken $\mu_{\tilde{a}3}(x) \approx 0,64$, or $\mu_{\tilde{a}3}(x) = 0,72$, or $\mu_{\tilde{a}3}(x) = 0,8$;

5) very high level – bottled water of the company satisfies absolutely all the needs and wishes of the consumer. In this case $\mu_{\tilde{a}3}(x) \in (0,8;\ 1)$, and for calculations can be taken $\mu_{\tilde{a}3}(x) \approx 0,8$, or $\mu_{\tilde{a}3}(x) = 0,9$, or $\mu_{\tilde{a}3}(x) \approx 1$.

Analogical gradations can be formulated for other assessments either, including the resulting one.

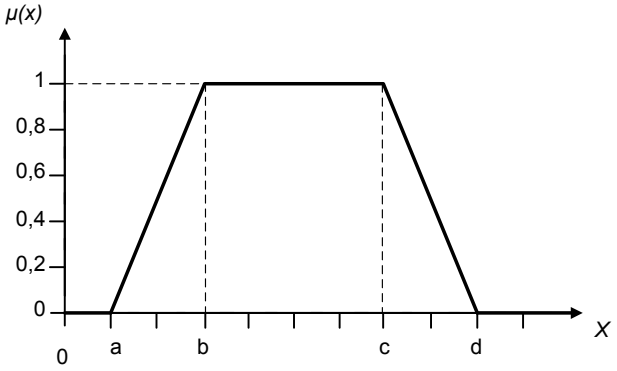
In case of using the module of the difference between psychologically comfortable price and real price for one bottle of water as an assessment $\tilde{a}3$, it is necessary to normalize the module of this difference (for example, divide by psychologically comfortable price) so that the received value lies within the range from 0 to 1. Note: if real price exceeds the psychologically comfortable price by 2 times it is necessary to select the other means of normalization. The closer to 0 is this value – the better, that is why for transition to membership function value it is necessary to minus it from 1.

For example, psychologically comfortable price is defined by the consumer on the level of 42 UAH for one bottle of water, and real price for one bottle of water constitutes 44 UAH at one company and 26 UAH at the other. In the first case the module of the difference equals to 2, in the other – 16. After normalization we received 0.048 for the first case and 0.38 for the second. Then the value of the membership function will equal correspondingly $\mu_{\tilde{a}3}(x) = 1 - 0,048 = 0,952$ (very high level by the Harrington scale) and $\mu_{\tilde{a}3}(x) = 1 - 0,38 = 0,62$ (medium level by the Harrington scale).

It is also possible to estimate the readiness of the consumer to make a choice by the model (3) in the following way. We formulate five quality terms which will reflect the possible assessments levels (including the resulting one): very low assessment, low assessment, medium assessment, high assessment, very high assessment. We can use a trapezium-shaped membership function as a membership function of the fuzzy terms [19]:

$$\mu(x) = \begin{cases} 0, & x \le a \text{ or } x \ge d, \\ \dfrac{x-a}{b-a}, & a < x \le b, \\ 1, & b < x \le c, \\ \dfrac{d-x}{d-c}, & c < x < d, \end{cases} \qquad (5)$$

where a, b, c, d – coordinates of the X-axis, which correspond to the apexes of the trapezium (see pic. 1).



Pic. 1. Model of the trapezium-shaped membership function [19]

For the graphs of membership functions of the fuzzy terms "very low assessment" (VLA), "low assessment" (LA), "medium assessment" (MA), "high assessment" (HA), "very high assessment" (VHA) the coordinates on the *X-axis* *a*, *b*, *c*, *d* are defined for each of the assessments of the model (3) individually and depend on the actual choice situation.

Further we build the expert fuzzy knowledge base which consists of linguistic rules like "If-then", in particular, by the way described in [19] with experts involvement. Every rule like this reflects the result at the possible combination of assessments $\tilde{a}1$, $\tilde{a}2$, $\tilde{a}3$. There will be 125 rules. With the help of the membership functions and weighing coefficients we represent the analytical form of the record of the decision rule of defining the possible various assessments $\tilde{A}1$: very low, low, medium, high, very

high. Such final solution is selected for which the value of the membership function $\tilde{A}1$ is maximal.

Besides, in the reflexive management of the processes of making decisions by the consumer as for choosing the company delivering water various instruments of modeling can be used, in particular[11]: methods of statistical analysis; methods of economical dynamics; imitation dynamics etc. The usage of economical-mathematical methods and models allows strengthening of the groundings of decisions of the company delivering water as for changing the terms of delivery, packing, the price of water which should facilitate the increase of the company income. The development and implementation of the models of reflexive management, in our opinion, allow to reach this target the best way and for this reason they should become basic in managing the relations between the company delivering water and its consumers.

Conclusions. The article regards the actual problem of provision of the population with high quality drinking water. At the moment various types of bottled water are available for the consumers, and this is why the problem occurs of its choice according to different criteria. The consumer makes such choice following, in particular, his financial abilities. Natural is the wish to spare money, but in the case with water this may mean using water of the worse quality which may affect health. On the other hand, "expensive" water does not automatically mean high quality water.

Various organizations of the consumers and organizations protecting the rights of the consumers, mass media conduct the researches of the quality of goods including water on the basis of which the consumer may take a considerate decision. Such researches are quite expensive and cannot be conducted all the time, although they are extremely needed. The situation on the market of water supply, in particular in Kyiv, changes each year: new companies offering cheap water appear, and common consumers need to know whether this water is high quality or not. Besides, such companies stipulate the growth of competition on the market, and its constant players should take some measures.

The article proposes the companies delivering water to use the elements of reflexive management of the process of decision making by the consumer as for choosing the company delivering water. In our opinion, this will allow to increase the compatibility of the companies and their income.

The received results can be the basis for further various theoretical and applied researches of the problem of the consumer's choice of high quality drinking water. It is necessary to develop and improve the existing economical-mathematical methods and models of the reflexive management and develop the new ones, in particular, using the elements of fuzzy sets and fuzzy logic, genetic algorithms, artificial neural networks etc.

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Надійшла до редколегії 05.05.14

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МОДЕЛЮВАННЯ В ПРОЦЕСАХ ВИБОРУ СПОЖИВАЧАМИ КОМПАНІЇ З ДОСТАВКИ БУТИЛЬОВАНОЇ ВОДИ НА ПІДГРУНТІ РЕФЛЕКСИВНОГО УПРАВЛІННЯ

Людина може отримати якісну питну воду кількома способами, одним з яких є доставка питної бутильованої води спеціалізованими компаніями. Існування великої кількості гравців на ринку питної води зумовлює виникнення низки проблем, зокрема, вибір споживачем компанії з доставки води та боротьба таких компаній за споживача. У роботі запропоновано для впливу на рішення споживача використовувати рефлексивний підхід.

Ключові слова: питна вода, рефлексивне управління, прийняття рішення.

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МОДЕЛИРОВАНИЕ В ПРОЦЕССАХ ВЫБОРА ПОТРЕБИТЕЛЯМИ КОМПАНИИ ПО ДОСТАВКЕ БУТЫЛИРОВАНОЙ ВОДЫ НА ОСНОВЕ РЕФЛЕКСИВНОГО УПРАВЛЕНИЯ

Человек может получить качественную питьевую воду несколькими способами, одним из которых является доставка питьевой бутилированной воды специализированными компаниями. Существование большого количества игроков на рынке питьевой воды приводит к возникновению ряда проблем, в частности, выбор потребителем компании по доставке воды и борьба таких компаний за потребителя. В работе предложено для влияния на решение потребителя использовать рефлексивных подход.

Ключевые слова: питьевая вода, рефлексивное управление, принятие решения.