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MULTICRITERIA PREDICTION OF DEMAND AS A CONTEMPORARY APPROACH TO SOLVING THE PROBLEM OF STOCK MANAGEMENT

The paper describes the application of the analytic hierarchy process (the AHP) in modelling and analysis of different factors, especially in situations when there is a necessity for integration of contextual pieces of information which are the consequence of sudden and unpredictable changes in business environment in which an enterprise operates. The model is applied on the example of demand prediction on the sale of products of the Centropromet Cuprija enterprise with the aim of bringing to balance the level of the width of the assortment and an adequate level of stocks. The model is based on the expert knowledge of those knowing the movements at the market of products of plastic masses, the so-called granules, the existing real and projected trends in sales of granules. Subjective assessments is then made by the authors, taking into account the global economic crisis with its significant influence on the sale of granules at global markets.

Keywords: *multicriteria prediction; demand; stocks; analytic hierarchy process.*
JEL codes: C53; D81; E27; G14; F47.

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БАГАТОКРИТЕРІАЛЬНЕ ПРОГНОЗУВАННЯ ПОПИТУ ЯК СУЧАСНИЙ ПІДХІД ДО УПРАВЛІННЯ ТОВАРНИМИ ЗАПАСАМИ

У статті описано застосування методу аналітичної ієрархії в моделюванні та аналізі різних факторів впливу, особливо в ситуації раптових та непередбачуваних змін середовища бізнесу. Застосування моделі продемонстровано на прикладі прогнозування попиту та продажів сербського підприємства з метою збалансування широти асортименту та розміру товарних запасів. Модель спирається на оцінки експертів, що добре знають ринок пластмас у цілому та гранульованого пластику зокрема. Проведено суб'єктивне оцінювання актуальних та прогнозованих трендів продажів гранульованого пластику з урахуванням фактору світової кризи, яка суттєво вплинула на обсяги продажів на глобальних ринках пластмас.

Ключові слова: *багатокритеріальне прогнозування; попит; запаси; метод аналітичної ієрархії.*
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МНОГОКРИТЕРИАЛЬНОЕ ПРОГНОЗИРОВАНИЕ СПРОСА КАК СОВРЕМЕННЫЙ ПОДХОД К УПРАВЛЕНИЮ ТОВАРНЫМИ ЗАПАСАМИ

В статье описано применение метода аналитической иерархии в моделировании и анализе различных факторов влияния, особенно в ситуации внезапных и непредсказуемых изменений среды бизнеса. Применение модели продемонстрировано на примере прогнозирования спроса и продаж сербского предприятия с целью сбалансирования широты ассортимента и величины запасов товара. Модель опирается на оценки экспертов, хорошо знающих рынок пластмассы в целом и гранулированного пластика в частности. Проведено субъективное оценивание актуальных и прогнозируемых трендов продаж гранулированного пластика с учётом фактора мирового кризиса, который существенно повлиял на объёмы продаж на глобальных рынках пластмасс.

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Ключевые слова: *многокритериальное прогнозирование; спрос; запасы; метод аналитической иерархии.*

Introduction. Stock management in enterprise business presupposes the prediction of demand. Demand planning, as an important part of contemporary conditions of business doing, represents a critical business process with a direct impact on enterprise performances. Income, costs and resources exploitation are under the direct impact of the quality, temporal conformability and precision of demand planning. The reason for which the precision of demand planning is measured is the creation of a possibility of ensuring the availability for products and increasing the level of the buyer service.

Heizer and Render (2004) pointed at the fact that losses on stocks, which account for up to 1% of sales in retail, are marked as good, whereas in numerous retail facilities, the same amount to even more than 3% of sales. According to Raman, DeHoratius and Ton (2001), the leading enterprises in retail lose from 10% to 25% of their profits exactly for the reason of their inappropriate management of stocks.

According to Mimovic (2013), in the past decades, great significance has been ascribed to the AHP method, i.e. the analytic hierarchy process, which is a relatively new approach, suitable for solving problems of this sort and those of a similar sort. Also Randjelovic et al. (2013) indicate that determining the importance of criteria in the multicriteria model is one of the key issues in multicriteria analysis.

The basic goal of the research is the analysis of multicriteria prediction of demand in managing stocks in retail. To be more precise, the adequacy of this model application on the example of the Centropromet Cuprija-Serbia trading enterprise is researched within the time period from 2008 to 2013. 3 hypotheses are tested in the paper: first, if one wants to ensure the adequate management of the level of stocks at the level of an enterprise, as a whole, it is necessary for demand prediction to be optimized. Second, adequate management of stocks implies lower costs of doing business, higher productivity, bigger profits and, simultaneously, greater buyer loyalty. Third, having in view the direct causal dependence between demand prediction and stocks management, a scientifically founded process of multi-criteria prediction of demand should be ascribed a significant role in contemporary conditions of business doing.

The methodology in this paper is based on the application of the AHP method, while the hierarchical structure of the problem is going to be constructed by means of the Expert Choice 12 Software Package and demand prediction.

Literature review. It has been proved (Fitzsimons, 2000) that to a large extent buyers notice and respond to the situations of staying without stocks with sellers who are their first choice as well as with those who are not. The situation of staying without stocks in shops has a very significant influence on consumer decision to change the point of purchase, changes in the assessment of the purchase made and the manner of decision-making with respect to the next purchase, which leads to a decrease in satisfaction.

According to Hanic (1990), when predicting demand for some product, there are two important factors that must particularly be taken care of. The first one is the level of stocks the inadequate size, structure or lack of information on which can

interrupt a possible sale. Despite the existence of orders, they will not be accompanied by a sale unless there is an appropriate product in stock. If a product has not been shelved, although there is potential demand, buyers not being aware of those goods, therefore will not order or buy them.

The analytic hierarchy process was developed by Saaty (1980) and it stands for an intuitive method for formulating and analyzing decisions; it can successfully be used for measuring a relative impact of numerous relevant factors on possible outcomes as well as for prediction, i.e. the performing of distribution of relative probabilities of the outcome. In literature, the AHP is suggested as a solution to big, dynamic and complex multicriteria decision-making-related problems such as strategic planning of organizational resources, evaluation of strategic alternatives and the introduction of new production technologies.

While applying the AHP method to evaluation and ranking of alternative outcomes, there are 4 basic steps to follow: 1) the decomposition of the problem – the development of a hierarchy of interrelated elements in decision-making describing the problem; 2) comparing pairs – a comparison of elements in decision-making, usually by using the comparison scale from 1 to 9, in order to obtain the incoming data; 3) prioritization – computation of the relative weighting factors of decision-making elements, most frequently by using the method of the characteristic value; 4) synthesis – the derivation of relative weighting factors of elements of decision-making so as to calculate a rating of alternative decision-making options (rankings).

The hierarchical model with different levels is formed in a manner that AHP decomposes a decision-making problem into elements according to their mutual characteristics. Each level corresponds (Saaty and Kearns, 1985) to mutual characteristic of the elements at that level – the principle of identity and decomposition. The problem is usually formulated as a hierarchy with 3 main levels: at the highest level, there is an explicitly defined goal, criteria are at the second one, and alternatives are at the third level. The goal is defined as a statement of the general task, whereas tasks or criteria are an expression of what one wants to achieve.

Once the AHP structure has been formed, pairs are compared to determine the relevant strength or intensity of influences of the elements in the hierarchy (Saaty and Kearns, 1985) – the principle of discrimination and a comparative assessment. Comparisons of pairs are the basis of the AHP method. When a pair of criteria are compared, the following questions are asked: what is more important? what has bigger influence?, by means of which a coefficient of their relative significance is determined. If a large number has been given during the comparison of two criteria, this is indicative of a bigger difference at the level of the observed criteria.

The square matrix accounts for a comparison of pairs in the AHP, and the same provides information on the domination of each element of the decision-making problem in comparison between the elements of the same level of a decision-making problem. A set of local priorities reflecting the relative impact of the set of elements on the element at the level immediately above is generated from the set of pair comparison matrices. In that manner, relative strength, value, desirability or probability of each element undergoing such comparison is revealed by solving the comparison matrices. For n decision-making elements, it is needed to make $n\ (n-1)\ /\ 2$ comparisons, which can be seen in Table 1.

Table 1. **The number of goals against pair comparison in the AHP model**

Number of goals	2	3	4	5	6	7	8	9	10
Number of pair comparisons	1	3	6	10	15	21	28	36	45

According to Leskinen (2000) and Saaty (2010), the comparison of pairs of decision-making elements is made on the basis of the 1–9 comparison scale, displayed in Table 2.

Table 2. **1–9 comparison scale** (Saaty, 2010: 10)

First section	
Question	***Answer type***
What can you say about your willingness to take financial risks, in general?	the scale ranging from 1 to 9 "1" refers to "*I never take risk*" "9" refers to "*I like taking risk*"
How do you invest your money?	Demand deposit account, % Time deposit account (1 month), % Time deposit account (3 months), % Time deposit account (6 months), % Time deposit account (1 year), % FCA (demand deposit), % FCA (time deposit), % REPO/T-bills/T-bonds, % Mutual fund (type B), % Mutual fund (type A), % Common stock, % Real estate, % **TOTAL, 100%**
Second section	
Question	***Answer type***
1. What are the 5 five words that come to mind when you hear the word "***risk"***?	unstructured question / maximum 5 items / in order of priorities
2. What are the first 5 words that come to mind when you are thinking about the risk factors that may create risk in your ***life***?	unstructured question / maximum 5 items / in order of priorities
3. What are the first 5 words that come to mind when you are thinking about the ***deficiencies*** that may create risk for you?	unstructured question / maximum 5 items / in order of priorities
4. What are the first 5 words that come to mind when you hear the word "***investment"***?	unstructured question / maximum 5 items / in order of priorities
5. What are the first 5 words that come to mind when you hear the phrase "***financial risk"***?	unstructured question / maximum 5 items / in order of priorities
6. What are the first 5 words that come to mind when you are thinking about the ***financial risks that you can undertake***?	unstructured question / maximum 5 items / in order of priorities

When speaking about efficiency, this scale has been validated in numerous practical applications as well as through theoretical comparison with a large number of other scales.

By entering assessments for each part of the model, information is synthesized so as to reflect the general preference (Saaty and Kearns, 1985) – the principle of synthesis. On the basis of synthesis, a report ranking alternatives against the general

goal is generated. The report implies a detailed ranking showing how each alternative has been evaluated against each criterion.

According to Saaty and Kearns (1985), the consistency index is a significant indicator of breaching the numerical (cardinal, $a_{ij}a_{jk} = a_{ik}$) and the transitive (ordinal) consistencies. The value of the consistency index should be around 10% or lower for it to be acceptable – otherwise, there is a need for a decision-maker to revise his/her assessments through seeking additional information. The mentioned index is calculated in the following manner:

$$CI = (\lambda_{max} - n)/(n-1), \quad (1)$$

where λ_{max} is the maximal characteristic value of the comparison matrix; n is the number of decision-making elements, while *CI* can be compared with the index for the accidental matrix, *RI* (Table 3).

Table 3. **Average consistencies for accidental matrices of a different order**

Size of matrix	1	2	3	4	5	6	7	8	9	10
Average consistency	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

The consistency index is then tested by using the λ_{max} deviation from n, in comparison with appropriate average values for accidental entries, by means of which the CR consistency coefficient is obtained. It is exactly for the reason of the request for consistency in pair comparison matrices that reciprocal entries ($a_{ij} = 1 / a_{ij}$) are used instead of traditional ones ($a_{ij} = -a_{ij}$), which are used for interval scale constructions.

The very application of the AHP is characteristic for the fact that, through synthesis, i.e. coordination of information, this method performs preferences in the form of an explicitly given structure, while simultaneously resulting preferences correspond to a significant extent to decision-makers' real preferences.

Research methodology and data. The Expert Choice 12 (EC12) stands for one of the most efficient tools in solving multi-criteria decision-making problems. It is a tool with strong performances for analyzing decisions at the organization level. The EC12 is a robust application intended for personal computers and enables the priority sorting of alternatives and reliable decisions-making on alternatives for achieving the desired goals.

In the application of the AHP and EC12 to a prediction problem, the 4 basic steps – evaluations of alternative outcomes are present: 1) the decomposition of the problem – the hierarchy development; 2) pair comparisons; 3) synthesis; 4) the analysis of sensitivity.

The explanation of all the 4 steps reflects itself in the process of 7 steps, which are as follows:

Step 1. The definition of the problem and research: 1a) the identification of the problem; 1b) the identification of tasks and alternatives; 1c) the research on alternatives.

Step 2. Elimination of unfeasible alternatives: 2a) determining the obligations, i.e. what is "a must-do"; 2b) elimination of the alternatives which do not meet obligations.

Step 3. Defining the prediction problem in the form of a hierarchy so that it contains the goal, the criteria (and sub-criteria) and the alternatives. Other factors should also be included, primarily scenarios, if it is feasible and needed.

Step 4. The evaluation of the factors in the model through pair comparisons: 4a) It is necessary for the majority of available facts to be used, on the condition that they are interpreted in a manner to meet the formulated tasks; 4b) for qualitative aspects of the problem, knowledge, experience and intuition should be used.

Step 5. Synthesis and deriving the best alternative.

Step 6. Examination and verification of the decision: 6a) the examination of the solution and analyzing sensitivity; 6b) checking the decision against intuition.

Step 7. Due to necessary control, it is needed for the result to be based on data, i.e. to be documented.

Since it was established at the beginning of the 1990's, the Centropromet enterprise has been operating as a private enterprise with trade as its profiled basic activity. The sales program is based on over 9,000 commodities, and first of all it is about trading food products, chemical products, the distribution of milk for the Nis Dairy and PVC product trade.

The Centropromet Cuprija enterprise has a rather diversified sales program and sells its products to other enterprises. Demand prediction is the basic input for tactical planning of sales as well as the level of stocks. Together with that, it also stands for one of the most significant determinants of its income. The enterprise owner wants to predict demand for plastic mass products, the so-called granules, which most significantly participate in the income within the overall assortment. Starting from the fact that it is a trading enterprise, rather than a production one, the following hypotheses to be tested in the research are formulated:

H1: If we want to ensure the adequate management of stocks at the level of the enterprise as a whole, it is necessary for demand prediction process to be optimized.

On the basis of prediction, it is possible to obtain necessary new knowledge on future phenomena and processes. The contemporary conditions of doing business impose the need for predicting future processes in business. The existence of prediction results enables a far more facilitated communication inside an enterprise between management and employees. The necessary precondition here is the accurate definition of the user's goals, since without understanding goals, it is impossible to predict successfully.

H2: Adequate stocks management implies lower costs of doing business, higher productivity, bigger profits and, consequently, greater buyer loyalty.

Managers find the practical application of the AHP very attractive because, in comparison with qualitative factors, the pair comparison procedure itself offers relative but not absolute assessments of preferences. The AHP method can be said to have in itself a mechanism for reviewing inconsistency so that the same could be identified at early stages of problem-solving.

In practice, there is a number of controversies in using the AHP method, so one of the goals was to remove some of the dilemmas in using this method. So far, the AHP method, recognized worldwide, has been applied in various strategic management fields, where decisions have far-reaching significance and where decision-makers readily opt for quality and reliable advisor at the stage of discussing alternatives and determining their effects in comparison with the goals set. Apart from that, too, the domestic professional and scientific public as well as analysts at enterprises main-

ly rely on statistical methods of prediction. From that relationship, the following statistical hypothesis to be tested in this research is formulated:

H3: A scientifically founded process of multicriteria prediction of demand should be given a significant role under the contemporary conditions of doing business.

The example of the Centropromet enterprise, supported by the AHP, is the proof that the application of multicriteria methods of prediction qualitatively upgrades the formal models of prediction and, in that way, enables sustainable and more systematic generation of additional factors as well as the adjustment of exogenous variables. The hypothesis has been proved that problems of economic prediction do satisfy the key assumptions for modelling and solving through the AHP method.

For the practical demonstration of the prediction process in 7 steps, we are going to focus on the sale of PVC products. PVC products characterized by the greatest value in the total turnover are the subject matter of our analysis. These are the so-called granules, and the most significant products are the following ones: low density polyethylene, high density polyethylene, polystyrene and polypropylene.

The key features of prediction under contemporary conditions of doing business are high complexity and uncertainty so they can be organized in the form of a hierarchical structure, on top of which there is the prediction goal; criteria are at the second level, and alternatives are at the third one.

Research results. The elements at the last level of the hierarchy define the possible rates of change in demand for plastic mass products in comparison with the assessment of sales for the year 2015. First, the unfeasible alternatives related to possible rates of demand growth in comparison to the estimated one are eliminated. This is explained by the existence of the perennial trend of decreasing demand and by the lack of the belief that something significant will change in market needs.

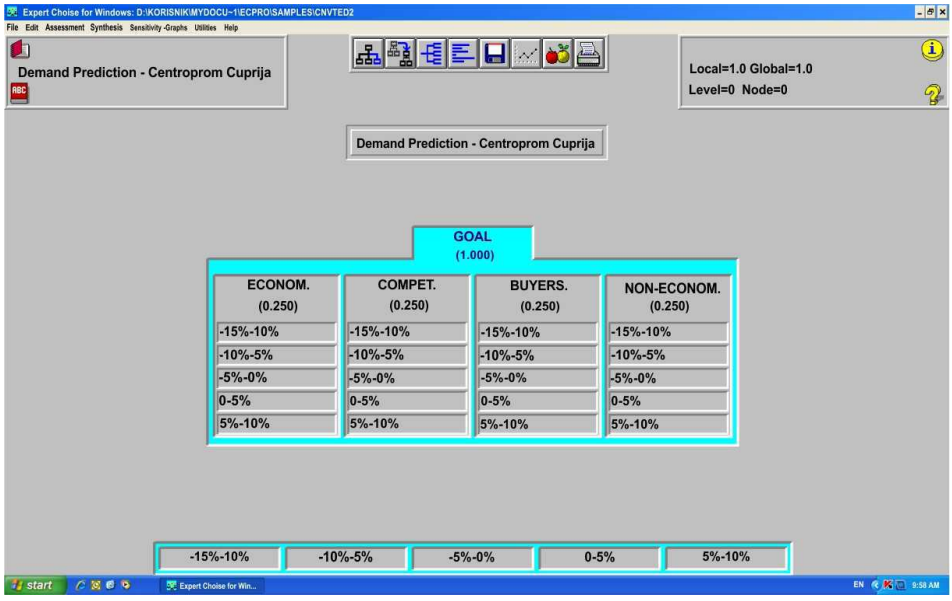


Figure 1. **The AHP structure for problem of predicting the demand for the products of Centropromet Cuprija**

Table 4. **The percentage share of individual products in the total income in the period from 2010 to 2014**

	2010		2011		2012		2013		2014	
	Realized income, RSD	Share in the total income, %	Realized income, RSD	Share in the total income, %	Realized income, RSD	Share in the total income, %	Realized income, RSD	Share in the total income, %	Realized income, RSD	Share in the total income, %
low density polyethylene	3,984,495	2.74	3,069,688	2.38	1,120,210	0.88	666,015	0.69	791,985	0.82
high density polyethylene	11,074,689	7.63	4,517,054	3.51	1,988,828	1.57	1,575,358	1.62	1,479,141	1.54
polystyrene	1,115,867	0.77	917,425	0.71	2,311,489	1.83	1,399,452	1.44	1,615,583	0.68
polypropylene	1,806,926	1.24	877,558	0.68	472,351	0.34	734,602	0.76	856,181	0.89
Granules-Total	17,981,977	12.4	9,381,725	7.29	5,892,878	4.66	4,375,427	4.51	4,742,890	4.94

Source: Internal Documentation, Centropromet, Cuprija.

Table 5. **Realized income per individual products in the period from 2010 to 2014,** *RSD*

	2010		2011		2012		2013		2014	
	Planned income	Realized income	Planned income	Realized income	Planned income	Realized income	Planned income	Realized income	Planned income	Realized income
low density polyethylene	3,500.000	3,984,495	3,000,000	3,069,688	1,000,000	1,120,210	500,000	666,015	500,000	791,985
high density polyethylene	10,000.000	11,074,689	4,000,000	4,517,054	2,000,000	1,988,828	1,000,000	1,575,358	1,500,000	1,479,141
polystyrene	1,500.000	1,115,867	1,000,000	917,425	500,000	2,311,489	500,000	1,399,452	1,000,000	1,615,583
polypropylene	2,000.000	1,806,926	1,500,000	877,558	1,000,000	472,351	500,000	734,602	500,000	856,181
Granules-Total	15,000.000	17,981,977	8,000,000	9,381,725	4,000,000	5,892,878	4,000,000	4,375,427	4,000,000	4,742,890
Total Income	130,000.000	145,189,000	120,000,000	128,727,000	120,000,000	126,549,000	100,000,000	96,963,000	90,000,000	96,061,000

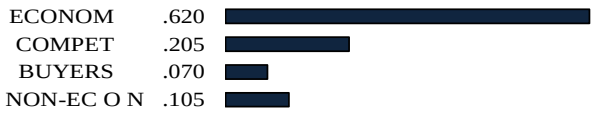
Source: Internal Documentation, Centropromet, Cuprija.

Node: 0

Compare the relative IMPORTANCE with respect to: GOAL

	COMPET	BUYERS	NON-ECONOM
ECONOM	5.0	4.0	5.0
COMPET		3.0	3.0
BUYERS			(2.0)

Abbrevation	Definition
Goal	PREDICTION OF DEMAND FOR CENTROPROMET PRODUCTS
ECONOM	Economic factors
COMPET	Competition
BUYERS	Buyers
NON-ECONOM	Non-economic factors



Inconsistency Ratio = 0.1

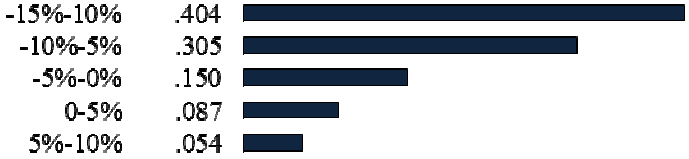
Figure 2. **The relative importance of criteria in the problem of demand prediction**

Node: 10000

Compare the relative IMPORTANCE with respect to: COMPET < GOAL

	-10%-5%	-5%-0%	0-5%	5%-10%
-15%-10%	2.0	3.0	4.0	5.0
-10%-5%		3.0	4.0	5.0
-5%-0%			2.0	4.0
0-5%				2.0

Abbrevation	Definition
Goal	PREDICTION OF DEMAND FOR CENTROPROMET PRODUCTS
COMPET	Competition
-15%-10%	Economic factors
-10%-5%	Competition
-5%-0%	Buyers
0-5%	Non-economic factors
5%-10%	



Inconsistency Ratio = 0.03

Figure 3. **The estimated probabilities of the alternatives against the economic factors criterion**

Second, the intervals are 5%, so there are 5 possible rates of change in demand identified: 1) strong reduction (from -15 to -10%); 2) weak reduction (from -10 to -5%); 3) very weak reduction (from -5% to 0%); 4) very weak growth (0–5%); 5) weak growth (5–10%). The possibility of having the growth rate of demand for plastic mass products yet slightly positive in comparison to the estimated one, even though the negative trend has been present in the recent years, is also allowed.

Differentiating the alternatives into positive and the negative growth rates is explained by the fact that there is a certain instability at the market and a lot of uncertainty when players and forces of the environment conditioned by daily political events are concerned.

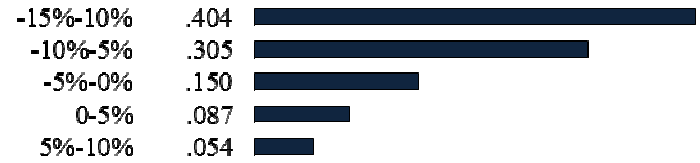
The hierarchical structure of the problem is constructed by means of Expert Choice 12 Software Package, according to the basic structure implying that the goal of the prediction is located at the highest level, and players and forces of the environment (the criteria) are at the second level. Decision-making alternatives that define the possible growth rates of demand are located at the lowest level of the hierarchy.

Node: 10000

Compare the relative IMPORTANCE with respect to: COMPET < GOAL

	-10%-5%	-5%-0%	0-5%	5%-10%
-15%-10%	2.0	3.0	4.0	5.0
-10%-5%		3.0	4.0	5.0
-5%-0%			2.0	4.0
0-5%				2.0

Abbrevation	Definition
Goal	PREDICTION OF DEMAND FOR CENTROPROMET PRODUCTS
COMPET	Competition
-15%-10%	Economic factors
-10%-5%	Competition
-5%-0%	Buyers
0-5%	Non-economic factors
5%-10%	



Inconsistency Ratio = 0.03

Figure 4. **The estimated probabilities of the alternatives against the competition criterion**

The next step in the prediction process is the derivation of the priorities for the elements in the hierarchy. With the hierarchy illustrated in Figure 4, the procedure of priorities establishment starts with the comparison of players and forces of the environment, in pairs, against the general goal of the prediction process (how important each element is at the second level of the hierarchy in comparison with the growth

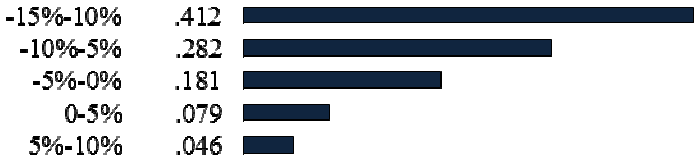
rate of demand). After several tries, in which the inconsistency index was above the permitted 0.10, it is estimated that the general situation in the national economy has the biggest impact on the demand growth, so the importance of this criterion is 0.620, whereas the criterion of *competition* has the 0.205 priority. "Centropromet" is one of the key players at the local market but, in the prediction process, the activities performed by competitors must be taken into consideration, too.

Node: 10000

Compare the relative IMPORTANCE with respect to: BUYERS < GOAL

	-10%-5%	-5%-0%	0-5%	5%-10%
-15%-10%	2.0	3.0	4.0	6.0
-10%-5%		2.0	4.0	6.0
-5%-0%			3.0	5.0
0-5%				2.0

Abbrevation	Definition
Goal	PREDICTION OF DEMAND FOR CENTROPROMET PRODUCTS
BUYERS	Buyers
-15%-10%	Economic factors
-10%-5%	Competition
-5%-0%	Buyers
0-5%	Non-economic factors
5%-10%	



Inconsistency Ratio = 0.03

Figure 5. **The estimated probabilities of the alternatives against the buyers criterion**

Somewhat surprisingly small estimated relative impact of buyers (0.070) is explained by the belief that their requests depend on general economic and political circumstances, so, only a clear distance from them could have influence on buyers as the factor that significantly determines demand in this case. For the same reasons, a relatively greater significance (0.105) has been ascribed to non-economic factors which, evidently, have a certain impact on this segment of the market.

Pair comparisons of the alternatives against the estimated significance of the criteria have resulted in the following probabilities of the defined growth rates of demand.

The synthesis of the priorities – the calculation of the prediction. The first step in defining the real demand is the synthesizing of the priorities of elements into a hierarchy so that general probabilities for alternatives of the demand growth rate could be obtained. Of all the discussed factors in the hierarchy, strong reduction has the biggest general probability (0.464), which is significantly bigger than the probability of the

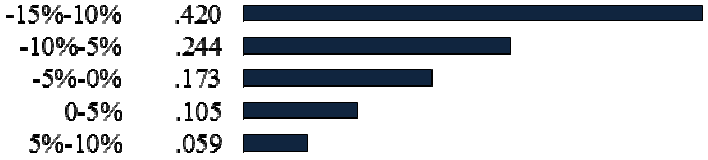
alternative of weak reduction (0.269), which is in compliance with the expectation that the trend of decreasing demand will continue within the defined frames. The illustrated above results represent the probabilities that a certain growth rate will materialize itself.

Node: 40000

Compare the relative IMPORTANCE with respect to: NONECONOM < GOAL

	-10%-5%	-5%-0%	0-5%	5%-10%
-15%-10%	2.0	3.0	4.0	5.0
-10%-5%		2.0	2.0	4.0
-5%-0%			2.0	4.0
0-5%				2.0

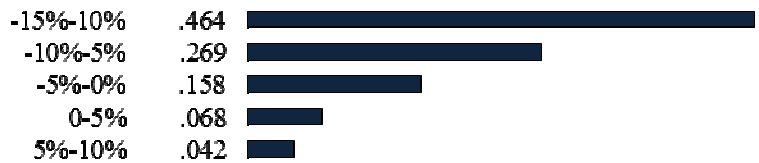
Abbrevation	Definition
Goal	PREDICTION OF DEMAND FOR CENTROPROMET PRODUCTS
NON-ECONOM	Non-economic factors
-15%-10%	Economic factors
-10%-5%	Competition
-5%-0%	Buyers
0-5%	Non-economic factors
5%-10%	



Inconsistency Ratio = 0.02

Figure 6. **The estimated probabilities of the alternatives against the non-economic factors criterion**

Synthesis of Leaf Nodes with respect to GOAL
Ideal Mode
OVERALL INCONSISTENCY INDEX = 0.06



Abbrevation	Definition
-15%-10%	decrease in demand from -15% to -10%
-10%-5%	decrease in demand from -10% to -5%
-5%-0%	decrease in demand from -5% to 0%
0-5%	increase in demand up to 5%
5%-10%	increase in demand over 5%

Figure 7. **Priorities in the alternative rates of change in demand**

Now, composite prediction can be defined in the manner that probabilities are combined by multiplying the average of the range of each growth rate by its general probability calculated by means of the AHP model. Composite prediction is shown in Table 6.

Table 6. **Calculation of composite prediction**

Growth rate	Range (%)	Average Rate (PO) (%)	Probability of alternative rates of change in demand (VA)	PO*VA (%)
Weak growth	5% - 10%	7.5	0.042	**0.315**
Very weak growth	0% - 5%	2.5	0.068	**0.17**
Very weak reduction	-5% - 0%	-2.5	0.158	**-0.395**
Weak reduction	-10% - (-5%)	-7.5	0.269	**-2.018**
Strong reduction	-15% - (-10%)	-12.5	0.464	**-5.8**
Total			1.000	**-7.7**

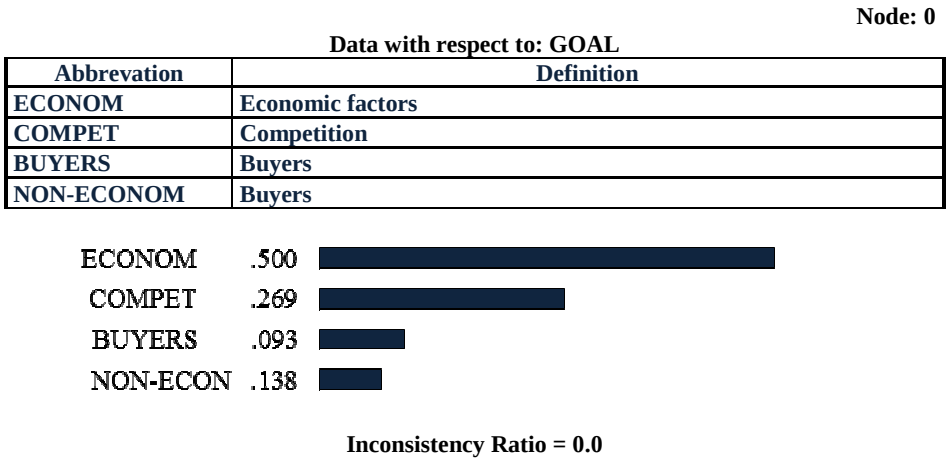
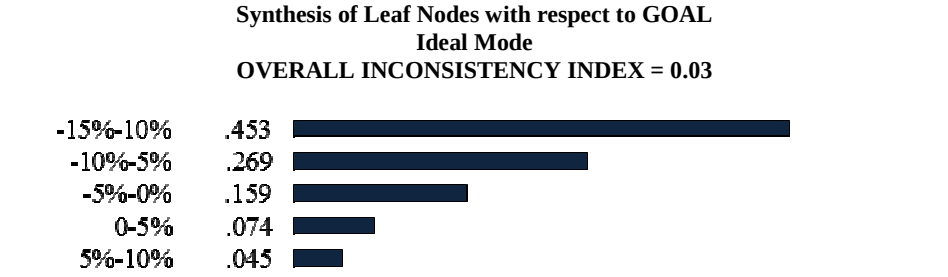


Figure 8. **The relative importance of the criteria in the problem of the prediction of demand**



Abbrevation	Definition
-15%-10%	**decrease in demand from -15% to -10%**
-10%-5%	**decrease in demand from -10% to -5%**
-5%-0%	**decrease in demand from -5% to 0%**
0-5%	**increase in demand up to 5%**
5%-10%	**increase in demand over 5%**

Figure 9. **Priorities of the alternative rates of demand change**

On the basis of the prediction process, supported by the AHP, the expected growth rate of demand for plastic mass products of the Centropromet enterprise in the year 2015 is -7.7%. The result of the prediction process can further be analyzed by performing the sensitivity analysis, as illustrated in Figure 10.

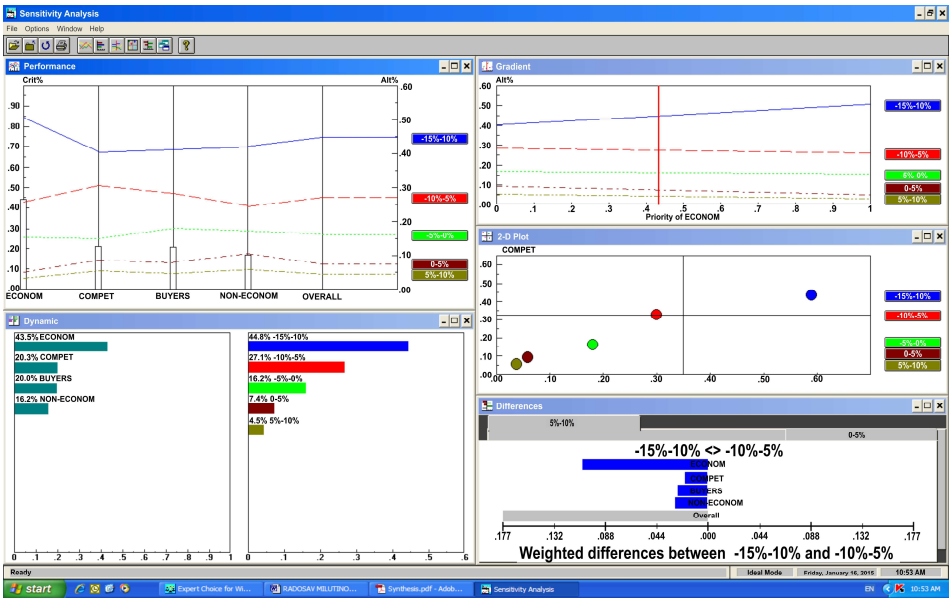


Figure 10. **The analysis of solution sensitivity against the buyers' criterion**

Allow us assume in that sense that the estimated relative importance of the criteria is now such that economy (0.500), competition (0.269) etc. as presented in the following figures.

As we can see, the changes are slight, the order of the alternatives according to importance has not changed, whereas their probabilities of realization have only slightly changed. Strong reduction in demand still has the biggest probability of realization (0.453), contrary to weak reduction in demand, which has the probability of 0.269 etc.

On the basis of the presented, one can notice that even substantially bigger relative importance of the *buyers* criterion does not have any influence on the order of alternatives (strong reduction in demand still has the biggest probability of realization), which only confirms the thesis that macroeconomic movements have the key influence on the movement of demand for the products of the Centropromet Cuprija enterprise.

Conclusion. Optimal stock management is of great significance for the efficiency of business in all economic sectors. Stocks stand for one of the most expensive types of enterprise's property, accounting for more than 50% of the total invested capital. Even today, especially at the time of the economic crisis, the theory and practice of stock management point out the fundamental importance of this segment for raising the efficiency level of working capital and at the same time enterprise's competitiveness. As a consequence, inefficient stock management has high costs and big losses in enterprise's profit.

Throughout the last millennium, the theory of stocks was continually being developed, offering new solutions and new models for efficient stock management. Contemporary approaches to stock management are the consequence of broad computerization of business. However, in spite of that, it can be concluded that their implementation in business practice of Serbian enterprises is still at the early stage.

On the example of the movement of future demand for plastic mass products of the Centropromet enterprise, the prediction being made by the evaluation of alternative future outcomes on the basis of the AHP method has practically been presented. Pieces of information on demand for the mentioned products indicate that during 2015 demand will be almost at the level which has been estimated on the basis of the composite prediction of the AHP method.

On the basis of all of the foregoing, a need for greater application of the formal prediction methods in practice is logically imposed; in that manner, decision-making process would be improved. By the empirical analysis on the example of the Centropromet enterprise, the possibility of applying the multi-criteria analysis (the AHP method) in the process of the prediction of economic phenomena has been demonstrated and confirmed. We argue that this method enables the achievement of precise and accurate results in predicting future demand and that it is relevant for Serbian conditions of doing business, which are characterized by a high degree of uncertainty and unpredictability.

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