SERBIA JOINING THE EUROPEAN UNION: AN ANP MODEL FOR FORECASTING THE ACCESSING DATE

Predrag Miroslav Mimović
University of Kragujevac, Faculty of Economics
mimovicp@kg.ac.rs

Ana Krstić
University of Kragujevac, Faculty of Economics
anakrstic@kg.ac.rs

Jovana Savic
University of Kragujevac, Faculty of Economics
jokasavic92@gmail.com

ABSTRACT

For the Republic of Serbia to acquire full membership in the European Union depends on a large number of factors, and it is very difficult to predict whether the country will attain membership and when it will happen. This paper first describes the Analytic Network Process (ANP), which is then applied to predict the most probable date of the Republic of Serbia's entry into the European Union taking into account the economic, political and legal conditions that the Republic must fulfill in the stabilization and association process. The model is based on negotiating chapters that are considered crucial in the process of Eurointegration and their interactions and relationships. The work is an extensive and improved version of the paper titled "Forecasting the accession of the Republic of Serbia to the European Union by using the Analytic Network Process" (Krstić et al., 2018). It is based on the complex network model of the Analytic Network Process, which encompasses not only multiple clusters and their elements, as well as their external and internal networks of influence, but in particular the impact of alternatives on relevant factors. All calculations were performed using the SuperDecisions software package.

Keywords: Eurointegration; forecasting; accession date; Analytic Network Process, Republic of Serbia

1. Introduction

Modern business conditions are characterized by high uncertainty and complexity, which is why the decision making process is rather difficult and focused not on the best, but the optimal solution. The choice of an optimal solution depends on a large number of heterogeneous criteria and their interdependencies. In the conditions of multicenter decision making, many methods can be used, and one of the most famous is the Analytic Hierarchy Process (AHP). This method is based on a clear hierarchical structure and division of goals, criteria and decision making alternatives, as well as neglecting the impacts and relationships that can exist between criteria, which can lead to decisions that are not optimal. In order to expand the scope of application of the Analytic Hierarchy Process on the decision problems an extension called the Analytic Network Process (ANP) which deals with conditions of interdependence and

feedback between and within clusters was developed. Many decision problems cannot be structured in the form of a hierarchy precisely because of the existence of interactions and dependencies between the elements at the higher and lower levels of the hierarchy. The ANP can accommodate these interactions because the elements are structured in the form of a network (Saaty, 2001a). This approach allows us to more fully comprehend and encompass complex relationships, especially in situations characterized by risk and uncertainty with two-way pairwise comparisons. In light of this, this paper examines the possibility of applying the Analytic Network Process to forecast the date that the Republic of Serbia could acquire full membership into the European Union (EU). The European Union is one of the most powerful regional communities today and is characterized by numerous political, economic and other complex problems stemming from the relationships between member states and candidates which affect the survival of the European Union. Therefore, the acquisition of the status of full member depends not only on how quickly the reforms are harmonized between the regulations in the Republic of Serbia and the legal requirements and heritage of the European Union, but also how satisfied the other countries are with the proposals of the Republic of Serbia as a candidate for membership.

The aim of this research is to use the Analytic Network Process to predict the most probable date that the Republic of Serbia can enter the European Union by examining the economic, political and legal conditions which the Republic must fulfill in the process of stabilization and association. In accordance with the defined object and goal, the paper starts with the assumption that the implementation of the Analytic Network Process, respecting the economic, political and legal conditions that must be included in the negotiating chapters, will enable us to accurately forecast the date of the Republic of Serbia's entry into the European Union.

The paper is organized as follows: the first section of the paper includes a review of the literature in which decision and prediction problems are presented that use multi-criteria prediction methods or the Analytic Hierarchy Process, or its extensions, the Analytic Network Process. In the second section of the paper, the research methodology is presented. First, we describe the Analytic Network Process, and then the prediction problem and the construction of the model itself. The results of the model are presented in the third section, while the last section contains the concluding observations, work restrictions and guidelines for the future research.

2. Literature review

The ANP has a wide application for solving decision making problems that involve risk, uncertainty, dynamics and complexity. The ANP is widely applied as a predictive instrument based on the distribution of the relative probabilities of future outcomes. Mimović (2012) studied the prediction of sales of a new car model, and the Fiat 500L showed that the ANP can be used very successfully to structure the influence of various factors on the final outcome of the prediction process. Sales forecasting using the ANP was carried out by Voulgaridou et al. (2009) who envisaged the volume of sales of a new product (the new edition of the book), as well as Shih et al.(2012) who researched the scope of sales of printers in Taiwan. Ozorhon et al. (2007) applied the ANP to predict the performance of international construction joint ventures. Using the ANP model, the authors examined the determinants of the performance of these joint ventures and came to the conclusion that the most important determinants of their success are the relationships between partners,

structural factors and partner compliance, primarily cultural. The ANP proved to be a good model for predicting the probability of failure in the business of construction companies in Turkey, including internal and external factors that determine the current business situation of the company and the links between them (Ozorhon et al. 2007; Dikmen et al. 2010). In the field of economic forecasting, the ANP method is often used to predict the likelihood of a financial crisis or predict the recovery of the economy (Niemira & Saaty, 2004; Saaty & Vargas, 2006, 2013; Blair et al. 2010; Azis, 2010). Interesting research by Adamus (2010) and Saaty and Vargas (2013) was carried out in connection with forecasting Poland's entry into the Eurozone. The results showed that the optimal alternative for Poland was late entry (after 2011). Political problems are also common in the application of the ANP method. Saaty and Vargas (2006, 2013) used this method to deal with forecasting possible ways to overcome the conflict between China and Taiwan and America's response to North Korea's nuclear threats. Further, Wu et al. (2014) combined Wireless Sensor Networks (WSN) and the ANP to reliably predict and monitor disasters, and to build the hill slope prediction model. Historical disaster data is analyzed using the ANP model, enabling users to predict and prevent disasters. Wey (2014) used the ANP in Environment Planning Support Systems and showed that when historical data are lacking and a broad spectrum of social impact was involved, the ANP, with the capacity to manage dependence and feedback among the factors, could serve as a tool to forecast outcomes by using expert judgment. These are obtained from the limit super matrix of the ANP that represents forecasts for the next period. Chung et al. (2016) applied a two-stage ANP to develop a predictive model for strategy execution problems. This study sought to help the case corporation predict possible types of problems encountered in the strategy execution stage, establishing corresponding executive methods to the types of problems that could help the case corporation prepare for strategy execution, and focusing on the strategy execution point that elevates corporate executive ability corresponding directly to the corporation's international competitiveness. They showed that the ANP provides a systematic structure and clear network system, affording different element indicators but related weights, by allowing decision makers to make better decisions in the application of strategic planning and resource allocation. Popa et al. (2018) applied the ANP as an alternative to econometric tools for predicting the market share in the farming industry, in which the market share is described as a network of nodes and clusters. This showed that the ANP model is a powerful instrument which can provide a deep understanding of the research problem which was how different factors affect the market share in the plant protection products industry.

3. Methodology

3.1 Analytic Network Process

Due to the limited use of the AHP method for decision making in situations of risk and uncertainty because of its inability to encompass complex relationships, Thomas L. Saaty (2001c) developed the ANP method as an extension of the AHP method. The essential concept of the ANP method is the impacts i.e. the interactions that exist between elements and clusters, which can be inner (between cluster elements) and outer (between clusters). In fact, this indicates that in this method it is not necessary to clearly define the levels of hierarchy, but there is a network consisting of elements and influences. Therefore, the ANP model consists of two parts. The first part consists of a control hierarchy or a network of criteria and sub-criteria, which control the interactions in the system being studied, while the other part represents a network of influences between elements and clusters. It is important to note that one ANP

model can have more than one network of influences. The use of the ANP method often involves reliance on the control hierarchy, i.e. the control system of profit, costs, chances and risks. The synthesis of results obtained from the control systems is first performed by calculating the profit margin and the chances, costs and risks for each individual alternative, and then the result is normalized at the level of all alternatives in order to achieve the best outcome (Saaty, 1999). The procedure for applying the ANP method involves the following five steps:

1. The decomposition of the problem – A decision problem is decomposed into its main components.
2. The cluster formation for the evaluation – After defining the decision making objectives, it is also necessary to generate clusters for the purpose of evaluation by a criterion, sub-criterion (if it is possible) and cluster alternative.
3. The structuring of the ANP model – The ANP is applied to different decision making problems in the field of marketing, health, politics, military issues, society, predictions, etc. Their accuracy of forecasting has been proven in impressive applications in the field of economic trends, sports events etc.
4. A paired comparison and prioritization – In this step, it is necessary to compare the pairs of elements of decision making as well as the synthesis of priorities for all of the alternatives. The estimations are made with a fundamental scale of 1-9 (Table 1), which the comparative study showed simulates human thinking most adequately.
5. The sensitivity analysis of the solution – It is finally possible to make a decision and carry out a sensitivity analysis in terms of the impact which, according to the importance of some criteria or sub-criteria, a final outcome has on a given solution; it is also possible to determine how big or small these indicators are through an analysis.

Table 1
Scale of comparison 1–9

Intensity of importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one activity over another
5	Strong importance	Experience and judgment strongly favor one activity over another
7	Very strong or demonstrated importance	An activity is favored very strongly over another; its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8	Mean value of two estimates	A compromise is needed
Reciprocals of the above		If activity i has one of the above nonzero numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i

Source: Saaty, T. L. & Kearns P. K. (1985)

In relation to the AHP, the ANP method allows each decision to appear in the form of a network rather than a strict hierarchy. Hierarchical decisions can be subjective and predetermined due to the imposed structure, while matrix decisions, whose structure includes dependencies and feedback, represent the world more realistically. This makes the ANP method a more effective tool in relation to AHP for deciding in practice (Saaty, 2001b). Additionally, the ANP has been successfully applied in many areas of forecasting since it allows for the quick incorporation of feedback and simple comparison with actual results. However, the deficiencies of this model must be mentioned, and include its complexity, the fact that comparison of clusters can often be unclear and confusing, the fact that the process takes longer than in the AHP method, and the imprecise results that can be obtained.

3.2 Problem description and the construction of ANP model

In this paper, we use the ANP to predict the date of the Republic of Serbia's entry into the European Union, whose model is based on negotiating chapters that are grouped into three clusters including economic, political and legal conditions. Fulfilling these conditions is considered crucial for the European integration process for many reasons. According to the National Convention (2016) on the Accession of the Republic of Serbia to the European Union, the harmonization of the legislation of the candidate country with the regulations of the Union implies fulfillment of the first, political criteria. The economic criteria involves the democratic organization of the state, stability of institutions, rule of law, protection of human and minority rights and existence of a functional market economy able to withstand the pressure of competition in the unified market of the European Union. The political issue of special importance is the normalization of relations with Kosovo, which, in the

opinion of many analysts including the Council of the European Union, together with the chapter on the rule of law, is considered fundamental to the negotiation process. Also, this chapter is one of the key aspects of foreign, security and defense policy. As a candidate, the Republic of Serbia is obliged to adopt the legal acquis of the European Union, which is why the most important issue is the harmonization of domestic legislation with this law and the construction of institutions that will ensure its implementation. Consequently, the most complex chapters of accession are chapters 23 and 24 which are dedicated to justice, human rights, freedom and security and are collectively called "the rule of law" (EU Info Center, 2014). Regarding legal requirements, the competition chapter is one of the most demanding and complex in the negotiation process, and this is one of the chapters for which transitional deadlines are often sought, mostly due to the state aid policy (EU Info Center, 2015). Related to this chapter is the chapter on the right of companies that defines the conditions that will allow economic entities equal treatment in the market of the European Union. From the economic perspective, the Republic of Serbia has to take certain measures regarding the improvement of the investment climate and liberalization in foreign trade policy. According to the European Commission, the economic problems of the Republic of Serbia are represented by a high budget deficit and the absence of more stringent financial controls, as well as poor conditions in the labor market and high unemployment. Because trade integration with the European Union has remained high, a smooth implementation of the Transitional Trade Agreement has continued.

An economic chapter of vital importance for the integration process relates to the principle of the free movement of goods since this is the principle on which the European Union is based (EU Info Center, 2014). In the context of accession to the Eurozone, an important chapter relates to the regulation of economic and monetary policy and the adoption of the euro as the national currency. Another important economic aspect is the functioning of a customs union. Without this the EU's Common Trade Policy and Development, its common agricultural market and the effective coordination of economic and monetary policies, would not be possible (EU Info Center, 2015). As for the definition of the accession date, Jean-Claude Juncker, President of the European Commission said in a 2017 mandate that there would be no enlargement of the European Union until 2019. This indicates that there is no room for the entry of the Republic of Serbia before that period. The European Union budget that is being prepared for the period 2021-2026 is an important indicator for entry, and the European Union plans for expansion will be based on it. According to Jadranka Joksimović, the Minister for Eurointegration, the definition of a more precise time of entry is important for the planning of activities and budgets related to certain areas such as environmental protection, agriculture or food safety. Bearing in mind this statement, the fourth cluster is defined, which includes the alternative periods of time of the Republic of Serbia's entry into the European Union.

Based on the *White paper on the future of Europe: five scenarios*, the description of the problem of forecasting and the Republic of Serbia's process of Eurointegration, an ANP model was formed that included the following clusters and their elements (EC, 2017).[a,b,c,d]

---

[a]https://ec.europa.eu/commission/future-europe/white-paper-future-europe/white-paper-future-europe-five-scenarios_en
[b]http://www.parlament.gov.rs/upload/documents/seio/NAC_STRAT_UNDP_2006_gledanje.pdfhttp://cep.org.rs/images/cepgizkonf/policy_brief_pm_and_eu_neg_srb.pdf

- A cluster of criteria, which includes groups of relevant factors that need to be taken into account when evaluating alternative future outcomes - entry or non-EU entry dates, which includes: internal factors, external factors, costs factors and risk factors (European Comission - accesion criteria)[e];

- Cluster of internal factors, which includes sub-criterion of the internal factors criteria: compatibility of economic, legal-political and social system, internal political conflicts and relations with the former autonomous province of Kosovo (with Metohija).

According to the publication published at the end of the first phase of negotiations, the so-called screening process in 2015, the conditions defined by negotiation chapters taken in this paper within this cluster are (EU Info Center, 2015):

- chapters that include the free movement of goods from one end of the European Union to another; coordination of economic policies through joint planning of integration of the economy, stimulation of economic growth, securing jobs and competitiveness of the economy, independence of the National Bank of Serbia and adoption of the euro as the national currency; the abolition of duties at the national borders of the member states of the European Union, the establishment of a uniform system of taxation of imports, the adoption of rules for combating all forms of smuggling, organized crime, terrorism, money laundering, the adoption of the "e-duties" system; improving the social protection system, increasing the educational level of the workforce, achieving high employment rates and social inclusion;
- rules on the establishment, registration, performance of activities, domestic and cross-border mergers and divisions of companies; rules for suppressing agreements to negotiate prices, limit production, development and investment or sharing markets and sources of supply, rules for preventing the abuse of a dominant position and mergers that may have an impact on competition in the market;
- reform the judiciary, fight against corruption, fundamental rights and citizens' rights; rules for border control, visa, migration, asylum, police cooperation, fight against organized crime, terrorism and human trafficking, cooperation in the field of drugs, customs cooperation and judicial cooperation in criminal and civil matters; rules for the prevention of arms trafficking, participation in civilian and military missions, the expansion of the diplomatic-consular network and conditions that the Republic of Serbia has to fulfill in relation to Kosovo.

Regarding the regulation of relations with Pristina, the European Council (2015) defined the following conditions: the establishment of the Community of Serbian Municipalities, the establishment of an electricity supply company in Kosovo, the establishment of a telecommunications company, the termination of financing Serbian structures and participation in elections, the payment of pensions to members

---

[c] European Council Conclusions (2015). Madrid European Council, Reproduced from the Bulletin of the European Communities, No. 12/1995.
[d] European Security Strategy (2004). A Secure Europe in a Better World, Internet, 11/06/2004, http://www.iue.eu.int/cms3_fo/showpage.asp?id=391&lang=en
[e] https://ec.europa.eu/neighbourhood-enlargement/policy/glossary/terms/accession-criteria_en

of the police, judiciary and civil protection regulation, respecting the provisions on official visits, regulating customs and controlling passageways, ensuring free entry of people from Kosovo to the Republic of Serbia, ensuring Kosovo's participation in regional initiatives, recognition of university diplomas and support to EULEX-led trials;

- External factors cluster consisting of geo-political factors, fatigue from EU enlargement, the security challenges facing the EU and the strengthening of conservative right forces in the EU;

- The costs cluster, which consists of the costs of alignment with EU standards, norms and regulations, the reduction of budget revenues due to the loss of existing customs revenues, the negative current balance due to the liberalization of imports and opportunity costs in case of non-EU accession;

- The risk cluster, which, in the case of joining the EU constitutes the risk of unequal exchange and exploitation in relations to developed EU member states, the risk of alienation and exploitation of natural resources, the risk of potential disproportions in economic development, the risk of increased competition and, in this regard, the risk of potential choking on certain branches of industry, as well as the risk of an increase in unemployment and, implicitly, as a consequence, the risk of strengthening social problems.

- The alternative cluster containing four alternative outcomes which include entering the EU by 2025 at the latest, entering the EU between 2025 and 2030, joining the EU between 2030 and 2035, as well as the possibility that Serbia will not become a member of the EU. Obviously, there are generally two possible outcomes regarding the perspective of Serbia's membership in the EU which are to become a member of the EU or not. Differentiating the possible deadlines for joining the EU is not uniquely determined, but is the result of the interaction of several different factors, variables in time and space. The mentioned deadlines were those that most often appeared in the media, in the statements of EU officials and members of the government of the Republic of Serbia, and, of course, could be changed depending on many circumstances.

Interactions and relations that exist between and within clusters, which are important for the comparison of couples, can be determined based on insight into the description of the problem. These are the following relations:

- The criteria are compared with the main objective of the model;

- Internal factors cluster elements are, as sub-criteria of the internal factors criteria, compared to each other on a scale of 1-9;

- External factors cluster elements are, as sub-criteria of the external factors criteria, compared to each other on a scale of 1-9;

- Costs cluster elements are, as sub-criteria of the costs criteria, compared to each other on a scale of 1-9;

- Risk cluster elements are, as sub-criteria of the risk criteria, compared to each other on a scale of 1-9;

- Internal factors cluster elements influence alternative outcomes in the sense that the dynamics and degree of their realization determine the outcome and dynamics of the EU accession process;

- External factors cluster elements also affect alternative outcomes. Geo-political factors, as well as movements and trends within the EU itself, can significantly affect the final outcome of the EU accession process not only for Serbia, but for other countries in the region. They can also have a dynamic determinant in terms of potential accession dates. In addition, some of these factors also have an impact on the elements of other clusters, as is the case with geo-political factors that can significantly affect not only the internal political life in Serbia, depending on the movement of current global geo- political relations, but also affect relations with Kosovo;

- Elements of cluster costs affect alternative outcomes because the process of accession of any EU country has its own cost, whereby this price is reflected not only in different categories of costs associated with systemic alignments and potential losses in case of EU entry, but also in lost revenue in the case of not entering the EU. Therefore, the costs cluster and the internal factors cluster also have one-way dependency;

- Risk cluster elements definitely influence alternative outcomes because the nature and degree of possible risks associated with entering the EU largely define the dynamics of association, but also the consciousness and mood of the citizens about to the idea of association.

In addition to these dependencies, there is also feedback from the alternatives cluster to other clusters of the sub-criteria. Namely, it is obvious that the decision to enter or not enter the EU, as well as the decision about the dynamics and date of accession can affect priorities of the internal factors cluster elements, costs factor and risk factor. The ability to join the EU earlier will certainly affect the acceleration of the dynamics and degree of systemic harmonization with EU standards, as well as the rising costs of alignment, and the speeding up of the process of resolving the problems of Kosovo, etc., The accession to the EU will increase numerous potential risks from the integration of the economic system of the EU, on the other hand, giving up membership in the EU reduces the mentioned risks, but also carries a big opportunity cost. Finally, the model also has a number of internal interdependencies. Thus, in a external factors cluster, geo-political factors definitely affect the internal political opportunities in the EU. These factors include the fatigue of EU enlargement, security challenges and the strengthening of the conservative right. Enhanced competition of European manufacturers can put pressure on domestic producers and extinguish production in certain branches of industry, and thus lead to an increase in unemployment and the aggravation of social problems. Based on the factors discussed above, the ANP model was constructed and is shown in Figure 1.
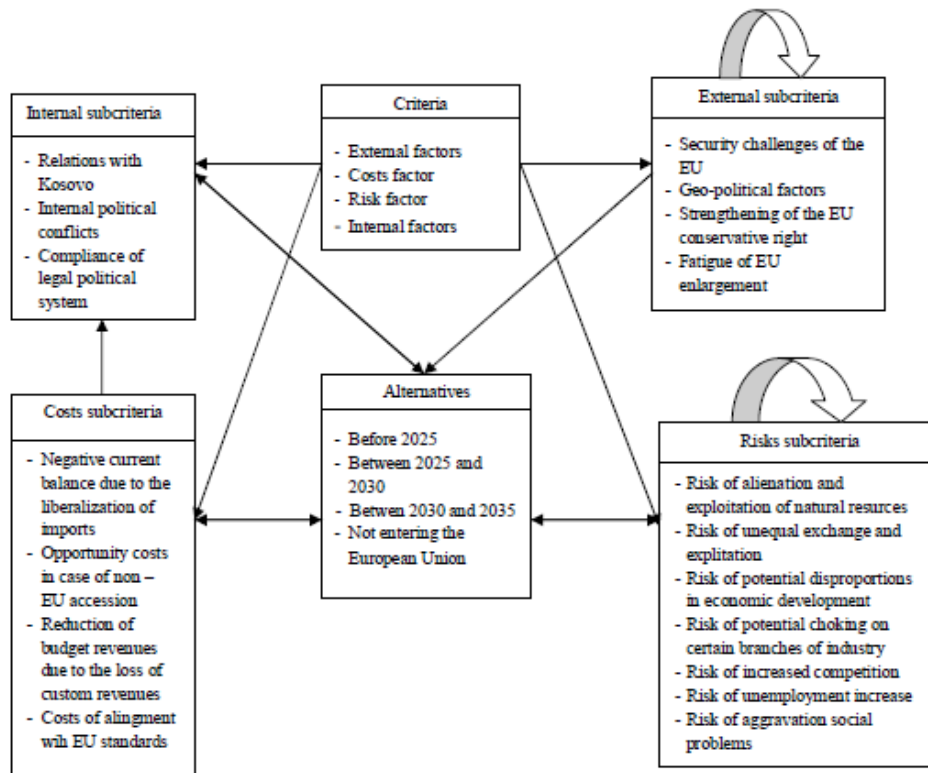
Figure 1 ANP model for forecasting the entry of Serbia into the EU. Source: authors

The results of the model are shown in the tables below.

Table 2
Matrix of criteria comparison

	Costs factor	Risk factor	Internal factors
External factors	**7**	3	5
Costs factor		¼	1/3
Risk factor			3

Inconsistency   0.04435
Source: Authors

Table 3
Relative importance of the criteria in relation to the main goal of the model

Criteria	Relative importance of the criteria
External factors	0.56829
Costs factor	0.05912
Risk factor	0.25230
Internal factors	0.12029

Table 4
Relative importance subcriteria of the internal factors criteria

Name	Normalized By Cluster
Relations with Kosovo	0.31503
Internal political conflicts	0.10009
Compliance of legal-political system	0.21425
Compliance of economic system	0.19582
Compliance of social system	0.17481

Table 5
Relative importance subcriteria of the external factors criteria

Name	Normalized By Cluster
Security challenges of the EU	0.23015
Geo-political factors	0.61264
Strengthening of the EU conservative right	0.09393
Fatigue of EU enlargement	0.06329

Table 6
Relative importance subcriteria of the costs factors criteria

Name	Normalized By Cluster
Negative current balance due to the liberalization of imports	0.07916
Opportunity costs in case of non-EU accession	0.69699
Reduction of budget revenues due to the loss of customs revenues	0.07827
Costs of alignment with EU standards	0.14558

Table 7
Relative importance subcriteria of the risk factors criteria

Name	Normalized By Cluster
Risk of alienation and exploitation of natural resources	0.14916
Risk of unequal exchange and exploitation	0.06836
Risk of potential disproportions in economic development	0.14282
Risk of potential choking on certain branches of industry	0.08153
Risk of increased competition	0.11403
Risk of unemployment increase	0.20677
Risk of aggravation social problems	0.23734

Table 8
The likelihood of achievement and alternatives ranking

Alternatives	Raw	Normal	Ideal	Ranking
Before 2025	0.203559	0.425020	1.000000	1
Between 2025 and 2030	0.091804	0.191682	0.450995	3
Between 2030 and 2035	0.095800	0.200024	0.470624	2
Not entering the European Union	0.087777	0.183274	0.431213	4

In Figure 1, the ANP model of the prediction of the indicative date of Serbia's entry into the EU is presented. Its structure is made up of clusters, elements and connections between them. These links, represented by arrows, indicate the direction of influence between the model elements established when structuring and modeling the problem. Comparison of pairs of model elements, clusters, or elements within the same cluster, or between different clusters, is normally done using the 1-9 scale (Table 1). Pair comparisons are basic to the AHP/ANP methodology. When comparing a few factors, one can determine the rationale of the relative importance, preference, or probability of these factors depending on the need. This ratio is the ratio of two factors to be compared. Comparison of factors, or sub-criterion within certain groups of conditions is carried out according to the 1-9 scale in relation to the factor that influences them from either the observed group of conditions (inner dependence) or from another group of conditions (outer dependence). This determines the relative importance of these factors. Comparison of alternatives is also done on the 1-9 scale, but in terms of what is more likely to be achieved than in terms of the observed factor, which determines the priority of the alternative. In this case, it can be interpreted as its likelihood of achievement.

Once inputs are made for each segment of the model, the information is synthesized in order to achieve the general preference of alternative outcomes. This synthesis gives a report that ranks alternatives (outcomes) with respect to the general goal. The report may include a detailed ranking showing how each alternative is evaluated against each criterion. The results are shown in Tables 3-8 after all the necessary comparisons have been made in accordance with theoretically based principles, taking into account the assumed inner and outer interdependencies within the cluster and between them, and after executing calculations using the SuperDecisions software package which was developed as software support for ANP application.

Table 3 shows the relative importance of the criteria in the model. It is estimated that the highest relative importance in relation to the main objective of the model is an external factors criteria (the weight coefficient is 0.56829), then the risk factors (0.25230), the internal factors (0.12029) and the costs factors (0.05912). This result could be interpreted such that the final outcome of Serbia's EU accession process is highly influenced by the factors on which the Republic of Serbia has the lowest influence, and as such have the greatest significance. Tables 4-7 show the relative importance of the sub-criterion within the criteria to which they belong. Thus, among the internal factors cluster elements, it is estimated that the greatest relative importance, in the context of European integrations, is the sub-criteria 'relations with Kosovo' (0.31503). Among the external factors cluster elements, the greatest relative importance is the sub-criteria 'geopolitical factors' (0.61264), among the costs criteria the sub-criteria with the greatest importance is 'opportunity costs of non-entry into the EU' (0.69699), and among the elements of the risk factors sub-criteria the

'risk of aggravation of social problems' (0.23734) as a result of the impact of other risk factors. The obtained priorities of the alternatives, shown in Table 8, are interpreted in terms of the probability of achieving the chosen alternatives. We see that the highest estimated probability of achievement is the accession of Serbia to the EU by 2025 (42.5%), then the entry of Serbia between 2030 and 2035 (20%), then between 2025 and 2030 (19.17%), and the probability that Serbia will not enter the EU is 18.32%. The obtained results show a clear commitment to joining the EU, with the view that if the accession does not come to 2025, it will not be until at least 2030. The Ideal column shows the results divided by the highest value, so that the highest ranking has a priority of 1, while the others are in the same proportion as in the Normalized value column. When there are multiple decision makers, in order to find the final weights, i.e. priorities of the criteria and the ranks of the alternatives, the following formula is used to calculate the geometric mean (Saaty & Peniwati, 2008):

$$w_i = \sqrt[K]{\pi_{k=1}^{k=K} w_{ik}} \quad \forall \ i$$

where w_i represents the final weight of the i criterion, and W_{ik} the relative weight of the i element calculated using k evaluator. In this case, instead of engaging external experts in the field of politics, law and economics, as well as individual comparisons to evaluate and calculate the final priorities of alternatives using a geometric environment, the authors, agreed on common assessments. The authors consider the approach to the construction and implementation of an ANP model in this article to be measured and unpretentious. This is because the goal is not to answer questions that society as a whole is concerned with, but to point out the need and possibilities of the ANP to analyze and solve such complex social problems. The application and methodology of decision making methods like the ANP can coordinate and synthesize a multitude of information and deal with complexities. For these reasons, the observed model is structured as a general, formal framework for forecasting, which is subject to changes in individual elements of the problem of the so-called predetermination (prediction), and their relatively easy incorporation into the model.

The goal of the forecasting and the obtained results indicate the high level of uncertainty present in the forecasting process, which only confirms the need for additional analysis of the sensitivity of the results to changes in the values of the key parameters of the model. This will allow the authors to obtain a more complete and comprehensive estimation of the target value. A sensitivity analysis of the results performed by changing the level of significance of the higher level elements, i.e. basic elements, may more or less significantly affect the order of importance and the assessment of the observed options. This shows the performance of the alternative in relation to each criterion, and how these alternatives are sensitive to the changes in the importance of the criteria. Thus, from Table 8, it can be seen that the growth of the relative importance of the criterion 'relations with Kosovo' from 0.0001 to 0.9999 affects, to a certain extent, the likelihood of alternative outcomes. It increases the likelihood that there will be no entry into the EU (from 13.43% to 24.53%), and slightly reduces the probability of expected entry by 2025 (from 43.19% to 41.63%). There is a greater sensitivity to changing the relative importance of the sub-criteria 'relates with Kosovo' shows the remaining alternative outcomes, whose likelihood of achievement decreases to a greater extent. It decreases the likelihood of entry into the EU between 2025 and 2030 from 20.46% to 17.53%, while the probability of joining the EU in the period from 2030 to 2035 decreases from 22.92% to 16.31%.

The obtained results are fundamentally different from those derived from the previous simple model of forecasting Serbia's entry into the EU (Krstić, et al., 2018). In this model, the sub-criteria 'relations with Kosovo' essentially influences the entry of Serbia into the EU only in terms of deadlines, but will not stop the process, if the remaining presumed interdependencies of the factors are unchanged. How can this difference be explained? First of all, the observed model is much more complex than the previous simple model because it includes multiple clusters, nodes and direct feedback network interactions between them, which are the result of existing interdependencies. In addition, in the meantime, there were several events and circumstances that radically influenced the importance of relations with Kosovo in the process of Serbia's accession to the EU. First of all, the US administration has a more flexible attitude towards resolving the problem of Kosovo's unrecognized independence, and Brussels also has a more relaxed attitude, in which no deadlines exist for resolving the Kosovo node. This, as well as other complicated political situations in the world, gave Serbia more maneuvering space for political calculations and bargaining. This left the option for Serbia to decide not to enter the EU in case of a lose-lose outcome, that is nothing is gained and everything is lost in terms of Kosovo. In any case, when it comes to relations with Kosovo, the dissolution depends very much on Serbia itself, which is not the case with some other factors and circumstances. Thus, if the influence of changing the relative importance of the sub-criteria 'unemployment increase' is viewed, the probability of achieving alternative outcomes do not show a pronounced sensitivity to these changes. The growth of the relative importance of this sub-criteria leads to a slight increase in the likelihood of Serbia entering the EU after 2030 from 18% to 22%, decreases the likelihood of entry between 2025 and 2030 from 19% to 18%, reduces the probability of entry by 2025 from 43% to 40%, while the probability of entry between 2030 and 2035 remains unchanged at 20% (Table 9). Similar sensitivity analyses can be performed for other sub-criteria in the model.

Table 9
The impact of changing the relative importance of the sub-criteria 'relations with Kosovo' on the movement of achieving alternatives probability

Relations with Kosovo	Not entering into the EU	Entering in the EU by 2025	Entering the EU between 2025 and 2030	Entering the EU between 2030 and 2035
0.0000	0.1343	0.4319	0.2046	0.2292
0.1667	0.1515	0.4295	0.2001	0.2190
0.3333	0.1691	0.4270	0.1954	0.2084
0.5000	0.1873	0.4245	0.1906	0.1976
0.6667	0.2061	0.4218	0.1857	0.1864
0.8333	0.2254	0.4191	0.1806	0.1749
1.0000	0.2453	0.4163	0.1753	0.1631

4. Conclusion

This paper presents the possibility of using the Analytic Network Process methodology in the process of predicting the probability of alternative future outcomes. The specific example is of Serbia's entrance into the European Union. Bearing in mind that a large number of factors and their influence networks have to be taken into account for a serious analysis, its theoretical as well as methodological and practical implications can be considered. Theoretical implications are reflected in

the fact that the effective ability of the Analytic Network Process to conceptually encompass all relevant factors from the prediction/decision-making context is confirmed. Despite the usual limitations encountered when applying qualitative predictive methods (precision, lack of information, bias, price, etc.) the ANP can serve as a satisfactory basis for the creative solution of decision-making issues in situations of growing complexity and uncertainty when a decision needs to be made quickly. Presenting the use of an ANP forecasting model in the field of Eurointegration, which is extremely complex and uncertain, confirms its ability to be a good support in the forecasting process. In situations characterized by the pronounced dynamics and unpredictability of the environment and many factors that determine it, as is the case with the European Union and Serbia, prediction methods based on econometric models do not yield satisfactory results. Social justification is reflected in the possibility of using the results of the research by the competent institutions of the Republic of Serbia for redefining or making new and better strategic decisions in the process of stabilization and association. The limitations of this research relate primarily to the fact that within certain sub-criteria it is possible to identify and evaluate more complex influence networks which would greatly increase the complexity of the model and the number of assessments that should be carried out. Given the limited cognitive capacities of the decision makers, this would certainly influence the increase of subjectivity in the assessment. Significant objectivity could be achieved by including a group of experts in the areas relevant to the EU integration process in the comparison process. Then after obtaining the individual ranking lists of alternatives and their probability of achievement, one could use a geometric mean to obtain a unique and objective ranking list of alternative outcomes and a better assessment of their probability. Also, clusters cover only some negotiating chapters which may have an impact on the obtained results.

The proposed decision support system, based on the ANP, forms a flexible and systematic framework for forecasting. The ANP qualitatively improves formal prediction models by allowing more consistent and systematic generation of additional factors and alignment of exogenous variables. The ANP-based approach to forecasting allows decision makers to take into account both quantitative and qualitative variables. By structuring the network, the relationships between factors can be defined and analyzed effectively. In the priority setting process, qualitative and subjective assessments may be included by several people, as well as quantitative data from different sources. By using the presented approach, decision makers are not limited to past data, as assumptions and predictions about the future development of factors involved, and future actions of actors involved in the hierarchy can be made. The ANP proved to be a methodology capable of producing results that match the perceptions and expectations. Of course, this does not imply uncritical acceptance of the ANP. Auto correction is an essential component of scientific thinking and only through continuous practical testing in terms of endpoints and outcomes of the prediction process will it be possible to see the true predictive abilities of the ANP.

REFERENCES

Adamus, W. (2010). When shall Poland enter the euro zone? Decision making with the ANP. *The School of Business*, *1*, 31-52.

Azis, I. J. (2010). Predicting a recovery date from the economic crisis of 2008. *Socio-Economic Planning Sciences*, *44(3),* 122-129. Doi: https://doi.org/10.1016/j.seps.2010.03.003

Blair, A. R., Mandelker, G. N., Saaty, T. L., & Whitaker, R. (2010). Forecasting the resurgence of the US economy in 2010: An expert judgment approach. *Socio-Economic Planning Sciences*, *44(3),* 114-121. Doi: https://doi.org/10.1016/j.seps.2010.03.002

Chung, C-C., Chao, L-C., Lou, S-J. (2016). Constructing the predictive model for strategy execution problems -The application of the two-stage Analytic Network Process. *Journal of Information Hiding and Multimedia Signal Processing*, *7(1),* 184-197.

Dikmen, I., Talat Birgonul, M., Ozorhon, B., & Egilmezer Sapci, N. (2010). Using analytic network process to assess business failure risks of construction firms. *Engineering, Construction and Architectural Management*, *17(4),* 369-386. Doi: https://doi.org/10.1108/09699981011056574

EU Info Centar. (2014). *Negotiation chapters - 35 steps towards the European Union*, http://euinfo.rs/srbija-i-eu/

EU Info Centar. (2015). *Negotiation chapters - 35 steps towards the European Union*. Drugo, revised edition: http://euinfo.rs/srbija-i-eu/

European Council. (2015). Normalisation of relations between Serbia and Kosovo, Chapter 35: Other issues. *Conference on accession to the European Union–Serbia–Brussels*, 1-8.

European Council Conclusions (2015). Madrid European Council, Reproduced from the Bulletin of the European Communities, No. 12/1995.

European Security Strategy (2004). A Secure Europe in a Better World, Internet, 11/06/2004, http://www.iue.eu.int/cms3_fo/showpage.asp?id=391&lang=en

Krstić A., Savić, J., Mimović, P. (2018). Forecasting the accession of the Republic Serbia to the European Union by using Analytic Network Process, XIII Balkan Conference on Operational Research, BALCOR 2018, 25-28.may, Belgrade, Proceedings, Mladenović, N., Martić, M., Vidović, M., Urošević, D. 243-250, ISBN: 978-86-80593-64-7

Mimović, P. (2012). Application of ANP in forecasting automobile sales of FIAT 500L, *Economic Horizons*, *14(3),* 169-179. Doi: https://doi.org/10.5937/ekonhor1203165m

Niemira, M. P., & Saaty, T. L. (2004). An analytic network process model for financial-crisis forecasting. *International Journal of Forecasting*, *20(4),* 573-587. Doi: https://doi.org/10.1016/j.ijforecast.2003.09.013

Ozorhon, B., Dikmen, I., Birgonul, M. T. (2007). Using analytic network process to predict the performance of international construction joint ventures. *Journal of Management in Engineering*, *23*(3), 156-163.

Popa, A., Hadad, S., Paiusan, R. & Nastase, M. (2018). A new method for agricultural market share assessment. *Sustainability, 11(88),* 1-13. Doi: https://doi.org/10.3390/su11010088

Saaty, T.L., Kearns, K. P. (1985). *Analytical Planning: The organization of systems, The Analytic Hierarchy Process Series.* Pittsburgh: RWS Publications.

Saaty, T. L. (1999). Fundamentals of the analytic network process. *Proceedings of the 5th International Symposium on the Analytic Hierarchy Process*, 12-14.

Saaty, T. L. (2001a). Analytic network process. *Encyclopedia of Operations Research and Management Science*, 28-35. Doi: https://doi.org/10.1007/1-4020-0611-x_32

Saaty, T. L. (2001b). Decision making with the analytic network process (ANP) and its "super-decisions" software the national missile defense (NMD) exANPle. *ISAHP 2001,* Berne, Switzerland, 365-382.

Saaty, T. L. (2001c). *Decision making with dependence and feedback: The ANP.* Pittsburgh: RWS Publications.

Saaty, T. L., & Vargas, L. G. (2006). *Decision making with the Analytic Network Process. Economic, political, social and technological applications with benefits, opportunities, costs and risks*. New York: Springer.

Saaty, T.L., Peniwati, K. (2008). *Group decision making: Drawing out and reconciling differences*. Pittsburgh, PA: RWS Publications.

Saaty, T. L., & Vargas, L. G. (2013). *Decision making with the Analytic Network Process. Economic, political, social and technological applications with benefits, opportunities, costs and risks*. 2nd edition. New York: Springer.

Shih, H. S., Lee, E. S., Chuang, S. H., & Chen, C. C. (2012). A forecasting decision on the sales volume of printers in Taiwan: An exploitation of the Analytic Network Process. *Computers & Mathematics with Applications*, *64(6),* 1545-1556. Doi: https://doi.org/10.1016/j.camwa.2011.12.082

Vargas, L. G. (1990). An overview of the analytic hierarchy process and its applications. *European Journal of Operational Research*, *48(1),* 2-8.

Voulgaridou, D., Kirytopoulos, K., & Leopoulos, V. (2009). An analytic network process approach for sales forecasting. *Operational Research*, *9(1),* 35-53. Doi: https://doi.org/10.1007/s12351-008-0026-2

Wey, W- M. (2014). The application of dynamic network process to Environment Planning Support Systems. *International Journal of Environmental and Ecological Engineering*, *8(8),* 914-917.

Wu, C-I., Kung, H-Y., Chen, C-H., Kuo, L-C. (2014). An intelligent slope disaster prediction and monitoring system based on WSN and ANP. *Expert Systems with Applications, 41*, 4554-4562. Doi: https://doi.org/10.1016/j.eswa.2013.12.049

Internet sources

http://www.parlament.gov.rs/upload/documents/seio/NAC_STRAT_UNDP_2006_gl
edanje.df
http://cep.org.rs/images/cepgizkonf/policy_brief_pm_and_eu_neg_srb.pdf
https://ec.europa.eu/neighbourhood-enlargement/policy/glossary/terms/accession-
criteria_en
https://ec.europa.eu/commission/future-europe/white-paper-future-europe/white-
paper-future-europe-five-scenarios_en