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Review paper

ANALYSIS OF POSSIBILITIES FOR RECYCLING INDUSTRY DEVELOPMENT - MULTI-CRITERIA APPROACH

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Abstract. *Since it is directly in line with the National Waste Management Strategy, the development of recycling in Serbia has primarily strategic importance in achieving objectives towards EU standards. On the other hand, it is an industrial sector with great economic potential. The support of the state through institutions is an important factor for sustainable development of any industry, especially when it comes to the industry that can be considered a pioneer in Serbia. Development and strengthening of regional cooperation in environmental protection and sustainable development can be achieved by linking and harmonizing the activities of economic entities, involved in waste management and recycling. On the territory of South Serbia, this networking is realized through the action of the cluster "South Recycling". The research on profitability of these types of investments, development opportunities, as well as the role of institutions in this process, was carried out in cooperation with the cluster "South Recycling". The results of that research are the subject of this paper. Based on the analysis of the investment project and the experience of investors, it is evident that investment in recycling is a profitable investment. In addition to cost effectiveness, this type of investment is justified according to all environmental criteria, in terms of contribution to fulfilling the objectives of the Regional Strategic Waste Management Plan for the region of Niš. As this industry is only at the beginning of its development in Serbia, the role of government and the Ministry of Environment and Spatial Planning in supporting this type of investment projects should be higher. The establishment and functioning of the Fund for Environmental Protection is an important step in improving the financing in this area.*

Key Words: *recycling, sustainable development, institutions, environmental protection, profitability.*

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INTRODUCTION

Waste management represents one of the top priorities in the area of environmental protection. Given that Serbia is in the period when it tries to provide an increase of economic growth, forthcoming increase in consumption of industrial goods and natural resources is understandable. For both reasons, waste management should be given considerable attention. On the one hand, as a result of the increased consumption of industrial goods, the increase in the amount of waste will appear. On the other hand, as a result of the increased consumption of natural resources, degradation of the natural balance may appear, and, in order to hold that up, if there is a possibility, the reuse of resources should be provided. The reuse of resources means recycling.

Recycling is one of the segments of waste management and, since recently, one of the segments of business management, too. This is because recycling, besides the undeniable environmental effects, contributes to achieving savings for enterprises (in terms of cost), and is considered the logical next step in relation to the continuous reduction of resource consumption. The effects of recycling on the environment are known and arguably important, but what is less known is the economic benefit of recycling. By transforming waste into useful, usable materials, recycling industry provides new jobs and contributes to economy competitiveness.

Bearing in mind the economic effects of recycling in the developed countries, but also some examples in Serbia, it is desirable to stimulate the development of this industry, both at the state level, as well as at the local level. In this sense, loans and incentives for reuse and utilization of waste as secondary raw materials have an important role. Though activities which concern waste management at the local level are important, the things must start and be supported from the top – in this case at the state level. This means the existence of the National Waste Management Strategy. This strategy has to be formulated according to the strategy for environment protection in the European Union, since it is a strategic goal of our country to join this integration.

Through the adoption of the Waste Management Law and the Law on Packaging and Packaging Waste from 2009, Serbia has harmonized the national legislation with the relevant EU laws and regulations. However, the situation in waste management is not at the level as it is in the developed countries. The percentage of 9.6 in Serbia is far below the EU average of 40% of waste recycled, or Japan which recycles 90% of waste [17].

1. NATIONAL WASTE MANAGEMENT STRATEGY AND PROBLEMS IT SHOULD SOLVE

Besides standards, the significance of recycling and, broadly, of environment protection in the European Union is stressed through an event called *Green week*. During this week, in one place at the same time there are representatives from EU institutions, business and industry, non-governmental organizations, public services, scientific and academic community and media with the unique goal, which is environment protection improvement.

Since the strategic goal of Serbia is to join the European Union, the establishment of a system for waste collecting and recycling represents a very important task. Therefore, the national strategy for waste management represents a significant document. To be precise, the strategy is the basic document that determines long-term goals of waste management

and provides conditions for rational and sustainable waste management, but it is also used for evaluation of the state of waste management in our country.

Through the application of the basic principles of waste management, the Agency for environment protection aims to provide the fulfillment of the basic principles of the European Union in this area and to prevent further risks for the environment and human health. As an important solution to many problems or in function of an efficient waste management in Serbia, the national strategy for waste management suggests formation of a network of infrastructure of facilities and cooperation of authorities at the local and state level.

According to the Report about the state of the environment in Serbia from 2009 [1], our country is missing systematically organized collecting, sorting and recycling of waste. Also, there is no location for dangerous waste disposal or treatment. Similar to this, there is a great problem with some kinds of waste (such as medical waste), because there are no registered enterprises for collection, sorting, disposal, recycling or export of these kinds of waste. Therefore, the main challenges of waste management in our country concern basic activities, like ensuring good coverage and capacity for collection, transportation and disposal of waste. Above this, our country should provide the economic effects from recycling, since there is potential for that. Also, one of the problems concerns the movement of waste over the boundaries and negative imbalance that characterizes our country. Last, but not least, is the problem that concerns the financing of waste management or providing funds for the development of the recycling industry.

1.1. Economic effects of recycling

The economic effects that can be provided through recycling can be observed from three aspects, or at three levels. At the first level there are direct effects, which are reflected in the creation of new business and providing new jobs, increased sales, and consequently increased revenues. The second level consists of indirect effects, which include economic benefits for other enterprises, from which the ones that deal with waste recycling have been purchasing waste which will be processed. At the third level there are induced effects, like an increase of the purchasing power of the population, due to increased employment, who, thanks to the earnings in the recycling industry, have been buying products and services of enterprises from other industries [15, p. 1]. Today, the economic effects of recycling are significant. The recycling industry employs about 1.1 million people. In this industry the average annual income amounts to 236 billion dollars, with an average annual profit of 37 billion dollars [18]. The investments of public sector in local recycling programs have proven to be very effective, both in terms of job creation and in terms of dividends security. The same research has shown that for every job that relates to the waste collection there are up to 26 jobs where employees are engaged in processing waste into useful new raw materials, ready to be reused. This shows that recycling is a lot more economical than ecology, because the enterprises would not engage themselves in collection and processing waste if they did not find economic justification.

Economic effects of recycling industry development in Serbia are reflected in the increase of the number of employees, where approximately 10.000 employees is the number planned to be reached. Besides employment, the effects at the state level can be described through additional investments in recycling, as well as through collection of eco-tax, which has provided the gain of about one billion dollars. However, according to the in-

formation from the Ministry for environmental protection and technological development in Serbia, the recycling of waste is at a very low level (quantitatively and qualitatively). One of the problems that concern waste management is waste collection. Since the coverage of waste collection is about 60%, it means that almost one million tons of communal waste ends up on illegal (wild) dumps. In order to speed up the development of the recycling industry, the Ministry has planned to open 30 recycling yards (Figure 1).

These yards will facilitate collection and recycling of huge amounts of waste (glass bottles, paper, aluminum cans), which will increase the number of employees. This is supposed to be the first step to recycling industry development. The above mentioned recycling yards could be one possible solution to the problem that concerns waste management coverage. However, what needs to be changed is the awareness of the population about the importance of the collection, selection and recycling of waste, which represents the second step to recycling industry development.

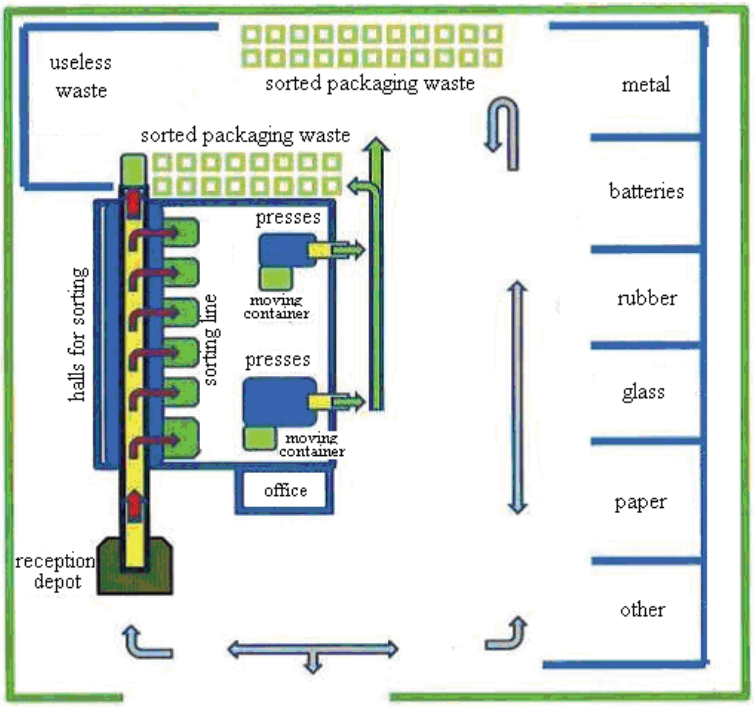

Fig. 1. Recycling yard scheme
Source: www.compete.rs/files/Komercijalizacija_sekundarnih_sirovina_i_reciklaze_otpada_u_Srbiji_0.pdf

Trans-boundary movement of waste has to be accompanied by appropriate documentation from the place where the movement began till its final destination in accordance with the national and international standards and international regulations relating to cross-border waste flow. The waste, which is a subject of export-import, has to be packaged, marked and transported properly. In this way, there are small chances that waste transport will affect human health and the environment.

The waste for whose treatment or disposal in an environmentally sound and efficient manner there are no technical capabilities and facilities in the Republic of Serbia, should be exported. Non-hazardous waste may be imported in order to be preceded and transformed into secondary raw materials. This, however, means that there are available plants for the treatment of such waste.

Everyone who wants to deal with the trans-boundary movement of waste has to provide an adequate financial guarantee and insurance policy or other form of insurance, depending on the requirements of the state of import, export or transit. The amount of financial guarantee and insurance policy depends on the costs of waste treatment, as well as on the recovery costs in the event of an accident [8]. This leads to an additional problem of waste management, which is the financing of waste management and intensities for recycling industry.

1.2. Waste management financing

The implementation of national waste management strategy and realization of plans for waste management improvement, which include the construction of storage, treatment and disposal of waste, implies the necessity for certain financial capital. The financial resources for the implementation of strategy and realization of plans for waste management proceed from the earmarked budget of the Republic of Serbia, which represents the income for the Fund for Environmental Protection, then from loans, grants and funds for waste management, fees and other sources of financing. With analogy to the previously highlighted, the implementation of regional and local waste management plans, and construction of storage, treatment and disposal within the jurisdiction of local governments is financed from the earmarked budget of the local self-government, loans, grants and funds of legal entities and individuals that manage waste, fees and other sources of financing [8].

In Serbia there is a combination of a few systems for financing of waste management. For example, some financial resources have been provided through a free system, but there is also a possibility for the population to provide some benefits by disposal of some kinds of waste, such as glass and plastic bottles.

The importance of waste management can be emphasised by the fact that the Republic of Serbia, from the earmarked budget, and through the Fund for Environmental Protection, provides loans and grants for enterprises and entrepreneurs that have been performing activities in waste management. According to the Law on Waste Management (Article 80), from the income of the Fund for Environmental Protection and special accounts, different programs, projects and other investment and operational activities related to waste management can be funded.

2. WASTE MANAGEMENT STRATEGY IN THE REGION OF NIS

Looking at the previous period, it can be concluded that the manner of waste management in Serbia is not at a satisfactory level. The fact that there are still a large number of obsolete landfills operated by public utility companies (164) and over 4,400 illegal dump sites supports this assertion [1, p. 53]. Applying the model, which the EU countries use to estimate the value of indicators related to municipal waste, the Agency for Envi-

ronmental Protection reports on the quantities of generated waste. The results that show the application of this methodology are presented in Table 1.

Table 1. The indicators relating to municipal waste

Indicator	Year			
	2006	2007	2008	2009
The total quantity of generated waste (in million t)	1,73	2,07	2,55	2,63
The amount collected and disposed of waste by public utility companies (in million t)	1,04	1,24	1,52	1,58
The average daily amount of waste per capita (kg)	0,62	0,77	0,95	0,98
The average annual amount of waste per capita (t)	0,23	0,28	0,35	0,36

Source: Report on the environmental situation in the Republic of Serbia in 2009, p. 53.

For the purpose of the model, ten representative communities in Serbia are selected, including the municipality of Nis. The results show that the average daily amount of waste generated per capita in Nis is 0.73 kg, which is slightly below the republic average. The application of these indicators is an integral part of the harmonization of reporting on waste with the EU standards. A plan for the local waste management from 2011 to 2021 on the territory of Nis, including additional elements of the feasibility study, was made in order to implement the National Waste Management Strategy. The plan contains the basic objectives of waste management from 2011 to 2021 on the territory of Nis.

The region was formed according to The Local Waste Management Plan and except for the town of Nis, includes a number of municipalities that are mostly located in the region of Nis and in the south-eastern part of Serbia. The region of Nis, for the purposes of this Plan, includes the territory of Nis with 5 city municipalities.

2.1. Collection system and treatment of waste in the city of Nis

The institutional framework in waste management in the city of Nis is defined by the Decision on cleanliness [11] laying down the conditions and ways of organizing work in providing the public utilities hygiene. The Public Utility Company (PUC) "Mediana" is no longer able to dispose of waste efficiently and effectively because of organizational structure of the public utility, the lack of modern methodology of calculating the price of waste collection, the lack of clear strategy for managing the overall waste in the city and the unresolved problem of the city's sanitary landfill. Therefore, the jurisdiction of PUC "Mediana" is directly related to the formation of the supply of raw materials in the recycling industry. A changed relationship in this area, would clearly improve the working conditions and development of enterprises engaged in waste recycling.

The amount of waste deposited at the landfill in the period from 2000 to 2010 [12, p. 8] shows a constant increase in the amount of waste at the landfill. Also, there is an evident trend of an increase in the amount of waste collected by third parties, which is a positive step in reducing the share of PUC "Mediana" in "the waste market" in Nis. The structure of waste collected in the city of Nis is shown in Figure 2.

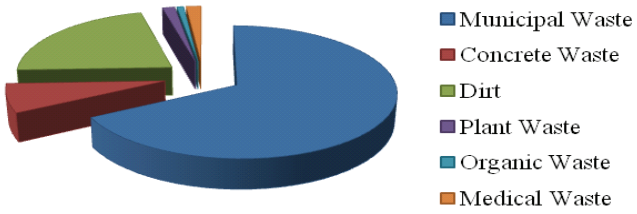

Fig. 2. Structure of waste collected in the city of Nis
Source: Public Utility Company "Mediana", Waste collection program for 2011.

The previous figure shows that the largest share in generated waste in the city of Nis is municipal waste (67.16%), which suggests that the key segment of waste management should be municipal waste management [12, p. 10]. For this reason, recycling is imposed as an appropriate method of waste minimization, which also creates a new value.

2.2. Cluster "Recycling South"

One of the local initiatives, in terms of improving waste management, as well as the development of recycling industry, is the creation of the cluster "Recycling South" in 2010, whose members are companies from a broad territory of Nis, which are engaged in collecting and processing of different types of waste. The idea of this initiative is to strengthen regional cooperation in environmental protection and sustainable development by consolidating the activities of business entities engaged in waste management, especially recycling, in the territory of South Serbia. The companies, members of the cluster are: Jugo-Impex, Jugo-Impex EER, Denipet Ltd, Nives Ltd, Administrative Group Ltd, Maxi Co. Ltd., SNG Company Ltd. and Put inžinjering Ltd. The cluster activities are: minimization of waste, the support of development of technical solutions, monitoring and control of raw materials and special waste streams, protection and improvement of the environment, advocating for health and social protection, establishment and development of special training and capacity building of cluster members, development of public awareness, etc.

In the previous period, only two members of the cluster have managed to get some incentives, loan arrangements from the Fund for Environment Protection. The state authorities or the local self-government bodies take actions to reduce pressure on the environment using economic and other measures, and they have to choose the best available techniques, plant and equipment that do not require excessive costs. This means that it is necessary to intensify the cooperation between state bodies and local authorities and the Cluster in order to increase the participation of recyclers, members of the Cluster, as well as the use of available incentive funds.

3. Quantitative Analysis of Some Actors' Effects - Case Study

Some of the actors that may have an active role in encouraging waste collection and waste management improvement are the state government, local self government, population and professional societies (in the field of recycling). Their influence has been observed from the environmental, social, financial and technological aspect. The subject of

the research is the identification of waste management actors' influence on the above mentioned factors. The purpose of the research is to provide an optimal composition of relations between the actors and the factors in order to ensure positive effects on recycling industry development.

3.1. Research methodology

The research is based on the data from the cluster "Recycling South". These data represent the attitudes of some cluster managers about the level of influence of the actors on certain waste management factors. The managers have evaluated the influence of actors in the process of waste management on all relevant factors of the process by using Likert-type scale from 1 to 5, where 1 represent the lowest level of impact and 5 the dominant influence. This has also made it possible to compare the mutual importance of actors, by pair-wise comparison, by using the Saaty scale [6, p. 62].

The analysis is based on a few hypotheses:

Hypothesis 1: Actors of waste management have a different level of influence on waste management factors.

Hypothesis 2: The state government has a dominant influence on recycling industry development.

Hypothesis 3: Actors may provide the greatest influence on waste management improvement through sociological factors.

In order to provide information needed for making conclusions weather to accept or reject the mentioned hypotheses, multi-criteria analysis has been applied. This method is appropriate when the analysis assumes crossbreeding of two or more variables with few modalities.

3.2. Formulation of multi-criteria model

Multi-criteria analysis involves assessing the effects of key actors in the process of waste management and the factors that are important for successful management of waste. For the purpose of forming models, the actors, who have been playing certain roles in this process, until the present, are listed:

1. State Government (SG)
2. Local Self-Government (LSG)
3. Population (P) and
4. Professional Societies in the field of Recycling (PS-R).

The important factors that determine the level of success in waste management are:

1. Environmental
2. Financial
3. Social
4. Technological.

Environmental factors include the environment - pollution levels, the existence of illegal dumps, and so on. Financial factors include available funds for investment in environmental protection and waste management. These funds are primarily from the budget of the Republic of Serbia, as well as fee income from the disposal of the Fund for the En-

vironment and Local Self Government. Social factors include the level of awareness of citizens and their willingness to engage in modern methods of waste disposal, as well as legislation that would provide adequate sorting and disposal of waste. Finally, the technical equipment of landfills and recyclers is very important for a good waste management. Specifically, the low technological level of existing landfills is a significant constraint for development of recycling industry, because there are no adequate facilities for waste treatment. The described model is shown in Figure 3.

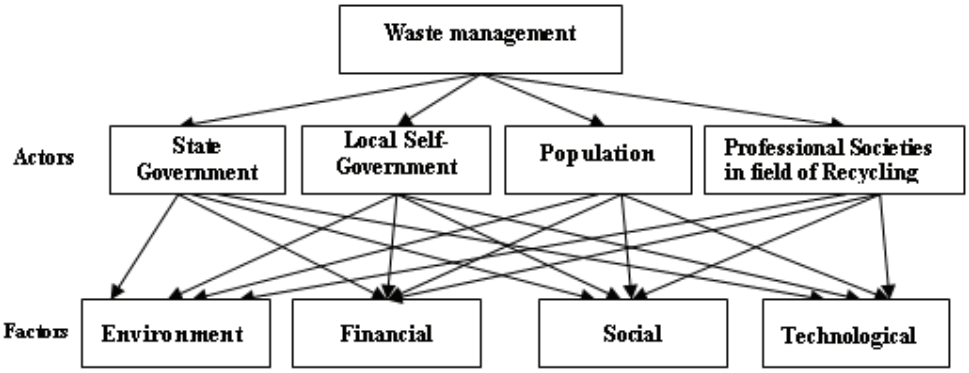

Fig. 3. Multi-criteria model for waste management

The Analytical Hierarchy Process is used to solve the model. The analytical hierarchical process (AHP), as one of the multi-criteria optimization methods, represents a tool for decision making about choosing one from a series of alternatives, particularly in cases where there are several criteria. The method was created in the last century and its creator was Thomas Saaty. The essence of the method can be briefly described as follows: that is structuring of complex decision problems that can contain multiple criteria, more alternatives, as well as a huge number of decision makers (group decision) on many hierarchical levels, determining the weights of criteria and alternatives by levels and thus form a final ranking of alternatives. The modelling process can be divided into four phases [6, p. 62]:

- Structuring the problem,
- Data collection,
- Determining relative weights,
- Determining solutions.

The problem is viewed as a hierarchy where the goal of the observed problem is at the top, while at the lower levels there are attributes. The decision-making process is carried out by the treatment of these attributes. At the lowest hierarchical level, there are *m* alternatives.

The strength of preference is expressed by the ration scale with increments of 1 – 9. Preferential level 1 shows the equality of the observed attributes, while the absolute level of 9 indicates the strongest preference for one attribute over another. Such a scale is formed by Saaty [6, p. 62]. The fuzzy approach to AHP method assumes that the weights of criteria importance are fuzzy numbers, as well as coefficients of reciprocal pair's comparison matrix. Such conditions require some adaptation of the method.

Triangular fuzzy numbers represent the equivalent Saaty's scale of relative importance. As in the case of the classical AHP method, for comparison of pairs of alternatives

matrix reciprocity is assumed in fuzzy variant, too. When the alternative is compared with itself, instead of 1, the triangular fuzzy number (1,1,1) is used.

Theoretical assumptions of AHP method are based on the fact that the vector of relevance of alternatives in comparison to the observed criterion is actually its own vector matrix for comparison of pairs of these alternatives on that criterion. The adopted procedure assumes that an approximation of elements of their own fuzzy vector matrix is calculated as the *n*-th root of the multiplication of elements of each row of the matrix, where n is the number of elements in the row.

The procedure for applying the AHP method assumes normalization of the coefficient of decision-making matrix. Therefore, the fuzzy vector, which is used to express the importance of alternatives, must be normalized, and this is achieved by dividing each coefficient in the vector with the sum of the same. In accordance with the described procedure the relevant importance of impact for each actor in the model is calculated (Table 2 and Table 3). Estimates are formed based on experiences from previous years.

Table 2. Reciprocal comparison matrix for actors in waste management model

	SG	LSG	P	PS-R
SG	(1,1,1)	(4,5,6)	(6,7,8)	(2,3,4)
LSG	(1/6,1/5,1/4)	(1,1,1)	(2,3,4)	(1/4,1/3,1/2)
P	(1/8,1/7,1/6)	(1/4,1/3,1/2)	(1,1,1)	(1/6,1/5,1/4)
PS-R	(1/4,1/3,1/2)	(2,3,4)	(4,5,6)	(1,1,1)

Table 3. Priority vector for actors in waste management model

	Weights		
	Lower	Medium	Upper
SG	**0.550624**	**0.551535**	**0.561384**
LSG	0.113825	0.115221	0.12004
P	0.052912	0.053824	0.054234
PS-R	0.251935	0.257643	0.265692

The vector of priorities clearly shows that so far the state government had a dominant role in developing waste management system. By influencing the creation of the favourable institutional environment, the state contributes to the lowering of the economic and other risks [9, p. 111] The relationship between the factors according to the impact of the state government is given in Table 4.

Table 4. Reciprocal comparison matrix for relevant factors from the aspect of State Government influence

	E	F	S	T
E	(1,1,1)	(1/6,1/5,1/4)	(1/4,1/3,1/2)	(1/6,1/5,1/4)
F	(4,5,6)	(1,1,1)	(4,5,6)	(2,3,4)
S	(2,3,4)	(1/6,1/5,1/4)	(1,1,1)	(1/6,1/5,1/4)
T	(4,5,6)	(1/4,1/3,1/2)	(4,5,6)	(1,1,1)

The results indicate that the role of state governments is reflected in providing funds for waste management, because it has the highest value of relative importance of financial factors (Table 5).

Table 5. Relative importance of factors from the aspect of State Government influence

	Weights		
	Lower	Medium	Upper
E	0.056967	0.057614	0.059316
F	**0.494073**	**0.498954**	**0.508705**
S	0.097852	0.098791	0.099756
T	0.273778	0.288071	0.290586

By comparing the pairs of factors in terms of local self government given in Table 6, the vector of relative importance is formed. It is clearly shown that local authorities have a dominant impact on the sociological factors (Table 7).

Table 6. Reciprocal comparison matrix for relevant factors from the aspect of Local Self Government influence

	E	F	S	T
E	(1,1,1)	(4,5,6)	(1/4,1/3,1/2)	(6,7,8)
F	(1/6,1/5,1/4)	(1,1,1)	(1/8,1/7,1/6)	(2,3,4)
S	(2,3,4)	(6,7,8)	(1,1,1)	(6,7,8)
T	(1/8,1/7,1/6)	(1/4,1/3,1/2)	(1/8,1/7,1/6)	(1,1,1)

Table 7. Relative importance of factors from the aspect of Local Self Government influence

	Weights		
	Lower	Medium	Upper
E	0.291306	0.288353	0.293543
F	0.084093	0.084421	0.084739
S	**0.542182**	**0.543273**	**0.530492**
T	0.046532	0.044808	0.045529

Iterative process of comparison in terms of population activities (Table 8) shows that, as in the case of local self government, the population has the greatest impact on socio-logical factors (Table 9). This is logical because people can mostly influence the creation of awareness about the need for environmental protection.

Table 8. Reciprocal comparison matrix for relevant factors in terms of actions of population

	E	F	S	T
E	(1,1,1)	(4,5,6)	(1/4,1/3,1/2)	(4,5,6)
F	(1/6,1/5,1/4)	(1,1,1)	(1/8,1/7,1/6)	(1/4,1/3,1/2)
S	(2,3,4)	(6,7,8)	(1,1,1)	(4,5,6)
T	(1/6,1/5,1/4)	(2,3,4)	(1/6,1/5,1/4)	(1,1,1)

Table 9. Relative importance of factors in terms of actions of population

	Weights		
	Lower	Medium	Upper
E	0.273646	0.280958	0.28564
F	0.053881	0.054658	0.055685
S	**0.527924**	**0.529339**	**0.53621**
T	0.097374	0.097727	0.098059

The following tables show the relationship between factors in terms of the influence of professional societies in the field of recycling (Table 10). The results indicate that these associations made the largest contribution in the field of environmental protection, because of the dominant value of relative importance of environmental factors (Table 11).

Table 10. Reciprocal comparison matrix for relevant factors in terms of actions of professional societies in the field of recycling

	E	F	S	T
E	(1,1,1)	(2,3,4)	(2,3,4)	(4,5,6)
F	(1/4,1/3,1/2)	(1,1,1)	(1/6,1/5,1/4)	(1/4,1/3,1/2)
S	(1/4,1/3,1/2)	(4,5,6)	(1,1,1)	(2,3,4)
T	(1/6,1/5,1/4)	(2,3,4)	(1/4,1/3,1/2)	(1,1,1)

Table 11. Relative importance of factors in terms of actions of professional societies in the field of recycling

	Weights		
	Lower	Lower	Lower
E	**0.455535**	**0.466796**	**0.469416**
F	0.072165	0.072586	0.072746
S	0.270863	0.279505	0.280792
T	0.122376	0.127526	0.129344

Sensitivity analysis of the obtained solution with respect to the role of the state and local authorities is provided in Figure 4 and Figure 5, respectively. The analysis is based on the linearized medium values of the vector of priorities from Table 4.

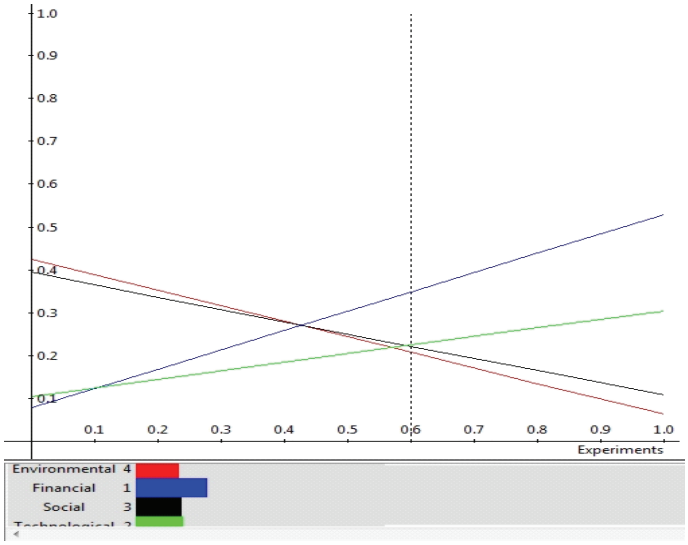

Fig. 4. Determination of the critical level of State Government influence

To maintain the existing relations between the factors that influence the relative importance of the state government, the state authorities influence should not be less than 0.6 compared to the parameters entered into the model (Figure 4).

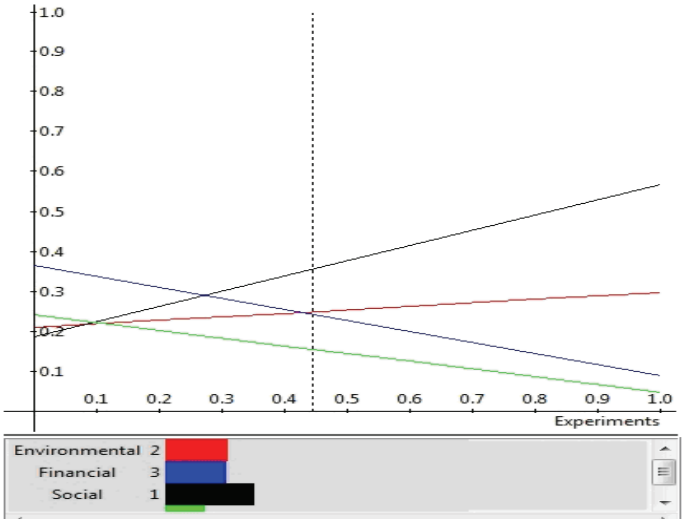

Fig. 5. Determination of the critical level of Local Self-Government influence

To maintain the existing relations between the factors that influence the relative importance of the local self- government, the intervention of local authorities should not be less than 0.45 compared to the parameters entered into the model (Figure 5). The observed trends

are desirable, but to ensure a favourable impact of the above mentioned relevant factors, it is required that both the state and local government play a more significant role.

CONCLUSION

Of all the methods used to minimize the amount of waste, recycling is the only one that creates new value. Recycling reduces the consumption of resources and provides a rational and sustainable usage of limited resources. The European Union promotes the reduction of waste by implementation of clean technologies and permanent campaign to raise public awareness on the subject.

In Serbia, the greatest problem in the field of environmental protection is inadequate waste management. The main causes of this problem are under-developed infrastructure and low awareness of environmental protection. Therefore, there is no systematic and organized collection, sorting and recycling. Also, there is no location for the disposal of hazardous waste, nor authorized treatment facilities and waste streams.

The main challenges of waste management in Serbia are about defining security coverage and capacity for collection, transportation and disposal, which can be considered as essential services in this field. Municipal waste is dominant in the structure of waste, and it needs greater attention. The local government and the state must establish a higher degree of cooperation with recyclers and provide them with adequate legal framework, and incentives to develop their businesses successfully.

The examples from practice show that recyclers from the Nis region do not use all available resources of financial support in the form of soft loans and incentive funds granted by the Fund for Environmental Protection. A better exploitation of this possibility may be a way for recycling industry development.

The state government still has a dominant role in waste management development. This conclusion proceeds from the fact that the state government has the greatest influence on the financial factor, which is the most important, from the managers' point of view. Besides the state government, the other type of institutions – the local self government also has a significant influence on waste management development, though its influence is reflected through the sociological factor. This means that the population and the local self government have similar effects and therefore they should unite their forces with the purpose of waste management improvement. This research confirms the thesis that every initiative for improvement and therefore, the initiative for waste management improvement must proceed from the top, in this case from the state government, in order to ensure positive results. With financial support at the state government and promotion and awareness development at the local self government level, the chances for waste management development will be greater.

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ANALIZA MOGUĆNOSTI RAZVOJA INDUSTRIJE RECIKLAŽE – VIŠEKRITERIJUMSKI PRISTUP

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Direktnom povezanošću sa Nacionalnom strategijom za upravljanje otpadom, razvoj recikliranja u Srbiji ima, pre svega, strategijski značaj za ostvarivanje ciljeva prema standardima Evropske Unije. Sa druge strane, to je sektor industrije koji ima veliki ekonomski potencijal. Podrška od strane države, kroz institucije, predstavlja značajan faktor održivog razvoja bilo koje industrije, a posebno kada je reč o industriji koja se može smatrati pionirskom u Srbiji. Razvoj i jačanje regionalne kooperacije u zaštiti životne sredine i održivog razvoja mogu biti obezbedjeni uspostavljanjem veze i uskladjivanjem aktivnosti ekonomskih entiteta, aktera uključenih u upravljanje otpadom i reciklažu. Na teritoriji Južne Srbije ovo povezivanje realizovano je kroz klaster "Reciklaža Jug". Istraživanje profitabilnosti ovakvog oblika investicije, razvoj mogućnosti, kao i uloga institucija u ovom procesu, realizovano je u saradnji sa klasterom "Reciklaža Jug". Rezultat istraživanja predmet je ovog rada. Analiza projekata investiranja i iskustva investitora pokazuju da investicije u industriju reciklaže jesu profitabilne. Osim troškovne efikasnosti, ova vrsta investicija opravdana je i sa aspekta zaštite životne sredine, u smislu doprinosa ispunjenju ciljeva Regionalne strategije upravljanja otpadom u regionu Niš. Kako je ova grana industrije tek u povoju u Srbiji, uloga Vlade i Ministarstva za zaštitu životne sredine i prostorno planiranje u smislu podrške ovoj vrsti investicija morala bi biti veća. Uspostavljanje i funkcionisanje Fonda za zaštitu životne sredine predstavlja značajan korak napred u unapredjenju finansiranja u ovoj oblasti.

Ključne reči: *reciklaža, održivi razvoj, institucije, zaštita životne sredine, profitabilnost.*