



Comprehensive Measurement of Social Benefits Generated by Public Investment Projects

JURGITA BARANAUSKIENE¹, and VILIJ ALEKNEVICIENE²

¹ Lector, Vytautas Magnus University, Research Institute for Bioeconomy, Kaunas, Lithuania,
e-mail jurgita.baranauskiene@vdu.lt

² Professor, Vytautas Magnus University, Research Institute for Bioeconomy, Kaunas, Lithuania,
e-mail vilija.alekneviciene@asu.lt

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ABSTRACT

Initiators of public investment projects and representatives of target groups seek to choose the best option ensuring the greatest benefits generated to the public. Measurement of social benefits is complicated due to a multifaceted character and complexity of monetary measures as well as other quantitative and qualitative measures. The issue of social benefits' measurement is controversial and full of criticism. Consequently, discussing it is highly relevant. We propose a model for comprehensive evaluation of social benefits generated by public investment projects. This model allows choosing the best option of a project irrespective of the areas of social environment, initiators and operators, target groups, size of initial investments, locations of implementation, as well as tangibility of investments. This model was tested by employing a method of case study analysis. SAW was applied for combining different social benefit indicators into one comparable indicator and TOPSIS – for determination of general indicator variation values. The model was developed for ex-ante evaluation of social benefits generated by public investment projects. It does not cover financial outcome, operating costs, risk appraisal and issues of determining the social discount rate.

INTRODUCTION

Although public investment projects do not generate sufficient net income to be effective in terms of finance, they do provide social benefits to the public. Their goals are oriented to public welfare rather than to direct financial outcome and are intended to satisfy public needs that are ensured by the state through its institutions, non-profit organisations and associations. The goals of public investment projects are related to the implementation of state's functions, such as promotion of health, improvement of social security, education and occupation of children and youth, reduction of unemployment, internal and external security of state, protection of environment, development of national engineering networks, and etc. These projects help to reduce social exclu-

sion, encourage regional and promote economic development. The aim of an ex-ante evaluation is to identify and evaluate the potential positive and negative outcomes of a planned project and to choose the most efficient investment option. Since the goals of public investment projects are oriented towards generating social benefits for the public, the measurement of their efficiency prioritizes social benefits they generate. Economic and social benefits generated by a project are often intertwined as improvement of social environment indirectly promotes economic growth. Considering the objectives of public investment projects, the decision to invest should be mainly based on the social benefits created. This can be achieved by evaluating the influence of a public investment project on society's social environment.

Initiators of public investment projects as well as representatives of target groups seek to choose the most efficient option for investment project ensuring the greatest benefits to the public. An essential reason behind efficiency of public investment projects being relatively poor is an insufficient justification of their selection. Flyvbjerg et al. (2003) and Dabla-Norris et al. (2012) recognised that in order to determine marginal investment efficiency and their influence on national social environment and economic growth, analysis and evaluation of efficiency and investment in a comprehensive manner is important. In other words, evaluation of the overall potential effects of a project, both beneficial and harmful ones, is a must. Social benefits generated by public investment projects are difficult to measure due to a multifaceted character and complexity of monetary measures, other quantitative and qualitative measures as well as long-term investing periods. Public investment projects are oriented towards provision of public goods, non-product goods and positive externalities. Generally, the measurement of social benefits generated by public investment projects relies on Utility Theory: a limited amount of disposable funds is intended to achieve the maximum utility by investing in implementation of the selected project. Utility Theory requires every criterion that influences the scope of social benefits from the project to be evaluated. Aggregated values of benefits for each criterion, obtained by applying weight factors, show the total value of benefits. It is not difficult to reveal the utility perceived by one individual while evaluation of utility for multiple individuals is more complicated. Since the needs of society members are diverse, they cannot be represented by the same utility function. In such a case one may not simply rely on the average of society members' needs, but has to take into account the strength of these needs (Beuthe et al. 2000; Dubra et al. 2004; Ok 2002; Vind 2000).

Cost-benefit analysis (CBA), based on neoclassical economic welfare and utility theories, is commonly applied for evaluation of social benefits of public investment projects. Nevertheless, it attracts major criticism among scientists because it can only be used to evaluate what is measurable in monetary terms. If the priorities are given in an inappropriate way, the essential values, i.e. social welfare, ecology, sustainability, justice of distribution, are not always identified (Parks and Gowdy 2013). Another important problem of using CBA is measuring social benefits in monetary terms. Researchers discussed quantification of non-market goods, such as human life, environmental impact on human health i.e. how to measure social benefits for the public but still have not found a unanimous answer (Clark et al. 2014; Glazer et al. 2003; Jacoby 2000; Nyborg 2000; Price 2010; Van de Walle 2002). Nyborg (2000) suggested measuring social benefits in non-monetary terms. However, he pointed out that project valuation is impossible without attaching weights (levels of significance) to the indicators of social benefits. Scientists suggested various methods for determining the coefficients of social benefits with the highest-scoring project producing the greatest benefit. However, not all the necessary information is always available (Jacoby 2000; Van de Walle 2002). Moreover, Button and Eklund (2018) extended discussions of potential existing biases rising when applying CBA. According them, the heart of problem mainly lies in the application of CBA rather than in the intrinsic methodology. Zapata-Diomedí et al. (2018) explored a method for incorporating monetised physical activity-related health benefits in CBA of built environment interventions. They used a value of statistical life year and monetised the health-adjusted life years.

Time value of money is particularly important for valuation of public investment projects – even if the future costs and benefits are known, decisions must be made today. Future costs and benefits need to be discounted, which requires selecting an appropriate discount rate (Brukas et al. 2001; Frederick et al. 2002; Gollier 2002; Gollier 2010; Grijalva et al. 2014; Hepburn 2006; Jouini and Napp 2014; Price 2010). The issue of social benefits' measurement is controversial and full of criticism. As a result, it should be discussed from both theoretical and practical viewpoints. The problem of identifying the significance and scope of social benefits, measuring them in terms of money, combining various quantitative and qualitative indicators and determining an appropriate discount rate are discussed in different studies (Brukas et al. 2001; Chen 2012; De Nooij 2011; Gollier 2010; Hepburn 2006; Hepburn and Koundouri 2007; Jacoby 2000; Nyborg 2000; Price 2010; Van de Walle 2002). Suggested methods and models such as cost-efficiency analysis (Ernst 2006; Simić et al. 2011), Littles-Mirrlees (Stern 1972), methodology of United Nations Industrial Development Organisation (UNIDO) (Simić et al. 2011), Strategic Landscape Investment Model (SLIM) (Hajkowicz et al. 2005), Marginal Cost of Funds (MFC) (Liu 2003) do not allow determining how to quantify the scope of social benefits, how to compare investment options and how to select the most efficient one.

In recent years multi-criteria decision-making methods have been increasingly more applied for qualitative and quantitative valuation of complex economic and social phenomenon (Ginevičius et al. 2008; Greco et al. 2005; Greening and Bernow 2004; Parkan and Wu 2000; Podvezko and Podvezko 2010; Podvezko 2011; Podvezko and Podvezko 2014; Schieg 2009; Zavadskas et al. 2010). The quantitative measurement of social benefits can employ multi-criteria decision-making methods as they offer the possibility of quantifying social benefits expressed in a number of different quantitative and qualitative indicators: maximised and minimised indicators make it possible to evaluate the benefits generated and/or damage inflicted by public investment project. Even though the researchers mentioned above emphasised the advantages of multi-criteria decision-making methods for valuation of economic and social phenomenon, they have not presented any particular models. In summary, researchers tend to focus on the following problems: what characteristics are important for measurement of social benefits of public investment projects; what indicators can be used to measure social benefits; how the measurement of social benefits is influenced by time horizon; how to improve the methods used for evaluation of social benefits. It should be noted that research have paid too little attention to modelling the comprehensive measurement of social benefits. Consequently, the scientific problem is what methods and indicators could be applied for measuring social benefits generated by public investment projects, and how to evaluate these benefits comprehensively. The remainder of the paper is structured as follows. Section 2 presents the characteristics of public investment projects and the concept of social benefits. Section 3 follows with a logic diagram for identifying social benefits' measurement indicators as well as with the methodology for comprehensive evaluation of social benefits. The model is tested by using case studies in Section 4. Summary of results, conclusions and research limitations are presented in the end of the research.

1. THE CHARACTERISTICS OF PUBLIC INVESTMENT PROJECTS AND THE CONCEPT OF SOCIAL BENEFITS

The main difference between public and private investment projects lies in the fact that public investment projects are financed from public funds and aim satisfying society needs as opposed to increasing cash flows. Public investments are intended to improve the social environment of residents and to preserve nature at the same time creating an attractive social environment which indirectly contributes to country's economic growth. These characteristics influence evaluation of public investment projects, i.e. selection of valuation methods and measurement of expected outcomes, i.e. social benefits. There is no clear and universally recognised definition of the concept of

social benefits. Researchers argue about this concept and its importance to society (Jacoby 2000; Nyborg 2000). Representatives of Classical Economic Theory described social benefits for public – free provision of goods – as additional benefits related to the fair market value, however, without attaching a greater importance to them (Dietz and Fankhauser 2010; Frederick et al. 2002; Gómez-Baggethun et al. 2010). Neoclassical Welfare Theory is mainly focused on efficient use of economic resources as well as on renewable natural resources, i.e. natural capital, and handover thereof to future generations. Theoretically, CBA method based on Neoclassical Welfare Theory does not always reveal all social benefits due to inappropriate selection of preferences (essential values), e.g. ecology, sustainability, justice of distribution or social welfare (Davis 2006; Parks and Gowdy 2013). Eventually, an opinion was formed that an investment decision of public investment projects should be based taking into account the generated social benefits. Consequently, search for the most effective ways and methods for expressing and evaluating these benefits continued.

After summarising the concept of social benefits, investment projects' social benefits were described. Social benefits of public investment projects are public goods, not available within the market system, resulting from purposeful implementation of public investment project activities. These benefits are showing through improvement of social conditions, moral (emotional) society's satisfaction, as well as reduction of negative impact on social environment.

2. METHODOLOGY FOR COMPREHENSIVE EVALUATION OF SOCIAL BENEFITS

In order to develop the methodology for comprehensive evaluation of social benefits generated by public investment projects, the principles of evaluation – comprehensiveness, consistency, priority, simplicity, justification, accuracy, comparability and wide applicability – were formulated and described. It should be noted that the principles formulated are intertwined and interrelated, at the same time supplement each other and contradict to each other. Assumptions of comprehensive evaluation of social benefits describe the conditions for applying the developed methodology. The model for comprehensive evaluation of social benefits covers three main phases: 1) identification and selection of social benefits; 2) measurement of the social benefit indicators; 3) combination of the indicators of social benefits into one comparable indicator.

Social benefits are identified by taking into account the goals set by a project that may be divided into partial goals related to the forecasted impact of investment project on public. The network diagram of a public investment project (Fig. 1) presents the sequence of its implementation and logic relationships between goals, tasks, activities and expected effects on the public.

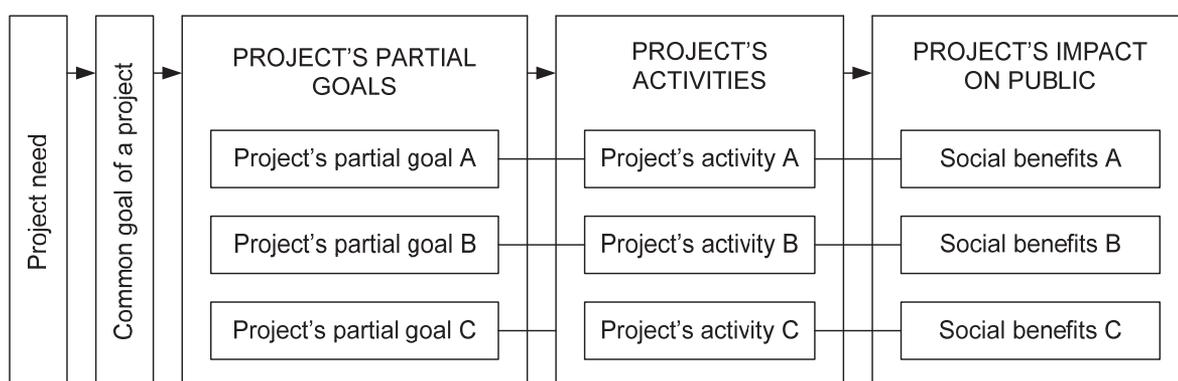


Figure 1. Network Diagram of a Public Investment Project

Source: compiled by authors

Social benefits can be identified according to the areas of social environment. These areas representing the social benefits of public investment projects cover the groups of indicators resulting from the partial goals of public investment projects. Taking into account the goals set for them, public investment projects cover at least one area of social environment. Since every public investment project is exceptional according to the goals set for it, expected effects and other influencing circumstances, indicators of evaluation of social benefits for public investment projects should be selected on a case-by-case basis. Implementation of public investment projects may also cause negative effects on the public (damage). Damage inflicted by a public investment project is identified as a negative result that is contrary to the set project goal. When doing the evaluation, firstly the quantitative indicators of social benefits were measured in monetary terms by applying the methods for evaluating public goods (cost estimation and revealed preference). The indicators of social benefits, not measurable in monetary terms, were assessed in quantitative measurement units by drawing up matrices relating quantitative measurement of project activities and outcomes. In this phase of evaluation of social benefits the most diverse methods could be used: analysis of literature, analogues or statistics, expert evaluation, public participation, situation modelling. The choice of quantitative method depended on the particular project as well as competences and experience of the expert evaluating. Rank scales should be used if social benefits could be expressed in only qualitative indicators. A scale rank describes an impact of an indicator on a public investment project. When a numerical value is provided to qualitative indicators, depending on the need, three-, four- and five-point scales could be used. This ranking could be implemented by a project evaluator or an expert. Selection of methods applied for measuring social benefits in monetary terms, other quantitative and qualitative measurement units are presented in the algorithm developed (Fig. 2). Methods applied for measuring the indicators of social benefits are selected to comply with the principles for evaluating the social benefits of public investment projects based on justified assumptions in the best possible way. Assessment of significance (weights) of the indicators of social benefits is related to the priority of the partial goals of the project. This priority should be determined by the project need analysed in the preparation phase, while the numerical value of project priority could be determined based on the number of partial goals. Significance of a specific indicator of social benefit is calculated by dividing the weight of the partial goal attributed to the indicator by the amount of weights attached to all the indicators based on the partial goals:

$$w_{ki} = \frac{R_k}{\sum_{k=1}^m N_k R_k} \quad (1)$$

where: w_{ki} – weight of the i^{th} indicator for the k^{th} partial goal; R_k – weight of the k^{th} partial goal; N_k – the number of the k^{th} indicators for the k^{th} partial goal.

When evaluating the social benefits it is common to use multi-criteria evaluation methods as they provide the possibility of combining different social benefit indicators into one comparable indicator. The principles of multi-criteria evaluation methods tend to be similar. Consequently, the selection depends on the evaluator's experience and knowledge rather than on the advantages of particular methods. Simple Additive Weighting (SAW) method was used for this empirical research. While applying it, linear normalisation of values for maximisation or minimisation of indicators is calculated by using the formulas of Ginevičius and Podvezko (2008):

$$\hat{r}_{ij1} = \frac{\min_j r_{ij}}{r_{ij}} \quad (2)$$

$$\hat{r}_{ij2} = \frac{r_{ij}}{\max_j r_{ij}} \quad (3)$$

where: \hat{r}_{ij} – normalised value of the i^{th} indicator for the j^{th} option; r_{ij} – value of the i^{th} indicator for the j^{th} option; $\min_j r_{ij}$ – the lowest value of the i^{th} indicator for the j^{th} option; $\max_j r_{ij}$ – the highest value of the i^{th} indicator for the j^{th} option.

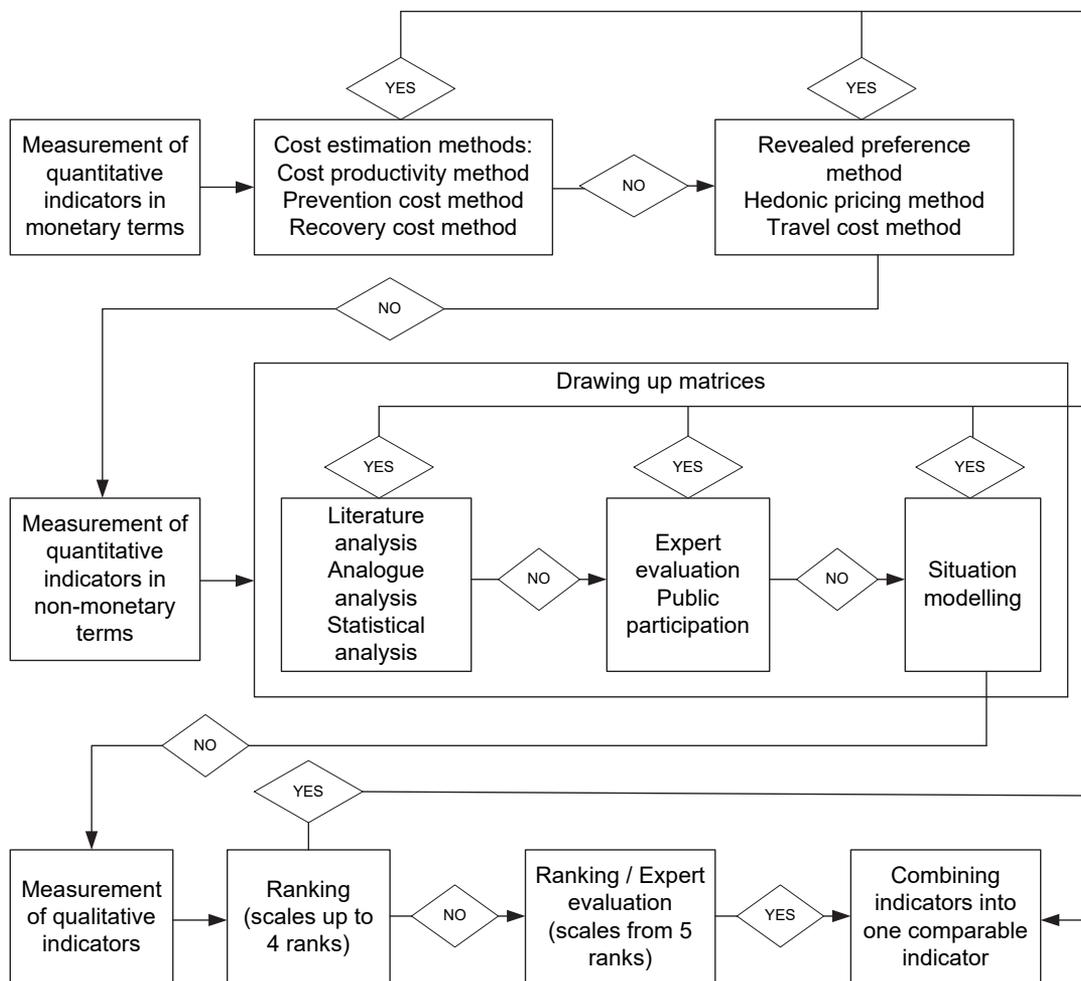


Figure 2. Selection Algorithm for the Methods Applied for Measuring the Indicators of Social Benefits Generated by the Public Investment Projects

Source: compiled by authors

Integration of indicators by the SAW method:

$$S_j = \sum_{i=1}^m w_i \tilde{r}_{ij} \quad (4)$$

where: S_j – value of multi-criteria evaluation of the j^{th} option; w_i – weight of the i^{th} indicator; \tilde{r}_{ij} – normalised minimum and maximum values of the i^{th} indicator for the j^{th} option.

The technique estimating the order of preference by similarity to ideal solution (TOPSIS) allows determining the values of general indicator variation. Vector normalisation of values is used for application of the method (Ginevičius et al. 2008; Ginevičius and Podvezko 2008):

$$\tilde{r}_{ij} = \frac{r_{ij}}{\sqrt{\sum_{j=1}^n r_{ij}^2}} \quad (i = 1, \dots, m; j = 1, \dots, n) \quad (5)$$

where: \tilde{r}_{ij} – the normalised value of the i^{th} indicator for j^{th} option; m is the number of criteria; n is the number of options.

The best investment option V^* and the worst investment option V^- are calculated by using the below formulas: (Lotfi et al. 2007):

$$V^* = \{V_1^*, V_2^*, \dots, V_m^*\} = \{(max_j w_i \hat{r}_{ij} / i \in I_1), (min_j w_i \hat{r}_{ij} / i \in I_2) \dots (min_j w_i \hat{r}_{ij} / i \in I_m)\} \quad (6)$$

$$V^- = \{V_1^-, V_2^-, \dots, V_m^-\} = \{(min_j w_i \hat{r}_{ij} / i \in I_1), (max_j w_i \hat{r}_{ij} / i \in I_2), \dots (max_j w_i \hat{r}_{ij} / i \in I_m)\} \quad (7)$$

where: I_1 – set of indices of maximised indicators, I_2 – set of indices of minimised indicators.

The total distance of each option to the best solutions D_j^* and to the worst solutions D_j^- is calculated by the formulas:

$$D_j^* = \sqrt{\sum_{i=1}^m (w_i \hat{r}_{ij} - V_i^*)^2} \quad (8)$$

$$D_j^- = \sqrt{\sum_{i=1}^m (w_i \hat{r}_{ij} - V_i^-)^2} \quad (9)$$

The below formula is used to calculate the criterion of TOPSIS method C_j^* :

$$C_j^* = \frac{D_j^-}{D_j^* + D_j^-} \quad (j=1, \dots, n) \quad (10)$$

Value of the criterion C_j^* can vary from 0 to 1 ($0 \leq C_j^* \leq 1$) and the best investment option corresponds to the highest value of C_j^* . The theoretical model of comprehensive evaluation of social benefits generated by public investment project is presented in Figure 3. Significant advantages of the developed model come from the fact that selected indicators for social benefits are directly linked with the project's goals and expected impact on public. These benefits are expressed in different units of measurement. The model allows combining different units of measurement, enables ranking investment options and comparing them with regard to the benefits resulting from the public investment project.

When all the social benefits are evaluated, they should be compared to investment costs, i. e. cost-benefit ratio should be calculated. The relative size has no dimension, so should be used only for comparing the investment options. The model of comprehensive evaluation of social benefits provides an opportunity to compare and rank investment options in terms of social benefits. Nevertheless, it cannot be used to evaluate the efficiency of one investment option and does not allow comparing the efficiency of different investment projects. When integrating financial and economic benefits into the model, the overall benefits generated by public investment projects should be considered. Financial and economic benefits should be integrated in calculation of present value of cash flows, together with the social benefits measured in monetary terms. Considering all the benefits, investment costs and operating costs for the project's infrastructure, the most efficient investment option should be chosen.

Public investment projects are usually planned for a distant future, so are associated with high risk. The indicators of social benefit are influenced by specific risk factors that may lead to deviations from the expected result of a project, i.e. its impact on public. That supposes the necessity of integrating the tools of risk analysis such as sensitivity analysis or scenario analysis in the model. However, this research is only focused on evaluation of social benefits because its complicated measurement causes most of the problems in evaluation process.

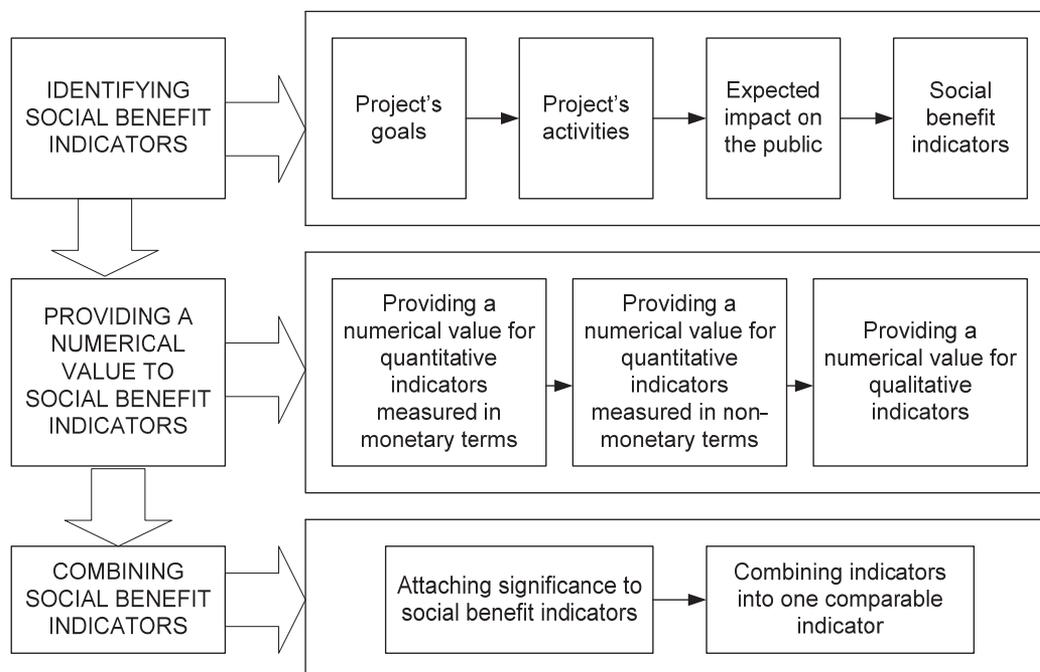


Figure 3. Model of Comprehensive Evaluation of Social Benefits Generated by a Public Investment Project

Source: compiled by authors

3. APPLICATION OF THE MODEL OF COMPREHENSIVE EVALUATION OF SOCIAL BENEFITS GENERATED BY A PUBLIC INVESTMENT PROJECT

A case study analysis was used for testing the developed model. Selection of projects was aimed at substantiating the universality of the model of comprehensive evaluation of social benefits. Universality of the developed model lies on its suitability for evaluating the social benefits generated by different public investment projects. This model can be applied irrespective of the areas of social environment to which the goals of the projects are oriented, project initiators and operators, the size of initial investments and target groups, locations of project implementation, and the tangibility of investments. Five public investment projects in Lithuania initiated by Municipality Foster Home, Farmers' Association, Rural Community, Municipality of a Resort, and University were chosen for evaluation.

After implementation of Municipality Foster Home project, the physical infrastructure of Municipal Children' Care House will be improved and better living and learning conditions will be provided for children. Improvement of employees' competence should not only allow solving the problems of mutual communication, but also improving pedagogical and psychological methods of integration, presenting life experience, developing their qualities, revealing skills and talents. The project of Association of interested farmers for reconstruction of drainage systems should ensure timely water drainage from agricultural land and village itself. It should reduce the annual harvest losses, increase the attractiveness of living and working in countryside, reduce the risk of contamination of surface and groundwater. Rural Community project should create an opportunity for people to more actively engage in sports and cultural activities as well as provide a great place for children, young people and adults to have healthy and purposeful leisure time with their community members. In addition, it is expected to expand the horizons of people by creating a possibility to participate in events with visiting guests. Children and young people should also have a chance to

play sports safely after eliminating harmful activities. The project should stimulate rural development and create an attractive and functional public space. The project of Resort Municipality is aimed at ensuring safe traffic in one of the main streets: installing the networks of surface water collection, amending the sidewalks to be suitable for disabled people, and etc. The project of University is expected to have a lasting impact on the development of students' entrepreneurship, creativity, motivation. In addition, it should provide real business knowledge and practical skills that will help them better adapt to the labor market.

The indicators of social benefits resulting from the public investment projects were identified by drawing a network diagram for each project evaluated. In order to reach the goal of each project, 2 to 3 investment options were formulated aiming to make a compare them in terms of social benefits. First, the monetarily quantifiable indicators of social benefits generated by each project were evaluated by using public goods' evaluation methods (Table 1). It is worth noting that calculation of monetarily quantifiable indicators is complicated due to a long prediction period and justification of assumptions. Inaccuracies of the assumptions for the predictions affect the final outcome of evaluation.

Table 1. Social Benefit Indicators of the Evaluated Public Investment Projects Measured in Monetary Terms (EUR/year)

Social Benefit Indicators Measured in Monetary Terms	Evaluation of Social Benefit Indicators according to Investment Options		
	I	II	III
1. RENOVATION AND PERSONNEL TRAINING IN MUNICIPALITY FOSTER HOME			
Increase in added value created by former foster children	25 065	75 195	50 130
Decrease of social payments to former foster children	2 693	8 079	5 386
2. RECONSTRUCTION OF DRAINAGE SYSTEM FOR FARMERS			
Liquidation of losses resulting from flooded yards and basements	800	800	-
Increase in land value (in the first year after the project implementation)	126 000	140 000	-
3. INSTALLATION OF MULTI-FUNCTIONAL GROUNDS IN RURAL COMMUNITY			
Travel costs	50 368	39 040	50 368
Increase of the real estate value in the residential area	222 075	148 050	296 100
4. RECONSTRUCTION OF MUNICIPALITY STREET OF A RESORT			
Travel costs (during the first year after the project implementation)	83 307	83 307	-
Accident rate reduction (impact on property in the first year after the project implementation)	198	139	-
5. CREATION OF ORGANISATIONAL AND METHODOLOGICAL CONDITIONS FOR DEVELOPING STUDENTS' ENTREPRENEURSHIP SKILLS THROUGH THE USE OF A PRACTICAL TRAINING MODEL IN UNIVERSITY			
Increase in the added value created by the University's graduates	56 400	112 800	-

Source: compiled by authors, based on selected projects data

The indicators of social benefits that could not be measured were evaluated by drawing a matrix of project activities and related results (Table 2). Each project has 1-3 activities related to it.

Each activity represents one or more outcomes, i.e. social benefit indicators measured in different units. For example, social benefits in Municipality Foster Home project are measured in square metres, hours, and units. Social benefits from the project of Resort Municipality are measured by metres, numbers and tons per year.

Table 2. Matrix for Determination of Non-Measurable in Monetary Terms Quantitative Social Benefit Indicators of the Evaluated Public Investment Projects

Project Activities	Social Benefit Indicators according to Investment Options			Outcomes of Project Activities = Social Benefit Indicators
	I	II	III	
1. RENOVATION AND PERSONNEL TRAINING IN MUNICIPALITY FOSTER HOME				
Reconstruction of the building	1 865	1 077	1 865	Area of reconstructed premises (m ²)
Personnel training	0	30	15	Number of organised training hours for teachers (h)
Acquisition of Equipment	0	12	12	Number of equipped computerised workplaces (units)
2. RECONSTRUCTION OF DRAINAGE SYSTEM FOR FARMERS				
Reconstruction of land reclamation systems	140	140	-	Reclaimed agricultural land area (ha)
3. INSTALLATION OF MULTI-FUNCTIONAL GROUNDS IN GUDELIAI RURAL COMMUNITY				
Installation of multi-functional grounds	9 515	9 515	10 000	Area of developed territory (m ²)
4. RECONSTRUCTION OF MUNICIPALITY STREET OF A RESORT				
Reconstruction of street	686	686	-	Length of reconstructed street (m)
	61	0	-	Number of set up parking lots
	4 789	4 789	-	Reduction of atmospheric CO ₂ emissions (t/year)
5. CREATION OF ORGANISATIONAL AND METHODOLOGICAL CONDITIONS FOR DEVELOPING STUDENTS' ENTREPRENEURSHIP SKILLS THROUGH THE USE OF A PRACTICAL TRAINING MODEL IN UNIVERSITY				
Establishment of an imitative enterprise for practical training in business	1	1	-	An imitative enterprise for practical training in business was established
Training of directors and formation of students' practical skills	0	30	-	Number of teachers having advanced qualifications
	0	10	-	Number of business entities attracted for cooperation

Source: compiled by authors

Numerical values were attached to qualitative indicators of social benefits of evaluated projects based on a rank scale. A four-rank scale selected for four evaluated projects helped to identify the project effects on each evaluated indicator of social benefits according to investment options (Table 3). Since the project of water resource management is a specific area of farmers'

association, an expert evaluation was performed based on the qualitative indicators with a wider scale of evaluation. 10 experts were interviewed with the questionnaire composed. A non-parametric statistic – Kendall's coefficient of concordance – was used to assess the level of agreement among the experts.

Table 3. Qualitative Indicators of Social Benefits of Evaluated Public Investment Projects

Qualitative Indicators of Social Benefits	Social Benefit Indicators according to Investment Options		
	I	II	III
1. RENOVATION AND PERSONNEL TRAINING IN MUNICIPALITY FOSTER HOME			
Better conditions ensured in the living environment of children	4	3	4
Improved assurance of child security	1	4	2
Improved living conditions for children	4	3	2
Improved micro-climate in foster home	2	4	3
Better conditions for leisure activities of children	1	4	2
2. RECONSTRUCTION OF DRAINAGE SYSTEM FOR FARMERS			
Reduced contamination of dug wells	5	6	-
Improved infrastructure of communication	3	6	-
Improved landscape	5	5	-
Positive effects on the ecological properties of soil and water	5	5	-
Undermined naturally occurring diversity	2	3	-
3. INSTALLATION OF MULTI-FUNCTIONAL GROUNDS IN GUDELIAI RURAL COMMUNITY			
Increased diversity and quality of residents' leisure activities	4	2	4
Improved health of population	2	2	3
Decreased number of harmful activities of youth	3	2	3
Promotion of residents' community spirit	4	3	4
Decreased rural depopulation	4	3	4
Damage to naturally occurring diversity	1	1	2
4. RECONSTRUCTION OF MUNICIPALITY STREET OF A RESORT			
Reduction of accident rate (effects on human health)	4	3	-
Reduction of social exclusion	3	3	-
Improvement of resort's image	4	3	-
Ensuring timely collection of storm water	4	3	-
5. CREATION OF ORGANISATIONAL AND METHODOLOGICAL CONDITIONS FOR DEVELOPING STUDENTS' ENTREPRENEURSHIP SKILLS THROUGH THE USE OF A PRACTICAL TRAINING MODEL IN UNIVERSITY			
Improved development of skills of student entrepreneurship	3	4	-
Improved interdisciplinary character of studies	3	3	-
Decreased drop-out	2	3	-
Increased number of students interested in studying	2	3	-

Source: compiled by authors

Prior to combining the social benefit indicators of each investment option, the indicators measured in monetary terms are converted into the present value. A social discount rate of 4% was used for discounting. The project life cycle was selected taking into account the recommendations of the Guide to Cost-Benefit Analysis (Guide, 2008) and the forecast period of use of the developed infrastructure.

Determining the level of significance of social benefit indicators of each evaluated public investment project depending on the priority of project's partial goals allowed developing a matrix of

all the social benefit indicators of each project. These indicators were combined by employing SAW and TOPSIS multi-criteria evaluation methods (Fig. 4).

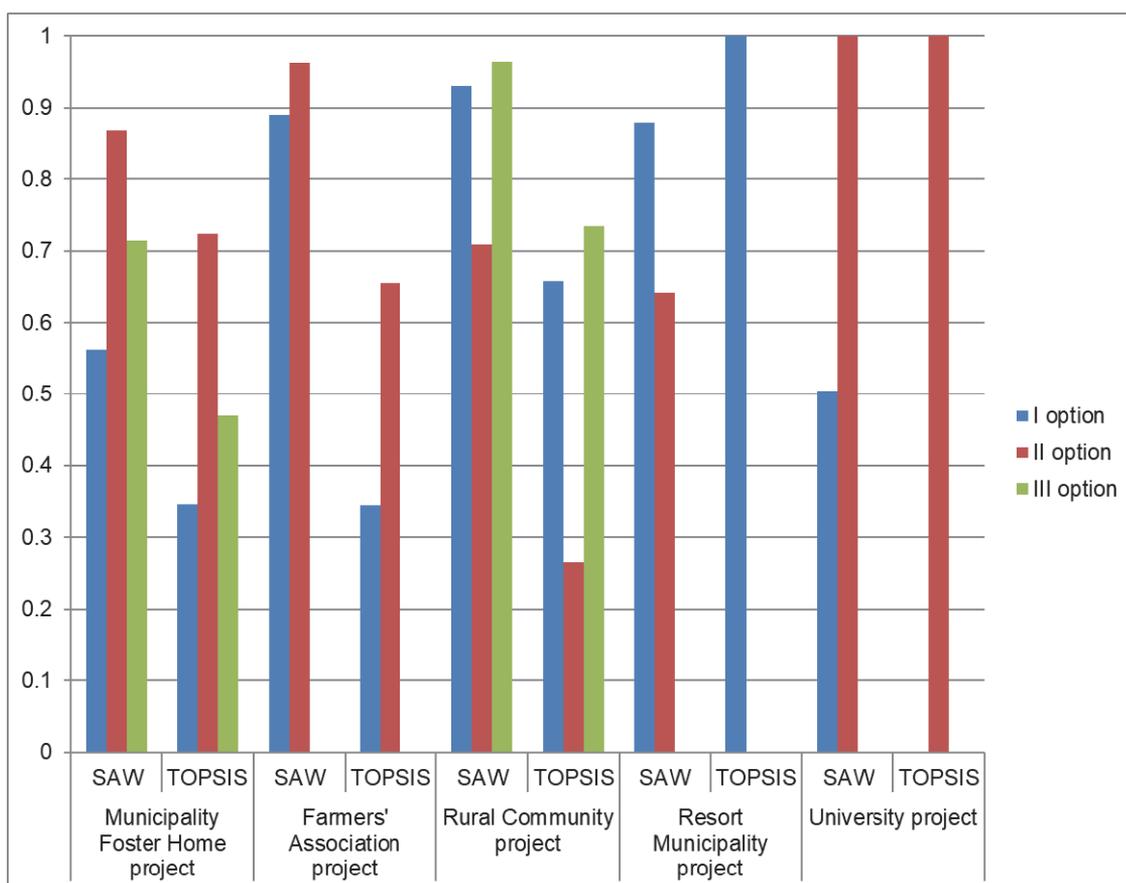


Figure 4. Summary Indicator of the Social Benefits of the Public Investment Projects Evaluated

Source: compiled by authors

The results from using both selected multi-criteria evaluation methods are not contradictory – the summary indicator for social benefits allows selecting the investment option which generates the greatest social benefits for public. Since social benefit does not measure efficiency, the efficiency of each option is evaluated by dividing the social benefits by investment initial outlay (presented for each evaluated project in Figure 5). It should be highlighted that efficiency indicator does not include financial outcome and operating costs – they are out of the frame of the prepared model. However, they should be integrated in comprehensive evaluation of public investment projects. It leaves space for future research.

In summary, the model for comprehensive evaluation of social benefits generated by public investment projects allows us to evaluate the expected social benefits in an exhaustive manner. SAW and TOPSIS multi-criteria methods provided a possibility to combine social benefit indicators measured in different units and to compare investment options with regard to social benefits generated.

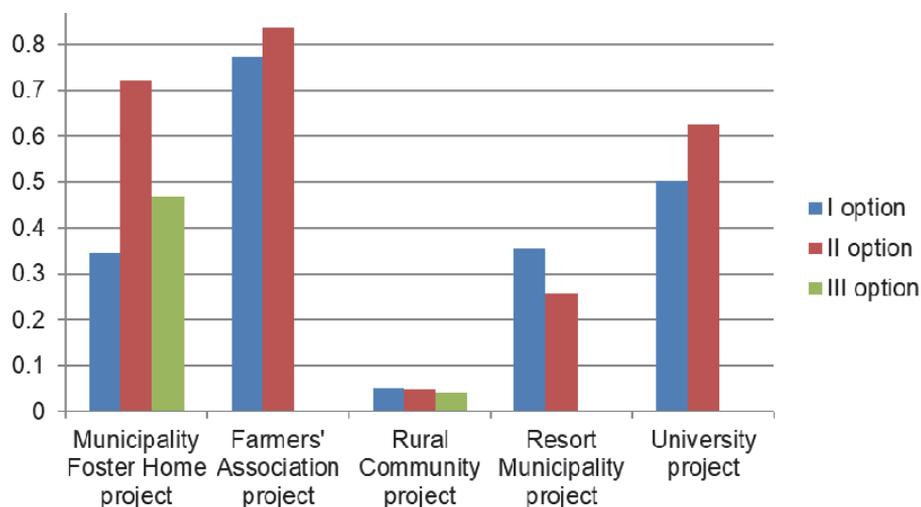


Figure 5. Social Benefits (SAW method)/Cost Ratio of the Evaluated Public Investment Projects

Source: compiled by authors

In summary, the model for comprehensive evaluation of social benefits generated by public investment projects allows us to evaluate the expected social benefits in an exhaustive manner. SAW and TOPSIS multi-criteria methods provided a possibility to combine social benefit indicators measured in different units and to compare investment options with regard to social benefits generated. Practical application of the model of comprehensive evaluation of social benefits for evaluating the investment options of public investment projects enables identifying the advantages and limitations of the model as well as drawing the conclusions below.

RESEARCH CONCLUSIONS AND LIMITATIONS

Public investment projects, unlike private ones, do not generate net income or generate insufficient income to be financially justified. The main objective of such projects is satisfying the public needs. Normally, public investment projects are evaluated by using cost-benefit analysis (CBA). Nevertheless, its main drawback is that not all social benefits can be evaluated. Multi-criteria valuation methods, cost-effectiveness analysis, Littles-Mirrlees, UNIDO, SLIM, MFC, MPSP methods do not eliminate the essential limitations of social benefits valuation, such as insufficiently justified determination of the significance of the social benefits of a project; uncertain evaluation of scopes; complicated monetary quantification; disregard of inflicted damage; complicated integration of social benefit indicators into a comparable indicator. These limitations and advantages of mentioned methods laid foundations for developing the model for evaluation of social benefits generated by public investment projects.

The designed model is based on the following principles of evaluation: comprehensiveness, consistency, priority, simplicity, justification, accuracy, comparability and wide applicability. The main assumptions of the model: i) evaluation is carried out from the investor's point of view; ii) social benefits are prioritized over economic and financial benefits; iii) methodology is unsuitable for experiments resulting in unusual effects of project activities or public behaviour. The model consists of three steps: 1) identification of the indicators of social benefits; 2) provision of numerical value to social benefit indicators; and 3) combination of social benefit indicators. The indicators of social benefits are identified by using the network diagram. This diagram shows the order of priority of project implementation and logic relationships between goals, tasks, activities and ex-

pected impact on public. The algorithm of the methods applied for measuring the social benefit indicators is used to attach a numerical value to quantitative and qualitative indicators. Cost estimation and revealed preference methods were used to measure the indicators in monetary terms, matrices were developed for measurement of quantitative indicators in non-monetary terms, and ranking was applied to measure the qualitative indicators.

A multi-criteria evaluation method SAW, selected for combining social benefit indicators, made it possible to: 1) combine social benefit indicators that are measured in different units; 2) combine maximised (social benefit) and minimised (inflicted damage) indicators. A multi-criteria evaluation method TOPSIS was used to verify whether or not the results obtained by applying different multi-criteria valuation methods were contradictory.

A case study analysis was used to test the model. Five different projects irrespective of the areas of social environment, initiators and operators, target groups, size of initial investment, location, and tangibility of investment were selected for empirical testing confirming universality of the model. Only social benefits that are directly related to the project goals are identified, one comparable indicator is calculated, and both positive and negative impacts on public were covered in this model. However, the model has several limitations. Firstly, the model does not allow comparing social benefits with different goals. Secondly, it cannot be used for evaluating the efficiency of one investment project as the results are intended for comparison of investment options. Thirdly, assumptions made for the provision of a numerical value to social benefit indicators may have a decisive influence on the outcome. Finally, the evaluation highly depends on evaluator's qualification, logical thinking, creativity, and comprehensive understanding of the project concerned, environmental situation and public preferences.

There exist several research limitations as well. Case study analysis was only used for ex-ante evaluation of social benefits generated by public investment projects, and the research does not cover ex-post evaluation, i.e. evaluation of effectiveness and risk appraisal. Determination of social discount rate was also out of the research frame.

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