Economic Benefits and Sustainability of Passenger and Recreational Transport on the Waterway

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Abstract. Economic evaluation of a public investment project is key document for assessing its suitability for financing. This paper deals with the evaluation of the benefit of water structure projects, which is not explicitly addressed in the methodological documents. It is a benefit in the form of assets related to the passenger and recreational transport on the waterway, which represent the key benefits applied to the projects promoting recreational navigation. The aim of the paper is to identify and methodically describe the possibilities of determining the benefits of passenger and recreational transport on the waterway and, on a case study, present the method of evaluation of these benefits for a real project of a recreational port realization. From the methodological point of view, the paper is based on the principles of cost-benefit analysis and the basic procedures for the evaluation of benefits, which are subsequently supplemented with data on the existing and expected use of the waterway for recreational purposes. Conclusions of the paper further declare the applicability of the CBA principles as well as the analyses and prognoses made so far concerning the use of the recreational waterway for the economic assessment of the types of projects being dealt with.

1. Introduction

The subject of the paper is the issue of economic evaluation of public investment projects implemented on the waterway intended primarily for passenger and recreational navigation. Support of this kind of transport leads to the natural and sustainable development of the landscape from economic and ecological point of view. In general, the importance of the economic evaluation of projects implemented within the public sector can be emphasized. Similarly to the private sector, resources in the public sector are limited and it is very important to take the right decision on the optimal allocation of resources for the implementation of individual public projects. Correctly performed socio-economic evaluation of the public project assessing the complex impacts (positive and negative) of this planned project on the society or other partial target groups helps to the allocation of resources. General calculation formula for determining the economic cash flow of transport infrastructure projects contains the following aggregated variables ([1], [2]):

1) Infrastructure investment and operating costs
2) Reduction (effect) of general costs of the transport of goods or persons, i.e.
   a. Savings in vehicle/vessel operating costs,
   b. Time savings of vehicle/vessel users,
3) Change (effect) of external transport costs in the areas of:
a. Accident reduction,
b. Reducing noise emissions,
c. Reducing non-greenhouse gas emissions;
d. Reducing greenhouse gas emissions.

4) Other (benefits or costs).

The authors focused on the evaluation of benefits associated with the expansion of passenger and recreational transport on the waterway. The identification and subsequent evaluation of benefits considered relevant by the authors of the article for assessing the socio-economic impacts of passenger and recreational waterway transport, is based on procedures related to the formation of economic cash flows used by the Cost Benefit Analysis (CBA) for the evaluation of investment projects. The solution presented in the paper is based in principle on generally applicable methodological guidelines given in particular in the Guide to Cost-Benefit Analysis of Investment Projects [1] and Departmental Guideline for the Evaluation of Economic Efficiency of Transport Construction Projects [2], which are complemented by research outputs of the authors.

The paper is structured as follows: Firstly, review of the scientific literature dealing with the issue of relationship of waterway infrastructure projects and socio-economic impacts has been presented. Then, methodology employed in the research has been explained. Consequently, results have been presented, discussed, compared with other similar studies and verified by a case study of one recreational port which is planned to be implemented on the Bat'a Canal waterway. Finally, at the end of the paper, the main findings and outline of future research directions have been proposed.

2. Literature review

Czech methodological approaches to the evaluation of investment projects of passenger and recreational transport on the waterway are elaborated in detail especially for aggregated items 1, 2 and 3 of the calculation formula mentioned below. The economic evaluation of individual sub-components can be made on the basis of technical-economic information, which results from the project documentation, the relevant transport model and the price evaluation of individual input variables. The output of this article focuses on item 4 (other benefits), which presents further possible socio-economic benefits of passenger and recreational waterway transport.

In general, the development of passenger and recreational waterway transport is primarily aimed at increasing tourism, which, in addition to satisfying visitors with well-spent leisure time, brings related economic activities to the affected region. Source [3] states that the additional economic activity is referred to as “net new” economic activity in the region and takes into account two factors: the amount of money spent in the region and the amount of substitution that occurs. Benton [4] extends the impact by creating new jobs.

New York State Canal Corporation [5] expresses total impacts, which encompass the following effects: Direct effects - Economic activity directly attributed to the business that uses the Canal System and Indirect effects - Economic activity occurring in support of the direct effects; the purchase of supplies and services required by businesses that use the Canal system. Induced effects include purchases (of such items as food, clothing, personal services, vehicles, etc.) made by employees whose wages are supported (directly or indirectly) by the business that uses the Canal system.

Also [6] Kalinovski states that the location of local ports is closely related to the development of economic functions of the immediate environment. Functioning of the port, in addition to certain financial effects, also has a fairly wide economic impact on the immediate surroundings. The main, though hard to measure, economic benefits include, among others, the possibility of reducing unemployment, economic activation of the region or an increase in tax revenues. Impacts considered in the CBA analysis, like reduction of noise level and job creation for target groups that are weak on the labour market, are also commented in the research of Hoogmartens at all. [7] The application for the evaluation of the social and economic benefits of infrastructure projects is solved by Nguyen at all. [8].

As part of the research studies, background research and own investigations (set of 6 projects), the authors identified the following benefits in the place of the project implementation and its surroundings:
1) Increase in sales of business entities
2) Increase in the number of jobs
3) Increase/decrease in the value of immovable property.

These benefits associated with passenger and recreational navigation are based on the prediction of their difference between the no-project variant (zero variant) and the project-based variant (investment variant).

3. Methodology
The evaluation of individual benefits used in these research is based on a detailed study of all relevant data, links and relations that need to be analysed in detail. The first of these socio-economic benefits is “increasing the sales of business entities”. However, the overall increase in sales of businesses is not a direct reflection of the overall socio-economic benefits of the society as a whole. In this context, it is necessary to identify only the added value of the market segment and the effect of intermediate consumption, which expresses the multiplying economic effects of the newly created business. Marketing analysis determines the basis for their determination.

The authors set to determine the value of the socio-economic impact on revenue growth the following formula:

\[ B_s = \sum_{i=1}^{n} (V_i \times T_i \times C_i) \times (I_m + I_c) \]  

Where
\( B_s \) Social benefit from sales growth as a result of the implementation of the project in CZK, benefits, sales
\( V_i \) Number of tourists who will stay longer in the region thanks to the project (number of people/year) - visitors
\( T_i \) Average length of tourist stay in the region (number of days/person)
\( C_i \) Average tourist expense in the region (CZK/day)
i Economic activity (e.g. 1 - revenues from vessels selling/renting, 2 - revenues from accommodation, 3 - revenues from refreshment, etc.) takes values from 1 to n
\( I_m \) Market value added index in %/100, added value, market segment
\( I_c \) Intermediate consumption effect index in %/100, intermediate consumption

Increase in the number of jobs mostly occurs in direct connection to the operation of the newly created infrastructure (direct jobs), but also in connection to the increased number of visitors in the relevant territory (indirect jobs). Calculation can be done by multiplying the number of jobs and by a society-wide evaluation of 1 job (calculation of the shadow price).

\[ B_L = \sum_{j=1}^{n} (L_{dj} + L_{idj}) \times W_{sj} \]  

Where
\( B_L \) Social benefit from the creation of a new job in CZK, - benefit, labour
\( L_{dj} \) Number of direct jobs j (number of persons/year)
\( L_{idj} \) Number of indirect jobs j (number of persons/year)
\( W_{sj} \) Shadow wage for a job position j (CZK/person and year)
j Working position j = 1 to n
n Number of specific jobs

Increase in the real estate prices can be identified by comparing real estate prices before and after the project. The data source may be statistical data for similar projects already implemented.

\[ B_A = \sum_{i=1}^{k} (P_{lt} - P_{lt-1}) \]  

Where
\( B_A \) Social benefit from an increase in the real estate prices in CZK, benefits, sales
\( P_{lt} \) Real estate price in year t
\( P_{lt-1} \) Real estate price in the previous year
Where
\[ B_A \] All-society benefit from the increase in the real estate price in CZK, (assets, land)
\[ P_i \] The price of the \( i \)\textsuperscript{th} property (CZK)
\[ t \] Year in which the price of the \( i \)\textsuperscript{th} property is determined

The total value of the “other” benefits of the personal and recreational waterway is the sum of the above-mentioned partial benefits, i.e.:
\[ B = B_S + B_L + B_A \] \hspace{1cm} (4)

4. Results

A specific quantification of other benefits associated with the establishment or extension of passenger and recreational navigation is demonstrated on a case study of a new recreational port on the Baťa Canal waterway implementation. In relation to the methodological part of the paper data were identified for increase sales, in the following two levels:

- Increase in the revenues of business entities in the place of project implementation and its vicinity as a result of greater interest in using the given location caused by the emergence of new tourist infrastructure; in the case study, it is represented by the accommodation and catering capacities,
- Increase in sales on the Baťa Canal as a result of the projected increase in the visitor rate to the Baťa Canal due to the implementation of the project.

**Increase in sales of current catering and accommodation capacities**

Prediction of the increase in sales of current catering and accommodation capacities in the location of the new recreational port is based on the development of the visitor rate to the catering and accommodation capacities in the given location. Background information is given in Tables 1 and 2.

**Table 1.** Development of the visitor rate in the catering capacities in 2015–2019 (Source: authors’ own elaboration according to [9])

| Year | Restaurants | Buffet | Cycle bistro | Total |
|------|-------------|--------|--------------|-------|
| 2015 | 154         | 30,047 | 0            | 30,201|
| 2016 | 142         | 29,957 | 0            | 30,099|
| 2017 | 540         | 26,528 | 0            | 27,068|
| 2018 | 111         | 31,424 | 4,055        | 35,590|
| 2019 | 3,255       | 40,983 | 2,709        | 46,947|
| Total| 4,202       | 158,939| 6,764        | 169,905|
| Average| 3,255     | 31,788 | 3,382        | 38,425|

Due to the fact that the restaurant has been operating on a daily basis since 2019, the average value is the same as the value of 2019. Similarly, the average number of bistro visitors is based only on 2018 and 2019 data when the bistro was in operation.

Estimated revenues entering the calculation of benefits associated with passenger and recreational navigation were determined on the basis of the above-mentioned visitor rate values and prices of services listed in the current price list of the premises for 2019. For accommodation services, a seven-day stay was considered and expenses of CZK 300/person for a restaurant, CZK 150/person for a buffet and CZK 150/person for a bistro. 21% VAT was subsequently deducted from the resulting sales values.
Table 2. Development of the number of accommodated guests in 2015–2019 (Source: authors’ own elaboration according to the results of the local survey)

| Year | Number of people in bungalows | Number of tents | Number of caravans | Number of people in tents, caravans |
|------|-------------------------------|----------------|-------------------|-------------------------------------|
| 2015 | 4,462                         | 679            | 350               | 3,029                               |
| 2016 | 5,405                         | 610            | 329               | 2,830                               |
| 2017 | 7,080                         | 836            | 409               | 3,540                               |
| 2018 | 6,019                         | 734            | 429               | 3,112                               |
| 2019 | 6,297                         | 707            | 497               | 3,285                               |
| Total| 29,263                        | 3,566          | 2,014             | 15,796                              |
| Average per year | 5,853 | 713 | 403 | 3,159 |

Total annual sales of the recreational area are:

- For the zero variant, they were calculated in the amount of CZK 34,914,275 without VAT,
- For the variant with the project, they were calculated in the amount of CZK 43,642,843 without VAT.

Increase in the revenue on the Baťa Canal due to prognosed increase in the visitor rate to Baťa Canal

The assumption of increase in the visitor rate to the Baťa canal is based on the analysis of the economic efficiency of the recreational navigation on the Baťa Canal ([9], p. 122), within which four variants of possible traffic development of the visitor rate to the Baťa canal are defined depending on the amount of investments made, as visible on Figure 1. When comparing variants 2 and 4, it can be seen that the only difference between these variants is the implementation of three river ports in the case of variant 2. The following chart shows the total expected recreational navigation performance on the waterway researched per year for the sub-variants considered.

Figure 1. Performance of recreational navigation in individual variants after implementation of appropriate measures (Source: authors’ own elaboration according to [9])
Using the available characteristics of the waterway and its visitor rate, it is possible to deduce from the above chart the total annual increase in waterway visitor rate due to the implementation of one port of 6,913 persons/year. Taking into account the average expenditures of visitors to the Baťa Canal (see analysis [7]), it is subsequently possible to determine the overall increase in sales, or more precisely the amount of sales in case of zero variant and variant with project. Average visitor expenditure calculations are shown in the following table.

**Table 3. Average expenditures of the visitors to the Baťa Canal (Source: authors’ own elaboration according to [9])**

|                          | CZK/pers/day | Share |
|--------------------------|--------------|-------|
| Own vessel residents     | 469          | 50%   |
| Own vessel foreigners    | 1,722        | 2%    |
| Vessel rented by residents | 700         | 36%   |
| Vessel rented by foreigners | 2,570       | 12%   |
| Average expenditure      | 829          | 100%  |

Based on the above-stated data, it is possible to determine that the total amount of sales generated by the visitors to the Baťa Canal represents CZK 16,379,465 per year in the case of the zero variant and CZK 22,112,278 per year in the case of the variant with the project. In accordance with the previous text, these sales are related to the implementation of one river port.

5. **Discussion**

The benefits presented in the case study serve as a key input into the economic analysis of the investment project for the implementation of a recreational port on the waterway. As no additional cash flow enters the economic analysis of the project, the demonstration of the economic effectiveness of the evaluated project is dependent on a fair and transparent determination of benefits that can be evaluated. For the sake of clarity, it is possible to compare the results of the economic analysis of the project without considering the benefits mentioned and with their inclusion. When considering the calculated benefits as inputs into the economic assessment, the economic efficiency indicators - Net Present Value (NPV), Benefit-Cost Ratio (IRR), Benefit-Cost Ratio (BCR) achieve favourable values:

- $\text{NPV} = €990,404$
- $\text{IRR} = 6.8\%$
- $\text{BCR} = 1.283$

If the calculated benefits were not considered in the economic evaluation, the project would be economically unacceptable:

- $\text{NPV} = €-4,398,731$
- $\text{IRR}$ cannot be established,
- $\text{BCR} = -0.255$

A simple comparison thus shows the key importance of a correct and comprehensive evaluation of the benefits associated with the implementation and operation of the projects on the waterway, since without positive results of economic evaluation it would be difficult to enforce the project realization in the public sector. At the end it is important to state that within the presented project were benefits connected with the appearance of new working position included into the basic calculation. However from data mentioned above is evident that they didn’t influence the economic efficiency a lot (1 new part time job position). Original Net Present Value is negative. In methodology described changes in prices of immovable property will be the subject of the consequent research, which requires the monitoring of the longer time period of the operational phase of the projects.
6. Conclusions
The paper is focused on the evaluation of economic efficiency of the projects in the field of recreational navigation on the waterway. The paper summarizes the basic points of the current knowledge in the area of evaluation of benefits associated with the implementation of projects on the waterway. The conclusions of the background research indicate the need to focus especially on the benefits associated with the increase in the economic activity of the population, especially tourists, and the related increase in sales in the region connected to it. Other key benefits are the increase in employment, both direct and indirect, and the positive impact on the property prices in the affected area. In these points, the background research is consistent with the experience of the authors of the paper, who within the methodological part define a comprehensive approach to taking into account the relevant benefits of the projects in the field of recreational navigation on the waterway. The proposed methodical procedure was subsequently applied to a case study of the realization of a recreational river port on the waterway. The case study includes a real evaluation of the benefits associated with the anticipated increase in waterway visitor rate due to the implementation of the project considered. Moreover, the real impact of taking into account the evaluated benefits into the economic evaluation of the project is also discussed. The discussion reveals the key importance of benefits as inputs into the economic analysis and emphasizes the need for fair and the most comprehensive evaluation of benefits possible.

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