Challenges to the efficiency of libraries: the case of the Slovak public libraries

Abstract. The current economic situation puts cultural sector performance under pressure in most European countries. On the one side, the demand for the quality of public services is rising, while on the other side, the budgets, especially for culture, are shrinking. This trend has been followed by introducing performance-based management into cultural institutions. In this regard, libraries may be considered as the best cultural institutions for introducing the techniques of benchmarking the performance of the organisation. They provide statistics about their visitors and loans of the books which can be reliable sources for measurement of their output and input indicators.

The objective of the paper was to identify key indicators suitable for analysing efficiency based on available cultural statistics in Slovakia (which ended up with 2017 at the time of research) using the non-parametric frontier method of data envelopment analysis (DEA). In the research, three models are estimated. The first model is an over-parametrized model involving all available variables. In the second one, loan efficiency is examined. The third model focuses on financing efficiency. The findings show that the efficiency of libraries differs significantly in the three examined models. Percentage of efficient public libraries in the specialized models two and three is lower than in case of the first model (5.57% and 9.11% vs. 12.92%). It clearly points to the fields of the Slovak public libraries’ management which need improvement, namely: low circulation, low number of users in connection with high current expenditure and large floor space. As this research is the first complex analysis of the efficiency of all Slovak libraries, the findings can be helpful in practice for improving their performance management.

Keywords: Public Library; Efficiency; Data Envelopment Analysis (DEA); Performance Management; Slovak Libraries; Cultural Management

JEL Classification: Z1; Z11

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краші міжнародними установами для впровадження методів оцінки ефективності діяльності організації. Вони надають статистичні дані про своїх відвідувачів і запозичення книг, які можуть бути надійними джерелами для вимірювання показників їх результатів і витрат.

Метою даного дослідження було визначення ключових показників, придатних для аналізу ефективності, на основі наявної статистики культури в Словаччині (яка на момент дослідження закінчувалася 2017 р.) з використанням непараметричного граничного методу аналізу середовища функціонування (АСФ, DEA). У досліджених оцінюються три моделі. Перша модель - це високопараметризована модель, що включає всі доступні змінні. У другій моделі оцінюється ефективність використання кредитних коштів. Третя модель орієнтована на оцінку ефективності фінансування. Результати показують, що ефективність бібліотек істотно розрізняється в трьох досліджених моделях. Відсоток ефективних публічних бібліотек у спеціалізованих моделях два і три нижче, ніж у випадку з першою моделлю (5,57% і 9,11% проти 12,92%). Результати дослідження дозволяють чітко вказати області управління публічними бібліотеками Словаччини, які потребують поліпшення, а саме: низька циркуляція, невелика кількість користувачів у поєднанні з високими поточними витратами й великою площею. Оскільки це дослідження є першим комплексним аналізом ефективності всіх словацьких бібліотек, отримані результати можуть бути корисні на практиці для поліпшення їх менеджменту.

Ключові слова: публічна бібліотека; ефективність; аналіз середовища функціонування (АСФ, DEA); оперативний менеджмент; словацькі бібліотеки; культурний менеджмент.

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Висновки ефективності бібліотек: кейс Словаччини

Аннотація. Нинішня економічна ситуація ставить під загрозу роботу сектора культури в більшості европейських країн. С одной стороны, спрос на качество публичных услуг растет, с другой стороны, бюджеты, особенно на культуру, сокращаются. Такая тенденция сопровождается внедрением в учреждения культуры менеджмента, основанного на результатах. В этом отношении библиотеки могут считаться лучшими культурными учреждениями для внедрения методов оценки эффективности деятельности организации. Они предоставляют статистические данные о своих посетителях и заимствовании книг, которые могут быть надежными источниками для измерения показателей их результатов и затрат.

Целью данного исследования было определение ключевых показателей, пригодных для анализа эффективности, на основе имеющейся статистики культуры в Словакии (которая на момент исследования заканчивалась 2017 г.) с использованием непараметрического граничного метода анализа среды функционирования (АСФ, DEA). В исследовании оцениваются три модели. Первая модель - это сверхпараметризованная модель, включающая все доступные переменные. Во второй модели оценивается эффективность использования кредитных средств. Третья модель ориентирована на оценку эффективности финансирования. Результаты показывают, что эффективность библиотек существенно различается в трех исследованных моделях. Процент эффективных публичных библиотек в специализированных моделях два и три ниже, чем в случае с первой моделью (5,57% и 9,11% против 12,92%). Результаты исследования позволяют четко указать области управления публичными библиотеками Словакии, которые нуждаются в улучшении, а именно: низкая циркуляция, небольшое количество пользователей в сочетании с высокими текущими расходами и большой площадью.

Поскольку это исследование является первым комплексным анализом эффективности всех словацких библиотек, полученные результаты могут быть полезны на практике для улучшения их менеджмента.

Ключевые слова: публичная библиотека; эффективность; анализ среды функционирования (АСФ, DEA); операционный менеджмент; словацкие библиотеки; культурный менеджмент.

1. Introduction

Cultural institutions, as well as all public institutions, face the challenge to become more efficient in the age of austerity. Performance-based management become the mantra for all public policies introduced by the concept of new public management, but its implementation is often hampered by the scarcity of available data in the cultural sector. Important data about cultural participation in different cultural activities and the audience demography are mostly collected by demanding surveys in museums or galleries.

In contrary public libraries have detailed evidence of their visitors with the frequency of book loans and borrowed books. Libraries become a popular object for sophisticated analysis within cultural economics using their potential for a data-driven organisation. The economic analysis is mostly focused on the funding of libraries, on the value for the community and on the efficiency of delivering public services (Stejskal, Hájek, & Řehák, 2019; Stroobants & Bouckaert, 2014).
The economic perspective of libraries has to take into account the rapid technological change, which also shapes the role and space of public libraries. It redefines the traditional functions of libraries and shifts them to places with multiple services for citizens. According to Luis Herrera, Director of the San Francisco Public Library, five challenges can change the libraries:
1) offering inspired experiences that spark curiosity and learning;
2) designing buildings that become destinations;
3) creating a high-tech, high-touch environment;
4) preserving and cultivating our cultural narrative;
5) preparing for future-readiness (Herrera, 2016).

New library functions also impact their performance, which becomes multifaceted, including extended societal impacts. The relevance and importance of public libraries in the digital age are clearly seen in many countries, which recently renovated or built new libraries as vital city spaces with iconic architecture, e.g. Oodi in Helsinki or Seattle Central Library.

This is still not the case in most countries of Eastern and Central Europe. The pressure to reduce public budgets has been affecting most often the cultural institutions in the region. Similarly, the political attention to public libraries in Slovakia remains low even though the Slovak people are reading less and reading literacy is getting worse (Eurobarometer, 2013; TIMSS & PIRLS, 2017).

According to results from Eurobarometer about Cultural access and participation, there was a decline in reading activities. In 2013, 68% of people in Slovakia have read at least one book a year (compared to 2007 it was 12% less). Fewer respondents have visited the public library at least once a year - only 26% (16% less compared to 2007). In contrast, 31% of people visit the library on average in Europe at least once a year (Eurobarometer, 2013). According to the results from PISA testing, the children literacy in Slovakia remains slightly below the average of OECD countries (OECD, 2016).

The services of Slovak libraries remain very traditional. The libraries did not change their habits in the term of opening hours or offer of their services. There is still lack of programmes supporting early readers or children literacy during the summer.

Our study is focused on the economics of libraries. It is the first study using the benchmarking techniques to compare the performance of libraries in Slovakia. The paper aims to examine the efficiency of public libraries in Slovakia employing the DEA method. Efficiency is expressed as an input-output ratio between selected indicators.

The paper is organised as follows. The theoretical part summarises the discussion about the role of libraries and their performance measurement in academic literature. To explain the role of public libraries in Slovakia, we also introduce the basic statistics about public libraries. In the second part is clarified the methodology and selection of indicators for analysis. Three models with different sets of indicators were generated to test the efficiency of production units (libraries). Their results are presented and discussed in the last part of the paper.

2. Brief Literature Review

Public library applies the characteristic of the public good. However, its pureness derived from pure public good (Musgrave, 1959) is limited by several conditions arranged by the public library provider (e.g. fees limit the non-excludability of the public good, non-rivalry in consumption is reduced by the impossibility of doubled hard copy borrowing).

The role of libraries changed over time. From the past to now, libraries as centre of erudition (e.g. Great Library of Alexandria), concentrating the knowledge of the times, have become institutions often on the edge of disinterest of the current generation gobbled by the digital era (Aabø, 2005). Therefore, contemporarily, libraries have to face challenges corresponding to their functioning, despite the key role of libraries which is civic and educational (Donnelly, 2015) did not change significantly through the time.

At the basis of related literature, libraries, as a part of cultural infrastructure, play an important role in society. According to Guo, Chan & Yip (2017), libraries are important for supplying educational and cultural services for citizens and for creating social equality by providing access to information and public spaces. Donelly (2015), besides the educational role of libraries, also mentions the civic aspects, that plays an important role in communities. Since Kerslake & Kinnell (1998) emphasised the need of continuing vitality of libraries as promoters of citizenship and democracy, libraries have to face challenges of digital age, as mentioned by Aabø (2005) or McClure & Jaeger (2009).
Aabo (2005) explains the potentially enhanced role and value of public libraries. She suggests strengthening the democratic role of libraries by supporting social inclusiveness and citizenship. Her vision of the library’s future is about regarding the library as a public room and social and physical meeting place in the digitised age. McClure & Jaeger (2009) also stress the significant impact of the Internet on public libraries in the USA. They observe that the Internet has initiated important changes in the social roles of libraries.

According to Linhartová & Stejskal (2017), today’s challenge of public libraries consists of greater competition, rising costs, lower budgets and greater pressure to demonstrate their success. Additionally, as mentioned by Jaeger et al. (2014), parameters of public libraries are influenced by the correspondent political incumbent national policies, while their funding depends on state and local policies.

A branch of the empirical literature on public libraries focuses on several spatial aspects influencing the consummation of public libraries’ services by the current society. Allen (2019) makes research on spatial access to library services in Canada. Mentions that the geographical proximity to the library enhances the citizens to visit the library, while reduced proximity reduces the library visits. Former study of Guo et al. (2017) investigates for spatial inequity in the distribution of libraries in Hong Kong, where in developed inner-city areas the accessibility to libraries is higher than in the suburbs. Donelly (2015) observed significant regional differences in accessibility to public libraries in the USA.

A huge body of empirical research covers topics on deeper economic evaluation of public libraries. Besides using the panel data analysis (Reichmann & Sommersguter-Reichmann, 2009), cost-benefit analysis (Linhartová & Stejskal, 2017) or contingent valuation (Stejskal, Mikušová Meričková, & Rehák, 2016; Stjeskal et al., 2019), the data envelopment analysis (DEA) is widely used in the research. According to Shim (2003), the efficiency side of library performance has received less attention in the library literature. He defines the efficiency as the library’s ability to transform its inputs (resources) into the production of outputs (services), or to produce a given level of outputs with the minimum amount of inputs. Earlier, in Vitaliano (1998), the public library’s efficiency is defined as whether or not a library could reduce the inputs it uses proportionately and still produce the same output. Vitaliano (1998) finds on his sample of 184 public libraries in New York, that they operate at the 67% efficiency and long opening hours are the basic source of inefficiency.

Sharma, Leung & Zane (1999) investigated the technical efficiency of state libraries in Hawaii, where public libraries operated with limited resources under budget constraints in the times of economic stagnation. In their case, 14 from 47 public libraries were technically efficient and only the size of the collection has a positive and significant effect on library performance. Worthington (1999) identifies on the sample of 168 local Australian public libraries the 9.5% overall technical efficiency. Hammond (2002) finds that a prevalent part of 99 public library systems in the UK is efficient or near-efficient.


DeWitte & Geys (2011) investigate the efficiency of all 290 Flemish local public libraries, considering the good public provision as a two-stage production process. According to them, local public libraries are more efficient in the case of left-wing local government, wealthier population, higher population density, and when public service is provided at the base of local resources. De Caravalho et al. (2012) investigated the efficiency score to each library in the sample of 37 federal universities of Rio de Janeiro. Shahwan & Kaba (2013) made related research on the small sample of 11 public libraries in Gulf Cooperation Countries (GCC) where five academic libraries seem to be fully efficient. Stroobants & Bouckaert (2014) provided a coherent approach to efficiency analysis by comparing two techniques (FDH and DEA) and critically evaluated their results on a sample of Flemish public libraries. Li & Yang (2014) find on the sample of 51 state libraries in the USA, that public library services in 20 states operate efficiently.
Guajardo (2018) analysed the sample of USA special district libraries. He identified 30% efficient libraries. Tavares et al. (2018) compiled a meta-analysis of empirical evidence on public libraries efficiency using the DEA approach.


Benchmarking and performance measurement of public libraries are usually conducted by using several techniques linked to the objective of the analysis. The literature review confirms the popularity of non-parametric frontier methods as an appropriate tool for such analysis.

3. The purpose of the article is to identify key indicators suitable for analysing the efficiency of libraries based on available cultural statistics and to analyse the efficiency of public libraries in Slovakia.

4. Methodology

DEA was initially developed for evaluating the efficiency of public organisations where using parametric models would not be suitable due to the necessity to set a mathematical ratio between inputs and outputs. The term relative efficiency refers to the efficiency achieved by the evaluated production unit within a homogenous group of production units which perform the same or very similar activity through applying the defined input and output criteria. (Cooper et al., 2007) Thus, DEA analysis enables to assess the technical efficiency of a library which can be defined as its capacity to maximize outputs for determined inputs or as library’s capacity to produce the same volume of outputs along with maximizing outputs.

Stroobants & Bouckaert (2014) compared the results of efficiency measurement of two frontier methods DEA and FDH. The comparison shows that the results using DEA were able to explain the efficiency differences in a more reliable way.

DEA can be used for the library if perceived library as a production unit. DEA method allows comparing the efficiency of library and identifying the most efficient ones (with efficiency equal 1) and inefficient libraries (with efficiency less than 1). DEA is used to determine the so-called relative efficiency as it can to identify a library with the highest performance only in the observed group. DEA compares each library with all other libraries and optimises the weights of individual indicators towards the highest possible efficiency of a library using the process of linear programming.

Basic DEA models include the CCR and the BCC model named after their authors. The difference between these models is that the CCR model (Charnes, Cooper, & Rhodes, 1978) assumes constant returns to scale whereas the BCC model (Banker, Charnes, & Cooper, 1984) allows for variable returns to scale (Cooper, Seiford, & Tone, 2007).

Both CCR and BCC models can be oriented either to inputs or outputs. Input-oriented models help to identify a minimum input level necessary to reach maximum efficiency for the outputs. Output-oriented models identify the maximum output level necessary to reach maximum efficiency for outputs in comparison with other units in the assessed group. Both models not only evaluate the DMU efficiency rate but also calculate how a DMU can improve its performance on the inputs or outputs to be efficient.

Both forms of the DEA model (input and output-oriented) can be significant for the assessment of the efficiency in the library. The practice of management plays an essential role when deciding on the DEA form. If it is not possible to change the volume of inputs within a short period, then it is better to use an output form of the model. DMUs are investigated to maximise outputs so that they do not require more inputs (Basso & Funari, 2004).

Output-oriented models are mostly used for the analysis of libraries that inform non-efficient ones on the outputs that should be changed in order to be more efficient. For that reason, we also used the output DEA model in our experimental analysis. Generally, the output-oriented BCC-efficiency can be expressed as follows (Cooper, Seiford, & Zhu, 2011):
Our analysis evaluates the technical efficiency of libraries in Slovakia in 2017. The data stem from the national statistics on libraries collected by the Ministry of Culture of the Slovak Republic. In 2017, 1872 libraries reported the statistical indicators. Only 1525 libraries were included in the analysis due to the missing data of the rest of the sample. The calculations were provided using DEA Solver software.

In order to make an appropriate choice of indicators, we looked at the indicators used in published studies in this field. In this paper, to capture the static technical efficiency of public libraries in Slovakia in 2017, three models are estimated. As many authors proceeded before, various inputs and outputs are with different intensity employed in these three models. Model A is an over-parametrized model, which employs all available input and output variables collected from the Ministry of Culture of the Slovak Republic reports. Model B focuses on volume variables concerning on estimation of the loan efficiency. Model C is enriched by economic variables in outputs to examine the efficiency of public libraries’ financing (similarly to Vrabková, 2018).

Inputs used in models are the following:

- $I_1$: holdings (library collections) expressed as the number of library units on December 31 of corresponding year,
- $I_2$: number of opening hours per week (if the public library has several affiliations, the longest opening hour is recorded),
- $I_3$: number of employees expressed as the average registered number of employees divided by the number of working hours per week,
- $I_4$: number of events organised for registered users and public, when the public library is the main organiser,
- $I_5$: floor space available for users in square metres,
- $I_6$: overall floor space of the public library in square metres,
- $I_7$: the sum of received grants, gifts, sponsorship and other revenues of public libraries,
- $I_8$: costs on the purchase of new library units,
- $I_9$: operating expenditure related to the public library functioning (besides the expenditure on holdings, labour costs, energies and materials, depreciation).

Outputs involved in models are the following:

- $O_1$: circulation (total number of borrowings, where any other prolongation is considered as new borrowing),
- $O_2$: number of visits, covering active registered users, library additional services consumers (e.g. copying, internet) and visitors of events (indoor and outdoor, when outdoor event),
- $O_3$: number of active registered users (registered or reregistered user with at least one borrowing or other service consumption),
- $O_4$: circulation of books for youth,
- $O_5$: the sum of ear-marked transfers received from correspondent public budgets,
- $O_6$: own revenues created by the public library itself at the base of sale of own services, editorial activities and rental, excluding revenues from the sale of movable and immovable property.

The production function of a public library according to three hereinbefore defined models are displayed in Figure 1. It informs about the BCC-O input and output variables of correspondent models.

The descriptive statistics of input and output variables in question is given in Table 1.
5. Results and Discussion

The libraries in Slovakia are classified according to their founder to six types (national, scientific, academic, public, school and special libraries) in Slovakia. Regional or local public authorities provide most of the public libraries. Our paper focused on public libraries which is the biggest group of libraries (1525 active units in 2017).

These libraries offer 15 128 511 holdings for 399 138 registered active users (38 titles per user). The collection was frequently used because the registered users borrowed together 14 270 816 books (36 borrowed titles in average). The expenditures for buying new books were only 1 842 490 EUR (1208 per library). The underfunded and insufficient purchase of new books remains the limit of increasing the attractiveness of Slovak libraries (Ministry of Culture of the Slovak Republic, 2018).

There is an evident decrease in the number of public libraries since 2007 (26% less). Basic numbers about public libraries in period 2007-2018 are displayed in Figure 2.

Since fewer numbers of libraries, the average number of holdings per library slightly increased from 7,625 in 2012 up to 9,538 in 2017. Simultaneously, the decrease in registered active users of library services is observed. There are several reasons for this trend, including the digitalisation.

Table 2 presents the results of all three efficiency analyses. Their results differ significantly. Model A with the highest number of indicators returned to 197 efficient public libraries (see Table 2, section model A). They present 12.92% of the total number of public libraries in Slovakia. Average
**Number of public libraries in Slovakia, their holdings and borrowings in 2007-2018**

Source: Own compilation, based on data from the reports of the Ministry of Culture of the Slovak Republic, 2018, 2019

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**Table 2:**

**Summary of results of model A, B and C**

<table>
<thead>
<tr>
<th>Efficiency basic results</th>
<th>Further analysis on efficient/inefficient libraries' location</th>
<th>location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of efficient public libraries</td>
<td>197/1525 (12.92%)</td>
<td>The highest number of efficient public libraries</td>
</tr>
<tr>
<td>Number of inefficient public libraries</td>
<td>1328/1525 (87.08%)</td>
<td>The highest number of inefficient public libraries</td>
</tr>
<tr>
<td>Average efficiency</td>
<td>0.4628</td>
<td>The most inefficient public library</td>
</tr>
<tr>
<td>The highest efficiency score</td>
<td>1</td>
<td>municipality</td>
</tr>
<tr>
<td>The lowest efficiency score</td>
<td>0.0009</td>
<td>Hlboké municipal library</td>
</tr>
<tr>
<td><strong>Model B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of efficient public libraries</td>
<td>85/1525 (5.57%)</td>
<td>The highest number of efficient public libraries</td>
</tr>
<tr>
<td>Number of inefficient public libraries</td>
<td>1440/1525 (94.43%)</td>
<td>The highest number of inefficient public libraries</td>
</tr>
<tr>
<td>Average efficiency</td>
<td>0.2875</td>
<td>The most inefficient public library</td>
</tr>
<tr>
<td>The highest efficiency score</td>
<td>1</td>
<td>municipality</td>
</tr>
<tr>
<td>The lowest efficiency score</td>
<td>0.0003</td>
<td>Hlboké municipal library</td>
</tr>
<tr>
<td><strong>Model C</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of efficient public libraries</td>
<td>139/1525 (9.11%)</td>
<td>The highest number of efficient public libraries</td>
</tr>
<tr>
<td>Number of inefficient public libraries</td>
<td>1386/1525 (90.89%)</td>
<td>The highest number of inefficient public libraries</td>
</tr>
<tr>
<td>Average efficiency</td>
<td>0.3792</td>
<td>The most inefficient public library</td>
</tr>
<tr>
<td>The highest efficiency score</td>
<td>1</td>
<td>municipality</td>
</tr>
<tr>
<td>The lowest efficiency score</td>
<td>0.0014</td>
<td>Jesenské municipal library</td>
</tr>
</tbody>
</table>

Source: Own processing

efficiency score was at the level of 46.28%. One may conclude, that Slovak Public libraries should increase their outputs by 54% on average, to optimise the efficiency. The DMU with the lowest efficiency score (0.09%) is Municipal library in Hlboké (914 inhabitants in 2018 (E-obce.sk Slovensko, 2019), Trnava region, Senica district, western Slovakia). The highest number of efficient public libraries is located in the Prešov region (eastern Slovakia). The highest number of inefficient public libraries is in Banská Bystrica region (central Slovakia).

When reduced certain economic inputs and outputs and with an accent on volume indicator, in the case of the model B the number of efficient public libraries decreased to 85 (see Table 2, section model B). It presents 5.57% of all public libraries in Slovakia. Average efficiency score is 28.75%. Again, the DMU with the lowest efficiency score (0.03%) is the municipal library in Hlboké. Similarly, in comparison with model A, the highest number of efficient public libraries is located in Prešov region. The highest number of inefficient public libraries is in Banská Bystrica region. District with the highest number of efficient public libraries is Bardejov (Prešov region).

Employing economic inputs and outputs, results of model C show (see Table 2, section model C), that static technical efficiency is observed in 139 from 1525 Slovak public libraries. It presents 9.11% of a total number of public libraries in Slovakia. Average efficiency score is 37.92%. DMU with the lowest efficiency score (0.14%) is Municipal folk library in Jesenské (2,238 inhabitants in 2018 (E-obce.sk Slovensko, 2019), Banská Bystrica region, Rimavská Sobota district, central Slovakia). The highest number of efficient public libraries (34) is located in Prešov region. The highest number of inefficient public libraries (236) is in Banská Bystrica region.

Ascendant level of the achieved score by DMU in all three models (shaded area) is displayed in Figure 3. White space determines the gap in efficiency, and for concrete public libraries, it expresses the space for improvement.

The number of efficient public libraries varies among models. Hence, the investigation, which public libraries emerge as efficient in all three models is provided. These public libraries create a benchmark to evaluate the rest of public libraries. There are 62 efficient public libraries (from the total number of 1,525) which are efficient in all three cases (model A, B and C). Their distribution across the country is concentrated to Prešov region. In this region, the highest number of efficient public libraries is covered, following the results presented in Table 3. In a sample of 62 public libraries efficient in all three models, 66% are municipal libraries. 19 of 62 the most efficient public libraries are located in Prešov region. Some of them are located even in small villages as Harhaj (270 inhabitants in 2018), Ondavské Matiašovce (825) or Gregorovce (822) (E-obce.sk Slovensko, 2019). Beside it, regional libraries located in large cities are represented, too. Namely, Podtatranská Library in Poprad and Public library of Ján Bocatius in Košice.

It is obvious that in a group of 62 public libraries efficient in all three models, their location or size does not matter. Accordingly, Slovak public libraries have the potential to attract new users and visitors at the current level of available resources. Key factors of public libraries efficiency improvement may resist in several fields. For inefficient public libraries in model A, the reduction of I9 input (total current expenditure) may be suggested, with a simultaneous increase of output O4 (circulation of books for youth). In the case of model B, too much of I5 (floor space available for users) and low O1 (circulation) are the main sources of inefficiency. Results of models C stays for lowering the I4 (number of events) and rise of O3 (number of active registered users). Generally, results show, that Slovak public libraries suffer from high costs on the library’s functioning and a low number of borrowings, which should be related to a low number of registered users.

![Figure 3: Comparison of efficiency reached in various BCC-O models](source: Own processing)
The findings of the research differ from the findings of former studies provided on the sample of Czech (Vrabkova, 2017, 2018) or Czech and Slovak public libraries (Vrabkova & Fridrich, 2019). It might originate in the unique sample of public libraries, which covers all public libraries in the Slovak Republic. Regardless of the different sample contain, to obtain a more compact image of the problem, certain findings of former researches should be pointed out in relation with results obtained in this research.

As mentions Vrabková & Friedrich (2017), gaps in performance represent opportunities for improvement. In the case of the Czech and Slovak libraries, the fundamental gap in performance is represented by library additions, that means renewal and updating of the library collection (Vrabková & Friedrich, 2017). In the latest report of the Institute of the Cultural Policy of the Slovak Republic (Ministry of Culture of the Slovak Republic, 2019), the consilient statement is provided. In 2017, the acquisition debt (acquisition is meant as the increase of collection) of Slovak public libraries achieved 7.9 millions of Eur. Excluding gifts, compulsory copies and other sources from the acquisitions resources, the public libraries’ holdings would decrease. According to our findings, the eventual reduction of identified inputs might create supplementary resources to the collection enlargement and renewal. That might lead to the increase of the public libraries’ attractiveness ending in the increase of circulation and registered users, what is consistent with our findings.

6. Conclusion

The paper fills the lack of empirical evidence on performance analysis on the sample of public libraries operating in Slovakia.

The paper aimed to estimate the level of the relative technical efficiency of libraries in Slovakia for the year 2017. The technical efficiency was measured by Output BCC model of DEA. The relevance of benchmarking with non-parametric frontier methods lies in the fact that the benchmarked entities can compare their relative performance to other comparable units.

Our findings showed that in 2017, the vast majority of the Slovak libraries (87% - 95%) did not reach the level of efficiency. In other words, they could have been more efficient with the same resources they have. They can be more active in attracting the readers and organising the events. Almost 13% of the Slovak efficient libraries (model A) proved that it was possible to perform better with the resources available to them. According to our case study, the average technical efficiency in the year 2017 ranged from 29% to 46% (according to different models).

The study showed that it is possible to assess the efficiency of libraries and compare their efficiency with each other based on the data obtained from the surveys of the Ministry of Culture of the Slovak Republic.

But our analysis showed the necessity to revise these surveys. The collected indicators should be properly modified in such a way that it will be possible to carry out deeper analyses of the efficiency of libraries. Performance management of libraries could create stimuli for improvement of their services, management and marketing. To interpret the results appropriately, the holistic approach is necessary.

The contribution of our paper is also in its practical application and practical results.

The limitation of our results can be the scope of our sample. In the sample were all public libraries in Slovakia which differ in the size, equipment and locality. In further research, we will use more step approach and also include other methods (e.g. cluster analysis) to create a better comparable group of units.

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