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Economic Efficiency of Cultural Institutions: The Case of Museums in Slovakia

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ABSTRACT

The efficiency analysis is widely applied in public institutions, but they are still rarely used in case of cultural institutions. The paper deals with the technical efficiency of museums that are characterized by diverse activities and multiple objectives. This multidimensionality complicates the evaluation of efficiency by using traditional economic methods. The paper evaluates the technical efficiency of museums in Slovakia using the method Data Envelopment Analysis. The objective of the paper was to identify key indicators suitable for analyzing efficiency based on available cultural statistics. The appropriate indicators were selected using multivariate statistical techniques - Principal Component Analysis. The findings of the analysis point to significant differences in the efficiency of slovak museums and enable defining the characteristics of the most effective museums. As this is the first analysis of the efficiency of Slovak museums, the findings can be helpful in practice for improving the statistical surveys about museums and their efficiency in Slovakia.

INTRODUCTION

Economists started to examine the efficiency of cultural institutions relatively late. Analysing of culture and cultural institutions from a financial perspective have until recently been uncommon. The economic studies in this area have blossomed since Baumol and Bowen (1966) published their seminal work about economic dilemmas in the American cultural sector 60's of the 20th century. A possible reason for such lateness includes the uniqueness of cultural goods, which makes it difficult to evaluate the results of the performance of cultural institutions. Despite the specific character of cultural goods, evaluating the efficiency of theatres, museums, libraries, and galleries is equally relevant as for other institutions of the public sector such as in the area of education or health service. Providing cultural goods and services requires public resources which are scarce, and their allocation is subject to public choice. Assessment of the optimal allocation of public resources to public institutions requires as much information on the efficiency of their functioning as possible. Another fact is that, although services provided by cultural institutions are intangible and non-market, it is possible to relatively objectively determine the efficiency of their production and the organisation's management. (Herrero-Prieto, 2013) Methodologies used to evaluate the performance of cultural organisations are essential equally in terms of „fundraising". The survival of cultural institutions often depends on the availability of not only public but also private funding. The more efficient an organisation appears to be, the more likely it is to qualify for the public as well as private funding and grants (Basso and Funari, 2004).

At present, an ever-growing number of studies analyze the efficiency of, for example, and Wetzel, 2010); libraries (Miidla and Kikas, 2009); (Hemmeter, 2006) and museums (Carvalho, et al., 2014). The boom of these academic studies has been made possible by improvements in data availability, which allowed the more detailed quantitative analyses.

Slovakia, as other countries EU, higher attention focuses on the cultural sector. The effects of substantial investment in cultural infrastructure and cultural activities mainly driven by European structural funds need to be regular evaluate. A Eurobarometer survey from 2013 found that the the number of visitors to museums and galleries in Slovakia declined in comparison with the year 2007. Whereas in 2007 as many as 40% of people visited a museum or a gallery at least once a year, in 2013 this number was 9% lower. An average decline in the number of visitors to museums and galleries in the EU for the same period of time was only 4% (TNS, 2013). The countries that manage to attract a higher number of visitors to their museums include e.g. Sweden where as many as 76% of inhabitants visit a museum or a gallery at least once a year.

The efficiency of museums is interlinked with the management skills in museum management. We do not know any study in Slovakia that would analyse the efficiency of cultural institutions. It might be due to the complicated acquisition of data and their complex processing. Data about cultural institutions is collected in state statistical survey yearly. The collected data are evaluated only summarily by using descriptive statistics. The available data provide room for more sophisticated analyses that will enable deeper insight into the economy and management of cultural institutions.

This paper aims to analyse the technical efficiency of Slovak museums. The latest available data come from 2015. The study was conducted in cooperation with the statistical unit at the Ministry of Culture which grant us permission for access to individual data from the statistical surveys. Our objective was to perform a quantitative analysis of the efficiency of museums and identify the factors that influence their performance. As these are institutions funded from public resources, it is essential to deal with the optimisation of their performance.

In this study, we address the following research questions: *What indicators on the side of inputs and outputs are suitable for evaluating the technical efficiency of museums? How many museums in Slovakia are efficient and how many are non-efficient? Why are there differences in the performance of museums?*

The methodological approach to our research involves two techniques. We used multivariate statistical analysis to construct the evaluation indicator system and DEA to calculate the efficiency scores.

The structure of the paper follows this order. The first part of the paper gives a review of the literature and briefly introduces the method DEA. In the next part were identified input and output indicators using Principal Component Method. Secondly was analysed the technical efficiency using two basic DEA models. The last section offers some concluding remarks about results of the provided empirical investigation of Slovak museums which may be of interest in practice.

1. THEORETICAL FRAMEWORK

The museum provides a variety of services to the society. The Act of the National Council of the Slovak Republic No. 115/1998 on museums and galleries defines the objectives and functions of museums, particularly as regards the specialist care of objects e. g. the recording and documenting of collections, classification and presentation.

The traditional functions of museums conclude collecting of cultural objects, preservation, presentation, research and education. These functions have evolved with time and new functions emerge continually.

With the increasing role of museums in society, the economic impact of their activity becomes more visible. Museums provide employment, attract tourist, generate economic activity, contribute to urban regeneration and favour the growth of creative industries. (Carvalho et al., 2014) Some of the so-called big star museums have a substantial economic impact on a town or region where they are located. An iconic example is The Guggenheim Museum in the Spanish town of Bilbao with 380 thousand inhabitants. The localisation of the museum, which visits more than 1 million tourists annually, kick-started the development of tourism and revived the economy in the formerly declining post-industrial town (Plaza, 2000).

Academics discuss a diversity of topics related to the economy of museums. The papers range from managerial studies aimed at the assessment of different types of management in public, private or non-profit museums (McCall and Gray, 2013) to studies concerning marketing strategies of museums (vom Lehm & Heath, 2016). Other studies examine the potential of museums as drivers of heritage tourism (Smith, 2018) commonly interlinked with the research about benefits for a local economy in term of increased income and employment (Bowitz & Ibenholt, 2009). Other studies deal with the museum´s value using different methods of measurement of economic and social values of non-market goods. (Whelan, 2015).

Studies considering museum efficiency may be divided into two groups. The first group focuses on measuring a museum´s performance by drawing up a set of performance indicators, the second group of studies examine the efficiency of a set of museums using so-called frontier techniques (Barrio et al., 2009)

The earliest study aimed at measuring the economic efficiency of museums comes fromcomes from the USA (Jackson, 1988) and it introduced a simple production function for a selected group of North-American museums. Later, American authors developed a simple model of measuring the technical efficiency of museums and identified a basic set of indicators on the side of inputs and outputs. (Basso andFunari, 2004)

The public sector was interested in measuring the efficiency of museums and there were proposed a set of indicators for museums funded by local governments in Great Britain in 1991. Collection and interpretation of the proposed indicators proved to be complicated and poorly applied in practice. As a result, the British Department for Digital, Culture, Media & Sport (DCMS) developed a new framework for evaluating museums. The new study focused on the efficiency and effectiveness and identified as many as 365 indicators to measure the efficiency of various types of activities of museums and galleries. (Mairessse and Vanden Eeckaut, 2002)

Further analyses performed in different countries of Western Europe started to use more sophisticated methods: analysis of British museums (Bishop and Brand, 2003), analysis of the efficiency of French museums, Belgian museums (Mairessse and Vanden Eeckaut, 2002), Finnish museums, Italian museums (Basso and Funari, 2004). (Camarero, et al., 2011) published a study of the efficiency of 491 museums in Great Britain, France, Italy and Spain. The latest studies are mainly from southern countries – on the efficiency of Portuguese museums (Carvalho, et al., 2014), Spanish museums (Barrio, et al., 2009) (Herrero-Prieto, 2013) and Iranian studies (Taheri and Ansari, 2013). From the literature review, it is obvious that this research area is still emerging in Central and Eastern Europe where studies have begun to appear only recently. One of them is a study about the efficiency of cultural sites from the Czech Republic written by (Placek et al., 2016).

Herrero-Prieto (2013) summarises the difficulties of measuring the performance of museums as follows. Firstly the museums deal with a wide range of resources which are complicated to measure due to their qualitative or heterogeneous nature. Secondly, the objective of museums is to provide complex and multiple products, which is not always tangible or commercial. Thirdly the results of the museums as public or non-profit organisations may not be measured in solely financial terms.

These obstacles have to be taken into account by choosing the appropriate method to measure the efficiency. As museums have varied objectives which cannot be measured using only financial indicators, their assessment can be best performed using methods that allow comparing various inputs and outputs. These are mainly nonparametric methods such as Data envelopment analysis - DEA, whose variations are most often used for the analysis of the museums' efficiency, e.g. (Carvalho et al., 2014; Mairessse and Vanden Eeckaut, 2002; Basso and Funari, 2004; Barrio et al., 2009; Herrero-Prieto, 2013; Taheri and Ansari, 2013). An overview of the applied methods and indicators examined in the studies on museums' efficiency was summarized by (Sebova, 2016).

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 effectiveness 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) Efficiency can be simply defined as a ratio between input and output. More outputs relative to an input unit indicate a higher efficiency. If the production unit achieves the highest possible performance of output unit relative to an input unit, then it obtains the optimal efficiency and it is impossible for it to become more efficient without implementing new technologies or other changes to processes. (Cooper et al., 2011) Thus, DEA analysis enables to assess the technical efficiency of a museum which can be defined as museum's capacity to maximize outputs for determined inputs or as museum's capacity to produce the same volume of outputs along with maximizing outputs (Basso and Funari, 2004).

DEA can be used for museums if perceived museum as a production unit. DEA method allows to compare the efficiency of museums and identify the most efficient ones (with efficiency equal 1) and inefficient museums (with efficiency less than 1). DEA is used to determine the so-called relative efficiency as it can to identify a museum with the highest performance only in the observed group. DEA compares each museum with all other museums and optimizes the weights of individual indicators towards the highest possible efficiency of a museum 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 and Rhodes) assumes constant returns to scale whereas the BCC model (Banker, Charnes and Cooper) allows for variable returns to scale. (Cooper, et al., 2007)

The difference between the CCR and the BCC model is in the adjunction of the convexity condition , $\sum_{j=1}^{n} \lambda_j = 1$ which eliminates the restriction from the CCR model that DMU must achieve efficiency to scale. The BCC model divides the efficiency derived from the CCR model into pure technical efficiency and scale efficiency (Cooper et al., 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 museums‘ efficiency. The practice of management plays an essential role when deciding on the DEA form. If 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 in order to maximize outputs so that they do not require more inputs. (Basso and Funari, 2004).

Output-oriented models are mostly used for the analysis of museums 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 et al., 2011)

$$\max \emptyset + \varepsilon\left(\sum_{i=1}^{m} S_i^- + \sum_{r=1}^{s} S_r^+\right)$$

$$\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = x_{io} \qquad i=1,2,\dots,m$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} + s_r^+ = \emptyset y_{ro} \qquad i=1,2,\dots,s$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad j=1,2,\dots,n$$

2. DATA AND METHODOLOGY

Our analysis evaluates the efficiency of museums in Slovakia in 2015. The data stem from the national statistics on museums for the year 2015. In 2015, 111 museums in Slovakia provided performance reports. We had to exclude 11 museums from the analysis because of the missing data. Museums are obviously the emblematic representations of cultural heritage in the region or in the city. After public administration reform in 2001 Slovak museums are classified according to the ownership as state-owned museums, local-owned museums, regional-owned museums and private-owned museums. Over 90 % of the objects displayed in the museums and galleries of the Slovak Republic are the property of the State or the regional or local administration. Only a fraction is in possession of private owners (Zorjanova, 2004).

There are two models of financing the public museums. If all revenues and expenditures of the museum´s budget are linked to the the budget of subordinary institution (state, municipality or region) it is a budgetary model. If the museum covers its expenses (till 50%) by its own revenues it is called contributory model. The museums differ in their characteristics by specialization, size and locality.

In generally most of the studies e.g. (Barrio et al., 2009; Carvalho et al., 2014; Wang et al., 2016) indicate that the choice of variables for the measurement of inputs and outputs is the most demanding task due to the differences in the character of museums. The variables in DEA processing have to reflect the varios features of museums.

Table 1. Descriptive analysis of the basic indicators of analysed Slovak museums

Indicator	*Maximum*	*Minimum*	*Mean*	*Standard deviation*
Staff	96	0	19,5	20,9
Size (number of objects)	56	1	2	9,4
Size (number of expositions)	17	1	4,8	5,3
Number of exhibitions	63	0	11	10,8
Number of events	573	0	80,4	119,9
Number of visitors (in 2015)	375000	201	40280	62659,2

Source: Own elaboration

In order to make an appropriate choice of indicators, we looked at the indicators used in published studies in this field. We found out that the most common input indicators which describe the size and availability of museums i.e. the number of opening hours of museums and their exhibition areas (m^2) are not collected in surveys. For that reason we decided to include in our analysis as many indicators as possible to provide the best description of the variety of a museum's character and activities that could affect its efficiency.

Our analysis was performed in two steps. In the first step we used the principal component analysis (PCA) to choose appropriate indicators for DEA analysis. In a second step we provided efficiency analysing using DEA models.

3. CONSTRUCTING AN INDICATOR SYSTEM

DEA results depend decisively on the set of input and output variables that are used in the analysis. From the perspective of using DEA method a large number of input and output indicators lead to an increase in the number of effective DMUs, which reduces the evaluation effectiveness of DEA method (Wang et al., 2016).

The rules for the selection of variable in DEA was discussed deeply by (Wagner & Shimshak, 2007). As they stated, any resource used by a DMU should be treated as an input variable. The output variables come from the performance and activity measures that result when a DMU converts resources to products or services. There is the rule that the number of indicators should not exceed one third of DMUs. (Wagner and Shimshak, 2007)

Our statistical database about museums includes 94 indicators. This list of potential variables for DEA is too large. Therefore we selected 24 indicators with impact on the efficiency of the museum as the "feasible indicator system". These indicators reflecting the various functions of museums are shown in Table 2. Indicators from the reports were selected in such a way that on the side of *inputs* they would provide a description of :

- museum´s size (number of branches, their own facilities, expositions, etc.),
- equipment of museums (collection),
- human resources in the museum (structure and salaries of the staff)
- the museum's funding (costs, etc.).

On the side of *outputs*, indicators describe how a museum fulfils its functions:

– presentation (new exhibitions, new collections, maintenance, digitization, and exhibitions),
– communication (publishing activities, events).

It describes also how many visitors visit it and what revenues it manages to generate (including actual revenues indicator, grants and donations). We included the financial indicators into the analysis because of the absence of important volume indicators (m^2, opening hours etc.). Next, we reduced the set of 24 theoretically possible indicators from the list using PCA to 8 cumulative indicators (Table 2) which were used in the second step in DEA analysis. Using PCA in the selection procedure of indicators for DEA in museums was used for example by Barrio et al. (2009) and Wang, et al. (2016).

PCA is a procedure traditionally used in the multivariate analysis. The main idea of the technique is to reduce the dimension of a data set which includes a number of mutually interconnected variables while preserving the maximum number of possible variances of initial data. It is achieved by the transformation of the set to new variables called main components which are not intercorrelated and arranged in such a way that the first several components account for most of the variance. (Hendl, 2009).

In our case the PCA method brought together initial indicators according to the inner variability of data and the obtained cumulative indicators represented their combination. The method proved to be suitable for our data because the factors obtained well represented the initial ones and could be logically interpreted. These factors were sufficiently intercorrelated with new factors (Table 2) named according to their focus.

Table 2. Construction of indicator system

	Set of theoretically possible indicators	*Interpretation of cummulative indicators based on PCA*
Inputs	Number of branches	Factor of a museum's size
	Own facilities	
	Number of expositions	
	Collection (number)	Factor of growth
	Capital expenditures	
	Total expenditures	Factor of operation
	Operating costs	
	Employees	
	Expert staff	
	Average salaries of employees	
Outputs	Digitalization	Factor of digitalization and exposition
	New expositions	
	Maintenance of collections	
	New collections (number pcs of collection objects)	Factor of the growth of the collection
	Exhibitions	
	Own exhibitions	Factor of activities (exhibitions and events)
	Events	
	Visitors	
	Foreign visitors	Factor of visit rate
	Non-paying visitors	
	Editorial activities	
	Grants and donations	
	Revenues	Factor of revenues
	Earned returns	

Source: Own elaboration

The Kaiser-Meyer-Olkin measure (KMO) of Sampling Adequacy was higher than 0,6 implying that our sampling is adequate for factor analysis (Table 3).

Table 3. Principal Component Analysis: KMO statistics and the Bartlett coefficient

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,701
Bartlett's Test of Sphericity	Approx. Chi-Square	831,353
	df	45
	Sig.	,000

Source: Own elaboration

The communality of the variables is quite high, which indicate that they are well represented through the factors (Table 4). With the factorial scores for every museum we performed DEA analysis.

Table 4. Principal Component Analysis: Communalities

Inputs	*Extraction*	*Outputs*	*Extraction*
1	0,760658	1	0,787349
2	0,340488	2	0,8415
3	0,821437	3	0,300572
4	0,690197	4	0,781812
5	0,833296	5	0,910008
6	0,962069	6	0,847791
7	0,8336	7	0,605903
8	0,583055	8	0,765969
9	0,863345	9	0,871402
10	0,796418	10	0,933087
		11	0,382069
		12	0,691853
		13	0,727823
		14	0,723827

Source: Own elaboration

EFFICIENCY ANALYSIS OF MUSEUMS

In the DEA analysis, we evaluated two most frequently used simple DEA models, i.e. the BCC and the CCR model. As mentioned above, the difference between the models is that the CCR model considers a constant return to scale (thus, a change by a unit on the side of inputs leads to the same change by one unit on the side of outputs).

The BCC model considers a variable return to scale (thus, a change by a unit on the side of inputs results in a bigger or smaller change than by a unit). Therefore, the results of the BCC model take into account the museum's size. As we compare museums of different sizes, the BCC model is more suitable for the analysis. The DEA analysis was performed using DeaSolver software. Summary results of the overall technical efficiency and its two components (pure technical efficiency and efficiency to scale) are given in Table 5.

Table 5. Results of DEA analysis

	Overall technical efficiency (CCR model)	*Pure technical efficiency (BCC model)*
Number of efficient museums	11	20
Number of inefficient museums	89	80
The highest efficiency ratio	1	1
The lowest efficiency ratio	0,78	0,81
Mean of efficiency ratio	0,92	0,93

Source: Own elaboration

The overall technical efficiency can be divided into two components. We identified the sources of inefficiency using the decomposition of efficiency to identify if the inefficiency is caused by the museum's activities (rate of pure technical efficiency), unfavourable conditions (rate of efficiency to scale) or both. The first component is the rate of technical efficiency measured by the BCC model. The average BCC efficiency of the museums analyzed in 2015 was 93%, and the model identified 20 efficient museums (Table 5). The average BCC rate of efficiency showed the potential saving for the analyzed museums in order to increase their efficiency. It therefore suggests that the analyzed museums required on average only 92% of the inputs used when producing their outputs. The increase of outputs on average by 7% should have helped inefficient museums to reach the efficiency level.

The second component of the overall technical efficiency is an efficiency to scale that determines how efficiently a museum behaves in its size group. Based on the BCC and CCR rate of efficiency it is obvious that within the period evaluated, only 11 museums operated efficiently under conditions of constant returns to scale. These museums operate in the so-called most productive size range. Their combination of inputs and outputs allows them to be efficient under conditions of both constant and variable returns to scale. Other 9 museums indentified as BCC efficient, but not CRR efficient were only efficient at the local but not at the global level due to their size.

Looking at the highest and lowest score of efficiency it is obvious that the differences between the efficiencies of the museums compared are small. The average efficiency of museums was 92, 6%. It would seem that on average museums in Slovakia are highly effective. This result is biased due to the PCA analysis performed in the first step.

The advantage of the output-oriented DEA analysis is that apart from measuring the level of the achieved efficiency it gives recommendations on the number of outputs required for the given inputs to achieve efficiency. Using vectors of optimal values of variables and input values of effective production units it is possible to calculate the recommended values for individual outputs of non-efficient museums. As the indicators were modified by the PCA method for the purpose of their analysis, we do not quote any calculations, only their description. The deeper look on the results of efficiency analysis showed that the efficient museums are mostly museums attractive for visitors wich could be classified into three categories:

- Museums of the „superstar“ type situated in castles and manor houses which are the most attractive for visitors
- Specialised museums devoted to one specific topic, such as the Museum of Slovak National Uprising, the Postal Museum.
- Museums in Bratislava benefit from being located in the capital city, e.g. the Historical Museum Bratislava, the Natural Science Museum in Bratislava.

Besides these categories, there were also efficient museums in smaller towns. On the other hand, museums included in the previous three categories were not among the most efficient ones. The analysis thus showed that the size, attractive exposition of locality is not an essential assumption of the efficiency. The group of efficient museums included also smaller museums which, although they do not have economies of scale, are capable to „produce“ higher outputs from the available resources. It indicates the influence of the management and marketing of a museum on its efficiency. Smaller museums in minor towns can also be efficient if they manage to provide attractive events and exhibitions for their visitors. In fact, the number of visitors was the most frequent indicator of the DEA results which non-efficient museums should improve on the side of inputs.

CONCLUSION

The aim of this paper was to estimate the level of the relative technical efficiency of museums in Slovakia for the year 2015. Efficiency was measured by output CCR and BCC model using the PCA method in the first step to defining input and output indicators. The study showed that it is possible to assess the efficiency of museums and compare their efficiency with each other based on the data obtained from the surveys of the Ministry of Culture of SR. Our analysis showed the necessity to revise these surveys. The collected indicators should be properly amended or modified in such a way that it will be possible to carry out deeper analyses of the efficiency of cultural institutions. To perform better efficiency analysis they should include for example the information on the size of exhibition areas and the number of opening hours at a museum.

Our findings showed that in 2015, 80% of Slovak museums did not reach the level of efficiency – thus, they could be more efficient in terms of the events they organized to attract more visitors. 20% of the Slovak efficient museums 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 2015 was 92% where pure technical efficiency amounted to 92% and efficiency to scale was 93%. This high efficiency ratio was caused by the previous step of the PCA analysis. This counts also for the limitation of our study, that we can not interpret this result. The general weakness of DEA is that the results are sensitive to the number and character of the indicators in the analysis. Therefore we will continue with efficiency analysis using another system of indicators (for example only volume indicators) or other DEA models to improve the findings.

An important contribution of our study is the recommendations for practice in cultural statistics and cultural management in Slovakia. Comparison of the museums’ efficiency can have a practical influence on the improvement of the museums’ management by providing information on the indicators which could be improved compared to similar institutions.

Museums carry out numerous various activities that are not visible to visitors such as registration or maintenance of their collections, research, and digitization of collection items as well as publishing activities. The number of these activities is growing annually which is confirmed by long-term statistics of their growth. The analysis showed that the biggest gaps were on the side of outputs, i.e. working with visitors and potential for increasing their numbers. The study therefore confirmed that Slovak museums should use more intensively different promotional tools to draw in public and build relationships with visitors.

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