International Journal for Quality Research 14(2) 347–368
ISSN 1800-6450

Hadis Bajrić[1]
Edin Kadrić

Article info:
Received 30.06.2019
Accepted 22.11.2019

UDC – 303.022
DOI – 10.24874/IJQR14.02-02

EFFICIENCY ASSESSMENT OF MUNICIPAL COURTS IN FEDERATION OF BOSNIA AND HERZEGOVINA USING DATA ENVELOPMENT ANALYSIS

Abstract: *This paper deals with the assesment of municipal courts efficiency in the Federation of Bosnia and Herzegovina (FB&H). The aim of the study is to determine difference in efficiency between municipal courts, to identify ineficient courts, and to give recommendations for improvement of the efficiency of ineficient courts. Efficiency analysis was conducted on the data obtained through primary collection directly from 31 FB&H municipal courts, for time period 2014-2016. The method used for assesment of courts efficiency is Data Envelopment Analysis (DEA). The paper gives a brief theoretical overview of the DEA method, a review of the DEA literature related to the efficiency assessment of the courts in the world, and the comparison of the methodologies used in the reviewed studies with the methodology used in this study. The results of the DEA analysis were used to identify the most efficient, as well as ineficient courts, and to identify potentials for improvement of courts efficiency. Suggestions for improvement of the data collection system related to the work of the courts are given in this paper in order to increase the relevance of the analysis. Comparison of the courts efficiency and ranking of the courts are performed according to the courts efficiency in 2014, 2015 and 2016, and an aggregate for three-year period 2014-2016. Based on the estimated efficiency, a projection of increased number of resolved cases has been estimated, provided that all courts are efficient.*

Keywords: *Efficiency assessment; DEA model; Municipal courts*

1. Introduction

Starting point in the study of efficiency is identification of used resources (input quantity) and determination of produced output (output quantity). Efficiency studies are usually based on maximizing output or minimizing inputs. Approach based on the maximization of output tries to determine maximum amount of output that can be achieved with given input volume. In the case of assessment of court efficiency this means that attempts are made to determine maximum number of cases that a court can handle in a given time period and with available resources. Output maximization approach is dominant approach in international literature considering courts efficiency assessment (Riksrevisionen, 2017). An alternative approach is to try to determine the minimum input quantity that can be used to achieve already achieved output level.

[1] Corresponding author Hadis Bajrić
Email: bajric@mef.unsa.ba

The general impression is that municipal courts in FB&H, as well as other courts in B&H, are not sufficiently accurate and up-to-date. The courts in B&H have a chronic problem of transferring cases from one year to another, which is a major obstacle for establishment and building up of an efficient judiciary system, but also trust of B&H citizens in judicial system. This problem has been recognized by the High Judicial and Prosecutorial Council of Bosnia and Herzegovina (HJPC B&H), but also by other institutions, such as the B&H Ministry of Justice and some international institutions that have supported resolution of this problem. According to reports by some municipal courts and HJPC B&H reports, some initiatives have given positive results, but not at a planned and satisfactory level. Insufficient timeliness of the courts is often attributed to insufficient efficiency of courts.

According to the Analysis of Efficiency of Courts in B&H issued by the HJPC B&H (2015), certain courts achieved results above the standards set by the Rulebook on Orientation Measures for the Work of Judges and Associates (Službene Novine FB&H, 2012), while there are certain number of courts that are not able to achive prescribed norm. In the HJPC B&H (2015) analysis, and according to the applied methodology in relation to the norm set by the Rulebook, there is an enormous difference in the courts efficiency, which creates suspicion in the objectivity of the norm. Large differences in efficiency of FB&H municipal courts are best illustrated by data reported in the HJPC B&H (2015) analysis, where, for example, it is stated that in 2014 the Municipal Court in Visoko achived 237% of the norm, while the Municipal Court in Velika Kladuša achieved 90% of the norm.

Determining the efficiency of FB&H municipal courts is based on multi-criteria decision making. Each type of court case has a defined weight factor, and the efficiency or norm fulfillment of each judge is calculated by multiplying the number of resolved items and defined weights. The number of court staff and their norm fulfillment directly determines the efficiency of the municipal court, where efficiency is not related to court costs or the number of staff. The fact that certain courts can double their norm, while others are not able to achive defined norm, require revision and review of criteria set. The established practice for courts efficiency assesment, given that different courts have a different structure of the cases, depending on whether they cover the urban or rural environment, whether environment under their ingerence is more economically active and so on, can result with an unfair evaluation of their work.

Since 2003, judicial reform in B&H has been implemented. Within the reform, numerous projects were implemented, which included reorganization and capacity building of courts. In the annual report of the HJPC B&H for 2017, it has been stated that over EUR 19 million of funds from IPA have been invested since 2004 in order to improve efficiency, professionalism, independence and accountability of the BiH judiciary system. According to the statements, there are visible positive effects of reform in the courts, however, there is still a significant space and need for the improvement of the work efficiency of the courts.

Taking into account all the foregoing, there is a need for establishment of an objective and fair system for FB&H municipal courts efficiency assessment. The new system or approach would have to take not only the court staff, but also non-judical staff, costs generated, as well as the fact that the structure of cases varies depending on the social, economic and other characteristics of the court area.

The DEA method is chosen as a method that can answer the given requirements. Assessment of the efficiency of FB&H municipal courts was done using Data Envelopment Analysis (DEA). DEA is a deterministic and nonparametric method for determining the relative efficiency of comparable units, based on linear mathematical programming. Units whose

efficiency is to be assessed (Decision Making Unit, DMU), must be homogeneous, meaning that they use the same inputs in their processes and produce the same output, and differ only in terms of the amount of input they consume, or the amount of output they generate.

2. Theory of Data Envelopment Analysis

Charnes et al. (1978) proposed DEA method as one of approaches to assess relative efficiency of units having multiple inputs and/or outputs. DEA has become a very popular nonparametric technique that requires only a simple set of input and output values. Large number of papers have been published on this topic, and a large number of DEA models have been developed (see Cooper et al., 2007). It should be emphasized that DEA method estimates relative efficiency rather than absolute, which means that DEA method cannot provide an answer as to how much the productivity of individual units can be maximized, if among units being compared, there is no unit that has already achieved theoretically maximum productivity. This can be considered as a lack of method, however, this is actually advantage of the method, as this can help in identification of less efficient units and make relevant conclusions about potentials for improvements that objectively can be achieved, as there are already units that have same processes but achieve better results.

DEA method quantifies relative efficiency of each DMU by constructing the empirical efficiency frontier based on used inputs and achieved outputs of each DMU. DEA does not require any prior knowledge of the relationship between used inputs and achieved outputs, and completely objectively estimates the weight of each input and output, and efficiency frontier, based on empirical data of all DMUs. Units whose efficiency is 1 or 100% are considered efficient ones and are called Best Practice Units. Best Practice Units form an efficiency frontier that covers other inefficient units, and this is the characteristic by which this method has been named. The degree of inefficiency of inefficient units is determined by their distances from the efficiency frontier.

As previously been said, a large number of DEA models have been developed so far. The concept of the basic DEA model and DEA analysis with graphical interpretation is explained in an example with one input and one output.

Example: It is necessary to determine the relative efficiency of each of the 10 courts whose inputs are represented by the number of judges involved, and outputs by number of resolved cases. Number of judges involved and number of cases resolved, for each court, are given in Table 1.

Table 1. Number of judges involved and number of resolved cases

DMU	Court 1	Court 2	Court 3	Court 4	Court 5	Court 6	Court 7	Court 8	Court 9	Court 10
Judges involved	6	6	9	5	11	7	11	10	10	8
Resolved cases	10.000	13.000	16.000	7.000	6.000	4.000	17.000	4.000	14.000	7.000

Relative efficiency for each court estimated by DEA method and the ranking of the courts, according to the achieved efficiency, is shown in Table 2. Results shown in Table 2 were obtained using CCR DEA model. CCR model was developed by Charnes et al. (1978) and this model assumes Constant Returns to Scale (CRS). The assumption of constant returns on scale implies a direct linear relationship of input and output that does not change regardless of input value.

Table 2. Relative Court efficiency estimated by CCR DEA Model

DMU	Court 1	Court 2	Court 3	Court 4	Court 5	Court 6	Court 7	Court 8	Court 9	Court 10
Efficiency	0,769	1,000	0,821	0,646	0,252	0,264	0,713	0,185	0,646	0,404
Rank	3	1	2	5	9	8	4	10	5	7

Graphical representation of courts efficiencies, as well as efficiency frontier, estimated by CCR DEA model is shown in Figure 1. From Table 2, as well as Figure 1, it can be seen that Court 2 is the most efficient court and that it forms an efficiency frontier. Court 2 has an efficiency of 1 or 100%, while all other courts are inefficient courts. The second ranked court is Court 3 with efficiency of 0,821 or 82,1%. Court 8 is the most inefficient court with an efficiency of just 18,5%.

Efficiency frontier is determined by one direction that is unique to all courts. In Figure 1 it can be seen that the efficiency frontier is formed by Court 2 and it is the only reference for all other courts.

Inefficient courts need to be as close as possible to the efficiency frontier. This is the goal they can achieve, because there is a court (Court 2) which, under the same conditions, achieves better results. For each inefficient court, it is possible to determine the number of additional cases that need to be resolved, in order for that court to be at the efficiency frontier (output oriented DEA models, movement in direction of vertical arrow). For example, in order for Court 1 to become efficient it should resolve the same number of cases as Court 2 (output orientation), because they use the same amount of input. Efficiency of Court 1 is 0,769, which is obtained when the output of Court 2 is divided by the output of Court 1 ($10.000/13.000 = 0{,}769$). Inefficient courts can be at the efficiency frontier in a way they maintain the achieved level of output and reduce the input (input oriented DEA models, movement in direction of horizontal arrow) until they reach the efficiency frontier. For example, in order Court 1 to become efficient it is necessary for Court 1 to reduce the number of judges to 4,614, because $6 \cdot 0{,}769 = 4{,}614$ (input orientation). Court 1 can become efficient in a combination of these two approaches, for example, to reduce the number of judges to 5, and to increase the number of resolved cases to 10,833 (movement in direction of inclined arrow).

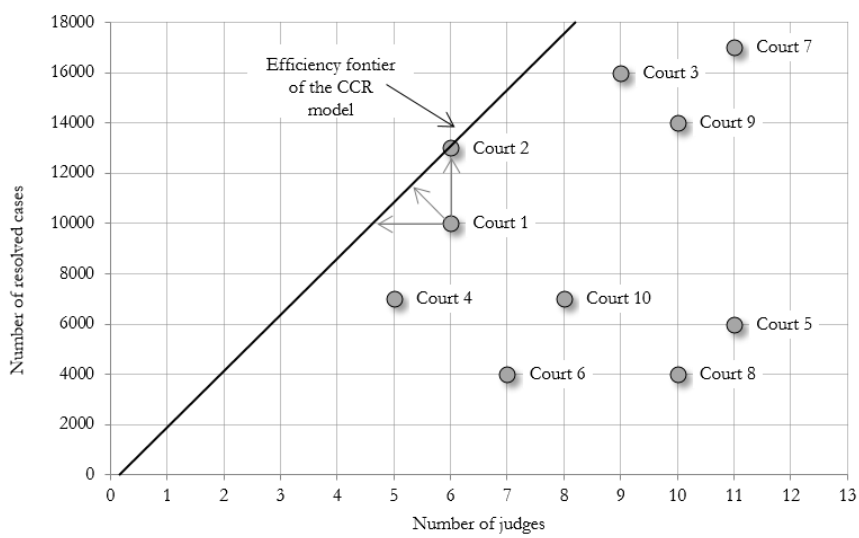

Figure 1. Graph of CCR DEA model

There are also models based on assumptions of Variable Returns to Scale (VRS). For variable returns on scale, the relationship between inputs and outputs is nonlinear, depending on returns on scale. The most popular DEA model, based on the assumption of variable returns on scale, is the BCC model developed by Banker et al. (1984).

Relative efficiency of the courts, given in Table 1 and estimated by BCC DEA model, is shown in Table 3. Graphical representation of courts efficiencies, as well as efficiency frontier, estimated by BCC DEA model is shown in Figure 2. From Table 3, as in Figure 2, it can be seen that there exist more efficient courts: Court 2, Court 3, Court 4 and Court 7. Efficiency of these courts is 1 or 100% and they form a efficiency frontier (envelope). The next ranked court is Court 9 with an efficiency of 0,848 or 84,8%. Court 8 is the most inefficient court in this analysis with an efficiency of just 24,2%. Courts that form the efficiency frontier are also the referential courts for inefficient ones, but in the following way e.g.:

- Court 1 has only one referential court and that is Court 2. Due to the output orientation of the model, Court 1 can become efficient only if it increases its output. In such case, Court 1 would be projected on Court 2 achieving maximum efficiency.
- Court 6 has two referential courts and those are Court 2 and Court 3, which form its referential set of courts. Again, due to the output orientation of the model, Court 6 has to increase its output in order to be at efficiency frontier. By vertical projection of Court 6, Court 6 comes to the point that lies at the efficiency frontier, but between Court 2 and 3. This is the reason why Courts 2 and 3 are referential ones for Court 6.

Table 3. Relative Court efficiency estimated by BCC DEA Model

DMU	Court 1	Court 2	Court 3	Court 4	Court 5	Court 6	Court 7	Court 8	Court 9	Court 10
Efficiency	0,769	1,000	1,000	1,000	0,353	0,286	1,000	0,242	0,848	0,467
Rank	6	1	1	1	8	9	1	10	5	7

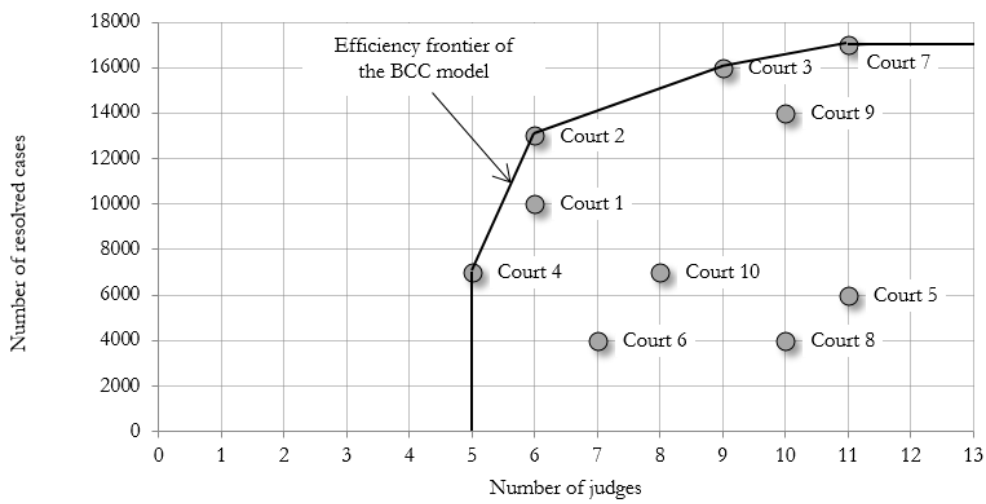

Figure 2. Graph of BCC DEA model

Efficiency estimated by BCC model cannot be less than the efficiency estimated by CCR model, which can be seen from results given in Table 2 and Table 3, as well as from the analysis of graphical interpretations of these models, shown in Figure 1 and Figure 2. Points representing inefficient courts are, in case of BCC model, closer to the efficiency frontier compared to those estimated by CCR model. In some cases, that distance may be the same but cannot be greater.

DEA analysis is based on identification of limit values and comparison of each production unit with only the best ones. The basic assumption is that if a given unit can produce Y outputs using X input resources, other units should be able to do the same if they work efficiently. Such defined model maximizes relative efficiency of each unit and obtained set of weights must be possible and achievable for each other unit, in the observed set. Thus, the best possible production capacity limit is determined, i.e. the maximum output for each unit for given amount of its inputs.

For each unit, specific problem of linear programming is resolved and maximum efficiency, compared to other units in the reference set, is estimated. Relative efficiency of any unit is calculated as the ratio of the weighted sum of output and input. The output and input weights of each unit are determined such that its efficiency is at maximum, with limitation that relative efficiency cannot be greater than 1 (100%). For a more detailed explanation of DEA analysis and the DEA model, mathematical formulations and solutions we recommended Cooper et al. (2007).

3. Data and methodology

Methodology for assessment of efficiency of FB&H municipal courts was adopted after reviewing literature available in international publications and scientific databases, as well as reports published by certain national audit offices that also dealt with assessment of efficiency of courts in their countries. For assessment of efficiency of FB&H municipal courts, data were collected directly from FB&H municipal courts and are related to period 2014-2016. Methodology adopted and applied for the purpose of assessment of efficiency of FB&H municipal courts can be summarized as follows:

- Efficiency Assessment Method: Data Envelopment Analysis (DEA).
- Model: CCR model.
- Assumption about returns on scale: Constant Returns to Scale (CRS).
- Model orientation: Output Oriented Model.
- Number of decision making units (DMU): 31 court.
- Input variables: (1) Number of judicial staff and (2) Number of non-judicial staff.
- Output variables: (1) Number of resolved cases of criminal division, (2) Number of resolved cases of civil division, (3) Number of resolved cases of misdemeanor division, (4) Number of resolved cases of economic division, and (5) Number of resolved cases of all other categories (divisions).
- Data: period of 3 years (2014-2016).

3.1. DEA analysis as a method for court efficiency assessment

DEA method is widely used method for analysis and assessment of efficiency in many different areas, especially in the public services sector and non-profit organizations, and it is the most commonly used method for court efficiency assessment, as reported in international literature (Azevedo & Yeung 2011). DEA method was also used for court efficiency assessment by national audit offices of countries (e.g. the Swedish National Audit Office, see Riksrevisionen 2017).

Table 4. Methods used for court efficiency assessment in literature

Study	Country	Num. of courts	Num. of inputs	Num. of outputs	Applied method	Model orientation	Returns on scale
Lewin et al. (1982)	USA	30	5	2	DEA	Output	CRS
Førsund and Kittelsen (1992)	Norway	107	2	7	DEA	Output	CRS
Tulkens (1993)	Belgium	187	1	3	FDH		
Pedraja-Chaparro and Salinas-Jimenez (1996)	Spain	21	2	2	DEA	Output	CRS
Rigsrevisionen (2000)	Denmark	82	2	5	DEA		CRS
Schneider (2005)	Germany	171	2	2	DEA	Output	CRS
Nissi and Rapposelli (2010)	Italy	26	2	1	DEA	Input	CRS, VRS
Azevedo and Yeung (2011)	Brazil	27	3	2	DEA	Output	CRS
Deyneli (2012)	Europe	22	2	3	DEA	Input	CRS
Ferrandino (2014)	USA	20	1	1	DEA	Output	VRS
Finocchiaro Castro and Guccio (2014)	Italy	27	1	2	DEA	Output	CRS, VRS
Santos and Amado (2014)	Portugal	223	2		DEA	Output	VRS
Falavigna et al. (2015)	Italy	309	3	1	DEA, DDF	Output	CRS
Major (2015)	Poland	26	3	1	DEA	Output	CRS, VRS
Finocchiaro Castro and Guccio (2016)	Italy	165	4	2	DEA	Output	CRS, VRS

3.2. Model of constant returns on scale - CCR-CRS model

For the purpose of analyzing the efficiency of FB&H municipal courts, the CCR model, developed by Charnes et al. (1978), was adopted. This model assumes Constant Returns to Scale. More details about the model itself as well as its mathematical formulation can be found in (Charnes et al., 1978). CCR model is probably the most known and most commonly used DEA model. CCR model was also used by the Swedish National Audit Office in assessment of efficiency of the Swedish courts (see Riksrevisionen, 2017). In the same report, study was conducted on the courts efficiency in the world, as well as used methods, models, numbers and types of input and output variables (Table 4).

According to research conducted by the Swedish National Audit Office, most studies on court efficiency assessment are based on the assumption that returns on scale does not depend on the scale (CRS model was used in 12 studies of 15). Some other researchers, such as Azevedo and Yeung (2011), who studied the efficiency of the Brazilian courts, has found that assumption of constant returns on scale is a dominant approach in the studies on the court efficiency. Pedraja-Chaparro and Salinas-Jimenez (1996) who studyied efficiency of the Spanish courts using DEA method, also used assumption of constant returns on scale which is based on the results of regression analysis. Even if there are no other studies, knowing how courts operate can lead to the conclusion of use of constant returns on scale. Judicial processes are structured processes, and regardless of the

number of cases, judges and staff are legally obliged to follow a defined sequence of steps, which is why these procedures do not change regardless on the number of received cases or cases being processed.

Thus, we adopted assumption that court efficiency does not depend on scale and use of CRS model is justified. In addition, conducted analyses will prove that assumption of constant returns on scale was justified, such that courts with the largest number of case, such as courts in Sarajevo, Tuzla, and Zenica are not the most efficient ones. This conclusion can be easily provided by scatter diagram analysis.

3.3. Output oriented model

When using CCR-CRS model for analysis of court efficiency, obtained information tell how many courts can increase their outputs (number of resolved cases) by maintaining the same input levels (Number of judicial staff and number of non-judicial staff). Alternatively, input oriented model could provide information to which level it is possible to reduce inputs (Number of judicial staff and number of non-judicial staff) while maintaining the same output level (number of resolved cases). Generally, the choice between these two orientations depends on what is to be achieved, increase/decrease inputs/outputs.

According to studies on court efficiency, use of output oriented models is more dominant. According to Table 4, the output orientation was used in 11 out of a total of 15 studies. Predominant use of output oriented models is not by chance, in many countries, the courts' promptness is not at a satisfactory level, and moreover, court management is usually under pressure to influence outputs rather than inputs.

For purpose of assessment of the efficiency of FB&H municipal courts, output oriented CCR-CRS model was used. It is intended to show that there are courts that are more efficient than others, and determine how much resolved cases can be increased if inefficient courts become effective.

3.4. Number of DMUs and variables

DEA method itself does not provide guidelines for selecting input and output variables in the model. However, results of DEA analysis depend on the number of variables used in relation to the number of DMUs. Evaluation power of DEA method depends on the number of DMUs and number of variables. Reducing number of DMUs and/or increasing the number of variables increases the efficiency of DMUs and reduces the evaluation power of DEA method (Khezrimotlagh, 2015). In the literature dealing with this issue, it is consistently suggested that the number of DMUs must be greater than the number of variables. Based on reviewed literature Dyson et al. (2001), Amirteimoori et al. (2014), Golany and Roll (1989), Cooper et al. (2007), Friedman and Sinuany-Stern (1998), it is possible to extract several criteria:

Criteria 1:

$$\text{Number of DMUs} > 2 \cdot (Number\ of\ input\ variables + Number\ of\ output\ variables).$$

Criteria 2:

$$\text{Number of DMUs} > 3 \cdot (Number\ of\ input\ variables + Number\ of\ output\ variables).$$

Criteria 3:

$$\text{Number of DMUs} > 2 \cdot Number\ of\ input\ variables \cdot Number\ of\ output\ variables.$$

A total of 7 variables (2 input variables and 5 output variables) were used to evaluate the efficiency of FB&H municipal courts, while the number of courts (number of DMUs) was 31 in total. According to the cited literature, the number of DMUs is sufficient for analysis by all three criteria:

Criteria 1:

$$\text{Number of DMUs} > 2 \cdot (Number\ of\ input\ variables + Number\ of\ output\ variables).$$
$$31 > 2 \cdot (2 + 5)$$
$$31 > 20$$

Criteria 2:

$$\text{Number of DMUs} > 3 \cdot (Number\ of\ input\ variables + Number\ of\ output\ variables).$$
$$31 > 3 \cdot (2 + 5)$$
$$31 > 21$$

Criteria 3:

$$\text{Number of DMUs} > 2 \cdot Number\ of\ input\ variables \cdot Number\ of\ output\ variables.$$
$$31 > 2 \cdot 2 \cdot 5$$
$$31 > 20$$

3.5. Input variables

For the purposes of FB&H municipal courts efficiency analysis, the following data and input variables were used:

- Number of full-time employed judges,
- Number of part-time employed judges,
- Number of professional associates,
- Number of civil officials,
- Number of other employees.

In order to reduce the number of variables, aggregation of certain types of personnel was performed. This resulted in a total of two input variables:

- Number of judicial staff (full-time employed judges, part-time employed judges, professional associates)
- Number of non-judicial staff (civil officials, other employees).

Number of other employees, as an input variable is not unambiguous, and in some cases, especially if viewed in the short term, can discriminate some courts. Number of other employees and number of working hours are not equal and convertible in certain cases (e.g. some court employees were on sick leave, maternity leave, etc.). This issue can be neglected if analysis is performed for a longer period of time, e.g. several years. For this reason, the efficiency analysis was conducted for a period of three years (2014-2016), which is statistically more relevant than analyses for particular years, as it balances certain inhomogeneity in inputs.

Number of input variables used in this study, in relation to number of DMUs and their representativeness for the efficiency evaluation, is more relevant than in most similar studies. For more details, see Table 4 and the Swedish National Audit Office's report on assessment of efficiency of the Swedish courts (Riksrevisionen, 2017).

3.6. Output variables

For the purposes of FB&H municipal courts efficiency analysis, the following data and output variables were used:

- Number of resolved cases of the criminal division,
- Number of resolved cases of the civil division,
- Number of resolved cases of misdemeanor division,
- Number of resolved cases of the economic division,
- Number of resolved cases of all other categories (divisions).

There was no need for certain variables aggregation in order to increase the evaluation power of the DEA model, because number of DMUs is significantly larger than number of variables. Additionally, aggregating different sets of cases into one variable could affect efficiency assessment and can discriminate some courts (e.g. merging cases that use different amounts of input resources).

Most studies typically use a number of resolved cases represented by one or two variables as a measure of output (see Riksrevisionen, 2017). Thus, Major (2015) in study on assessment of court's efficiency in Poland, uses total number of resolved cases as output. Finocchiaro Castro and Guccio (2016) use two output variables in their study: number of civil and number of criminal cases resolved. Azevedo and Yeung (2011) use two outputs to evaluate the efficiency of Brazilian courts: number of cases resolved in the first instance process and number of cases resolved in the second instance process. The Swedish National Audit Office (Riksrevisionen, 2017) uses three output variables to evaluate the efficiency of the Swedish courts: number of criminal, property and environmental cases resolved, number of civil cases resolved and number of misdemeanor cases resolved.

For the number of output variables used in this study, in relation to number of DMUs and their representativeness for the efficiency evaluation, it can be also stated that is more relevant than in most similar studies. For more details, see Table 4 and the Swedish National Audit Office's report on assessment of efficiency of the Swedish courts (Riksrevisionen, 2017).

4. Results of analysis of FB&H municipal courts efficiency

Structure and numeric values of input and output variables for all FB&H municipal courts are shown in Table 5. Analysis of efficiency was done on available data for the period 2014-2016. Input variables in Table 5 represent average number of judicial and non-judicial staff engaged in time period 2014-2016, which in some cases resulted in appearance of non-integer values. Output variables represent sum of cases resolved in time period 2014-2016.

Table 6 shows results of efficiency analysis of FB&H municipal courts obtained by DEA method for time period 2014-2016.

Average relative efficiency of all FB&H municipal courts is 0,8549 or 85,49%. From Table 6, it can be seen that 13 courts form an efficiency frontier. These 13 courts are said to be efficient ones as their efficiency is 1 or 100%. Remaining 18 courts are said to be inefficient ones and they can improve their efficiency by increasing number of resolved cases (output) without increasing number of employees (input). It should be emphasized again that DEA estimates relative and not absolute efficiency or theoretical maximum efficiency.

According to Article 23 of the Law on Courts in the Federation of Bosnia and Herzegovina (FB&H Official Gazette, No. 38/05), municipal courts with economic divisions are courts in Bihać, Orašje, Tuzla, Zenica, Goražde, Travnik, Mostar, Široki Brijeg, Sarajevo and Livno. These courts are responsible for economic affairs in the entire canton, and other municipal courts do not have an economic division or cannot handle economic cases (see Table 5). Due to this fact, there may be a suspicion that courts are not homogeneous, and that existence or absence of a economic division can have an impact on efficiency.

In order to investigate impact of potential inhomogeneity, an additional analysis was performed in such a way that courts that have economic division are excluded from analysis. For this analysis, the same methodology was used, but with number of courts reduced to 21, since 10 courts have economic division. Number of output variables was consequently reduced to four, because no court in this analysis had economic division. Results of analysis are shown in Table 7.

Comparing results given in Table 6 and Table 7, it can be seen that estimated efficiency of courts in both analyses is identical. This leads to the conclusion that existence or absence of economic division has no effect on efficiency.

In order to balance potential inconsistencies on input variables side and certain heterogeneity of court cases, efficiency

analysis was performed for a time period of three years (2014-2016), and this analysis is most relevant for assessment of municipal court efficiency in this research. In addition to this analysis, analyses were performed for each year (Table 8). Input data for 2014, 2015 and 2016 are given in the Annex. Table 9 gives a summary of efficiency statistics for performed analyses.

Table 5. Values of input and output variables of FB&H municipal courts for time period 2014-2016

Municip. court/ Court division DMU	Input variables Number of employees		Output variables Total number of resolved cases in time period 2014-2016				
	Judical staff (I)1	Non-judical staff (I)2	Criminal division (O)1	Civil division (O)2	Misdem. division (O)3	Econom. division (O)4	All other divisions (O)5
Bihać	26,3	77,7	3.310	17.243	10.905	5.090	63.361
Sanski most	10,0	37,0	2.199	6.039	3.740	0	4.714
Bos. Krupa	9,0	30,0	2.762	7.872	5.803	0	12.974
Cazin	11,3	32,3	2.308	6.982	5.601	0	12.764
Velika Kladuša	11,0	32,3	2.687	10.890	2.598	0	23.019
Orašje	10,7	34,7	1.676	9.749	4.964	402	17.389
Gračanica	8,0	24,0	2.537	5.375	3.316	0	26.359
Gradačac	14,7	29,7	4.235	18.667	3.842	0	32.399
Kalesija	6,0	22,0	1.971	4.692	2.751	0	1.599
Tuzla	54,3	121,7	13.247	36.322	16.090	29.074	61.748
Živinice	19,0	47,0	4.829	17.994	9.165	0	19.813
Lukavac	8,0	23,7	2.385	3.838	5.847	0	10.183
Banovići	4,0	17,7	1.170	10.758	1.608	0	9.608
Goražde	8,0	23,0	852	7.978	1.615	259	29.127
Zenica	39,0	117,3	7.497	16.629	17.541	19.279	116.091
Kakanj	8,0	24,0	1.847	12.509	5.694	0	30.782
Visoko	17,0	48,7	3.363	34.935	5.548	0	16.110
Tešanj	10,0	27,7	1.968	11.929	3.296	0	31.687
Zavidovići	13,0	34,7	3.186	19.630	5.977	0	12.570
Žepče	6,0	16,7	1.324	1.418	2.298	0	9.408
Kiseljak	10,0	32,0	1.947	4.786	2.504	0	7.858
Travnik	32,0	83,7	6.013	9.653	14.568	2.361	34.532
Bugojno	13,3	40,7	3.310	27.433	6.371	0	36.078
Jajce	6,0	21,0	625	3.340	2.483	0	5.414
Konjic	11,0	31,7	2.171	11.152	3.514	0	32.716
Mostar	30,7	83,7	4.376	17.728	11.244	4.371	18.770
Čapljina	10,3	31,3	1.919	7.088	1.713	0	4.265
Široki Brijeg	11,7	28,7	1.297	10.230	5.246	8.158	16.364
Ljubuški	8,3	22,0	1.574	3.721	1.398	0	14.697
Sarajevo	136,3	376,0	18.433	33.089	30.112	8.394	482.291
Livno	18,3	46,7	2.927	20.573	6.584	915	24.610

Table 6. Efficiency of FB&H municipal courts for time period 2014 - 2016

Municipal court	Efficiency	Rank
Bos. Krupa	1	1
Gračanica	1	1
Gradačac	1	1
Kalesija	1	1
Tuzla	1	1
Lukavac	1	1
Banovići	1	1
Zenica	1	1
Kakanj	1	1
Visoko	1	1
Bugojno	1	1
Široki Brijeg	1	1
Sarajevo	1	1
Goražde	0,9913	14
Zavidovići	0,95113	15
Živinice	0,94614	16
Tešanj	0,89761	17
Konjic	0,81991	18
Velika Kladuša	0,80433	19
Livno	0,7562	20
Travnik	0,75144	21
Cazin	0,73412	22
Bihać	0,7306	23
Žepče	0,72911	24
Sanski Most	0,69179	25
Orašje	0,67498	26
Mostar	0,62238	27
Ljubuški	0,61591	28
Kiseljak	0,60975	29
Čapljina	0,60128	30
Jajce	0,57303	31
Summary statistics		
Average	0,8549	
Minimum	1	
Maximum	0,573	

Table 7. Efficiency of FB&H municipal courts without economic division for time period 2014-2016

Municipal court	Efficiency	Rank
Bos. Krupa	1	1
Gračanica	1	1
Gradačac	1	1
Kalesija	1	1
Lukavac	1	1
Banovići	1	1
Kakanj	1	1
Visoko	1	1
Bugojno	1	1
Zavidovići	0,95113	10
Municipal court	Efficiency	Rank

Živinice	0,94614	11
Tešanj	0,89761	12
Konjic	0,81991	13
Velika Kladuša	0,80433	14
Cazin	0,73412	15
Žepče	0,7291	16
Sanski Most	0,69179	17
Ljubuški	0,6159	18
Kiseljak	0,60975	19
Čapljina	0,60128	20
Jajce	0,57302	21

Table 8. Efficiency of FB&H municipal courts for 2014, 2015, 2016 and whole time period from 2014 to 2016

Municipal court	Efficiency				Rank			
	2014-2016*	2014	2015	2016	2014-2016	2014	2015	2016
Bos. Krupa	1	1	1	0,9466	1	1	1	11
Gračanica	1	0,9405	1	1	1	14	1	1
Gradačac	1	1	1	1	1	1	1	1
Kalesija	1	0,9150	1	1	1	16	1	1
Tuzla	1	1	1	1	1	1	1	1
Lukavac	1	1	1	1	1	1	1	1
Banovići	1	1	1	1	1	1	1	1
Zenica	1	1	1	1	1	1	1	1
Kakanj	1	1	1	1	1	1	1	1
Visoko	1	1	1	0,7568	1	1	1	20
Bugojno	1	1	1	0,9233	1	1	1	13
Široki Brijeg	1	1	1	1	1	1	1	1
Sarajevo	1	1	0,8967	0,8446	1	1	17	16
Goražde	0,9913	0,7899	0,8571	1	14	20	20	1
Zavidovići	0,9511	0,9846	1	0,8929	15	13	1	14
Živinice	0,9461	1	1	0,8819	16	1	1	15
Tešanj	0,8976	0,9220	1	0,9356	17	15	1	12
Konjic	0,8199	0,8114	0,8204	0,8432	18	19	21	17
Velika Kladuša	0,8043	0,7318	0,8677	0,7836	19	25	19	18
Livno	0,7562	0,8974	0,7942	0,7699	20	17	22	19
Travnik	0,7514	0,7454	0,7850	0,7561	21	24	24	21
Cazin	0,7341	0,7662	0,9161	0,7370	22	21	16	25
Bihać	0,7306	0,7588	0,7909	0,7545	23	22	23	22
Žepče	0,7291	0,8574	0,7035	0,7424	24	18	27	24
Sanski Most	0,6918	0,5700	0,7110	0,7494	25	29	25	23
Orašje	0,6750	0,7580	0,8951	0,5684	26	23	18	27
Mostar	0,6224	0,7078	0,6271	0,5291	27	26	29	30
Ljubuški	0,6159	0,7020	0,5679	0,5654	28	27	30	28
Kiseljak	0,6098	0,5828	0,5547	0,6141	29	28	31	26
Čapljina	0,6013	0,5272	0,6809	0,5408	30	31	28	29
Jajce	0,5730	0,5695	0,7062	0,4285	31	30	26	31

*Efficiency in this column is not an average efficiency for three individual years but for time period 2014-2016. Thus, for example, the municipality court in Bosanska Krupa is efficient in time period 2014-2016, while in 2016 it was an inefficient court.

Table 9. Summary statistics of FB&H municipal courts efficiency

Statistical indicator	Efficiency			
	2014-2016	2014	2015	2016
Average	0,8549	0,8561	0,8766	0,8246
Maximum	1	1	1	1
Minimum	0,573	0,5272	0,5547	0,4285
Standard Deviation	0,1587	0,1566	0,1464	0,1726
Number of efficient courts	13	12	15	10
Number of inefficient courts	18	19	16	21

The lowest efficiency was recorded in 2016 and it was 82,46%, while the highest was in year of 2015 with estimated efficiency of 87,66%. Most inefficient courts were recorded in 2016, by number 21 court, while the least ineffective courts were in 2015, a total of 16 courts. According to the most relevant analysis in this paper, which is analysis for time period 2014-2016, 18 courts were ineffective, while remaining 13 courts were efficient. Efficient courts are municipal courts in Bosanska Krupa, Gračanica, Gradačac, Kalesija, Tuzla, Lukavac, Banovići, Zenica, Kakanj, Visoko, Bugojno, Široki Brijeg and Sarajevo. Last three ranked courts are municipal courts in Kiseljak (60,98%), Čapljina (52,72%), and Jajce with a minimum efficiency of 57,30%.

Based on the results given in Table 8 and Table 9, it can be concluded that there is a significant difference in the efficiency of FB&H municipal courts.

5. Interpretation and disscusion of DEA analysis results

Using results of DEA analysis, it is possible to identify referent efficient courts for each of ineffective courts. Number of appearances in the reference set (Table 10 and Table 11) can be interpreted as a "robustness" measure of the best practice unit. Thus, the courts in Kakanj, Gradačac and Lukavac appear as referent to 13, 12 and 9 ineffective courts, respectively, and can be said that they are efficient courts and example of best practice. The same cannot be said for courts at the end of the Table 10, although these courts have also been declared effective. Thus, for example, the court in Visoko is an effective court, but it is referent only to itself, while courts in Sarajevo and Bosanska Krupa are referent to themselves and one more court, so efficiency of these three courts, according to the DEA analysis, can be considered questionable. The reason their efficiency evaluates to 1, or 100%, may be due to characteristic values of input and/or output variables.

Table 10. Number of appearances in referent set

Municipal court	Number of appearances in referent set
Kakanj	13
Gradačac	12
Lukavac	9
Gračanica	6
Široki Brijeg	6
Kalesija	5
Banovići	5
Tuzla	3
Zenica	3
Bugojno	3
Bosanska Krupa	2
Sarajevo	2
Visoko	1

Using results of DEA analysis, it is possible to identify referent efficient courts for each of ineffective courts. Number of appearances in the reference set (Table 10 and Table 11) can be interpreted as a "robustness" measure of the best practice unit. Thus, the courts in Kakanj, Gradačac and Lukavac appear as referent to 13, 12 and 9 ineffective courts, respectively, and can be said that they are efficient courts and example of best practice.

The same cannot be said for courts at the end of the Table 10, although these courts have also been declared effective. Thus, for example, the court in Visoko is an effective court, but it is referent only to itself, while courts in Sarajevo and Bosanska Krupa are referent to themselves and one more court, so efficiency of these three courts, according to the DEA analysis, can be considered questionable. The reason their efficiency evaluates to 1, or 100%, may be due to characteristic values of input and/or output variables.

It is interesting to note that in this reference set there are no courts which do not have economic division. This fact is to some extent expected, as DEA analysis searches for similar courts and then compares them.

Table 11. Reference set of courts

Municipal courts	Referent courts (Lambda)							
Bihać	Zenica	0,328	Kakanj	1,538	Š. Brijeg	0,079		
S. Most	Bos. Krupa	0,499	Kalesija	0,876	Banovići	0,065		
Bos. Krupa	Bos. Krupa	1						
Cazin	Gradačac	0,078	Lukavac	0,893	Kakanj	0,37		
V. Kladuša	Gračanica	0,589	Gradačac	0,26	Kalesija	0,099	Banovići	0,47
Orašje	Lukavac	0,21	Banovići	0,038	Kakanj	0,998	Š. Brijeg	0,073
Gračanica	Gračanica	1						
Gradačac	Gradačac	1						
Kalesija	Kalesija	1						
Tuzla	Tuzla	1						
Živinice	Gradačac	0,519	Lukavac	0,84	Kakanj	0,488		
Lukavac	Lukavac	1						
Banovići	Banovići	1						
Goražde	Zenica	0,003	Kakanj	0,577	Sarajevo	0,023		
Zenica	Zenica	1						
Kakanj	Kakanj	1						
Visoko	Visoko	1						
Tešanj	Gradačac	0,032	Kakanj	1,113				
Zavidovići	Gradačac	0,315	Lukavac	0,027	Kakanj	0,543	Bugojno	0,287
Žepče	Gračanica	0,256	Gradačac	0,085	Lukavac	0,338		
Kiseljak	Gračanica	0,552	Gradačac	0,072	Kalesija	0,756		
Travnik	Tuzla	0,064	Lukavac	2,584	Kakanj	0,426	Š. Brijeg	0,156
Bugojno	Bugojno	1						
Jajce	Lukavac	0,41	Kakanj	0,34				
Konjic	Gračanica	0,042	Gradačac	0,093	Kakanj	1,162		
Mostar	Tuzla	0,099	Lukavac	1,182	Kakanj	1,212	Š. Brijeg	0,506
Čapljina	Gradačac	0,297	Kalesija	0,858	Banovići	0,205		
Š. Brijeg	Š. Brijeg	1						
Ljubuški	Gračanica	0,658	Gradačac	0,209				
Sarajevo	Sarajevo	1						
Livno	Gradačac	0,167	Kakanj	0,733	Bugojno	0,488	Š. Brijeg	0,148

Table 11 contains valuable information upon which maximum outputs could be determined (additional number of resolved cases) and which are achievable if inefficient courts should use their capacities as the efficient ones. This information is the most important benefit of DEA analysis and should be of interest primarily to the presidents of municipal courts, but also to other competent institutions, such as cantonal and federal

ministries of justice, High Judicial and Prosecutorial Council of Bosnia and Herzegovina and others.

Using information given in Table 11 in order to determine number of additional cases that could be resolved by ineffective courts, will be shown on the example of the municipal court in Bihać. Referent courts for municipal court in Bihać are courts in Zenica, Kakanj and Široki Brijeg. Number of criminal cases that court in Bihać had capacity to resolve, in observed period, and compared to those three effective courts are:

$$Bihać(O)1 = 0{,}328 \cdot Zenica(O)1 + 1{,}538 \cdot Kakanj(O)1 + 0{,}079 \cdot Široki\ Brijeg(O)1$$

$$Bihać(O)1 = 0{,}328 \cdot 7.497 + 1{,}538 \cdot 1.847 + 0{,}079 \cdot 1.297 = 5.402{,}2$$

Number of civil cases that court in Bihać had the capacity to resolve, in the observed period, and compared to those three efficient courts are:

$$Bihać(O)2 = 0{,}328 \cdot Zenica(O)2 + 1{,}538 \cdot Kakanj(O)2 + 0{,}079 \cdot Široki\ Brijeg(O)2$$

$$Bihać(O)1 = 0{,}328 \cdot 16.629 + 1{,}538 \cdot 12.509 + 0{,}079 \cdot 10.230 = 25.501{,}3$$

The same approach can be used to calculate number of other cases that court in Bihać had the capacity to resolve, as shown in Table 12. In Table 12 are given estimates of number of cases that could be resolved in time period 2014-2016, if all courts have been efficient. For efficient courts this projection is equal to the number of resolved cases.

Comparing estimated values, given in Table 12, to the number of resolved cases, given in Table 5, an additional number of cases could be estimated, in case inefficient courts used their capacities as the efficient ones. Projections of additional number of cases that could be resolved in time period 2014-2016, for each municipal court, are given in Table 13.

If inefficient courts used available resources to the extent of efficient courts, there would be an increase in total number of resolved cases by 18,73%. Structure of incremental increase of number of resolved individual cases is given in Table 14.

By elimination of ineffective courts from Table 13 it is possible to provide a summary statistics of efficiency increase of inefficient FB&H municipal courts (Table 15).

If inefficient courts used available resources to the extent of efficient courts, there would be an increase in total number of resolved cases by 53,48%. Structure of incremental increase of number of resolved individual cases is given in Table 15.

From Table 14 and Table 15, it can be seen that there is a potential for FB&H municipal courts to resolve more cases than in time period 2014-2016, using the same available resources. Number of additional cases that could be resolved are as follows:

- 17.717 criminal cases, representing an increase of 16,11% at the level of all courts, or 38,61% at the level of inefficient courts.
- 74.537 civil cases, representing an increase of 18,17% at the level of all courts, or 39,67% at the level of inefficient courts.
- 43.338 misdemeanor cases, representing an increase of 21,25% at the level of all courts, or 46,02% at the level of inefficient courts.
- 5.763 economic cases, representing an increase of 7,36% at the level of all courts, or 43,02% at the level of inefficient courts, and

273.304 all other cases, representing an increase of 19,46% at the level of all courts, or 64,71% at the level of inefficient courts.

Table 12. Projection of number of cases that FB&H municipal courts could resolve in time period 2014-2016 if they were efficient

Municipal court	Output variables Number of cases that could be resolved in time period 2014-2016				
	Criminal division (O)1	Civil division (O)2	Misdemeanor division (O)3	Economic division (O)4	All other divisions (O)5
Bihać	5.402,2	25.501,3	14.925,3	6.968,0	86.713,3
Sanski Most	3.180,9	8.737,6	5.410,1	0,0	8.499,3
Bos. Krupa	2.762,0	7.872,0	5.803,0	0,0	12.974,0
Cazin	3.143,5	9.511,7	7.627,8	0,0	23.009,9
Velika Kladuša	3.340,4	13.540,1	3.980,2	0,0	28.623,3
Orašje	2.483,3	14.445,6	7.354,5	595,5	34.418,5
Gračanica	2.537,0	5.375,0	3.316,0	0,0	26.359,0
Gradačac	4.235,0	18.667,0	3.842,0	0,0	32.399,0
Kalesija	1.971,0	4.692,0	2.751,0	0,0	1.599,0
Tuzla	13.247,0	36.322,0	16.090,0	29.074,0	61.748,0
Živinice	5.102,7	19.016,5	9.684,2	0,0	40.390,4
Lukavac	2.385,0	3.838,0	5.847,0	0,0	10.183,0
Banovići	1.170,0	10.758,0	1.608,0	0,0	9.608,0
Goražde	1.512,2	8.028,6	3.817,8	250,9	29.202,2
Zenica	7.497,0	16.629,0	17.541,0	19.279,0	116.091,0
Kakanj	1.847,0	12.509,0	5.694,0	0,0	30.782,0
Visoko	3.363,0	34.935,0	5.548,0	0,0	16.110,0
Tešanj	2.191,2	14.519,9	6.460,4	0,0	35.297,1
Zavidovići	3.351,3	20.649,4	6.288,4	0,0	37.549,6
Žepče	1.815,6	4.259,9	3.151,8	0,0	12.943,7
Kiseljak	3.195,4	7.858,2	4.186,8	0,0	18.091,7
Travnik	7.999,8	19.166,7	19.382,4	3.133,4	45.930,7
Bugojno	3.310,0	27.433,0	6.371,0	0,0	36.078,0
Jajce	1.605,8	5.826,6	4.333,2	0,0	14.640,9
Konjic	2.646,6	16.497,2	7.113,0	0,0	39.888,9
Mostar	7.025,4	28.469,7	18.059,7	7.006,3	63.737,3
Čapljina	3.188,8	11.775,2	3.831,1	0,0	12.964,1
Široki Brijeg	1.297,0	10.230,0	5.246,0	8.158,0	16.364,0
Ljubuški	2.554,5	7.438,2	2.984,9	0,0	24.115,6
Sarajevo	18.433,0	33.089,0	30.112,3	8.394,0	482.291,0
Livno	3.868,3	27.187,8	8.700,8	1.207,4	48.001,8

Table 13. Projections of additional number of cases that could be resolved in time period 2014-2016 for each municipal court

Municipal court	Output variables Projections of additional number of cases that could be resolved in time period 2014-2016				
	Criminal division (O)1	Civil division (O)2	Misdemeanor division (O)3	Economic division (O)4	All other divisions (O)5
Bihać	2.092,2	8.258,3	4.020,3	1.878,0	23.352,3
Sanski Most	981,9	2.698,6	1.670,1	0,0	3.785,3
Bos. Krupa	0,0	0,0	0,0	0,0	0,0
Cazin	835,5	2.529,7	2.026,8	0,0	10.245,9
Velika Kladuša	653,4	2.650,1	1.382,2	0,0	5.604,3

Orašje	807,3	4.696,6	2.390,5	193,5	17.029,5
Gračanica	0,0	0,0	0,0	0,0	0,0
Gradačac	0,0	0,0	0,0	0,0	0,0
Kalesija	0,0	0,0	0,0	0,0	0,0
Tuzla	0,0	0,0	0,0	0,0	0,0
Živinice	273,7	1.022,5	519,2	0,0	20.577,4
Lukavac	0,0	0,0	0,0	0,0	0,0
Banovići	0,0	0,0	0,0	0,0	0,0
Goražde	660,2	50,6	2.202,8	0,0	75,2
Zenica	0,0	0,0	0,0	0,0	0,0
Kakanj	0,0	0,0	0,0	0,0	0,0
Visoko	0,0	0,0	0,0	0,0	0,0
Tešanj	223,2	2.590,9	3.164,4	0,0	3.610,1
Zavidovići	165,3	1.019,4	311,4	0,0	24.979,6
Žepče	491,6	2.841,9	853,8	0,0	3.535,7
Kiseljak	1.248,4	3.072,2	1.682,8	0,0	10.233,7
Travnik	1.986,8	9.513,7	4.814,4	772,4	11.398,7
Bugojno	0,0	0,0	0,0	0,0	0,0
Jajce	980,8	2.486,6	1.850,2	0,0	9.226,9
Konjic	475,6	5.345,2	3.599,0	0,0	7.172,9
Mostar	2.649,4	10.741,7	6.815,7	2.635,3	44.967,3
Čapljina	1.269,8	4.687,2	2.118,1	0,0	8.699,1
Široki Brijeg	0,0	0,0	0,0	0,0	0,0
Ljubuški	980,5	3.717,2	1.586,9	0,0	9.418,6
Sarajevo	0,0	0,0	0,0	0,0	0,0
Livno	941,3	6.614,8	2.116,8	292,4	23.391,8

Table 14. Summarized statistics of efficiency increase of all FB&H municipal courts

Number of cases	Input variables Projections of additional number of cases that could be resolved in time period 2014-2016					
	Criminal division	Civil division	Misdem. division	Economic division	All other divisions	Total
Projection	127.662	484.779	247.274	84.066	1.456.604	2.400.386
Resolved	109.945	410.242	203.936	78.303	1.219.300	2.021.726
Difference	17.717	74.537	43.338	5.763	237.304	378.660
Difference (%)	16,11%	18,17%	21,25%	7,36%	19,46%	18,73%

Table 15. Summarized statistics of efficiency increase of inefficient FB&H municipal courts

Number of cases	Output variables Projections of additional number of cases that could be resolved in time period 2014-2016					
	Criminal division	Civil division	Misdem. division	Economic division	All other divisions	Total
Projection	63.608	262.430	137.505	19.161	604.018	1.086.723
Resolved	45.891	187.893	94.167	13.398	366.714	708.063
Difference	17.717	74.537	43.338	5.763	237.304	378.660
Difference (%)	38,61%	39,67%	46,02%	43,02%	64,71%	53,48%

In total, FB&H municipal courts could resolve additional 378.660 cases, with available resources, in time period 2014-2016, which is 126.220 (378.660/3) cases on an annual basis. Expressed in percentages, it can be concluded that there is a potential for FB&H municipal courts to resolve 18,73% more cases than they did in time period 2014-2016 (see Table 14), and if this increase relates only to inefficient courts then it means efficiency increase of inefficient courts by 53,48% (see Table 15).

During the time period 2014-2016, there were 581,3 judicial and 1.619 non-judicial staff engaged in FB&H municipal courts, while the total number of resolved cases was 2.021.726. It is interesting to show efficiency increase of municipal courts by 18,73% in the following numbers:

- 109 court staff and 303 non-judical staff less (the required capacity to solve 126,220 cases per year).
- Approximately 12,3 million KM of direct savings through the salary of judical and non-judicial staff at the annual level, engaged in solving 126,220 cases (approximately 5,3 million KM for judical and 7 million KM for non-judical staff).

If inefficient courts could perform at least at the level of efficient courts, then engagement of additional judicial and non-judicial staff would be unnecessary and would result in direct savings to courts themselves.

6. Conclusion and Recommendations

For assessment of FB&H municipal courts efficiency, DEA method, with the focus on maximizing output (number of resolved cases) using available resources, was used. Methodology applied in this analysis, data quality, number and selection of input and output variables and DEA model selection were adopted after reviewing literature available in international publications and scientific databases, as well as reports published by certain national audit offices related to assessment of courts efficiency in their countries.

According to performed analysis of the FB&H municipal courts efficiency, related to results obtained in time period 2014-2016, a total of 13 courts were identified as efficient, while remaining 18 were inefficient. It should be emphasized that DEA method estimates relative efficiency and not absolute efficiency or theoretical maximum efficiency that courts could achieve. This is considered to be the biggest disadvantage, but also the biggest advantage of DEA method. Disadvantage of DEA method can be explained such as it is not possible to estimate remained and unused potential for achievement of theoretical maximum efficiency, both for inefficient and efficient courts, while advantage of DEA method is clear evidence against inefficient courts that they can improve their efficiency, at least to the extent of the efficient courts, because they all have same preconditions.

The assessment of relative efficiency gained by DEA method, provided that assessment of efficiency is performed each year, creates a competitive atmosphere among courts and allows approach to theoretical maximum efficiency. Thus, if certain court, that has been declared efficient in one year, continues to operate with the same efficiency in the following year, does not have to be declared efficient again if some other court has achieved better results than it did.

Based on performed analyses, it can be concluded that there is a significant difference in efficiency of FB&H municipal courts. The lowest efficiency recorded, at the level of all courts, was 82,46% in 20016, while the highest was 87,66%. in 2015. Highest number of inefficient courts were recorded in 2016 (21 courts), while the lowest number of inefficient courts were recorded in 2015 (16 courts).

According to analysis performed for time period 2014-2016, 18 courts were inefficient, while remaining 13 courts were 100% efficient. Courts with 100% efficiency were

municipal courts: Bosanska Krupa, Gračanica, Gradačac, Kalesija, Tuzla, Lukavac, Banovići, Zenica, Kakanj, Visoko, Bugojno, Široki Brijeg, Sarajevo. The lowest ranked courts are municipal courts in Kiseljak (60,98%), in Čapljina (52,72%), and in Jajce, with a minimum efficiency of 57,30%.

Based on the number of appearances in the reference set, municipal courts in Kakanj, Gradačac and Lukavac can be considered as an example of best practice, while efficiency of municipal courts in Visoko, Sarajevo and Bosanska Krupa can be questionable, regardless DEA analysis evaluated them as efficient ones.

Analysis has also shown that there is a potential for FB&H municipal courts, using available resources, to increase number of resolved cases. FB&H municipal courts have potential to resolve:

- 17.717 more criminal cases, representing an increase of 16,11% at the level of all courts, or 38,61% at the level of inefficient courts.
- 74.537 more civil cases, representing an increase of 18,17% at the level of all courts, or 39,67% at the level of inefficient courts.
- 43.338 more misdemeanor cases, representing an increase of 21,25% at the level of all courts, or 46,02% at the level of inefficient courts.
- 5.763 more economic cases, representing an increase of 7,36% at the level of all courts, or 43,02% at the level of inefficient courts, and
- 273.304 more all other cases, representing an increase of 19,46% at the level of all courts, or 64,71% at the level of inefficient courts.

In total, FB&H municipal courts could resolve additional 378.660 cases, with available resources, in time period 2014-2016, which is 126.220 (378.660/3) cases on an annual basis. Expressed in percentages, it can be concluded that there is a potential for FB&H municipal courts to resolve 18,73% more cases than they did in time period 2014-2016, and if this increase relates only to inefficient courts then it means efficiency increase of inefficient courts by 53,48%.

It is interesting to show efficiency increase of municipal courts by 18,73% in the following numbers:

- 109 court staff and 303 non-judical staff less (the required capacity to solve 126,220 cases per year).
- Approximately 12,3 million KM of direct savings through the salary of judical and non-judicial staff at the annual level, engaged in solving 126,220 cases (approximately 5,3 million KM for judical and 7 million KM for non-judical staff).

Judical and non-judicial staff further engaged due to inefficiency can represent direct savings if the inefficient courts perform at least on the level of efficient ones.

References:

Amirteimoori, A., Despotis, D. K., & Kordrostami, S. (2014). Variables reduction in data envelopment analysis. *Optimization*, *65* (5), 735-745. doi:10.1080/02331934.2012.684354

Azevedo, P., & Yeung, L. (2011). Measuring efficiency of Brazilian courts with data envelopment analysis (DEA). *IMA Journal of Management Mathematics*, *22*(4), 343-356, doi:10.1093/imaman/dpr002

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. *Management Science*, *30*(9), 1078-1092. doi:10.1287/mnsc.30.9.1078

Castro, F. M., & Guccio, C. (2016). Measuring potential efficiency gains from mergers of Italian first instance courts through nonparametric model. *Public Finance Review*, *46*(1), 83-116. doi:10.1177/1091142116652723

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, *2*(6), 429-444. doi:10.1016/0377-2217(78)90138-8

Cooper, W. W., Seiford, L. M., & Tone, K. (2007). *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*, 2nd edition. New York: Springer.

Deyneli, F. (2012). Analysis of relationship between efficiency of justice services and salaries of judges with two-stage DEA method. *European Journal of Law and Economics*, *34*(3), 477-493. doi:10.1007/s10657-011-9258-3

Dyson, R., Allen, R., Camanho, A., Podinovski, V., Sarrico, C., & Shale, E. (2001). Pitfalls and protocols in DEA. *European Journal of Operational Research*, *132*(2), 245-259. doi:10.1016/S0377-2217(00)00149-1

Førsund, F., & Kittelsen. S. (1992). Efficiency analysis of Norwegian district courts. *Journal of Productivity Analysis*, *3*(3), 277-306. doi:10.1007/BF00158357

Friedman, L., & Sinuany-Stern, Z. (1998). Combining ranking scales and selecting variables in the DEA context: The case of industrial branches. *Computers and Operations Research*, *25*(9), 781-791. doi:10.1016/S0305-0548(97)00102-0

Golany, B. A., & Roll, Y. (1989). An application procedure for data envelopment analysis. *Omega*, *17*(3), 237-250. doi:10.1016/0305-0483(89)90029-7

Khezrimotlagh, D. (2015, August). *How to deal with numbers of decision making units and variables in data envelopment analysis*. Paper presented at the 13th International Conference on Data Envelopment Analysis, Braunschweig, Germany.

Lewin, A. Y., Morey, C. R., & Cook, J. T. (1982). Evaluating the administrative efficiency of courts. *Omega*, *10*(4), 401-411. doi:10.1016/0305-0483(82)90019-6

Riksrevisionen (2017). Tingsrätters effektivitet och produktivitet, Tryck: riksdagens interntryckeri, isbn 978-91-7086-433-9, Stockholm 2017, Retrived 14.1.2018, from https://www.riksrevisionen.se/PageFiles/26302/RiR_2017_6_TINGSRATTERS_EFFEKTIVITET_ANPASSAD.pdf

Službene novine FB&H (2006). Zakon o sudovima u FB&H. *Službene novine FB&H, 38/05*, 4. jula 2006.

Službene novine FB&H (2012). Pravilnikom o orijentacionim mjerilima za rad sudija i stručnih saradnika. *Službene novine BiH*, 2012.

VSTV (2015). *Efikasnost rada sudova u BiH – analiza*. Retrived 23.1.2018, from https://www.pravosudje.ba/vstv/faces/pdfservlet;jsessionid=4c72859fd2832dc328b39ead1c48d0fa934cc5c5bab367e5d400c0ed85dc66b0.e34TbxyRbNiRb40Lc3uPcheMbhiPe0?p_id_doc=30346.

Hadis Bajrić
University of Sarajevo
Faculty of Mechanical Engineering
Sarajevo, Bosnia & Herzegovina
bajric@mef.unsa.ba

Edin Kadrić
University of Sarajevo
Faculty of Mechanical Engineering
Sarajevo, Bosnia & Herzegovina
kadric@mef.unsa.ba