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Abstract

The paper introduces a system of indicators for measuring statistical methods use efficiency in enterprises. The indicators are formed based on the questionnaire, which is used to inspect the attitude of employees towards statistical methods use in Croatian enterprises. With the purpose of understanding statistical methods use effectiveness better, indicators are classified into two groups: comparative and individual indicators. These indicators were used in the construction of the E-score indicator, which can be used to predict if an enterprise will achieve a positive net income due to an effective use of statistical methods or not. The system of indicators of statistical methods use efficiency developed within this research can be easily used by any enterprise. Using these indicators an enterprise can estimate its competitive position compared to other enterprises and it can predict if the difference will increase or decrease. Despite the existence of many business systems of indicators, the impact of statistical methods use used to be neglected. This paper corrects this and introduces statistical methods as a very important part of business decision making and continuous monitoring of business processes.

Key words

statistical methods use; indicators; Croatia; enterprises; multivariate discriminant statistical analysis

JEL classification

C38, C83, L25

1. INTRODUCTION

In order to measure their performances and competitive positions, enterprises can use different benchmarks. Because only one indicator cannot provide a comprehensive insight into the business processes in an enterprise in an appropriate way, these benchmarks are regularly comprised of many different indicators. Consequently, these benchmarks are also known as systems of indicators. By using systems of indicators an enterprise can see its position on the market regards its competition. In the same time, indicators can show if there are some potential problems in the business and if there are some possibilities for achieving better business results. It has to be emphasized that the benefits of better business results of an enterprise, except the enterprise, have employees, suppliers, investors, state and all other subjects in the surrounding (see Al Ani, Jamil, 2015). Therefore, the importance of business indicators in the modern enterprises should not be underestimated.

A system of indicators can be specialized for observing a certain aspect of business in an enterprise. By far the most used systems of indicators are those which are based on accounting data (Bragg, 2007). That is not surprising because enterprises have an obligation to publish certain financial statements (Official Gazette, 2011). Easy data availability is the main reason why most systems of indicators are based on accounting data. Consequently, other systems of indicators, which inspect certain aspects of business and which are not mainly based on accounting data, are not so well represented and used in practice. Therefore, there is also a lack of statistical methods use indicators.

There are numerous reasons why a system of indicators related to statistical methods use and their position in enterprises has not been formed yet. Firstly, in order to form and to use statistical methods use indicators, data about statistical methods use in enterprises are necessary. So, collecting data about statistical methods use requires conducting a survey among enterprises. The main problems here refer to the fact that business surveys are very demanding and requesting special skills of the researcher (Kish, 1995) and that response rates could be very low (Žmuk, 2015b). Moreover, the second reason, the key one, why a system of statistical methods use indicators has not been formed yet is an unfavourable position of statistical methods use and of statistical thinking, in general, in enterprises (Dransfield, Fisher, Vogel, 1999, Gogala, Šimičević, 2005, Makrymichalos et al., 2005, Bergquist, Albing, 2006, Abraham, 2007, Grigg, Walls, 2007, Gjonbalaj, Dema, Miftari, 2009). The third reason of a scarce presence of statistical methods use indicators and their systems is that the process of forming a high quality system of indicators is a very demanding task. However, a system of indicators should be easy to use but, simultaneously, it also has to include all important business information.

The main aim of this paper is to address issues and to form a system of indicators for measuring the statistical methods use efficiency level in enterprises. So, the research question is whether a high quality system of indicators for measuring statistical methods use efficiency in enterprises can be formed. It has to be emphasized that under a high quality system of indicators is considered such a system of indicators which is easy to use and which includes all important information about statistical methods use in enterprises. Additionally, another research question is whether that system could be used for estimating whether an enterprise is going to achieve a positive net income or not. The research analysis, which will be applied in the paper, should be able to provide answers to these two research questions.

The paper is organized as follows. After a brief introduction of the research problem, the second chapter presents a literature review about development and characteristics of indicators systems which will be used as an example for constructing the new indicator system. In the third chapter data and methods are described, whereas in the fourth chapter the system of indicators for measuring statistical methods use efficiency in enterprises was formed and analysed. In the fifth, final, chapter conclusions, limitations and recommendations for further research are given.

2. LITERATURE REVIEW OF BUSINESS INDICATOR SYSTEMS DEVELOPMENT

The indicators use in enterprises has a long tradition. Consequently, it is considered as unavoidable, inevitable, and, in some cases, the only possible knowledge source of economic phenomena and processes in the enterprise (Osmanagić Bedenik, 1993). Indicators provide an insight into the current status of an enterprise and are useful tools in the processes planning, management and decision-making. Indicators are also considered as benchmarks of work and success of an enterprise. Furthermore, they are the signs of conscious shaping of a better future (Antoine, 1956).

The indicators are, in fact, the relative sizes incurred by comparing two or more absolute values that represent the value of a particular process or phenomenon in the enterprise (Foršek, 1985). Popović (1979) points out that there are three basic systems of expressing relative sizes: index numbers, percentage numbers, and relative numbers. In that way indicators can concisely express certain information making it comparable with other enterprises and previous values (Osmanagić Bedenik, 1993).

The first research papers which have examined indicators appeared in the United States of America in the beginning of the 20th century. So, those early papers included the paper published in 1900 that used indicators in the investments analysis in the railway industry whereas the paper published in 1905 used indicators in the financial abilities analysis of enterprises applying for loan in a bank (Krajčević, 1960). At the beginning, the indicator of liquidity had a key role in the loan-financial capabilities analysis, but soon profitability indicators were also included in the analysis as a standard. So, in the DuPont indicators system, which was introduced in 1919, the key roles were held by profitability indicators of assets (capital) (Žager et al., 2008). Of course, the basic DuPont indicators system was later considerably improved (Köppen, 2008). After that, efficiency indicators of enterprises began to develop. In the mid-50s of the last century, more attention was paid to the costs analysis and to the indicators analysis. That caused a shift from an external to an internal business analysis (Osmanagić Bedenik, 1993). Consequently, the greater emphasize on an internal quantitative and qualitative business analysis resulted in the emergence of new indicators and of new indicators systems that attempt to examine enterprises' business as a whole.

Despite its good properties, a single indicator cannot summarize and show in an appropriate way the whole business of an enterprise. Consequently, in practice different systems of indicators, which consist of many carefully selected indicators, are used. An indicator system can be oriented towards a certain characteristic of an enterprise. So, an indicator system can be used for evaluating risk of an enterprise to go bankrupt, estimating the success of a management strategy, or for estimating the value of an enterprise.

Investors and financial-credit institutions are interested in the use of indicator systems for evaluating risk of an enterprise to go bankrupt. Among the first to test the usefulness of the financial indicators in predicting financial failure was William H. Beaver in 1966 (Žager et al., 2008). The most famous indicators systems for predicting risk of an enterprise to go bankrupt are: Altman's Z-score model, Kralicek's DF indicator, Springate's model, Fulmer's model and CA-score (Zenzerović, 2008).

Most of the developed indicators systems for predicting bankruptcy are based on the application of the statistical multivariate discriminant analysis. Likewise Edward I. Altman formed his famous indicators system based on the multivariate discriminant analysis in 1968. His indicator system is known as the Altman Z-score, where the Z-score represents the synthetic indicator that predicts bankruptcy of an enterprise within one or two years (Žager et al., 2008). In designing his system of indicators, Altman started with 22 different financial indicators (Altman, 1968). The number of indicators was reduced to five financial indicators by applying the statistical multivariate discriminant analysis. These selected indicators have been shown to be statistically significant in explaining the financial situation of an enterprise. In the process of indicators selection, apart from observing the statistical significance of the indicators, the correlation analysis was applied, the accuracy of different combinations of indicators

was examined, and the additional analytical evaluation was performed (Žager et al., 2008). Finally, the following function was obtained:

$$Z = 1.2 \cdot X_1 + 1.4 \cdot X_2 + 3.3 \cdot X_3 + 0.6 \cdot X_4 + 0.999 \cdot X_5 \quad (1)$$

where Z is the Z-score and where X denotes selected financial indicators (X_1 is the working capital to total assets ratio, X_2 is the ratio of retained net income to total assets, X_3 is the ratio of net income before interest and taxes to total assets, X_4 is the market value of equity and total liabilities ratio, and X_5 is total revenue and total assets ratio).

The Z-score can reach a value in the interval from -4 to 8. The Z-score value higher than 2.99 indicates a low probability that an enterprise is going bankrupt in the next year. On the other side, the Z-score value lower than 1.81 indicates a high probability that an enterprise is going bankrupt in the next year. If the Z-score has a value between 1.81 and 2.99, a conclusion about the likelihood of an enterprise's bankruptcy in the next year cannot be brought (Bragg, 2007).

Peter Kralicek developed his own system of indicators using Altman's Z-score model as a role model. He developed a new indicators system because Altman had used data of enterprises from the United States of America and so Altman's model use in European enterprises was very limited and inadequate. Therefore Kralicek formed a new system of indicators, taking into account only data from European enterprises (Žager et al., 2008). Following Altman's procedure, Kralicek has come out with the following function:

$$DF = 1.5 \cdot X_1 + 0.08 \cdot X_2 + 10 \cdot X_3 + 5 \cdot X_4 + 0.3 \cdot X_5 + 0.1 \cdot X_6 \quad (2)$$

where DF is Kralicek's DF indicator and where X denotes selected financial indicators (X_1 is the pure cash flow to total liabilities ratio, X_2 is the ratio of total assets and total liabilities, X_3 is the ratio of net income before interest and taxes to total assets, X_4 is the ratio of net income before interest and taxes to total revenue, X_5 is supplies and total revenue ratio, and X_6 is the ratio of operating income and total assets). Kralicek's DF indicator can take on any positive or negative value. An enterprise with a negative value of Kralicek's DF indicator is considered to be insolvent, whereas an enterprise with a positive indicator value is considered to be solvent (Zenzerović, Peruško, 2006). So, the higher the Kralicek's DF indicator value is, the lower the probability of an enterprise's bankruptcy is.

Gordon Springate has also developed an indicators system to monitor the bankruptcy probability of enterprises (Springate, 1978). Unlike Altman's and Kralicek's model, Springate's model is based on data from 40 Canadian enterprises (Haseley, 2012). Springate came out with following function:

$$Z = 1.3 \cdot X_1 + 3.07 \cdot X_2 + 0.66 \cdot X_3 + 0.4 \cdot X_4 \quad (3)$$

where Z is Springate's indicator and where X denotes selected financial indicators (X_1 is the ratio of working capital and total assets, X_2 is the ratio of net income before interest and taxes to total assets, X_3 is the ratio of net income before interest and taxes to total liabilities, X_4 is sales revenue and total assets ratio) (Imanzadeh, Maran-Jouri, Sepehr, 2011). Enterprises with a high bankruptcy possibility have the Springate score lower than 0.862. The Springate model has proven to be accurate in 92.5% of cases (Ghodrati, Moghaddam, 2012).

The best-known indicators systems for the assessment of business excellence and business management strategies are considered to be: Balanced Scorecard, Deming's Prize, European Foundation for Quality Management (EFQM) model, Kanji's Business Excellence Model (KBEM), Malcolm Baldrige National Quality Award (MBNQA), Six Sigma model and index of business excellence (BEX). Unlike indicators systems for predicting bankruptcy, systems of indicators for the assessment of business excellence are usually based on qualitative rather than on quantitative data. Thus, for example, the Balance Scorecard evaluates business excellence of enterprises from four different perspectives: the perspective of customers, the perspective of the process, the perspective of learning and growth, and the financial perspective (Hoque, 2006). In general, the indicator systems for the assessment of business excellence commonly observe guidance, strategic planning, focus on customers and the market, focus on human resources, process management, and business results (Zenzerović, 2012). Since it is very difficult to make a valid conclusion using only qualitative

information, systems of indicators for the assessment of business excellence should have a quantitative component.

Out of the systems of indicators for evaluating business excellence mentioned above, the indicators system BEX is going to be emphasized. The indicator system BEX was developed for the assessment of business excellence of enterprises listed on the capital market (Belak, Aljinović Barać, 2008). In the BEX indicator system, 14 individual indicators were used as a starting point and only four of those were selected afterwards. Consequently, the final BEX indicator is equal to:

$$BEX = 0.388 \cdot X_1 + 0.579 \cdot X_2 + 0.153 \cdot X_3 + 0.316 \cdot X_4 \quad (4)$$

where *BEX* is the BEX index, X_1 is the profitability indicator, X_2 is the indicator of creating new values, X_3 is the liquidity indicator, and X_4 is the indicator of financial strength. If the BEX index has the value higher than one, an enterprise is considered to operate well. On the other hand, the value of BEX index between 0 and 1 suggests that an enterprise needs to make some improvements in its business.

In the economic literature and practice there are different approaches and methods of evaluation of an enterprise's value. Thus the value of an enterprise can be assessed as a set of assets forms. In that case the value of an enterprise is defined by the sum of all individual assets form values. It should be noted that during this evaluation methods which are primarily focused on the present are used. So, the historical accounting values are reduced to the present value. In the context of enterprises' asset value evaluation, a distinction among the following values should be made: (fair) market, liquidation, replacement, dismembered, and estimated value (Kolačević, Hreljac, 2009).

Instead of using static methods of estimating enterprises' values, which are based on the enterprises' assets, it is possible to use dynamic methods which are based on the expected future performance of an enterprise. In that way it is possible to calculate the economic value of an enterprise which is formed as the sum of the discounted cash flows in a given reference period. In order to discount cash flows to the present value, an appropriate rate of return on invested capital must be used (Kolačević, Hreljac, 2009, Miloš Sprčić, Orešković Sulje, 2012).

Evaluating values of enterprises can also be done using market methods. This approach has been widely accepted because of easy comparison among enterprises. Of course this makes sense if similar enterprises, i.e. enterprises from the same branch are compared. The biggest obstacles in market methods application are difficulties in collecting all necessary data (Poznanić, Cvijanović, 2011). The market evaluation of an enterprise is based on the calculation of certain multipliers by which the market value of an enterprise is estimated.

In the market evaluation of an enterprise, the following indicators are usually used: price/earnings ratio per share; ratio of the market value of an enterprise and the operating net income before interest, taxes, depreciation and amortization; ratio of the market value of an enterprise and the operating net income before interest and taxes; the market and accounting value ratio; ratio of the share price and sales revenue per share; dividend yields; the market and replacement value ratio (Kolačević, Hreljac, 2009, pp. 170-174).

3. DATA AND METHODS

A system of indicators should consist of the smallest number of indicators as possible, but, at the same time, it should include all necessary indicators. Furthermore, in order to use a system of indicators as a management tool some requirements must be fulfilled (Reichmann, Lachnit, 1976). The first requirement is that the system of indicators must quantitatively express the highest and the most important goals of an enterprise from the standpoint of the whole enterprise. The system of indicators must be adapted in a way that it includes a few indicators that highlight the essence and provide a simple overview of the whole enterprise. Nevertheless, the system of indicators must be complete and

must include all the facts which are used to manage the whole enterprise. Furthermore, a high-quality indicators system should be flexible enough allowing reliable results and the use in all enterprises regardless of their specific characteristics, i.e. different sizes or main activities. Also, a high-quality system of indicators should require data that are relatively quick and easy to reach, and its use should not be too long and too complicated.

Experiences from the abovementioned indicators systems are going to be used in the process of designing an indicators system for measuring the statistical methods use efficiency level in enterprises. The analysis of the existing indicators systems and the identification of their strengths and weaknesses will certainly contribute to designing a new high-quality system of indicators.

In order to design an indicators system for measuring the statistical methods use efficiency level in enterprises, the data from the conducted web survey are going to be used. The target population in the research included Croatian enterprises that are registered in the Court Register of the Republic of Croatia as limited liability enterprises (Official Gazette, 2011) and that are subject to the submission of annual financial statements in accordance with the Accounting Act (Official Gazette, 2007). The Croatian Company Directory of the Croatian Chamber of Economy has been used as the sampling frame (Croatian Chamber of Economy, 2016). Taking into account estimated response rate and possible technical difficulties (i.e. invalid e-mail, full inbox, and similar), it has been decided that the invitation for participating in the survey is going to be send to 26,186 randomly chosen Croatian enterprises. Simple random sampling (SRS) approach was used to select which enterprises will be contacted and invited to participate in the survey by e-mail. So many enterprises were invited to participate in the survey because low response rate and some technical difficulties were expected. In the survey period, from October 2012 to February 2013, overall 667 Croatian enterprises completely fulfilled the questionnaire. Consequently, it can be concluded that the Response Rate 1 or the minimum response rate (American Association for Public Opinion Research, 2016) is 2.55%. The structure of participated enterprises in the sample is quite similar to those from the population when the sizes of enterprises are observed. Accordingly, despite small response rate the sample can be observed as representative one.

The first question in the questionnaire which has been used in the web survey was about the use of statistical methods. Under the statistical methods use it is considered use of statistical methods for collecting, editing, processing, analysing data and presenting the results of statistical analysis in order to obtain additional information that serve as the foundation for business decisions and forecasting. Statistical methods use was confirmed by 237 (36%) enterprises, whereas 430 (64%) enterprises in the sample admitted that they do not use statistical methods in theirs business processes. Because an indicators system for measuring the statistical methods use efficiency level in enterprises is going to be examined an enterprise's use of statistical methods is the necessary requirement. Consequently, only enterprises which confirmed the use of statistical methods are going to be observed in the analysis. In addition to information from the survey, for the purpose of verifying new indicators, selected accounting data of enterprises related to 2011 are going to be used too.

The indicators system for measuring the statistical methods use efficiency level in enterprises is going to be split into two parts or levels. First, indicators which are going to be used for measuring the statistical methods use efficiency level in comparison to the other enterprises are introduced. Then, indicators which are going to enable measuring the statistical methods use efficiency level inside a certain enterprise are introduced. Based on the previous indicators in the system and using the discriminative multivariate analysis, a special indicator is going to be designed for estimating whether an enterprise will achieve a positive net income or not.

4. SYSTEM OF INDICATORS FOR MEASURING STATISTICAL METHODS USE EFFICIENCY LEVEL IN ENTERPRISES

4.1. Comparative indicators

The comparative indicators for measuring the statistical methods use efficiency level in enterprises are used to compare statistical methods use levels and use efficiency levels among enterprises. In this paper the comparative analysis is going to be made for all enterprises collectively, as well as for certain groups of enterprises stratified based on their size and main activity. Overall three comparative indicators are developed.

The first comparative indicator is an indicator of the statistical methods use level (C_1). This indicator is defined as the ratio of the number of statistical methods groups used in the observed enterprise and of the average number of statistical methods groups used in the group of enterprises with which the observed enterprise is compared. Thus, this indicator is calculated using the following equation:

$$C_1 = \frac{G_i}{AG}, \tag{3}$$

where G_i is the number of statistical methods groups used in the observed enterprise i and AG is the average number of statistical methods groups used in the group of enterprises intended for comparison. It is assumed that there are overall 13 different statistical methods groups which an enterprise can use: descriptive statistics methods, outliers detection methods, inferential statistics methods, sampling methods, multivariate clustering methods, statistical design of experiment methods, statistical process control methods, acceptance sampling methods, indicators of dynamics, naïve forecasting models, smoothing forecast models, trend models, and regression modelling. It is assumed that an enterprise uses a particular statistical methods group in its business if it uses at least one statistical method that belongs to the group. These statistical methods groups are selected according to estimated usefulness criteria in enterprises. The C_1 minimum value is zero (0) whereas the maximum value is not determined. Still, the C_1 value is recommended to be higher than one because that would mean that the observed enterprise uses more statistical methods groups than its competition.

Table 1: The percentages of enterprises in the sample with the statistical methods use level (C_1) indicator value higher than recommended

Size	Main activity				Total
	Industrial	Trade	Service	Other	
Small	37.25	30.19	36.19	33.33	32.56
Medium	40.00	33.33	25.00	---	33.33
Large	40.00	50.00	66.67	---	40.00
Total	36.07	29.31	36.61	33.33	34.18

Source: Authors' calculations based on the survey data.

Table 1 presents the shares of enterprises in the sample which have the C_1 indicator higher than one. If all enterprises are observed together, it can be concluded that 34.18% of enterprises use more different statistical methods groups than it is the average for all the enterprises together. In other words, 34.18% of surveyed enterprises had C_1 higher than 1. In the group of small industrial enterprises 37.25% of enterprises from this group used more different statistical methods groups than it is the average for that group of enterprises. In general, it can be concluded that about one third of enterprises use more different statistical methods groups in comparison to the average different statistical methods groups use in the group of enterprises where the enterprises belong.

The indicator of the statistical methods frequency use is the second comparative indicator (C_2). Unlike C_1 indicator, C_2 indicator takes into account both the number of used statistical methods groups and the frequency of their use. The C_2 indicator is the ratio of the statistical methods groups average use frequency in the observed enterprise and of the average frequency of statistical methods use in the

group of enterprises with which the observed enterprise is compared. The problem here is how to estimate the statistical methods group use frequency in an enterprise. In this paper, the estimation of the statistical methods group use frequency was made on time basis. So, if an enterprise chose the answer that it had used a statistical methods group in the last month, the weight value of 12 was added to this statistical group. If an enterprise used a statistical methods group in the last year, the corresponding weight value was set to 1. If an enterprise used a statistical methods group in the last three years, the corresponding weight value was set to 0.33. If an enterprise used a statistical methods group more than three years ago, the corresponding weight value was set to 0.10. Consequently, the C_2 indicator is given as:

$$C_2 = \frac{\frac{\sum_{i=1}^{G} w_i \cdot g_i}{G^*}}{\frac{\sum_{j=1}^{N}\sum_{i=1}^{G} w_{ij} \cdot g_{ij}}{N \cdot G^*}} = \frac{N \cdot \sum_{i=1}^{G} w_i \cdot g_i}{\sum_{j=1}^{N}\sum_{i=1}^{G} w_{ij} \cdot g_{ij}}, \quad (4)$$

where w_i is the i-th corresponding weight value, g_i is the i-th statistical methods group, $g_i \in \{0,1\}$, G^* is the maximum number of statistical methods groups (here 13), w_{ij} is the i-th corresponding weight value for the j-th enterprise, g_{ij} is the i-th statistical methods group for the j-th enterprise, N is the number of enterprises in the group with which an enterprise is being compared. The C_2 minimum value is zero whereas the maximum value is not determined. The recommended C_2 value is higher than one.

Table 2: The percentages of enterprises in the sample with the statistical methods frequency use (C_2) indicator value higher than recommended

Size	Main activity				Total
	Industrial	Trade	Service	Other	
Small	27.45	60.38	34.29	50.00	34.88
Medium	20.00	33.33	50.00	---	25.00
Large	40.00	50.00	33.33	---	30.00
Total	24.59	60.34	31.25	50.00	30.80

Source: Authors' calculations based on the survey data.

According to results provided in Table 2, 30.80% of enterprises in the sample use different statistical methods groups more often than it is the average. Consequently, 30.80% of enterprises have the C_2 indicator higher than one.

The third comparative indicator (C_3) is the indicator of the statistical methods use efficiency. The indicator C_3 is defined as a ratio of statistical methods use efficiency in the observed enterprise and the average statistical methods use efficiency in the certain group of enterprises. However, the problem here is how to measure efficiency of statistical methods use. The efficiency of statistical methods use can be viewed as a ratio of benefits of statistical methods use and of costs which happened because statistical methods were used. Unfortunately, the information about total benefits and total costs connected with statistical methods use were not collected in the conducted survey. Because of that the closest approximations of benefits and costs must be introduced. Therefore, in order to estimate statistical methods use efficiency, total revenues and costs of enterprises that use statistical methods are going to be compared. Consequently, the indicator C_3 is equal to:

$$C_3 = \frac{E}{AE} \approx \frac{\frac{TR_i}{TC_i}}{\frac{\sum_{i=1}^{N} TR_i}{\sum_{i=1}^{N} TC_i}}, \tag{5}$$

where E is statistical methods use efficiency in the enterprise i, which is defined as a ratio of total revenues TR_i and total costs TC_i in that enterprises, AE is the average statistical methods use efficiency in the group of selected enterprises given as total revenue of all enterprises in the group divided by total costs of all enterprises in the group. The minimum value of C_3 indicator is zero whereas the maximum value is not determined. The recommended C_3 value is higher than one which means that the observed enterprise uses statistical methods more efficiently than the average enterprise in the observed group.

Table 3: The percentages of enterprises in the sample with the statistical methods use efficiency (C_3) indicator value higher than recommended

Size	Main activity				Total
	Industrial	Trade	Service	Other	
Small	70.59	54.72	29.41	33.33	33.49
Medium	20.00	33.33	75.00	---	75.00
Large	60.00	50.00	33.33	---	40.00
Total	67.21	58.62	31.19	33.33	33.76

Source: Authors' calculations based on the survey data and enterprises' accounting data from 2011.

In order to calculate C_3 indicator values, accounting data for the enterprises in the sample were collected from their balance sheets for the year 2011. Results, given in Table 3, show that overall 33.76% of enterprises had the statistical methods use efficiency level higher than was the average efficiency level.

4.2. Individual indicators

The individual indicators for measuring the statistical methods use efficiency level in enterprises are used to compare statistical methods use levels and use efficiency levels inside an enterprise. This analysis can be made on the level of the whole enterprise or it can be used to compare different offices, departments, divisions, and similar. Overall eight individual indicators are developed.

The first individual indicator is the indicator of statistical methods groups use (I_1). This indicator is given as a ratio of the number of statistical methods groups used in the observed enterprise and of the number of maximum possible statistical methods groups which the enterprise could use. In this research it is assumed that the maximum number of statistical methods groups usable by enterprises is 13. Consequently, the I_1 indicator is equal to:

$$I_1 = \frac{G_i}{G^*}, \tag{6}$$

where G_i is the number of statistical methods groups used in the observed enterprise i and G^* is the maximum number of statistical methods groups (here 13).

Table 4: The percentages of enterprises in the sample with the statistical methods groups use (I_1) indicator value higher than recommended

Size	Main activity				Total
	Industrial	Trade	Service	Other	
Small	15.69	15.09	15.24	0.00	14.88
Medium	0.00	0.00	25.00	---	8.33
Large	40.00	0.00	66.67	---	40.00
Total	16.39	13.79	16.96	0.00	15.61

Source: Authors' calculations based on the survey data.

The I_1 indicator can take a value in the interval from 0 to 1. Three levels of statistical methods groups use are defined. If the I_1 indicator is equal or lower than 0.33, the conclusion is that the observed enterprise uses a very small number of statistical methods groups in its business. So, this enterprise would be in the group of enterprises with low statistical methods groups use. The enterprises in the medium statistical methods groups use group have the I_1 indicator higher than 0.33, but equal or lower than 0.66. The recommended I_1 indicator value is higher than 0.66 meaning that an enterprise is highly relied on the statistical results in the process of decision making. According to the results provided in Table 4 only 15.61% of enterprises, in comparison to all the surveyed enterprises, had the recommended I_1 indicator value.

Instead of observing the number of used statistical methods groups which an enterprise has ever used, the better approach would be to observe how many statistical methods groups the enterprise has used recently. This "recent" period can be defined as statistical methods groups use in the last three years, in the last year, in the last quarter or in the last month. The choice of the observation period depends on the researcher or analyst. In order to emphasize the included time variable, the indicator of statistical methods groups use with included time component (I_2) is:

$$I_2 = \frac{G_i^t}{G^*}, \tag{7}$$

where G_i^t is the number of statistical methods groups used in the observed enterprise i during last t periods and G^* is the maximum number of statistical methods groups (here 13).

Table 5: The percentages of enterprises in the sample with the statistical methods group use with the time component (I_2) indicator value higher than recommended, length of the observed period is one year

Size	Main activity				Total
	Industrial	Trade	Service	Other	
Small	2.44	2.13	4.30	0.00	3.23
Medium	0.00	0.00	0.00	---	0.00
Large	0.00	0.00	0.00	---	0.00
Total	1.96	1.92	4.00	0.00	2.88

Source: Authors' calculations based on the survey data.

As the I_1 indicator, the I_2 indicator can take a value in the interval from 0 to 1. Also, the higher the I_2 indicator is, the more different statistical methods groups are used by an enterprise. Again, it is recommended that an enterprise has the I_2 indicator higher than 0.66. If the statistical methods groups use by enterprises in the last year is observed, according to the results in Table 5 overall only 2.88% of enterprises met the recommended value. It is quite surprising that there are no medium-sized and large enterprises that have a high level of different statistical methods groups use in the last year.

The indicator of statistical methods groups use with the included time component and the changeable maximum number of statistical methods groups (I_3) presents a further improvement of the I_1 and I_2 indicators. Unlike the I_1 and I_2 indicators, the I_3 indicator as the maximum number of statistical methods groups takes the number of statistical methods groups which an enterprise has ever used. In

that way the total number of statistical methods groups used is different depending on the observed enterprise. The I_3 indicator is defined as:

$$I_3 = \frac{G_i^t}{G_i^*}, \tag{8}$$

where G_i^t is the number of statistical methods groups used in the observed enterprise i during last t periods and G_i^* is the total number of used statistical methods groups in the observed enterprise i.

Table 6: The percentages of enterprises in the sample with the statistical methods groups use with the time component and the changeable total number of statistical methods groups (I_3) indicator value higher than recommended, length of the observed period is one year

Size	Main activity				Total
	Industrial	Trade	Service	Other	
Small	19.51	12.77	30.11	20.00	23.12
Medium	0.00	0.00	50.00	---	16.67
Large	0.00	50.00	0.00	---	10.00
Total	15.69	13.46	30.00	20.00	22.12

Source: Authors' calculations based on the survey data.

The I_3 indicator shows the potential of statistical methods use in the certain period in compare to whole business period. The higher the I_3 indicator is, the higher statistical methods use level is and the higher business results could be as a result of intensive use of statistical methods. If the I_3 indicator is low it can be assumed that the business results are not at their maximum and that they could be improved by more intensive use of statistical methods (Žmuk, 2015a). Because of business cycles it is recommended for the I_3 indicator to be higher than 0.66. Table 6 shows the shares of enterprises that had the I_3 indicator higher than 0.66. In order to calculate the I_3 indicator for an enterprise, the number of different statistical methods used in the last year and the total number of statistical methods groups ever used were observed. According to the results, overall 22.12% of enterprises had the I_3 indicator higher than 0.66.

Unlike the previous individual indicators, the following three individual indicators observe the net income, total revenue and total costs per used statistical methods group:

$$I_4 = \frac{NI_i}{G_i}, \tag{9}$$

$$I_5 = \frac{TR_i}{G_i}, \tag{10}$$

$$I_6 = \frac{TC_i}{G_i}, \tag{11}$$

where I_4 is the indicator of the value of the net income per used statistical methods group, NI_i is the net income of the enterprise i, G_i is the number of statistical methods groups used in the observed enterprise i, I_5 is the indicator of the value of the total revenue per used statistical methods group, TR_i is the total revenue of the enterprise i, I_6 is the indicator of the value of the total costs per used statistical methods group, TC_i is the total costs of the enterprise i. The values of the indicators I_4 and I_5 are recommended to be higher than in the previous periods. The higher the values of the indicators I_4 and I_5 are, the higher efficiency of statistical methods use is. Namely, it is not only important how many statistical methods groups an enterprise uses, but it is also important how they are used. On the other hand, the suggested value for the indicator I_6 is not so easy to determine. Namely, the increased costs can be result of an increased business activity which is a positive development. Furthermore, it should be noticed that here it has been assumed that all statistical methods groups have the same importance level. Consequently, in the equations (9)-(11) all statistical methods groups have the same weight value of one.

Table 7: The basic descriptive statistics results for the indicator of the value of the net income per used statistical methods group (I_4), in million Croatian Kuna (HRK)

Size	Statistics	Main activity				Total
		Industrial	Trade	Service	Other	
Small	n	51	53	102	6	212
	Min	-2.69	-1.17	-2.27	-0.01	-2.69
	Max	10.16	1.25	2.91	0.28	10.16
	Mean	0.33	0.11	0.12	0.06	0.17
	Std. Dev.	1.60	0.37	0.48	0.11	0.87
Medium	n	5	3	4	---	12
	Min	-0.82	0.17	-7.03	---	-7.03
	Max	0.30	3.51	1.73	---	3.51
	Mean	-0.09	1.44	-1.91	---	-0.32
	Std. Dev.	0.42	1.81	3.69	---	2.48
Large	n	5	2	3	---	10
	Min	-4.89	-27.92	-0.70	---	-27.92
	Max	14.32	5.69	5.73	---	14.32
	Mean	2.04	-11.12	1.76	---	-0.68
	Std. Dev.	7.22	23.77	3.50	---	10.90
Total	n	61	58	109	6	234
	Min	-4.89	-27.92	-7.03	-0.01	-27.92
	Max	14.32	5.69	5.73	0.28	14.32
	Mean	0.44	-0.21	0.09	0.06	0.10
	Std. Dev.	2.42	3.82	1.02	0.11	2.37

Source: Authors' calculations based on the survey data and enterprises' accounting data from 2011.

According to the results provided in Table 7 the lowest I_4 indicator value among the observed 234 enterprises was HRK -27.92 million, whereas the highest value was HRK 14.32 million. The average I_4 indicator value for all the observed enterprises was HRK 0.10 million with the standard deviation of HRK 2.37 million.

The I_7 indicator shows the average costs per one statistical methods use. The frequency of statistical methods use is estimated in the same way as for the C_2 indicator. Consequently, the I_7 indicator is given as:

$$I_7 = \frac{TC_i}{\sum_{j=1}^{G} w_j \cdot g_j}, \tag{12}$$

where TC_i is the total costs of the enterprise i, w_j is the j-th corresponding weight value, g_j is the j-th statistical methods group. The I_7 indicator minimum value is zero whereas the maximum value is not determined. The lower the I_7 indicator value is, the lower the costs per statistical methods use are.

Table 8: The basic descriptive statistics results for the indicator of the average costs per one statistical methods use (I_7), in million Croatian Kuna (HRK)

Size	Statistics	Main activity				Total
		Industrial	Trade	Service	Other	
Small	n	40	46	90	5	181
	Min	0.001	0.002	0.001	0.181	0.001
	Max	116.356	37.954	49.959	170.555	170.555
	Mean	6.399	2.024	2.318	35.432	4.060
	Std. Dev.	21.529	5.641	7.445	75.558	17.140
Medium	n	5	3	4	---	12
	Min	0.907	8.076	2.729	---	0.907
	Max	14.612	38.056	242.485	---	242.485
	Mean	5.157	20.082	67.479	---	29.662
	Std. Dev.	5.456	15.856	116.831	---	67.802
Large	n	5	2	3	---	10
	Min	7.708	63.531	6.424	---	6.424
	Max	80.096	293.525	12.164	---	293.525
	Mean	31.502	178.528	8.693	---	54.065
	Std. Dev.	28.018	162.631	3.053	---	87.756
Total	n	50	51	97	5	203
	Min	0.001	0.002	0.001	0.181	0.001
	Max	116.356	293.525	242.485	170.555	293.525
	Mean	8.786	10.008	5.202	35.432	8.037
	Std. Dev.	22.228	42.052	25.454	75.558	31.656

Source: Authors' calculations based on the survey data and enterprises' accounting data from 2011.

According to Table 8, the lowest I_7 indicator values were in the small enterprises, whereas in the large enterprise those values were the highest. Still, the information that on average, when all 203 enterprises are observed together, the average cost per statistical method use is about HRK 8 million, is more than concerning.

The average revenue value per one statistical methods use is shown by the I_8 indicator. The I_8 indicator is calculated as follows:

$$I_8 = \frac{TR_i}{\sum_{j=1}^{G} w_j \cdot g_j}, \tag{13}$$

where TR_i is the total revenue of the enterprise i, w_j is the j-th corresponding weight value, g_j is the j-th statistical methods group. Unlike the I_7 indicator, the higher the I_8 indicator the better.

Table 9: The basic descriptive statistics results for the indicator of the average revenue per one statistical methods use (I_8), in million Croatian Kuna (HRK)

Size	Statistics	Main activity				Total
		Industrial	Trade	Service	Other	
Small	n	40	46	90	5	181
	Min	0.000	0.001	0.001	0.193	0.000
	Max	125.972	40.851	50.673	171.121	171.121
	Mean	6.446	2.116	2.426	35.579	4.151
	Std. Dev.	22.425	6.057	7.702	75.792	17.500
Medium	n	5	3	4	---	12
	Min	0.974	8.154	2.409	---	0.974
	Max	14.476	38.795	246.845	---	246.845
	Mean	5.151	20.614	67.525	---	29.808
	Std. Dev.	5.379	16.102	119.682	---	69.144
Large	n	5	2	3	---	10
	Min	7.752	64.779	6.425	---	6.425
	Max	88.820	265.601	11.961	---	265.601
	Mean	32.752	165.190	8.997	---	52.113
	Std. Dev.	31.979	142.002	2.789	---	79.788
Total	n	50	51	97	5	203
	Min	0.000	0.001	0.001	0.193	0.000
	Max	125.972	265.601	246.845	171.121	265.601
	Mean	8.947	9.599	5.313	35.579	8.030
	Std. Dev.	23.463	38.390	25.928	75.792	30.899

Source: Authors' calculations based on the survey data and enterprises' accounting data from 2011.

The information that on average, when all 203 enterprises are observed together, the average revenue per statistical method use is about HRK 8 million can be taken as positive. But if this value is compared with the average cost per statistical method use, it can be concluded that the average revenue is slightly smaller than average costs.

4.3. *E-score* indicator

Overall 11 different indicators are introduced and used in the analysis of usage levels and of statistical methods usage effectiveness in enterprises. However, at the end of the day, the management in an enterprise is interested in the impact of statistical methods use on the business result. So, they want to know if the current level of statistical methods use and the current efficiency level of their use would increase their probabilities to make a positive net income value in the future periods. In order to provide an answer to this question, a new indicator has to be introduced. The new indicator is going to be built on the basis of previous 11 indicators. In order to determine which of 11 indicators should be used in the new "synthetic" indicator and what impact they should have on the "synthetic" indicator value, the statistical multivariate discriminant analysis approach is going to be used. It should be noted that the "synthetic" indicator will be formed for all enterprises without taking into account their different characteristics. Accordingly, the "synthetic" indicator will not stratify enterprises according to their size or main activity. In order to make it easier to follow, the "synthetic" indicator is going to be named *E-score* indicator because it represents overall effectiveness of statistical methods use in an enterprise.

In order to form the *E-score* indicator the initial plan was to use data values of all 11 indicators for all 237 enterprises in the sample which stated that they use statistical methods. Unfortunately, for some enterprise it was not possible to calculate certain indicators. Because of that 34 enterprises are omitted from the further analysis. Finally, data from 203 enterprises were used in estimating the *E-score* indicator. Also, it has to be emphasized again that, in addition to responses provided by enterprises in the questionnaire, the basic financial statements relating to the year 2011 were used. The accounting

data has shown that, out of these 203 enterprises, 162 or 79.80% of them achieved a positive net income in 2011.

In the statistical multivariate discriminant analysis, the 11 indicators were used as independent variables whereas net income in 2011 was determined to be the dependent variable. The variable net income had modalities "Yes" and "No". In order to choose which independent variables will enter the model the forward stepwise selection method of the independent variables was used. The used settings in the forward stepwise selection method were the following: Tolerance=0.10; F to enter=5.00; F to remove=1.00. It turned out that, with these settings, only two indicators were statistically significant for the purpose of classification. The indicators which entered the model are C_3 (the indicator of the statistical methods use efficiency) and I_4 (the indicator of the value of the net income per used statistical methods group). The basic results of the conducted multivariate discriminant analysis are shown in Table 10.

Table 10: The basic multivariate discriminant analysis results

N=203	**Discriminant Function Analysis Summary Step 2, N of vars in model: 2; Grouping: Net Income (2 grps) Wilks' Lambda: .66844 approx. F (2,200)=49.601 p< .0000**					
	Wilks' Lambda	**Partial Lambda**	**F-remove (1,200)**	**p-value**	**Toler.**	**1-Toler. (R-Sqr.)**
C3	0.921440	0.725434	75.69711	0.000000	0.996417	0.003583
I4	0.698348	0.957179	8.94733	0.003128	0.996417	0.003583

Source: program output (Statistica 12).

The conducted multivariate discriminant analysis resulted in two classification functions:

$$CF_1 = -16.9875617147 + 30.8259442505 \cdot C_3 - 0.0000000561 \cdot I_4 \quad (14)$$

$$CF_2 = -10.5482387961 + 22.3636732897 \cdot C_3 - 0.0000002968 \cdot I_4 \quad (15)$$

The first classification function (CF_1) is given for enterprises which achieved a positive net income whereas the second one (CF_2) is given for enterprises which achieved a negative net income (loss). Depending on which classification function value is higher, the enterprise is classified in the group of enterprises which are projected to have a positive net income or in the group of enterprises which are projected not to have a positive net income. By using classification functions 86.21% of enterprises were classified into the right group. Because of this high rate it can be concluded that the model is very successful and its further use is thereby justified. Table 11 presents a summary classification table of enterprises.

Table 11: Summary classification table of enterprises

Enterprise achieved (positive) net income (real state):	Percent of correctly classified enterprises (in %)	Enterprise achieved (positive) net income (classification):	
		Yes	No
Yes	100.00	162	0
No	31.71	28	13
Total	86.21	190	13

Source: Authors' processing based on program output (Statistica 12).

Using the canonical analysis in the multivariate discriminant analysis, the following unstandardized (raw) function was obtained:

$$CA = 4.9962839427 - 4.8477962626 \cdot C_3 - 0.0000001379 \cdot I_4 \quad (13)$$

On the other hand, standardized coefficients for canonical variables are the following: for the indicator of the statistical methods use efficiency (C_3) it is equal to -0.911642 and for the indicator of the value of the net income per used statistical methods group (I_4) it is -0.360022. If absolute values of these two standardized coefficients are summed up, the resulted score is equal to 1.271664. Consequently, if an

enterprise has the canonical functions value lower than 1.271664, it will be put into the group of enterprises for which it is estimated that they will have a positive net income. As opposed to that, the value of the canonical functions higher than 1.271664 implies the estimation that an enterprise is not going to achieve a positive net income.

Because of an intuitive approach and an easier use in practice, the *E-score* indicator will be based on the unstandardized canonical function. In order to make the conclusion process easier, certain modifications to the unstandardized canonical function are going to be made. Firstly, the unstandardized canonical function is going to be, instead of to the value of 1.271664, benchmarked to the value of 0. Because of that the value of 1.271664 was deducted from the unstandardized canonical function constant value. Furthermore, the describing sides are going to be switched. In order to do that, all coefficients were multiplied by -1. Consequently, the final form of the *E-score* indicator is the following:

$$E-score = -3.7246199427 + 4.8477962626 \cdot C_3 + 0.0000001379 \cdot I_4 \quad (16)$$

If the value of the *E-score* indicator, which is a "synthetic" indicator which represents overall effectiveness of statistical methods use in an enterprise, is positive, it is anticipated that the observed enterprise, owing to the effective statistical methods use, is going to make a positive net income in the next period. Otherwise, if the value of the *E-score* indicator is negative, it is assumed that the observed enterprise is going to fail to make a positive net income in the next period because of an inefficient use of statistical methods.

5. CONCLUSION

Competition among enterprises is very high. In order to improve their competitiveness, enterprises use different tools, techniques, methods, knowledge, experience, etc. Statistical methods can also be used for improving business processes and an enterprise's competition level. Unfortunately, the problem is that many enterprises have not recognized the importance and usefulness of statistical methods use. Furthermore, only a few enterprises pay attention to the efficient use of statistical methods. In order to make the best of statistical methods use it is important that statistical methods are used with a certain aim and according to a plan. One of prerequisites for that are educated employees, especially managers who are expected to draw valid conclusions from the provided statistical methods results.

The existing research has recognized the importance of statistical methods use and the problem of scarce application of statistical methods is being emphasized. This paper is going a step further emphasizing the problem of an inefficient statistical methods use by introducing overall 11 different indicators. Each of the indicators covers a certain segment of measuring statistical methods use efficiency.

The intention was to construct such indicators which enterprises could very easily and quickly calculate on a monthly basis. Still, this was partially successful because in order to calculate the indicators certain data about statistical methods use must be known. Unfortunately, these data are not public and easily available. Because of that periodical surveys should be conducted, if possible each year, and a database should be formed so that enterprises can have an insight into some referent values and to be able to make comparisons. Consequently, the answer to the first research question is only partially positive. Namely, the introduced indicators can be used very easily but the lack of needed data and information present a serious shortcoming.

Further improvements of the indicators are needed and expected. The paper analysed 13 different statistical methods groups. However, it would be good to reconsider the conducted grouping of statistical methods. Also, in order to make things easier for enterprises and to facilitate data collection, maybe it would be good to reduce the number of statistical methods groups. Moreover, the measurement of statistical methods use benefits and costs must be improved. Because of the lack of information, only rough estimations were used in the paper.

The *E-score* indicator is introduced as a measure which shows if an enterprise is probable to achieve a positive net income in the next period due to an efficient statistical methods use or not. On that way the *E-score* indicator can be observed as a prediction tool. The conducted statistical multivariate discriminant analysis has shown that it would be the best for the *E-score* indicators to be built by only two indicators – the indicator of the statistical methods use efficiency (C_3) and the indicator of the value of the net income per used statistical methods group (I_4). The efficacy of classification of enterprises by using the *E-score* indicator is 86.21%, which could be considered as satisfactory. Consequently, the answer to the second research question is positive because the high efficacy of classification rate has shown that the system of indicators for measuring the statistical methods use efficiency level in enterprises can be used to estimate whether an enterprise is going to achieve a positive or a negative net income.

Despite a good classification rate, it has been shown that the *E-score* indicator overemphasises an enterprise's potential to achieve a positive net income. Namely, the success rate of the classification of enterprises that in reality did not have a positive net income is only 31.71%. That limitation has to be kept in mind during the interpretation of results for a certain enterprise. The reason for such underestimation of enterprises with negative net income can be found in the fact that the indicator of the statistical methods use efficiency (C_3) was approximated by ratio of total revenues and total costs. In the future research and in the future surveys the statistical methods use efficiency should be better estimated. Furthermore, the *E-score* indicator does not take into account specific characteristics of enterprises such as the size, the main activity and the legal form. Further research should take into account these characteristics and form special *E-score* indicators or indicators of statistical methods efficiency use just for them.

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