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QUANTITATIVE EVALUATION TECHNIQUE OF SME'S COMPETITIVE ADVANTAGE ON THE BASIS OF SAW METHOD

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Abstract. The paper deals with a complex quantitative evaluation of SMEs' competitive advantage on the basis of a multiple criteria evaluation technique. Creation of a system of primary evaluation criteria having different significance is emphasized; the proposed set of criteria encompasses the financial indices of performance effectiveness as well as the composite indicators of efficiency of human and material resource management. The general index reflecting the relative competitive advantage of SME must be determined when applying presented evaluation models on the basis of the *SAW* method. The suggested technique has been applied to a Lithuanian logistics enterprise. The offered system can be used in developing a complex model for the evaluation of the financial status of small enterprises.

Keywords: SMEs, competitive advantage, multiple criteria evaluation, *SAW* method, evaluation models.

JEL Classification: C02; C39; M10.

1. Introduction

The world economy has been transformed over the last decade. The Europe 2020 strategy responded to this by setting out the foundations for future growth and competitiveness. The development of entrepreneurship by increasing its competitive advantage is an important solution for enhancing economic competitiveness as well as sustainable development, especially in small open economy countries. Entrepreneurship is a powerful driver of economic growth and job creation, it makes economies more competitive and innovative. The strategic decisions of SMEs must be focused on the enhancement of competitive advantage and based on modern evaluation methods**.** This issue may be defined as an important object of scientific research.

Determinants of SMEs' competitiveness in specific areas of entrepreneurship (taking account of the international aspect) are considered in some scientific publications (Chikán 2008; Gries, Naude 2010). Other authors devote more attention to marketing management advantage in developing and implementing a competitive innovation-based strategy, also its positive impact in increasing the market share and income (Weerawardena 2003; Ma, Liao 2006; Gao 2010; Santos-Vijande *et al.* 2012). The authors reveal a significant relationship between the new opportunities emergingwith the creation of higher added value products and organizational and technological innovations, also the importance of an enterprise's sustainable competitive advantage (SCA) (Fleisher 2003; Paladino 2007; Man *et al.* 2008; McGee *et al.* 2009). Yet other articles emphasize the dynamism of both gain of markets and competitive advantage (Zahra *et al.* 2006), solutions to ensure the manifestation of synergistic effect (Simmons *et al*. 2009; Geoff *et al.* 2009).

Krisciunas and Greblikaite (2007) examine the issue on the basis of SMEs in Lithuania, identify and analyse in detail expenditures on innovations and R&D factor. It is not surprising, as in this respect even innovative SMEs in Lithuania are roughly at a medium level among the EU member states. Donate and Canales (2012) focus on an integrated knowledge strategy identifying four of its types: proactive, moderate, passive and inconsistent, because such strategies certainly have a different effect on business performance. This is linked with the so-called integrative set of critical success factors (CSFs) adapted for SMEs (Wong 2005), as well as with variation in product innovativeness dimensions (Avlonitis, Salavou 2007).

Corporate social responsibility (CSR) plays an important role in implementing a competitive strategy, especially in a small country with an open-economy. Therefore, some authors consider links between human capital and social capital in retail

trade and services sectors (Felício *et al.* 2012). Meanwhile**,** Chang and Chen (2012) generalise CSR conceptions and present an integral framework whose essence is the green intellectual capital of an enterprise.

When constructing a complex evaluation system, account must be taken of the mentioned composite determinants, which certainly have indisputable importance for the competitive advantage level of SMEs.

Undoubtedly, micro and macro factors of the business environment also affect strategic management decision-making. Therefore, forecasting of their effect must ensure the use of available opportunities and reduction of potential threats to a company. In other words, account must be taken of macro factor favourability and, on this basis, compatibility of strategic marketing decisions with their (macro factor) changes (Ginevicius *et al*. 2010).

Financial management is very important for the activities of companies, so the researchers pay attention to composition of the financial performance indicators, as well as to their measurement methods. Actually, the competitiveness of companies is based on the financial competitiveness determinants. An assessment of the financial state as well as the risks level parameters is basis for strengths recognition, and creating a competitive strategy. A commonly used methodological tool is also financial analysis that encompass computing and comparison (benchmarking) of well-known individual financial performance ratios, mostly reflecting the profitability, liquidity, asset management efficiency, state of debt management, company‘s market value. A comprehensive set of financial indices was discussed also in scientific literature (Mackevicius 2009; Kotane, Kuzmina-Merlino 2012). Unfortunately, an appropriate integrated evaluation technique has not been proposed here, thus the comparison of competing firms according to a whole of these ratios is not provided for.

Nevertheless, only few researchers make an attempt to describe the complex of essential indicators of SMEs' competitive advantage. This must be accomplished having regard to characteristics of the new European Union member states. Undoubtedly, the future evaluation methodology of overall business competitive advantage must be oriented towards the multiple criteria decision making (MCDM) methods and integration into the business control system.

The objective of the current study is to solve the problem of the complex evaluation of SMEs competitive advantage on the basis of SAW method. The analytical research findings consist in constructing of the technique for evaluation of services enterprises competitive advantage using SAW method and adequate models.

2. Main approaches to problem formalization

The principal approach of the proposed framework consists in the integrative measurement of SMEs' competitive advantage that has been performed on basis of the quantitative evaluation of its key competitiveness determinants, which, in their turn, determine a whole of essential primary factors.

Certainly, many integrated characteristics of competitiveness have stochastic nature (Tervonen, Lahdelma 2007). The present paper relies on a deterministic approach to the measurement of the investigated phenomenon and the described set of evaluation criteria; on the other hand, the quantitative evaluation technique is combined here with expert evaluation, *SWOT* analysis and the scenario method.

In fact, by means of formalization of the investigated system, a matrix expression of the general competitive advantage vector $\{C^{(M)}\}$, which describes interrelations among the integrated criteria having various directions of influence on competitive advantage, could be written as follows:

$$\{C^{(M)}\} = [A]\left[\{K\},\{L\},...,\{S\}\right], \quad (1)$$

where $\{K\}$, $\{L\}$, ..., $\{S\}$ are sub-vector expressions of integrated criteria; $[A]$ is a matrix of parameters of the direct and indirect influence of the integrated criteria on the general competitive advantage vector $\{C^{(M)}\}$.

To describe this system in respect of the application of appropriate evaluation methods, it is necessary to reflect in principle the direct and indirect influence of integrated criteria. Therefore, an Eq. (1) may be transformed into the following:

$$\{C^{(M)}\} = \begin{bmatrix} a_{11} & a_{12} & ... & a_{1n} \\ a_{21} & a_{22} & ... & a_{2n} \\ ... & ... & ... & ... \\ a_{n1} & a_{n2} & ... & a_{nn} \end{bmatrix} \begin{bmatrix} \{K\} \\ \{L\} \\ ... \\ \{S\} \end{bmatrix} \quad (2)$$

where a_{11}, a_{22}, …, a_{nn} (the diagonal elements of matrix) are the parameters of a direct influence of integrated criteria; a_{12}, a_{21}, …, $a_{nn\text{-}1}$ (the non-diagonal elements of matrix) are parameters of an indirect influence of integrated criteria on the general competitive advantage dimension; n-number of identified integrated criteria.

According to the utilitarian view, this generalised model must be adopted also for the reasoned evaluation methods which need to be developed. It is also necessary to justify a set of essential evaluation criteria. There is no doubt that a targeted analysis of applicable multiple criteria methods is a relevant part of this paper.

3. Quantitative evaluation methodology

3.1. Applicable multiple criteria methods

An available technique for quantitative evaluation of socio-economic processes can be a basis for developing the main assessment principles and models (Ginevicius *et al.* 2010). In this paper, the issue of complex evaluation of competitive advantage of an enterprise is addressed; besides, the technique is oriented to the requirement to apply a *MCDM* system when designing a competitive SME's strategy.

It should be pointed out that multiple criteria evaluation methods could be used under consideration of the criteria having multidimensional character, different directions of influence (maximizing or minimizing) and various significances (Doumpos, Pasiouras 2005; Dombi, Zsiros 2005; Ginevicius *et al.* 2008). These preconditions must be taken into consideration when selecting required evaluation methods (Zvirblis, Buracas 2012; Joksiene, Zvirblis 2014; Zvirblis *et al.* 2015; Mardani *et al.* 2016).

An analysis of the applicability of the multiple criteria methods specific for the measurement of equivalent processes shows that the approach must focus on the *SAW* as well as on the *COPRAS* and *TOPSIS* methods, which are most widespread for the purposes of assessment of identified tasks when the totality of data (alternatives) previously may be described (Peldschus 2007). The feature of the *SAW* method (Hwang, Yoon 1981) is its essential ability to join different primary indices (factors) when all factors in a system are interdependent and maximizing and to determine a generalized value. It is important to construct an adequate evaluation system on the basis of the *SAW* method. In respect of minimizing criteria, they may be easily converted into maximizing ones (by employing well-known formulas), negative values must be transformed to positive, when the smallest negative value is turned to unity (Podvezko 2011).

Another aspect is the fact that the relative criteria (indices) having various dimensions must be normalized; the best criterion value (the largest one for a maximizing criterion and the smallest one for a minimizing criterion) would get the largest value equal to unity.

A matter of importance is the fact that the significance of any criterion has to be determined, whereas the sum of significances of influence parameters with regard to the generalized competitiveness dimension amounts to 1, i.e. 100%. The significances of the criteria's influence may be determined by calculations on the basis of objective information and using the *AHP* method or by way of expert evaluation, only the most significant criteria can be revealed (Podvezko 2008). A special entropy method (while the subjective integrated weightiness has been found by pairwise comparison) for determining the integrated weightiness of criteria has been suggested by Ustinovichius (2007).

Another method, namely, the *COPRAS* method, must be applied for the evaluation of more complicated processes and opens the possibility to integrate maximizing and minimizing primary criteria (the influence of the maximizing and minimizing evaluation criteria should be assessed separately) and to determine the generalized index. This is an essential difference of this approach from the *SAW* method. Priority must be given to the application of the *COPRAS* method when considering a discrete number of decision-making alternatives arranged in the order of their preference (Zavadskas, Turskis 2011; Podvezko 2011).

When applying the *TOPSIS* method (which is based on a specific aggregation function representing 'closeness to ideal' and determines solution by the shortest distance to the ideal one and the greatest distance from the negative one (though does not consider the relative importance of these distances) based on the specific aggregation function) by comparative assessment of decision (project) making solution alternatives, vector normalization is applicable (linear normalization has been used in the *VIKOR* method). A comparative analysis of these methods has shown also priority areas of their applying (Opricovic, Tzeng 2004).

The presented analysis reveals that priority is given to application of the *SAW* method in the case evaluation of the state of system efficiency (in the case under consideration – the relative competitive advantage of a particular enterprise). This is main advantage of this method compared to classical application circumstances of multi criteria evaluation methods when, as it has been mentioned above, several alternatives are compared and evaluated by ranking of alternatives. It is expedient to use the *SAW* method when the data on only one enterprise (in the case under consideration – a specialized (small) logistics enterprise operating in Lithuania) are available. The quantitative and qual-

itative primary criteria could be encompassed by using the *SAW* method. In this case the qualitative indices could be assessed quantifiable by expert way.

On the other hand, the partially integrated criteria used for determining the general measure may be also computed by applying relevant (even different) systems (or methods). The determined value of competitive advantage shows a real situation at the time of evaluation.

3.2. Basic primary criteria groups

In order to examine the overall competitive advantage of SMEs, the relevant idiosyncratic World Economic Forum (WEF) indicators determining the global country competitiveness index (such as capacity for innovation, value chain breadth, technology absorption) can be added to the investigation of a complex of enterprise competitive advantage and may be taken into account (Bowen, Moesen 2009; The Global Competitiveness Report 2012–2013). In terms of method and technique (complex measurement construct on basis of the principles of quantitative evaluation methodology), composite indicators are generally additive ones with equally weighted influence.

It is expedient to compile criteria by their idiosyncratic groups (as partially integrated criteria in a complex evaluation system). A multitude (so-called matrix) of essential competitive advantage (primary evaluation criteria) obtained using the *SAW* method could be designed. Actually, these basic groups need to be adapted to evaluation conditions. Thus, the group (*P)* of primary quantitative financial indices of performance effectiveness first and foremost includes sales growth rate, net margin of profitability, ROA, liquidity, and solvency ratios, etc. (stock turnover ratio, dividend yield for small enterprises do not prevail). There are also included not only the traditional financial ratios, but also cash flow equilibrium, the ratio of cash flow to revenue ratio (by commonly analysis, cash flow equilibrium does not apply at all). Sales (net sales revenue) growth rate (calculated using data of an enterprise‘s profit and loss statement) should objectively determine the state of industry (mature, or emerging) and services sector conditions.

The second group is focusing on the composite competitive advantage indicators which don’t have the quantitative expression. The adaptation to influence of macro factors, financial management efficiency, use of human also material resources, extent of marketing sophistication, as well as competitiveness of production (services) primarily may be indicated. Some of them may be measured quantifiable on basis of derivative parameters, however their integrated measurement is preferred within unified dimensionless or point system. The gross operational profitability, diversification level, market share, export, spread in outsourcing, value chain breadth, CSR, ultimately the probability of bankruptcy (insolvency) also would be included independently, when identified in the case evaluation as having enlarged significance, or, for example, specific only to investigated performance in the small open economy countries.

It should be noted that the basic groups of adjustment options have been presented in order to incorporate the evaluation of other primary financial indices as well as composite non-dimensional indicators. A description of these groups can draw attention to 6–8 most important criteria. The evaluation process would also focus on changes in scripts that can be used for providing the forecasted trends of essential criteria.

3.3. Background for evaluation models

Finally, the following background model may be employed by including into a set exclusively maximizing criteria and applying the *SAW* method in order to estimate the first group index *P(I)* (as the first partially integrated criterion in the complex evaluation process):

$$P(I) = \sum_{i=1}^{i=r} a_i P_i ; \sum_{i=1}^{i=r} a_i = 1, \qquad (3)$$

where P_i is the normalized (dimensionless) value of the primary criterion (such as sales growth rate, margin of profitability, return on assets, return on investment, coverage ratio, solvency ratio, etc.); a_i is the weight coefficient of the direct impact of the primary criterion P_i on the group index *P(I); r* is the number of primary criteria determining the group index *P(I)*.

The normalized values of various financial indices may also be simply established as $P_i = p_i / p_i\,max$ (p_i – real value of appropriate financial index for the investigated enterprise; $p_i\,max$ – the maximal (highest) value of this index, for example, benchmark value for the particular sector). When the investigated enterprise has the maximal value for appropriate financial index, the normalized value of this index is equal to unity. It is purposeful to determine the weights of these primary criteria by expert ranking method, thus stressing the weight of profitability or liquidity indices. Transformation of some minimizing indices values into

maximizing must be performed by applying respective employed formulas (Podvezko 2011).

The *COPRAS* method has priority in determining the integrated criterion in the cases when both maximizing and minimizing criteria (debt ratios, etc.) are used. This allows for the ranking of comparable SMEs according to a whole of financial indices of performance. Respective evaluation models may be adopted on the basis of background expressions (see, for example, Podvezko 2011). In principle, the evaluation results obtained by the *COPRAS* method match the data yielded by the *SAW* method if using exclusively maximizing criteria and the classical normalization of primary criteria values.

The integral index *K(I)* of the second group (as second partially integrated criterion) may be defined on basis of a model:

$$K(I) = \sum_{i=1}^{i=n} b_i K_i ; \sum_{i=1}^{i=n} b_i = 1\,(100\%), \qquad (4)$$

where b_i is the weight of a direct impact of composite indicator K_i (financial management efficiency, human resource management efficiency, knowledge-based competitive strategy, extent of marketing sophistication, competitiveness of production (services), etc.) on the index *K(I); n* is the number of composite indicators, determining the group index *K(I)*.

Primary indicators K_i may be measured (by expert ranking method) as non-dimensional (when the highest score is equal to 1); the defined group index *K(I)* should also be expressed in the form of non-dimensional score. The determined score of the index *K(I)* may also be expressed in points when the primary indicators K_i have been measured in points (on a 10 or 100 point scale). The weights of indicators have been determined by expert ranking method.

The previously determined indices *P(I)* and *K(I)* is the basis for establishing the value of the general index *MF(I)* (overall score); the significance parameters of these partially integrated criteria to be allowed. An additive assessment model to be applied:

$$MF(I) = k_p P(I) + k_k K(I), \qquad (5)$$

where k_p and k_k are significance parameters (determined also by expert ranking method) of the partially integrated criteria *P(I)* and *K(I)* respectively describing the degree of their impact on the general index *MF(I),* for example, 45% and 55%. When the score of the previously determined index *K(I)* is expressed in points, it must be transformed into a dimensionless measure (the maximum score on a 10 or 100 point scale corresponds to dimensionless measure equal to 1).

The general index of relative competitive advantage of an enterprise may be determined based on evaluation models (2)–(4). When applying these models in practice, only the indices and composite indicators that are adequate for the enterprise concerned and correspond to selected impact weights must be taken into account (according to their ranking results in each specific group). It should be emphasized that the oneness of the proposed evaluation technique also suggests the application of different weights of primary financial indices and composite indicators and adequate differentiation significances of partially integrated criteria (groups of criteria).

An adequate evaluation system has been developed in the following way. At the first stage, primary criteria have been examined; whereas the composite indicators of the second group have been assessed quantifiably and also ranked by expert judgment method, its application requires a secure acceptable reliability. As regards performance of a simplified procedure of expert examination, the reliability of expert examination data has been achieved by applying well-proven methods, such as summing-up numbers (ratings) in a row, calculations of the concordance coefficient *W* as well as the concordance coefficient significance parameter χ^2 (Pearson's Chi- Square Test), etc. (see Kendall 1979). These preconditions are also important when establishing the impact weights of primary criteria as well as significance parameters of partially integrated criteria.

An algorithm of computer-generated multiple criteria evaluation process of a whole of enterprise competitive advantage is represented in Figure 1. So, the typical evaluation process (after describing the tasks of evaluation, formation of database and analysis of data) includes the consecutive procedures *A, B, C, D, E, F, G* and *H*. This algorithm is rather universal whereas can be applied when modeling (based on multivariate computations) the development of alternatives and changes of primary criteria as well as their significance parameters.

4. Case evaluation for a Lithuanian logistics enterprise

The prepared technique has been applied for assessing the relative competitive advantage for specialized (small) logistics enterprises acting in Lithuania. To estimate the general index of competitive

advantage in the case evaluation (for specific services enterprise A in 2014/2015) the adequate set of financial ratios (i.e. primary criteria) was compiled based on the primary criteria indicated in the section 3.2. The five criteria were identified by expert ranking method: the sales growth rate (with the highest weight – 0.26), further – cash flows sufficiency ratio and the traditional profitability, return, liquidity ratios (their weights see in Table 1).

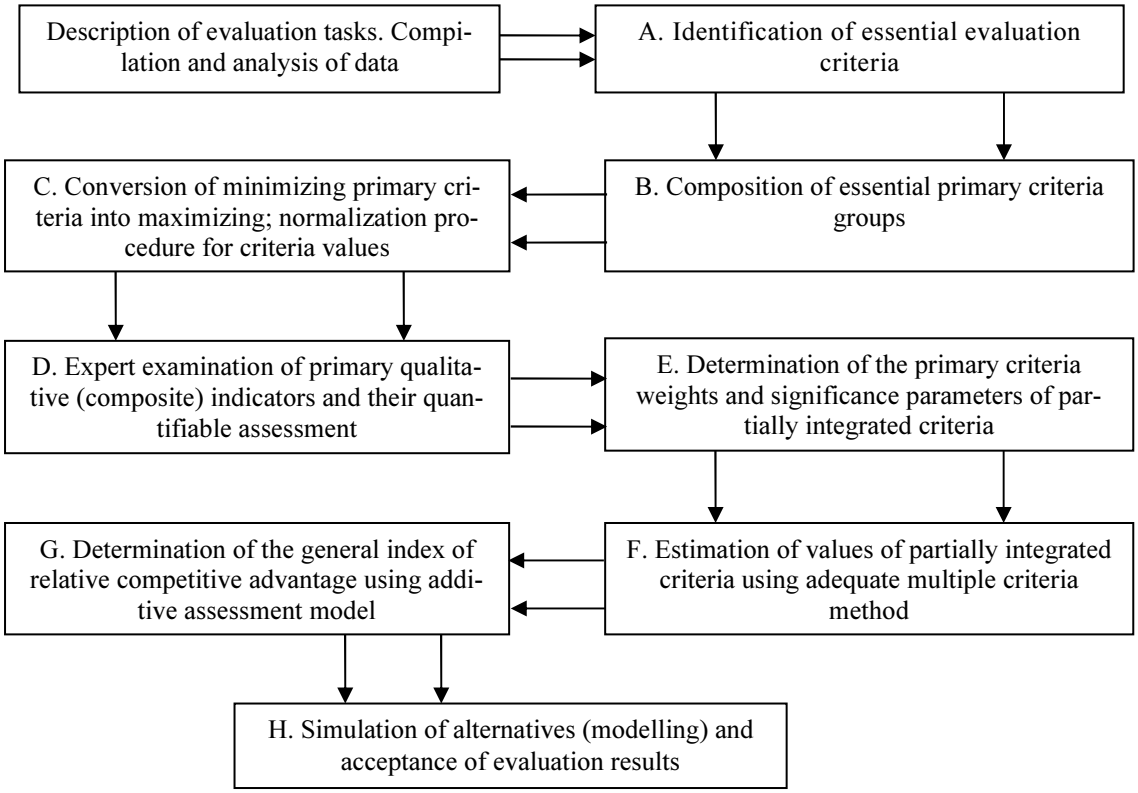

Fig. 1. Typical scheme of multiple criteria evaluation process algorithm (Source: designed by the authors)

Table 1. Expert examination of competitive advantage of the enterprise A and estimation of the general index by means of the *SAW* method (Source: designed by the authors on the basis of expert evaluation)

Primary competitive advantage	Symbol	Normalized value	Assessment in points	Weight coefficient	Significance Coefficient
First group					$k_p = 0.4$
Sales growth ratio	P_1	0.77		$a = 0.26$	
Cash flows sufficiency ratio	P_2	0.71		$a = 0.22$	
Profitability ratio	P_3	0.66		$a = 0.19$	
Liquidity ratio	P_4	0.64		$a = 0.18$	
Return ratio	P_5	0.80		$a = 0.15$	
First group index	*P(I)*	0.72			
Second group					$k_k = 0.6$
Capacity for innovation	K_1		4.7	$b = 0.28$	
Services competitiveness	K_2		5.9	$b = 0.24$	
Marketing sophistication	K_3		6.7	$b = 0.19$	
Use of intellectual resources	K_4		5.2	$b = 0.16$	
Corporate social responsibility	K_5		5.9	$b = 0.13$	
Second group index	*K(I)*	0.56	5.6		
General index	***MF(I)***	**0.624**	**6.24**		

The ranking procedure has been performed by a team of 7 experts. The consensus and the necessary reliability of identification (taking account of calculations of the applied expert opinion compatibility) has also been achieved, whereas the values of the coefficient W amount to 0.74 (usually reliability is achieved by $W = 0.7–0.8$). The parameter χ^2 in this case (the number of determinative primary criteria in the group as well as in the second group, $n \leq 7$) has also been calculated according to the access procedure (Kendall 1979). The normalized values of the identified criteria (Table 1) have been calculated according to the provision justified above.

Following the equivalent procedure, the experts have included (according to weights) in the second group of variables ($W = 0.69$) the following five composite competitive advantage indicators: capacity for innovation (the weight equals to 0.28), services competitiveness, marketing sophistication, use of intellectual resources, and CSR (the minimal weight equals to 0.13). The appropriate scores (assessed by the experts on a 10 point scale, $W = 0.72$) of the identified (essential in the case) competitive advantage indicators are shown in Table 1.

The values of partially integrated criteria have been computed on the basis of non-dimensional values of primary criteria, and their weights have been established at the second process stage (when applying the *SAW* method, the models (3) and (4) are also applied). At the last stage, the overall score of the general relative competitive advantage index has been determined (according to the model (5)) taking into account the significances of partially integrated criteria 40% and 60% respectively (assessed by experts, $W = 0.79$). Assessment results for the enterprise A have shown that the general index is equal to 0.624 (this score is equivalent to 6.24 points, Table 1).

The adopted algorithm of the proposed process (Fig. 1) may be integrated into forecasted *MCDM* systems, i.e. into a computerized support system of strategic business decisions.

The outcome of the analytical research is a framework for determining the general index as a quantitative measure of relative competitive advantage of an enterprise essentially based on multiple criteria evaluation methodology. The oneness of the evaluation technique suggested in the present paper means the following: it may be used when a particular enterprise is investigated. Simulation of different (by the stages mentioned above) conditions in specific businesses is possible by constructing an adequate system of primary evaluation criteria. The offered technique can be adopted for the purpose of evaluation of the financial status of a services enterprise.

5. Conclusions

The competitive advantage of specific enterprises and aspects of its measurement have so far been analyzed insufficiently in scientific publications. Individual finance management effectiveness indices are commonly analyzed for the purpose of evaluation of the enterprise performance. Yet, there is not enough studies dedicated to the complex assessment of business advantage, whereas the possibilities of application of quantitative evaluation methodology to evaluation of socio-economic processes are still being considered. The same could be said about business competitive advantage, as its determinants have a multidimensional character.

Certainly, with a view to applying a viable system of complex evaluation, the formalization of a whole of the factors determining efficient performance needs to be developed, therefore, in the case under consideration we must develop principles and, on their basis, also evaluation models for the purpose of complex evaluation of the competitive advantage of a particular SME using multiple criteria methods. For the purposes of application of appropriate methods, the authors have proposed to divide primary evaluation criteria characterised by different impact significances into two groups according to whether they are expressed quantitatively or only qualitatively. The first group comprises mainly financial indices of business effectiveness. The indicators of the second group reflect the efficiency of human and material resource management.

The quantitative assessment technique, which provides for the integration of separate expert evaluations of some primary criteria, should be applied when determining the general index as the overall quantitative measure of the relative competitive advantage of a services enterprise. The oneness (and advantage) of the presented evaluation technique should be pointed out: it is based essentially on the application of *SAW* method and may be used for evaluation of the competitive advantage of a particular enterprise (data on which are available).

It may also be noted that the algorithm of the computer-generated assessment process as presented in the paper can be applied when simulating the impact of trends of different indicators of SME performance effectiveness. An offered partially integrated criteria system can be used in developing a complex model for the evaluation of the financial status of small enterprises.

The prepared evaluation technique was approved by determining the general index of relative competitive advantage in specialized (small) logistics companies operating in Lithuania (thus, for the enterprise A the general index is equal to 0.624 and this score is equivalent to 6.24 points); moreover, it is applicable primarily to SMEs.

To sum up, it could be stressed that in fact, it has proved possible to develop a technique which, by applying multiple criteria evaluation methods, permits to quantitatively measure of the relative competitive advantage of SMEs. The authors have determined the general index, which is the measure of the relative competitive advantage of a particular SME and which reflects also the competitiveness of a services enterprise. This constitutes also the uniqueness of the present paper.

Even though the current study has presented several advantages, there are some limitations as well. Some composite indicators need to be determined by means of expert evaluation, which introduces a certain element of subjectivity. Thus, the following directions for future research could be identified**:** adaptation of the appropriate competitive advantage determinants and quantitative measures of the primary indices defining them, their adaptation for use in the area of application of multi criteria evaluation methodology.

Disclosure statement

The authors do not have any competing financial, professional, or personal interests from other parties.

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