



THE COMPLIANCE OF MASTER'S DEGREE STUDIES WITH THE ECONOMIC NEEDS OF THE COUNTRY

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Abstract. In the system of higher university education, Master's degree programmes of study making its second stage are of major importance. Therefore, determining the effectiveness of these programmes is a significant problem. The main factor determining Master's degree programme effectiveness is based on how well it meets the needs of state economy. As a complex phenomenon, it can be described only by a set of criteria. To determine which Master's degree programme directions satisfy the market needs better is possible only when all the above criteria are integrated into a single quantity. Multicriteria evaluation methods are most suitable for solving such problems. All the criteria significances or weights should be known in this case. In the present research, 6 directions of studies have been established, e.g. biomedicine, physical, social, technological sciences, humanities and art studies. Multicriteria evaluation has shown that the programme of art studies is the best in satisfying the needs of the state economy. It is followed by the programmes of technological, biomedicine and social sciences, as well as humanities and physical sciences.

Keywords: effectiveness of Master's degree programmes of studies, multicriteria evaluation methods.

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1. Introduction

In the three-stage system of education adopted in this country, which is aimed at providing Bachelor's, Master's and Doctor's degrees, the second, Master's degree stage, is the most important. This is because it pursues two goals (Capacities of Universities ... 2006). First, Master's degree studies are aimed at improving one's professional competence (qualification). Therefore, they should satisfy the needs of the labour market. Second, Master's degree studies are aimed at increasing general level of knowledge and scientific competence. This implies

that these programmes should not only satisfy the needs of the labour market but can be oriented to research activities. The students taking these courses may become researchers, teachers or make the career in analytical work and applied sciences.

The Master's degree studies have been provided for more than 15 years at higher (university) schools of Lithuania. On October 1, 1991 the law on research and studies, providing for the development of two-stage system of university studies in the country, was adopted. In most of the EU member-states (except for Great Britain and Ireland), the development of the above study system was started some years later (in 1999), when the Bologna process was launched. Therefore, the experience of Lithuania in this field is considerably longer than that of the most states of Central and Eastern Europe.

On the other hand, the development of Master's degree studies was rather complicated. The programmes were created spontaneously. Their relationships with basic study programmes had not been defined and their aims (associated with the problem for what type of activities the students should be trained) had not been determined. A great amount of programmes (above 500), which often duplicated each other and were obscure, were registered. Moreover, they were controversially interpreted not only by academic community, but by employers as well (The Institute of Labour ... 2003, 2004). Therefore, in 2006, a group of experts, established by the Institute of Public Policy and Management according to the contract for providing services, conducted the study 'The compliance of Master's degree programmes of studies with the needs of Lithuanian economy' (Capacities of Universities ... 2006). In addition to other problems, the integration of Master's degree students into the labour market was analysed. For this purpose, the results of the survey of these students, taking the Master's degree courses in biomedicine, physical, social, technological sciences, as well as humanities and arts were analysed. The results obtained were controversial. Some values of the criteria describing the compliance of the above programmes with the economic needs of the state were better for the studies in some fields, while others were better for other areas. Therefore, it is hardly possible to say which fields of studies are the leaders and which are lagging behind. To answer this question, the evaluation criteria used should be integrated into a single one. However, the situation is complicated by the fact that the significance of the particular criteria for the problem analysed varies considerably. The analysis of the literature on the problem shows that, in this environment, multicriteria evaluation methods are well suited for investigation (Brauers *et al.* 2007, 2008; Ginevičius and Podvezko 2008a, b; Ginevičius *et al.* 2006, 2008a, b; Kaklauskas *et al.* 2006, 2007; Ustinovichius *et al.* 2007; Viteikienė and Zavadskas 2007; Zavadskas *et al.* 2008a, b).

2. Master's degree studies in the system of Lithuanian higher education

The system of higher education in Lithuania includes two sectors – university and non-university studies (Ginevičius 2007a) (Fig. 1).

The state sector of university education embraces 10 universities and 5 academies, while the private sector includes 26 schools (Capacities of Universities ... 2006). In their activities state higher schools follow the law (statute) adopted by the Seimas (Parliament), the higher legislative body of Lithuania. According to this document, universities and academies enjoy

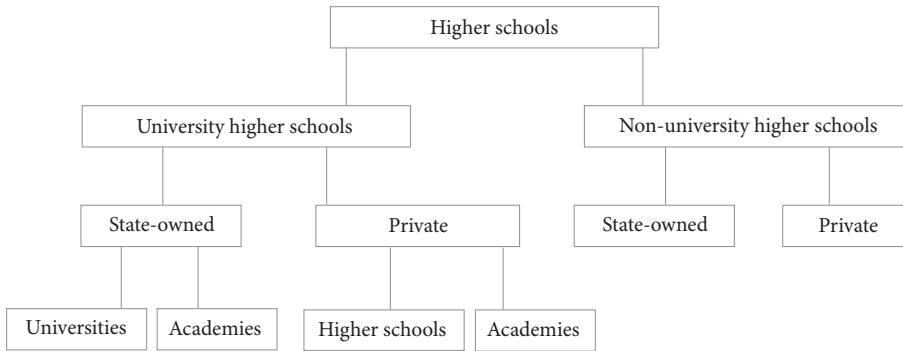


Fig 1. The system of higher education in Lithuania

the autonomy in many fields of their activities, e.g. in electing the Rector, determining the programmes of studies and their contents, spending the money earned, etc. The Conference of Rectors of Lithuanian Universities represents the interests of higher schools.

The sector of non-university higher education is represented by 32 colleges. They are mainly aimed at training specialists with higher education at intermediate level, e.g. engineers-technologists, assistants with the juridical education, etc.

Lithuania was among the countries which were the first to implement the three-stage higher education system. It was adopted in Lithuania in 1992. The above system was accepted as a model for all the EU member-states only in 2000 according to the Bologna declaration (Capacities of Universities to Implement ... 2006; Ginevičius 2007a; Valiulis *et al.* 2006; Zavadskas and Valiulis 2002). Today, the structure of higher education is of the type shown in Fig 2.

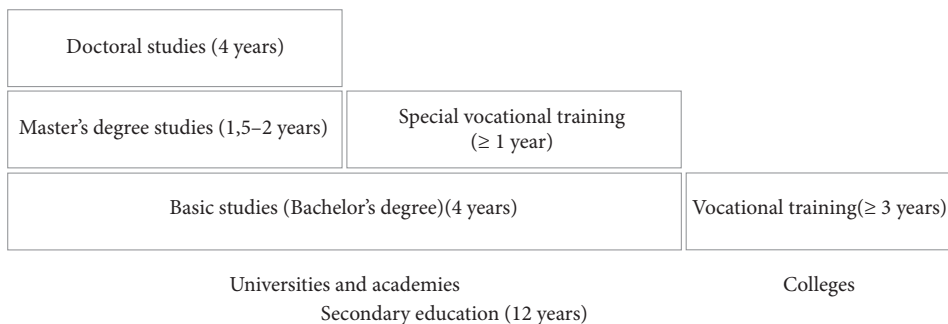


Fig. 2. The structure of higher education in Lithuania

Master's degree students make 18% of the total number of university and academy students. In some higher schools this number reaches even 40%. Therefore, its role in the system of higher university education is very important.

The Master's degree studies in Lithuanian universities are of 2 types, being aimed at extending the knowledge of students in the same field and extending their knowledge in other fields of studies (Capacities of Universities to Implement Master's Studies, 2006). In the first case, students raise their qualification in the field that they studied at the first (Bachelor's) stage. In the second case, the programmes not associated with the previous field of studies are taken.

3. Master's degree programmes of studies and economic needs

3.1. The role of Master's degree studies in the economy of the country

Two interrelated aspects are reflected in the title of the article – Master's degree studies and economic needs. Therefore, they should be defined first.

There are several definitions of Master's degree studies. In the Lithuanian law on higher education it is defined as 'the second-stage university studies aimed at raising one's professional qualification and knowledge'. This concept is extended in other documents dealing with Master's degree studies. It is stated, in particular, that 'Master's degree studies oriented to research activities and raising one's qualification in research are aimed at training the students for the researcher's or teacher's career'. Therefore, on the one hand, the aim of the Master's degree studies is to raise one's professional qualification. On the other hand, they are aimed at extending one's general and scientific competence. This implies that these studies are not always aimed at satisfying the needs of labour market.

Four main tasks of Master's degree studies may be stated (The compliance of Master's degree programmes of studies with the needs of Lithuanian economy, 2006):

Preparing the students for labour market; preparing the students for active participation in the life of democratic society; personal development; transfer and extension of the acquired knowledge. It is clear that all 4 tasks are interrelated.

The economical needs of the country may be perceived in the narrower and in the broader sense. In the narrow sense, they determine what specialists and in what fields of knowledge and skills are required for the enterprises of the state at the moment and will be required in the future. In the wide sense, the economic needs are associated with the need of various sectors of economy for growing and developing. Both definitions of economic needs have their merits and demerits (Table 1).

Therefore, in spite of the drawbacks and possible limitations of analysis, each of definitions reflects the essential aspects characterizing the need for Master's degree students. This implies that solving the problem of the compliance of Master's degree studies with the needs of economy, both definitions should be considered.

Table 1. Merits and demerits of definitions of the economic needs of the country

Economic needs of the country in the narrow sense		Economic needs of the country in the broad sense	
Merits of definition	Demerits of definition	Merits of definition	Demerits of definition
1. Allows the areas where the needs of Master's degree studies do not comply with economic needs of the country to be outlined.	<ol style="list-style-type: none"> 1. Does not take into account the fact that the graduates of Master's degree courses not only meet the needs of labour market, but also create things by founding enterprises, etc. 2. The forecast of the need for Master's degree holders requires precise information, which employers often lack. 3. The forecasts of the need for Master's degree holders are outdated before being used because the economic development is difficult to predict. 	1. Master's degree holders who founded enterprises may become employers or increase the need for other Master's degree holders by implementing innovations at the already operating enterprises and thus creating new workplaces.	<ol style="list-style-type: none"> 1. Limited possibilities of measuring the economic needs, particularly, in the field of innovations. 2. Limited possibilities of determining the proportion of innovations which are valuable and successfully applied.

3.2. The need for Master's degree holders (postgraduates) and their integration into the labour market

The analysis of the literature shows that the investigation of the problem associated with determining the need for specialists with the second degree are scarce (The Institute of Labour ... 2003, 2004). However, the compliance of the qualification of postgraduates with the needs of the state economy has not been studied in these works. The theoretical principles and model of the research are also rather obscure.

Payment is often considered to be an indicator of the need for the labour force (Dolton and Silles 2003; McIntosh 2004). It is evident that such analysis has some advantages. First, the comparison of the payment of Bachelor's and Master's degree holders shows how employers

value Master's degree studies. Second, comparing the payment of postgraduates of a particular field or direction of studies at different periods of time, it is possible to find the level of labour market saturation. Third, the comparison of Master's degree programmes is possible. In any case, payment as an indicator of the need for labour force may be used in the analysis only if the reliable data on the payment of Master's degree holders are available.

There are also other methods of determining the need for postgraduates which are widely used in the member-states of the Organization for Economic Cooperation and Development (OECD) (Dolton and Silles 2003; Sudman and Hawkey 2000). They allow us to find what specialists and in what amounts are required in particular sectors of economy without analysing all types of economic activities. The application of these methods requires the data on knowledge-based sectors of economy because only the availability of these data allows us to predict the rate of economic development.

Taking into account the statistical data which were at the disposal of the authors of the considered investigation, the methods discussed were modified and adapted to particular conditions (The compliance of Master's ... 2006; Gera and Mang 1997). Based on these data, all sectors of economy were divided in this study into several larger groups. The first group included traditional, stable and developing sectors. The second group embraced knowledge-based sectors with the highest potential for development, increasing the need for Master's degree holders. The third group included the sectors of public administration and those providing public services. The fourth group embraced large sectors, not susceptible to knowledge, which are withdrawing from the market. The fifth group consisted of small, dynamic or heterogeneous and hardly predictable sectors which could not provide the reliable data for the analysis of the need for postgraduates.

Several aspects of each sector were investigated. First, the prospects of sector development, second – the size of the sector and susceptibility to knowledge, third – the need for new employees caused by their natural turnover due to aging, and, fourth, the need for postgraduates of various programmes and competences in particular sectors of economy were analysed.

Investigation at the final stage is focussed on the problem of integration of Master's degree holders into the labour market. The first two stages may be considered as the preliminary ones compared to this final analysis.

To decide upon the method to be used in the analysis of postgraduates' integration into the labour market, the main aspects of professional integration should be considered. These may be economic, social and symbolic aspects of professional integration (Table 2) (The compliance of Master's ... 2006).

Based on the data presented in Table 2, the main aspects which can serve as the criteria describing the compliance of Master's degree studies with the economic needs of the country may be identified (Table 3).

Table 2. Structural diagram of professional integration (The compliance of Master's ... 2006)

Aspects of integration	Criteria	Empirical variables
Economic	Distribution of economic activities in particular sectors. Distribution with respect to administration and decision-making. Professional mobility. Territorial mobility.	Education level. Raising of qualification. A position held. Average income. Sector of employment. Professional career, the type of job according to the groups of professions in ISCO 88 or Lithuanian classifier of professions.
Social	The level of involvement in public life. Preferential relationships. Social capital.	Participation in organisations or groups (professional and alumni). Forms of participation. Type and structure of social relationships.
Symbolic	Perception of power and prestige. Social vision. Level of expectations.	Subjective evaluation of the position held. Individual perception of influence. Personal satisfaction.

The next step in the analysis of the compliance of Master's degree studies with the economic needs of the country is the generation of a set of evaluation criteria. This may be done based on the data provided in Table 3.

4. The criteria describing the compliance of Master's degree studies with the economic needs of the country

The problem considered in the present investigation is associated with a complex phenomenon – the compliance of Master's degree programmes of studies with the economic needs of the country. Such phenomena usually have many various aspects which can hardly be expressed by some particular criterion (Hwang and Yoon 1981). Each aspect should be identified as a particular form of the phenomenon considered. To evaluate a particular aspect and to include it in a system of units describing it in a general way, it should be expressed as a criterion. This applies to all aspects of the considered phenomenon. As a result of this procedure, a set of criteria describing the phenomenon and allowing its quantitative evaluation may be obtained.

The criteria for evaluating the compliance of Master's degree studies with the economic needs of the country were taken from a sociological study (The compliance of Master's ... 2006), which was based on the survey of 1539 postgraduates (Master's degree holders). Some of these criteria were either integrated or transformed to conform with the aims of the present investigation.

Table 3. Aspects of postgraduates' professional integration analysis (The compliance of Master's ... 2006)

Aspects of analysis	Sets of criteria used in analysis	Empirical variables
Structural	The position of Master's degree holders on labour market.	The level of unemployment among Master's degree holders. Job according to speciality acquired. Employment according to profession complying with the acquired qualification. The position held. Type of workplace. Payment. Enterprise (entrepreneurship)
Functional	Preparedness of Master's degree holders for entering the labour market.	Competence acquired in studies. Motives for entering Master's degree courses of studies. Preparedness for professional work. Paths of career. Ratio of professional competence to payment. Raising of qualification.
Assessing	Assessment of one's professional activities and preparedness for it.	Assessment of Master's degree studies. Assessment of professional activities. The potential for improving Master's degree courses. The rating of professional competence at an enterprise and labour market of Lithuania and other EU member-states. Assessment of educational, economic and social capital.

Master's degree holders refer to the segment of the most highly qualified manpower. Therefore, it is important to determine *what part of them work according to their speciality*. This criterion reflects the effectiveness of using the postgraduates' knowledge acquired in studies. This question may be answered by asking the postgraduates if they are working according to speciality acquired.

The criterion value is calculated as follows:

$$q_1 = \frac{\tilde{q}_1}{Q_1} 100, \quad (1)$$

where q_1 is work according to speciality; \tilde{q}_1 – the number of postgraduates working according to speciality; Q_1 is the total number of the postgraduates surveyed.

Another important aspect reflecting postgraduates' integration into the economic system of the country is *their ability to perform the work matching their qualification*. In the ideal case, postgraduates should get the positions corresponding to the highest, i.e. the fourth qualification level according to ISCO 88. It is defined by studies which began at the age of 17 or 18, continued for 3, 4 or more years and were completed with a university or further education degree. This criterion is calculated in this way:

$$q_2 = \frac{\tilde{q}_2}{Q_1} 100, \quad (2)$$

where q_2 is the work according to ISCO 88; \tilde{q}_2 – the number of postgraduates working according to ISCO 88; Q_1 – the total number of the postgraduates surveyed.

One more important criterion of postgraduates' structural integration into the labour market is *the work of postgraduates at various types of workplaces*. Based on the data elicited from the postgraduates, they mainly work at 3 types of workplaces: at business enterprises, public management or public services providing enterprises as well as research and (or) academic institutions and research institutes. A small part of postgraduates are employed at other institutions (e.g. non-governmental organizations, etc.). Based on the data obtained in the survey, 3 types of workplaces were accepted as the criterion sought – business enterprises, public management or public services providing enterprises and research and (or) academic institutions or research institutes. The criterion was calculated as follows:

$$q_3 = \frac{q_3^I + q_3^{II} + q_3^{III}}{Q_1} 100, \quad (3)$$

where q_3 is work at various types of workplaces; q_3^I – the number of postgraduates working at business enterprises; q_3^{II} – same for public management or services providing enterprises; q_3^{III} – same for research and (or) academic institutions or research institutes; Q_1 is the total number of the postgraduates surveyed.

The 4 criterion shows how *Master's degree studies facilitated postgraduates' professional integration (functional approach)*. As the survey shows, the competence in various areas acquired in studying helps postgraduates to climb up the career steps, etc. In the present analysis, 5 types of competence were considered (The compliance of Master's ... 2006). The first is referred to as the *creator's* competence. It reflects the potential of a Master's degree holder to develop new knowledge and skills and/or to implement the original ideas. The second one, called the *analyst's or researcher's* competence, reflects the skills to solve non-typical problems in the new or unknown environment by using the knowledge of several subjects. The third one, referred to as the *decision maker's or leader's* competence reflects the skills to integrate knowledge and control complicated situations as well as making decisions not having all the information and control implicated situations as well as making decisions not having all the information and following the main ethical principles. The fourth type of competence referred to as the *communication* competence reflects the skills of knowledge transfer as well as explanation of decisions and their causes to ordinary public and specialists.

The fifth competence is associated with *self-perfection* and reflects skills to choose the area of development and to continue studies on one's own.

The respondents (postgraduates) assessed in per cent each competence. It follows that, in the ideal case, the total number of 500 competences could be obtained. In this case, the criterion sought is calculated as follows:

$$q_4 = \frac{\sum_{j=1}^5 k_j}{500}, \quad (4)$$

where q_4 is the acquired qualification; k_i – the level of the i -th competence, in per cent.

The 5 criterion is associated with *preparedness for professional activities*. It is calculated by the formula:

$$q_5 = \frac{\tilde{q}_5}{Q} 100, \quad (5)$$

where q_5 is preparedness for professional activities; \tilde{q}_5 – the number of postgraduates positively assessing their preparedness; Q – the total number of postgraduates surveyed.

The 6 criterion is referred to as *functionality of Master's degree studies from the perspective of professional activities*. It is determined as follows:

$$q_6 = \frac{\tilde{q}_6}{Q} 100, \quad (6)$$

where q_6 is functionality of Master's degree studies from the perspective of professional activities; \tilde{q}_6 – the number of graduates positively assessing the functionality of their studies from the perspective of professional activities; Q – the total number of postgraduates surveyed.

The 7th criterion reflects *the adequacy of work payment to professional competence of postgraduates*. It is related to functionality of studies and is expressed in this way:

$$q_7 = \frac{\tilde{q}_7}{Q} 100, \quad (7)$$

where q_7 is the criterion of adequacy of work payment to professional competence of postgraduates; \tilde{q}_7 – the number of postgraduates positively assessing the issue; Q – the total number of postgraduates surveyed.

The 8th criterion describes the *motives for entering Master's degree courses of studies*. They were different and included competence level, qualifications, thirst for knowledge and acquiring of speciality as well as higher education, diploma, career, the selection of a new field, prestige, value, advantages, etc. All these motives can be divided into 2 groups. The first group embraces the motives making the basis for those of the second group, while the latter includes the motives following from those found in the first group. The first group may include the level of competence, qualification and thirst for knowledge and acquiring of speciality. They make the basis of the above criterion expressed as

$$q_8 = \frac{\tilde{q}_8}{Q} 100, \quad (8)$$

where q_8 is the criterion describing the motives for entering Master's degree courses of studies; \tilde{q}_8 – the number of postgraduates indicating competence level, qualification, thirst for knowledge and acquiring of speciality as their motives for taking Master's degree courses; Q – the total number of postgraduates surveyed.

The 9th criterion shows if *postgraduates* think that their *professional competence is higher than, equal to or lower than that of similar specialists* working at the same enterprise, in *Lithuanian market or the European Union member-states*. Lithuania is the EU member-state, therefore the problem of competitiveness at international level is acute for it. The same applies to its specialists. If Lithuanian postgraduates are competitive in international markets, they will be competitive in the local market as well. Therefore, the criterion is based on competence on the international scale and expressed as

$$q_9 = \frac{\tilde{q}_9}{Q} 100, \quad (9)$$

where q_9 is competence of postgraduates compared to that of the EU specialists; \tilde{q}_9 – the number of postgraduates positively assessing their competence compared to that of the EU specialists; Q – the total number of respondents.

Further analysis is based on determining the compliance of Master's degree programmes of studies with the economic needs of the country, taking into account the particular areas of studies and research. Most of the respondents completed the Master's degree programmes in social sciences (47.2%), technological sciences (25.0%), biomedicine sciences (10.7%), humanities (6.8%), physical sciences (5.7%) and arts (4.3%) (The compliance of Master's degree programmes of studies with the needs of Lithuanian economy, 2006). Based on this, the above 6 areas of studies and research were chosen as the investigation objects. The data on them and all 9 evaluation criteria were taken from the earlier performed study (The compliance of Master's degree programmes of studies with the needs of Lithuanian economy, 2006) (Table 4). As shown in the table, some areas of studies and research have the leading positions according to one group of criteria, while others – according to another group of criteria. A general view may be obtained by integrating all the criteria into a single one. This may be achieved by using multicriteria evaluation methods (Brauers and Zavadskas 2006, 2008; Ginevičius 2007b, c; Peldschus 2008; Zavadskas and Turskis 2008; Turskis 2008; Turskis *et al.* 2009; Zavadskas *et al.* 2007, 2008c).

5. Multicriteria evaluation of the compliance of Master's degree studies and research areas with the needs of economy

Multicriteria evaluation methods are based on 2 matrices: the matrix of criteria describing the compared objects, statistical data or expert estimates $R = \|r_{ij}\|$ and the vector $\Omega = \|\omega_i\|$ ($i = 1, \dots, m$); ($j = 1, \dots, n$) of the criteria weights (significances), where m is the number of criteria and n is the number of the objects being compared (in this case, the areas of Master's degree studies and research). The aim of multicriteria evaluation is to rank the considered objects in respect of the research task.

In multicriteria evaluation, the methods SR (sums of ranks) and SAW (Simple Additive Weighting) are used.

Table 4. The data obtained in postgraduates' survey

No	Criteria (areas of studies and research)	Work according to speciality, %	Work according to ISCO 88, %	Type of workplace according to the completed Master's degree programme	Competence acquired	Preparedness for professional activities	Functionality of Master's degree studies from the perspective of professional activities	Correspondence between work payment and the acquired professional competence	Motives for taking Master's degree courses	The equivalence of the qualification acquired to that of other employees working in the same area
1.	Biomedicine	82.3	83.0	95.2	0.711	82.3	63.4	31.1	28.5	12.1
2.	Art	78.5	73.8	95.5	0.726	80.0	64.6	33.8	61.5	16.9
3.	Technological sciences	71.1	82.0	95.6	0.674	76.7	47.1	49.0	47.4	13.3
4.	Social sciences	70.6	80.6	94.0	0.703	68.2	52.7	44.5	42.4	11.1
5.	Physical sciences	70.3	83.5	90.7	0.616	60.5	44.0	44.0	46.2	13.2
6.	Humanities	64.8	79.0	93.3	0.724	68.6	55.3	29.5	47.6	12.4

Table 5. Normalized data on postgraduates' survey

No	Criteria (areas of studies and research)	Work according to speciality, %	Work according to ISCO 88, %	Type of workplace according to the completed Master's degree programme	Competence acquired	Preparedness for professional activities	Functionality of Master's degree studies from the perspective of professional activities	Correspondence between work payment and the acquired professional competence	Motives for taking Master's degree courses	The equivalence of the qualification acquired to that of other employees working in the same area
1.	Biomedicine	0.188	0.172	0.169	0.171	0.189	0.194	0.134	0.104	0.153
2.	Art	0.180	0.153	0.169	0.175	0.183	0.197	0.146	0.225	0.214
3.	Technological sciences	0.162	0.170	0.169	0.169	0.176	0.144	0.211	0.173	0.168
4.	Social sciences	0.161	0.167	0.167	0.169	0.156	0.161	0.192	0.155	0.141
5.	Physical sciences	0.161	0.173	0.161	0.149	0.139	0.135	0.190	0.169	0.167
6.	Humanities	0.148	0.163	0.165	0.174	0.157	0.169	0.127	0.174	0.157

Table 6. Multicriteria evaluation of the compliance of Master's degree studies and research areas with the economic needs of the country based on the sum of ranks

No	Criteria (areas of studies and research)	Work according to speciality, %	Work according to ISCO 88, %	Type of workplace according to the completed Master's degree programme	Competence acquired	Preparedness for professional activities	Functionality of Master's degree studies from the perspective of professional activities	Correspondence between work payment and the acquired professional competence	Motives for taking Master's degree courses	The equivalence of the acquired qualification to that of other employees working in the same area	Sum of ranks	Total
7.	Biomedicine	1	2	3	3	1	2	5	6	5	28	3
8.	Art	2	6	2	1	2	1	4	1	1	20	1
9.	Technological sciences	3	3	1	5	3	5	1	3	2	26	2
10.	Social sciences	4	4	4	4	5	4	2	5	6	38	5
11.	Physical sciences	5	1	6	6	6	6	3	4	3	40	6
12.	Humanities	6	5	5	2	4	3	6	2	4	37	4

7 Table. Weights (significances) of the criteria describing the compliance of Master's degree studies and research areas with the economic needs of the country

Criterion	Work according to speciality, %	Work according to ISCO 88, %	Type of workplace according to the completed Master's degree programme	Competence acquired	Preparedness for professional activities	Functionality of Master's degree studies from the perspective of professional activities	Correspondence between work payment and the acquired professional competence	Motives for taking Master's degree courses	The equivalence of the acquired qualification to that of other employees working in the same area	Total
Criterion weight (significance)	0.104	0.137	0.088	0.163	0.132	0.108	0.119	0.102	0.047	1.0

In the method SR, the criterion V_j is calculated by the following formula (Ginevičius and Podvezko 2008a):

$$V_j = \sum_{i=1}^m m_{ij}, \tag{10}$$

where m_{ij} is the rank of the i -th criterion for j -th object.

A method SAW may be successfully used for quantitative multicriteria evaluation (Ginevičius and Podvezko 2007; Ginevičius *et al.* 2008a, b; Hwang and Yoon 1981; Shevchenko *et al.* 2008). The criterion of this method S_j is the sum of the weighted normalized values of the criteria:

$$S_j = \sum_{i=1}^m \omega_i \tilde{r}_{ij}, \tag{11}$$

where ω_i is the weight of i -th criterion; \tilde{r}_{ij} – normalized value of i -th criterion for j -th object.

In SAW method, ‘classical’ normalization technique is used (Ginevičius and Podvezko 2007; Ginevičius 2008):

$$\tilde{r}_{ij} = \frac{r_{ij}}{\sum_{j=1}^n r_{ij}}, \quad (i = 1, \dots, m; j = 1, \dots, n; \sum_{j=1}^n \tilde{r}_{ij} = 1). \tag{12}$$

The largest value of the criterion S_j is the best.

Normalized values of the criteria describing the areas of Master’s degree studies and research are given in Table 5.

The ranks given to particular areas of Master’s degree studies and research based on particular criteria, which were calculated by formula (10), are presented in Table 6.

Weights of the criteria ω_i were determined based on experts’ judgements; therefore, the agreement of their estimates should be checked. This may be performed by using the concordance coefficient W and the criterion χ^2 determined by the formulas (Bardauskienė 2007; Kendall 1970; Podvezko 2007; Zavadskas and Vilitienė 2006):

$$W = \frac{12 S}{r^2(m^3 - m)}, \tag{13}$$

$$\chi^2 = Wr(m-1) = \frac{12 S}{rm(m+1)}, \tag{14}$$

where S is the sum of squared deviations of the criterion values from the mean rank of experts; r – the number of experts; m – the number of criteria.

The calculated values of the concordance coefficient W and the criterion χ^2 are 0.33 and 23.73, respectively. Critical value of χ^2 taken from the distribution table with the degree of freedom $\nu = 9 - 1 = 8$ and the significance level $\alpha = 0.05$ is equal to 15.51. Therefore, the calculated value of χ^2 is larger than the critical value ($23.73 > 15.51$), implying that the experts’ estimates are in agreement.

Based on the harmonized expert judgements, the weights of the criteria describing the compliance of Master's degree studies with the economic needs of the country were determined (Table 7).

Given the values (Table 5) and significances (Table 7) of the above criteria, multicriteria evaluation of Master's degree studies with the economic needs of the country may be performed. The results obtained are given in Table 8.

Table 8. The results obtained in multicriteria evaluation of the compliance of the Master's degree studies and research areas with the economic needs of the country by the SAW method

Area of Master's degree studies and research	Biomedicine	Art	Technological sciences	Social sciences	Physical sciences	Humanities
The results obtained in multicriteria evaluation by the SAW method	0.1655	0.1789	0.1709	0.1651	0.1596	0.1598

The priority order of the areas of Master's degree studies and research according to their compliance with the economic needs which was established by using the methods of the sum of ranks and SAW are presented in Table 9.

Table 9. Multicriteria evaluation of the compliance of the areas of Master's degree studies and research with the economic needs of the country

Area of Master's degree studies and research	Biomedicine	Art	Technological sciences	Social sciences	Physical sciences	Humanities
The rank obtained by using the method SR (sum of ranks)	3	1	2	5	6	4
The rank obtained by using SAW method	3	1	2	4	6	5
Total rank	3	1	2	4-5	6	4-5

Based on the data presented in Table 9, a conclusion may be drawn that the results obtained are rather similar irrespective of the evaluation method used. However, the method SAW is more accurate because it takes into account both the criteria values and weights. As shown in Table 9, art studies are the best in satisfying the needs of the state economy, while physical studies are the worst in this respect.

6. Conclusion

Recently, Master's degree courses of studies in Lithuania have been rapidly expanding. Therefore, the question arises to what extent their programmes satisfy the economic needs of the country. This may be determined only if the criteria describing their compliance with economic demands are available. Based on the data obtained in a survey of postgraduates (Master's degree holders) and employers as well as the study of literature on the problem, the following 9 criteria were defined: work according to speciality; work according to ISCO 88; type of workplace according to the completed Master's degree programme; acquired competence; preparedness for professional activities; functionality of Master's degree studies from the perspective of professional activities; adequacy of work payment to professional competence of postgraduates; motives for entering Master's degree courses of studies; competence of postgraduates compared to that of the EU specialists.

The problem of compliance of Master's degree study programmes with the economic needs of the country is complicated, therefore, for quantitative evaluation of the compliance of particular areas of studies and research, multicriteria evaluation methods should be used. They allow us to compare multidimensional criteria and to determine their weights.

Multicriteria evaluation has shown that art studies are the best in meeting the needs of the state economy. They are followed by technological, biomedicine, social sciences, as well as humanities and physical sciences.

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MAGISTRANTŪROS ATITIKTIS ŠALIES ŪKIO POREIKIAMS

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Santrauka

Aukštojo universitetinio mokslo sistemoje ypatingas vaidmuo tenka antrajai jo pakopai – magistrantūrai, todėl svarbi problema yra jos efektyvumas. Esminis efektyvumo rodiklis yra magistrantūros atitiktis šalies ūkio poreikiams. Ją apibūdinti galima tik daugeliu rodiklių, nes tai yra sudėtingas kompleksinis reiškinys. Apibendrintai pasakyti, kuri magistrantūros studijų kryptis geriau atitinka rinkos poreikius, o kuri blogiau, galima tik visus minėtus rodiklius sujungus į vieną dydį. Tokiems uždaviniams spręsti gerai tinka daugiakriteriniai metodai. Juos taikant reikia žinoti lyginamąsias visų rodiklių reikšmes ir svorius. Tiriant buvo nustatytos šešios studijų kryptys – biomedicina, fiziniai, socialiniai, technologiniai, humanitariniai mokslai ir meno studijos. Daugiakriterinės analizės rezultatai parodė, kad šalies ūkio poreikius geriausiai atitinka meno studijos. Po jų eina technologiniai, biomedicinos, socialiniai ir humanitariniai bei fiziniai mokslai.

Reikšminiai žodžiai: magistrantūros efektyvumas, daugiakriteriniai vertinimo būdai.

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