6. THE FUTURE OF FACILITIES MANAGEMENT IN LITHUANIA

Willem Karel M. BRAUERS[1]
Edmundas Kazimieras ZAVADSKAS[2]
Natalija LEPKOVA[3]

Abstract

This article presents a facilities management sector analysis and future forecast for Lithuania. The analysis was made in two stages: in 2003 and 2016. Since 2003, the date of the previous research study on facilities management, many changes have occurred in the economy of Lithuania, due to its accession to the European Union on May 1, 2004. In particular, the facilities management sector changed from a non-tradable to an internationally tradable sector, accompanied by the entrance of firms working at the European Union level. This means that traditional firms would have a price level problem, solved either by assuming the fidelity of existing clients or by lowering the quality of their services. The Ameliorated Nominal Group Technique was applied in this study. In addition to comparisons, a multi-objective optimization method helped to obtain a ranking of effectiveness of the firms offering facilities management. Therefore, the MULTIMOORA method is preferred, given its superiority to other methods. The final ranking of preference for the facilities sector in Lithuania is presented in this article. The future of facilities management in Lithuania is outlined. The main conclusions of the article are based on research conducted.

Keywords: facilities management, Ameliorated Nominal Group Technique, MULTIMOORA

JEL Classification: C15, C61, E17, L5

1. Introduction

The current European definition of facility management (FM; presented in EN 15221-1: 2006) states that FM is “an integration of processes within an organisation to maintain

[1] *University of Antwerp, Faculty of Applied Economics, Antwerpen, Belgium. E-mail: willem.brauers@uantwerpen.be.*

[2] *Corresponding author. Vilnius Gediminas Technical University, Civil Engineering Faculty, Department of Construction Technology and Management, Vilnius, Lithuania. E-mail: edmundas.zavadskas@vgtu.lt.*

[3] *Vilnius Gediminas Technical University, Civil Engineering Faculty, Department of Construction Economics and Property Management, Vilnius, Lithuania. E-mail: natalija.lepkova@vgtu.lt .*

and develop the agreed services which support and improve the effectiveness of its primary activities" (EN 15221-1:2006). This European standard, EN 15221-1, provides relevant terms and definitions for the area of facilities management. It also provides insight into the scope of facilities management. Facilities management is a term which is closely associated with building management. More broadly, facilities management should not only be understood as general building management connected with everyday building operation, but it should also include long-term planning and focus on its users (Potkany, Vetrakova and Babiakova, 2015).

In facilities management, services are frequently categorised either as hard or soft. Hard services generally refer to building-related practices, such as maintenance, systems operation, energy management and landscaping, and are sometimes referred to as 'bricks and mortar'. By contrast, soft services are typically more people-related and involve practices such as cleaning, catering, reception, laundry, linens, ward housekeeping and portering (Klungseth and Blakstad, 2016).

The responsibility of an FM organization is to manage the services required for a core business. To ensure that those services meet appropriate quality standards and add value to the core business, the FM organization must have ample knowledge of the individual services (Klungseth and Blakstad, 2016). FM plays roles at normative, strategic and operational levels. FM adds value to an organisation while fulfilling non-core business tasks of clients. It is also involved in the management of systems, maintenance and service processes (Leiblein et al., 2016).

FM can achieve continuous improvements in building performance through low- and/or no-cost maintenance strategies, retrofits and commissioning, together with proactive operational control and maintenance (Min, Morgenstern and Marjanovic-Halburd, 2016).

Facilities management has developed extensively in the last ten years. FM has become more miscellaneous and flexible; it is more polarized towards the wishes and requirements of purchasers. Therefore, today, facilities management covers old 'traditional' ranges and absolutely new ranges, which are sometimes strongly related to FM (Maliene, Alexander and Lepkova, 2008; Lepkova and Ūselis, 2013).

Facilities management is a type of contract for services provision, which covers an extremely wide field of activities. Facilities management encompasses workplace, facilities, support services, property, corporate real estate, and infrastructure. In general, support services concerning FM range from building operational services, to construction management and real-estate activities (Ancarani and Capaldo, 2005; Chotipanich, 2004; Lepkova and Ūselis, 2013). A very important consideration in the facilities management field is the customer's satisfaction with the services provided (Lepkova and Ūselis, 2013).

The facilities sector in Lithuania provides the following services:

- Acquisition, leasing or renting existing buildings;
- Management of buildings, which is a multifunctional service. This means that all supervision, maintenance and repair are included in the sector.

In the past, the facilities sector was a very small sector in Lithuania, composed of a limited number of small firms, which even performed other tasks outside of facilities management, such as waste management. Nowadays, there are around 200 big

companies in addition to the small ones. They have also become more specialized, meaning that waste management is divided into a small number of firms.

In theory, the facilities sector could include the entire management of corporate real estate. This means effective management, which is called the fifth resource. Indeed, in a report by The Industrial Development Research Foundation of the United States, corporate real estate assets are indicated as a fifth resource, after the resources of people, technology, information and capital (McGregor and Shiem-Shim Then, 1999).

No official statistics on facilities management exist in Lithuania. Therefore, this research is based on projections for 2012 as shown by the Ameliorated Nominal Group Technique (Brauers and Lepkova, 2003) and the policy regarding the amortization of buildings.

2. The Ameliorated Nominal Group Technique

2.1 A Justification for Using the Ameliorated Nominal Group Technique

Committees or round-table discussions are not very suitable for the discussion of very broad issues (Quade, 1970). Quade says that "In broad problems, the range of expertise required is not likely to be provided by a single individual"; rather a variety of experts is needed. Nevertheless committees fail because:

- Opinions of dissenters are sometimes not recorded;
- "Bandwagon" effects – just following the leader – are produced;
- There is an unwillingness to abandon publicly expressed opinions.

Rather, it is necessary "to provide a setting in which pros and cons of an issue can be examined systematically and dispassionately". Brainstorming may help.
Jantsch (1967, p.136) gives the following basic rules for brainstorming sessions:
"1. State the problem in basic terms, with only one focal point;

2. Do not find fault with, or stop to explore, any idea;
3. Reach for any kind of idea, even if its relevance may seem remote at the time;
4. Provide the support and encouragement which are so necessary to liberate participants from inhibiting attitudes."

In any case, an efficient reporting system is necessary to memorize the ideas (stenography or recording). In general, brainstorming is insufficient for tackling broad problems and for obtaining judgmental data. Indeed, opinions can be too divergent for a consensus to be reached. Brainstorming must be considered too simplistic and too naive for tackling broad problems or for obtaining judgmental data. Brainstorming is valuable for obtaining a first approximation to find a complete set of objectives. If experts represent all stakeholders for a certain issue, the results remain rather fuzzy, unless an Ameliorated Nominal Group Technique is used.

The Ameliorated Approach of the Nominal Group Technique, which is explained here, was ameliorated by Brauers (1987, 1980, 2004; Brauers and Zavadskas, 2010a) but

the Nominal Group Technique was first elaborated by Van de Ven and Delbecq (1971), followed by different additional studies (Delbecq et al., 1975; 1983, 1986; Gill, Delbecq and Snodgrass, 1981; Gill et al., 2012, 2014; Tong et al., 2016). Gill et al. (2012, 2014) extended the use of the Nominal Group Technique to measure the quality of care of children in primary care.

2.1.1 The Original Nominal Group Technique

The Nominal Group Technique consists of a sequence of steps, each of which has been designed to achieve a specific purpose.

1) The steering group or the panel leader carefully phrases the problem to be researched as a question. Much of the success of the technique hinges around a well-phrased question. Otherwise, the exercise can easily yield a collection of truisms and obvious statements. A successful question is quite specific and refers to real problems. The question must have a singular meaning and, as often as possible, a quantitative form.
2) The steering group or the panel leader explains the technique to the audience. This group of participants is asked to generate and write down ideas about the problem under examination. These ideas also have to have a singular meaning and, as much as possible, a quantitative form. Participants do not discuss their ideas with each other at this stage. This stage lasts between five and twenty minutes.
3) Each person, in round-robin fashion, produces one idea from his own list and eventually gives further details. Other rounds are organized until all ideas are recorded.
4) The steering group or the panel leader will discuss with the participants the overlapping ideas and the final wording of the ideas.
5) The nominal voting consists of the selection of priorities, rated by each participant separately, while the outcome is the totality of the individual votes. A usual procedure consists of the selection of the n best ideas from his point of view by each participant, with the best idea receiving n points and the lowest idea receiving the lowest points. All the points of the group are added up. A ranking is the democratic result for the whole group.

The Original Nominal Group Technique can be characterized as weakly robust if the participants express too much of their personal feelings. Amelioration was proposed for that reason.

2.1.2 The Ameliorated Nominal Group Technique

As there was much wishful thinking, even among experts, better results were obtained when the group was also questioned about the probability of occurrence of the event. In this way, the experts became more critical even about their own ideas. The probability of the group is found as the median of the individual probabilities.

Finally, the group rating (R) is multiplied with the group probability (P) in order to obtain the effectiveness rate of the event (E):

$$E = R \times P \quad (1)$$

Once again, the effectiveness rates of the group are ordered by ranking. One may conclude that the Ameliorated Nominal Group Technique is more robust than the

Original Nominal Group Technique. In our research, it is clear that the Ameliorated Nominal Group Technique concerns the search for a complete set of representative and robust objectives and sub-objectives.

2.2 Facilities Management Approached using the Ameliorated Nominal Group Technique

A group was formed at the Vilnius Gediminas Technical University to study the impact of the facilities sector on the general well-being of Lithuania, considering possible economic, technical, political, social, medical and other events for the period 2003–2012.

In theory, all the stakeholders had to be involved in the Ameliorated Nominal Group Technique for Facilities Management; i.e., the sector representatives, the government services involved, a delegation of the employees and, finally, the consumers. Given the small size of firms concerned, no trade unions were present. In addition, at that time no representative consumer union existed in Lithuania. A delegation from the academic world (i.e., specialists in the field) was assumed to represent general well-being. Further delegations came from the facilities sector itself and, finally, from the ministerial departments concerned; altogether, 15 persons were involved (Brauers and Lepkova, 2003).

The steering group was composed of Prof. Dr. W.K.M. Brauers and Assoc. Prof. Dr. N. Lepkova. The panel leader directing the exercise was Prof. Dr. Brauers. Each participant chose the five most important events from his/her point of view, with the most important event receiving five points, the next most important receiving four points and so on to the least important event which received one point. The members of the steering group did not participate in the voting. The outcome is shown in Table 1.

Table 1

Important Events Influencing the Business Outlook of the Facilities Sector of Lithuania over the Period 2003-2012 (Ranked by Importance)

	Events 2003-2012	Given Points R	Rank	Median Probabilities P	E=RxP	Final rank
1	Member of the European Union	37	1	0.75	27.75	1
2	Large increase in foreign capital	20	2	0.75	15	2
3	More competition between facilities management companies	16	3	0.88	14.08	3
4	Large increase in GDP	16	3	0.75	12	4
5	New materials and technologies	12	6	0.75	9	5
6	Stability in international security	14	5	0.50	7	6
7	Higher quality in building construction	8	11	0.75	6	7
8	Application of new information technologies to facilities management	9	9	0.63	5.67	8
8	More relations with foreign companies having more experience in facilities management	9	9	0.63	5.67	8
10	Better legislation in supervision sector	11	7	0.5	5.5	10

	Events 2003-2012	Given Points R	Rank	Median Probabilities P	E=RxP	Final rank
11	Optimal quality-price relation for services	7	13	0.75	5.25	11
12	Better public estimation of facilities management	8	11	0.63	5.04	12
13	Increase in the cost of living	10	8	0.50	5	13
14	Positive influence of the laws in favour of facilities management	6	16	0.75	4.5	14
15	Higher qualifications of the staff in facilities management	5	20	0.75	3.75	15
16	Change taxation for buying and selling property	7	13	0.50	3.5	16
17	Higher demand for construction	6	16	0.50	3	17
17	Higher level of education	6	16	0.50	3	17
19	International exchanges between students in facilities management	7	13	0.25	1.75	19
20	Increase in industrial sector and decrease in agricultural sector	6	16	0.25	1.5	20
21	Improvement of sanitary services	4	21	0.25	1	21
22	Increase in individual property of housing	1	22	0.25	0.25	22
	Total Points	**225**			**145.21**	

The use of probabilities of realization, introducing a sense of reality and presenting a guaranty against wishful thinking, produces many changes in the rankings.

The total 225 is a control figure for the group result. Indeed, each participant could distribute a maximum of 15 points (5+4+3+2+1). With 15 participants, the total could not be more than 225. It could be less, as each participant is not obliged to allot the full 15 points. Here, the total of the given points, 225, means that each participant used his/her rights completely. A reality check, however, diminishes this figure to 145.21.

The results of the Nominal Group Technique by a group of people especially knowledgeable about the facilities sector are extremely interesting.

The criterion 'Member of the European Union' (ranked first) refers to the opening of the market to other countries of the European Union, with a change in the facilities sector from a non-tradable to an internationally tradable sector. Indeed, in between European firms moved to Lithuania and some of the Lithuanian firms started operating in other countries of the European Union. Consequently, the experts on the Nominal Group Technique ranked second a large increase in foreign capital, ranked fourth a large increase in Gross Domestic Product, ranked sixth more stability in international security, and ranked third more competition between facilities management companies.

New materials and technologies (Rank 5), higher quality in building construction (Rank 7), application of new information technologies and more relations with foreign companies having more experience in facilities management (Rank 8) are, for instance, illustrated when the problem of shortening the amortization period is discussed.

3. The Policy on Amortization of Buildings

In Lithuania, the average lifetime of a stone building is considered to be 100 years (STR. 1.12.06: 2002). This explains why much importance is given to renovation instead of complete demolition; for instance, the replacement of old walls and windows (Kracka, Brauers and Zavadskas, 2010), resolving energy losses and maintaining old buildings from Soviet times; i.e., from before 1990 (Brauers, Kracka and Zavadskas, 2012).

There is a difference between the technical lifetime of a building and its economic lifetime. The technical lifetime of a building is a function of its demolition by the owner or by the authority for reasons of hygiene, urbanism, etc.

The economic lifetime of a building in Western Europe is considered to be 50 years. Fiscally, this would mean a depreciation cost of 2% per year. After 50 years, if there is a remaining value, it will be taxed by the government as a plus-value. The European-oriented firms are inclined to follow that time limit. Moreover, there are also technical changes. From brick construction (wet construction), there has been a movement towards dry construction, or more precisely, skeleton construction combined with dry construction.

Due to the lack of official information, the results of the Ameliorated Nominal Group Technique and the modernization of the amortization period will be taken as the base information used in this study.

4. Scenarios and Objectives for a Multi-Objective Study

4.1 Scenarios

This study will consider scenarios of both the European firm and traditional firms which originally belonged to a non-tradable sector. What is the meaning of a non-tradable sector?

When countries with lower productivity join an economic union, the productivity of internationally tradable goods sectors, mostly the industrial sectors, will rise over time to approach, as much as possible, the higher productivity of the other countries. However, the “Balassa–Samuelson Effect” maintains that this increase is less often the case for non-tradables (Samuelson, 1964, 1994; Balassa, 1964; Balazs et al., 2002).

The internationally tradable goods sectors will have the opportunity to increase wages. By labour market osmosis, the non-tradable sectors have to raise their wages too, although their productivity does not increase equally. Inflation is the result, with an increase in the cost of living. In particular – and this was the case in Lithuania in 2003 – the facilities sector, belonging to the non-tradable segment, had to pay higher wages without a proportional increase in productivity and ipso facto in production.

With the entrance of international firms the situation changed; the Lithuanian sector of facilities management became an internationally tradable sector for these firms. The traditional firms could react either by keeping their price levels and hoping that they could keep their traditional clients or by avoiding a higher price level by lowering the

quality of their services. In both of these cases, the firms also maintained the official amortization rule of 100 years.

Finally, three scenarios are possible which are represented by the European firm (the fifth resource scenario), the traditional firm in a non-tradable sector (the status quo scenario) and the traditional firm offering services of lower quality (the status quo scenario of lower quality).

4.2 Objectives or Criteria

Given the information obtained from the Ameliorated Nominal Group Technique and the considerations with regard to amortization, the following objectives or criteria will be taken into account:

1. More competition;
2. Large increase in foreign capital;
3. Minimization of amortization period;
4. Minimization of increase in cost of living;
5. Optimal price-quality relation;
6. Better legislation for supervision;
7. Better laws with regard to the importance of facilities management.

Given scenarios and objectives the following decision matrix can be composed (Table 2):

Table 2

Decision Matrix for Facilities Management in Lithunia

<	1. More Competition MAX	2. Large Δ in foreign capital MAX	3. Amortization MIN	4. Increase Cost of Living MIN	5. Optimal Price-Quality Relation MAX	6. Better Legislation in supervision MAX	7. Better Laws MAX
European 5th Resource Scenario	14.08	15	50	0.1	5.25	0.1	0.1
Nontradable sector traditional firm	0.1	0.1	100	5	5	5.5	3.75
Nontradable sector firm with less quality	1	0.1	100	0.1	0.1	5.5	3.75

The next point concerns the choice of a method for Multi-Objective Optimization. Some authors demonstrate the superiority of the MULTIMOORA model for multi-optimization, such as Chakraborty (2011), Prasad and Sekar (2016) and Dai, Zhong and Qi (2016). From their point of view, Karande, Zavadskas and Chakraborty (2016) conclude: "MULTIMOORA is the most robust system of multiple objectives optimization with respect to stakeholders (decision makers), objectives, and interrelations between objectives and alternatives as it is non-subjective and based on cardinal data". Arian Hafezalkotob and Ashkan Hafezalkotob (2015) developed a target-based MULTIMOORA method by introducing a normalization technique for materials selection in biomedical applications. Hafezalkotob, Hafezalkotob and Sayadi (2016) extended the

MULTIMOORA method with interval numbers and applied it to materials selection. Çebi and Otay (2016) employed MULTIMOORA and integrated it with a multi-objective linear programming (MOLP) model under a fuzzy environment. Arian Hafezalkotob and Ashkan Hafezalkotob (2016) extended the MULTIMOORA approach based on the Shannon entropy concept under a fuzzy environment to solve a materials selection case that is a multiple-attribute group decision-making problem. The authors evaluated a practical materials selection problem related to the automotive industry. Altuntas, Dereli and Yilmaz (2015) applied the MULTIMOORA method for a technological evaluation of excavator alternatives. In their article, Liu et al. (2015) proposed a novel hybrid multi-criteria decision-making (MCDM) model by integrating the 2-tuple DEMATEL technique and fuzzy MULTIMOORA method for the selection of HCW treatment alternatives. This makes use of a modified 2-tuple DEMATEL for obtaining the relative weights of criteria and fuzzy MULTIMOORA for assessing the alternatives according to each criterion. Karabasevic et al. (2015) proposed the approach of selection of candidates in the mining industry based on the application of the SWARA and the MULTIMOORA methods. Stanujkic et al. (2015) proposed an extension of the MULTIMOORA method, primarily adapted for the use of interval-valued triangular fuzzy numbers as well as the use of the group decision-making approach and linguistic variables. In order to demonstrate the applicability and effectiveness of the proposed approach, the authors presented an example of comminution circuits design selection. Stanujkic (2016) proposed an extension of the ratio system approach of the Multi-Objective Optimization by Ratio Analysis (MOORA) method, which allows group decision-making as well as the use of interval-valued triangular fuzzy numbers. Baležentis, T. and Baležentis, A. (2013) discussed the MULTIMOORA method development as well as extensions along with an overview of their applications. The authors' paper discussed the extensions of MULTIMOORA to a fuzzy environment and group decision making.

In their paper, Baležentis and Baležentis (2016) propose a group multi-criteria decision-making approach based on the MULTIMOORA method and trapezoidal intuitionist fuzzy numbers (ITFNs). The proposed approach relies on the trapezoidal intuitionist fuzzy power aggregation operators, which reduce the impact of biased assessments in group decision making.

Reading the decision matrix vertically means creating dimensionless measurements with no further need of normalization and no problems with the number of objectives. The vertical reading of the response matrix is applied in the ratio analysis of MOORA and in its reference point method.

In the ratio analysis of MOORA, simple averages have to be excluded as they may change the sign and even lead to nonsensical results. A 2006 study showed several other solutions (Brauers and Zavadskas, 2006), concluding with the best one:

$$x_{ij}^{*} = \frac{x_{ij}}{\sqrt{\sum_{j=i}^{m} x_{ij}^{2}}} \tag{2}$$

if assuming all objectives have the same importance, the objectives to be maximized are added and the objectives to be minimized subtracted:

$$y_j^* = \sum_{i=1}^{i=g} x_{ij}^* - \sum_{i=g+1}^{i=n} x_{ij}^* \quad (3)$$

with:

i = 1, 2, …, g, objectives to be maximized

i = g+1, g+2, …, n objectives to minimized

= alternative j concerning all objectives and showing the final preference.

In the second part of MOORA – the method of reference point – a maximal objective reference point is used to which the Tchebycheff formula is applied (Karlin and Studden, 1966):

$$\underset{(j)}{Min}\left\{ \underset{(i)}{max} \left| r_i - x_{ij}^* \right| \right\} \quad (4)$$

The full multiplicative form adds a third method to MOORA by simply multiplying all objectives per alternative, in this way becoming MULTIMOORA – altogether three methods controlling each other (Brauers and Zavadskas, 2010b).

The following n-power form for multi-objectives will henceforth be called a full-multiplicative form in order to distinguish it from the mixed forms:

$$U_j = \prod_{i=1}^{n} x_{ij} \quad (5)$$

with:

j = 1, 2, ..., m; m the number of alternatives,

i = 1, 2, …, n; n being the number of objectives,

xij = response of alternative j on objective i,

Uj = overall utility of alternative j.

The overall utilities (Uj), obtained by multiplication of different units of measurement, become dimensionless.

How is it possible to combine a minimization problem with the maximization of the other objectives? Therefore, the objectives to be minimized are denominators in the formula:

$$U'_j = \frac{A_j}{B_j} \quad (6)$$

$$A_j = \prod_{g=1}^{i} x_{gj}$$

where: j = 1, 2, ..., m; m the number of alternatives,

i = the number of objectives to be maximized.

$$B_j = \prod_{k=i+1}^{n} x_{kj} \quad (7)$$

where: n-i = the number of objectives to be minimized,

Uj' = the utility of alternative j with objectives to be maximized and objectives to be minimized.

The full multiplicative form is read horizontally in the decision matrix of Table 1. Nevertheless, with the full-multiplicative form, the overall utilities, obtained by multiplication of different units of measurement, become dimensionless measures.

For MOORA, the ranking for the two methods is done on view, no more possible for MULTIMOORA with its three methods. Therefore, the ordinal dominance theory will interfere.

The adding of ranks – ranks meaning an ordinal scale (1st, 2nd, 3rd, etc.) – signifies a return to a cardinal operation (1 + 2 + 3 + …). Is this allowed? The answer is 'no' according to the Impossibility Theorem of Noble prize-winner, Arrow: "Obviously, a cardinal utility implies an ordinal preference but not vice versa" (Arrow, 1974, p.256).

According to Brauers and Zavadskas, the Axioms of Ordinal and Cardinal Scales (2011) are as follows:

1. A deduction of an ordinal scale – a ranking – from cardinal data is always possible.
2. An ordinal scale can never produce a series of cardinal numbers.
3. An ordinal scale of a certain kind – a ranking – can be translated in an ordinal scale of another kind.

In the application of Axiom 3, the rankings of the three methods of MULTIMOORA are translated into another ordinal scale based on dominance (being dominated), transitivity and equability.

Dominance. Absolute dominance means that an alternative, solution or project dominates in ranking all other alternatives, solutions or projects. This absolute dominance is manifested in rankings for MULTIMOORA: (1–1–1). General Dominance in two of the three methods is in the form of a < b < c <d:

(d–a–a) is generally dominating (c–b–b);

(a–d–a) is generally dominating (b–c–b);

(a–a–d) is generally dominating (b–b–c);

and further transitiveness plays fully.

Transitiveness. If a dominates b and b dominates c than also a will dominate c.

Overall Dominance of one alternative on the next one. For instance (a–a–a) is overall dominating (b–b–b) which is overall being dominated.

Equability. *Absolute Equability* can have the following form: for instance (e–e–e) for two alternatives. *Partial Equability* of 2 on 3 exists e. g. (5–e–7) and (6–e–3).

5. Ranking of the Possibilities for the Facilities Sector in Lithuania based on the MULTIMOORA Method

5.1 MULTIMOORA Concerning the Facilities Sector in Lithuania

Following Table 3 shows the details of the MULTIMOORA calculations concerning the different possible scenarios for the Facilities Sector in Lithuania.

Table 3

Decision Matrix for Facilities Management in Lithunia

a - Matrix of Responses of Alternatives on Objectives: (xij)

<	1. More Competition MAX	2. Large Δ in foreign capital MAX	3. Amortization Min	4. Increase Cost of Living MIN	5. Optimal Price-Quality Relation MAX	6. Better Legislation in supervision MAX	7. Better Laws MAX
European 5th Resource Sc.	**14.08**	**15**	**50**	**0.1**	**5.25**	**0.1**	**0.1**
Nontradable Sector Traditional Firm	**0.1**	**0.1**	**100**	**5**	**5**	**5.5**	**3.75**
Nontradable Sector Firm with less Quality	**1**	**0.1**	**100**	**0.1**	**0.1**	**5.5**	**3.75**

b - Sum of squares and their square roots

European 5th Resource Sc.	198.2464	225	2500	0.01	27.5625	0.01	0.01
Nontradable Sector Traditional Firm	0.01	0.01	10000	25	25	30.25	14.0625
Nontradable Sector Firm with less Quality	1	0.01	10000	0.01	0.01	30.25	14.0625
sum squares	199.2564	225.02	22500	25.02	52.5725	60.51	28.135
square roots	14.11582091	15.0006667	150	5.0019996	7.250689622	7.77881739	5.3042436

Table 3. cont.

c - Objectives divided by their square roots and MOORA

<	1. More Competition MAX	2. Large Δ in foreign capital MAX	3. Amortiza-tion Min	4. Increase Cost of Living MIN	5. Optimal Price-Quality Relation MAX	6. Better Legislation in supervision MAX	7. Better Laws MAX	**SUM**	**RANK**
European 5th Resource Sc.	0.997462357	0.999956	0.33333333	0.019992005	0.724069057	0.01286	0.0188528	2.39987	1
Nontradable Sector Traditional Firm	0.00708425	0.006666	0.66666667	0.99960024	0.689590	0.70704835	0.7069811	0.45110	3
Nontradable Sector Firm with less Quality	0.070842497	0.006666	0.66666667	0.019992005	0.013791792	0.70704835	0.7069811	0.81867	2
$\mathbf{r_i}$	0.997462357	0.999956	0.33333333	0.019992005	0.72407	0.70705	0.7069811		

d - Reference Point Theory: Deviations from the reference point

								MAX.	**RANK -MIN.**
European 5th Resource Sc.	0.0	0	0	0	0	0.69419	0.6881283	0.69419	1
Nontradable Sector Traditional Firm	0.990378108	0.993289	0.3333333	0.979608235	0.034479	0.00000	0.000000	0.993289	2
Nontradable Sector Firm with less Quality	0.92661986	0.993289	0.33333333	0	0.71028	0.00000	0	0.993289	2

e- Fulll Multiplicatve Form	MAX	MIN	MAX/MIN	**rank**
European 5th Resource Sc.	11.088	5.000	2.2	**1**
Nontradable Sector Traditional Firm	1.031	500.00	0.0020625	**2**
Nontradable Sector Firm with less Quality	0.20625	10.00	0.020625	**2**

Summary				**Conclusion**
European 5th Resource Sc.	**1**	**1**	**1**	**1**
Nontradable Sector Traditional Firm	**3**	**2**	**2**	**3**
Nontradable Sector Firm with less Quality	**2**	**2**	**2**	**2**
Non- European 5th Resource Sc. is excluded as being ranked low				**4**

5.2 The Final Ranking of Preference for the Facilities Sector in Lithuania

To the following final ranking can be concluded:

1. First Rank: Facilities sector firms operating in the European Union and originating from other European Union Countries or from Lithuania itself.
2. Second Rank: The status quo scenario whereby the facilities sector firms in Lithuania are the traditional ones with competition maintained by offering lower quality services.
3. Third Rank: The status quo scenario, whereby the facilities sector firms in Lithuania are the traditional ones, but which assume fidelity on the part of their traditional clients.
4. Fourth Rank: As mentioned in the Ameliorated Nominal Group Technique, exercise one can assume that facilities sector firms from outside the European Union have no chance of success in Lithuania.
5. Fifth Rank: All the Lithuanian firms who could use outside facilities management but are not aware of the possibilities, or are negatively inclined towards outside facilities management; some will use outside facilities management only partially.

In fact, reality is much more complicated. Facilities management is a typical example of outsourcing, but more specifically belongs to a non-core function of an enterprise or an institution.

Outsourcing can reduce production costs, avoid higher taxes, limit liabilities, etc. Co-sourcing is a mixture of work partly by the firm's staff and partly by an outside service. Insourcing means reversing the outsourcing process. Finally, insourcing should not be confused with vertical integration, as outsourcing and insourcing operate in a horizontal way. For instance, the international company NYRSTAR, a zinc refiner, buying zinc mines, represents an example of vertical integration.

6. Conclusion

Since Lithuania's entrance into the European Union on May 1, 2004, the facilities management sector changed from a non-tradable sector to an internationally tradable sector, accompanied by the entrance of firms working at the European Union level competing with traditional firms. Comparisons are not easy because of the lack of official statistics; nevertheless, they are possible given the results of an Ameliorated Nominal Group exercise and a more modern concept of amortization for buildings.

To obtain a ranking by importance of the firms offering facilities management in Lithuania, the MULTIMOORA method is preferred given its superiority over other methods. After application of MULTIMOORA, the outcome is the following ranking:

First Rank: Facilities sector firms operating in the European Union and originating from other European Union countries or from Lithuania itself.

Second Rank: The status quo scenario whereby the facilities sector firms in Lithuania are the traditional ones with competition maintained by offering lower quality services.

Third Rank: The status quo scenario whereby the facilities sector firms in Lithuania are the traditional ones but which assume fidelity on the part of their traditional clients, even under less favourable conditions.

Fourth Rank: One can assume that facilities sector firms from outside the European Union have no chance of success in Lithuania.

Fifth Rank: All the Lithuanian firms that could use outside facilities management but are not aware of the possibilities, or are negatively inclined towards outside facilities management; some will use outside facilities management only partially.

In fact, reality is much more complicated. Facilities management is a typical example of outsourcing and its traditional advantages should be taken into consideration. The clients should identify the set of needed services and exact timing of their provision.

References

Altuntas, S. Dereli, T. and Yilmaz, M.K., 2015. Evaluation of Excavator Technologies: Application of Data Fusion Based MULTIMOORA Methods. *Journal of Civil Engineering and Management*, 21(8), pp. 977-997.

Ancarani, A. and Capaldo, G., 2005. Supporting decision-making process in facilities management services procurement: A methodological approach. *Journal of Purchasing & Supply Management, 11*, pp. 232-241.

Arrow, K.J., 1974. General Economic Equilibrium: Purpose, Analytic Techniques, Collective Choice. *American Economic Review*, June.

Balassa, B., 1964. The Purchasing Power Parity Doctrine: A Reappraisal. *Journal of Political Economy*, pp. 584-596.

Balazs, E. Drine, I. Lommatzsch, K. and Rault, C., 2002. The Balassa-Samuelson Effect in Central and Eastern Europe: Myth or Reality? *Working Paper* 483, The William Davidson Institute, University of Michigan Business School.

Baležentis, T. and Baležentis, A., 2013. A Survey on Development and Applications of the Multi-criteria Decision Making Method MULTIMOORA. *Journal of Multi-Criteria Decision Analysis, 21(3-4), pp. 209-222.*

Baležentis, T. and Baležentis, A., 2016. Group Decision Making Procedure Based on Trapezoidal Intuitionistic Fuzzy Numbers: MULTIMOORA Methodology. *Economic Computation and Economic Cybernetics Studies and Research*, 50(1), pp. 103-122.

Brauers, W.K., 2004. *Optimization Methods for a Stakeholder Society. A Revolution in Economic Thinking by Multiobjective Optimization*. Boston: Kluwer Academic Publishers and Springer.

Brauers, W.K., 1987. *Nominal Methods in Group Multiple Criteria Decision Making*, University of Antwerp (RUCA), Institute for Developing Countries.

Brauers, W.K., 1980. *Het bedrijfsleven in de jaren 80 (the enterprises in the years 1980)*. HIBO, Gent.

Brauers, W.K. and Lepkova, N., 2003. The application of the Nominal Group Technique to the Business Outlook of the Facilities Sector of Lithuania over the period 2003-2012. *International Journal of Strategic Property Management*, 7(1), pp. 1-9.

Brauers, W.K.M. and Zavadskas, E.K., 2006. The MOORA method and its application to privatization in a transition economy. *Control and Cybernetics,* 35(2), pp. 445-469.

Brauers, W.K.M. and Zavadskas, E.K., 2010a. Robustness in the multimoora model: the example of Tanzania. *Transformations in business & economics,* 9(3), pp. 67-83.

Brauers, W.K.M. and Zavadskas, E.K., 2010b. Project management by MULTIMOORA as an instrument for transition economies. *Technological and economic development of economy,* 16(1), pp. 5-24.

Brauers, W.K.M. and Zavadskas, E.K., 2011. MULTIMOORA optimization used to decide on a bank loan to buy property. *Technological and economic development of economy*, 17(1), pp. 174-188.

Brauers W.K.M. Kracka, M. and Zavadskas, E.K., 2012. Lithuanian case study of Masonry Buildings from the Soviet Period. *Journal of Civil Engineering and Management*, 18(3), pp. 444-456.

Chakraborty, S., 2011. Applications of the MOORA method for decision making in manufacturing environment. *International Journal Advanced Manufacturing Technology*, 54, pp. 1155-1166.

Chotipanich, S., 2004. Positioning facility management. *Facilities,* 22(13/14), pp. 364-372.

Çebi, F. and Otay, I., 2016. A two-stage fuzzy approach for supplier evaluation and order allocation problem with quantity discounts and lead time. *Information Sciences,* 339(20), pp. 143-157.

Dai, W-F., Zhong, Q-Y. and Qi, C-Z., 2016. Multi-stage multi-attribute group decision making method based on triangular fuzzy MULTIMOORA. *Mathematical Problems of Engineering*, Article ID 1687068.

Delbecq, A.L. Van de Ven, A.H. and Gustafson, D., 1986. *Group Techniques for Program Planning.* Greenbriar Press, Madison, Wisconsin. 2nd edition.

Delbecq, A.L., 1983. The Nominal Group as a Technique for Understanding the Qualitative Dimension of Client Needs," in *Assessing Health and Human Service Needs*, R.A.Bell, editor, N. Y., Human Services Press, pp. 210-218.

Delbecq, A.L. Van De Ven, A.H. and Gustafson, D.H., 1975. *Group Techniques for Program Planning: A Guide to Nominal Group and Delphi Processes*, Scott, Foresman and Co, Glenview (Ill.).

EN 15221-1:2006 (E). Facility Management-Part 1: Terms and definitions. 2006 CEN. p. 20.

Gill, S.L. Delbecq, A.L. and Snodgrass, T.J., 1981. Three chapters on Program Planning, Nominal Group Technique and Value Engineering. In: Shirley Jones, ed. *Group Process Planning and Problem Solving Methods.* N.Y.: John Wiley and Sons.

Gill, P.J. Hewitson, P. Peile, E. and Harnden, A., 2012. Prioritizing areas for quality marker development in children in UK general practice: extending the

use of the nominal group technique. *Family Practice,* 29(5), pp. 567-575.
Gill, P.J. *et al*., 2014. Primary care quality indicators for children: measuring quality in UK general practice. *British Journal of General Practice*, 64, pp. e752-e757.
Hafezalkotob, A. Hafezalkotob, A. and Sayadi, M.K., 2016. Extension of MULTIMOORA method with interval numbers: Anapplication in materials selection. *Applied Mathematical Modelling,* 40, pp. 1372-1386.
Hafezalkotob, A. and Hafezalkotob, A., 2016. Fuzzy entropy-weighted MULTIMOORA method for materials selection. *Journal of Intelligent & Fuzzy Systems,* 31(3), pp. 1211-1226.
Hafezalkotob, A. and Hafezalkotob, A., 2015. Comprehensive MULTIMOORA method with target-based attributes and integrated significant coefficients for materials selection in biomedical applications. *Materials & Design*, 87, pp. 949-959.
Jantsch, E., 1967. *Technological Forecasting in Perspective.* OECD, Paris.
Karabasevic, D. Stanujkic, D. Urosevic, S.and Maksimovic, M., 2015. Selection of candidates in the mining industry based on the application of the SWARA and the MULTIMOORA methods. *Acta Montanistica Slovaca*, 20(2), pp. 116-124.
Karande, P. Zavadskas, E.K. and Chakraborty, S., 2016, A study on the ranking performance of some MCDM methods for industrial robot selection. *International Journal of Industrial Engineering Computations*, 7, pp. 399-422.
Karlin, S. and Studden, W.J., 1966. *Tchebycheff Systems: with Applications in Analysis and Statistics.* New York: Interscience Publishers.
Kracka, M. Brauers, W.K. and Zavadskas, E.K., 2010. Ranking Heating Losses in a Building by Applying MULTIMOORA. *Inžinerinė ekonomika–Engineering Economics*, 21 (4)*, pp.* 352-359*.*
Klungseth, N.J. and Blakstad, S.H., 2016. Organising in-house cleaning services in public FM. *Facilities*, 34(13-14), pp. 828-854.
Leiblein, T.W. *et al*., 2016. Legionella and risk management in hospitals - A bibliographic research methodology for people responsible for built environment and facility management. *International Journal of Hygiene and Environmental Health*, 219, pp. 890-897.
Lepkova, N. and Ūselis, R., 2013. Development of a Quality Criteria System for Facilities Management Services in Lithuania. *Procedia Engineering*, 57, pp. 697-706.
Liu, H-C. You, J-X. Lu, C. and Chen, Y-Z., 2015. Evaluating health-care waste treatment technologies using a hybrid multi-criteria decision making model. *Renewable and Sustainable Energy Reviews*, 41, pp. 932-942.
Maliene, V. Alexander, K. and Lepkova, N., 2008. Facilities Management Development in Europe. *International Journal of Environment and Pollution,* 35(2/3/4), pp.171-184.
McGregor, W. and Shiem-Shim Then, D*.,* 1999. *Facilities management and the business of space*. Butterworth-Heinemann, London.

Min, Z. Morgenstern, P. and Marjanovic-Halburd, L., 2016. Facilities management added value in closing the energy performance gap. *International Journal of Sustainable Built Environment*, 5, pp. 197-209.

Potkany, M. Vetrakova, M. and Babiakova, M. 2015. Facility Management and Its Importance in the Analysis of Building Life Cycle. *Procedia Economics and Finance*, 26, pp. 202-208.

Prasad, N. and Sekar, K., 2016. Selection of Best Alternative in Manufacturing and Service Sector using Multigrade Decision Approach – a Review. *Computer science and Information Technology*, pp. 57-74.

Quade, E.S., 1970. *Cost-Effectiveness: Some Trends in Analysis*. Rand Corporation, P-3529-1, Santa Monica (CAL), pp. 9-10.

Samuelson, P.A., 1994. Facets of Balassa-Samuelson Thirty Years Later. *Review of International Economics*, pp. 201-226.

Samuelson, P.A., 1964. Theoretical Notes on Trade Problems. *Review of Economics and Statistics*, pp. 145-154.

Stanujkic, D., 2016. An extension of the ratio system approach of MOORA method for group decision-making based on interval-valued triangular fuzzy numbers. *Technological and Economic Development of Economy*, 22(1), pp. 122-141.

Stanujkic, D. Zavadskas, E.K. Brauers, W.K.M. and Karabasevic, D., 2015. An extension of the MULTIMOORA method for solving complex decision-making problems based on the use of interval-valued triangular fuzzy numbers. *Transformations in business & economics,* 14(2B), pp. 355-375.

STR.1.12.06:2002. Building usage and lifetime. *Construction technical regulation*. Lithuania, 2002.

Van De Ven, A.H. and Delbecq, A.L, 1971. Nominal versus Interacting Group Processes for Committee Decision Making Effectiveness, *Academy of Management Journal*, 14(2), pp. 203-212.

Tong, A. *et al*., 2016. Standardised Outcomes in Nephrology—Children and Adolescents (SONG-Kids): a protocol for establishing a core outcome set for children with chronic kidney disease. *Trials*, 17 **(**401).