Production
ISSN: 0103-6513
production@editoracubo.com.br
Associação Brasileira de Engenharia de Produção
Brasil

Batista de Oliveira, Elaine Cristina; Hazin Alencar, Luciana; Cabral Seixas Costa, Ana Paula
A decision model for energy companies that sorts projects, classifies the project manager and recommends the final match between project and project manager
Production, vol. 26, núm. 1, enero-marzo, 2016, pp. 91-104
Associação Brasileira de Engenharia de Produção
São Paulo, Brasil

Available in: http://www.redalyc.org/articulo.oa?id=396745201008

- How to cite
- Complete issue
- More information about this article
- Journal's homepage in redalyc.org

Scientific Information System
Network of Scientific Journals from Latin America, the Caribbean, Spain and Portugal
Non-profit academic project, developed under the open access initiative

Production, 26(1), 91-104, jan./mar. 2016
http://dx.doi.org/10.1590/0103-6513.172314

PRODUCTION

A decision model for energy companies that sorts projects, classifies the project manager and recommends the final match between project and project manager

Elaine Cristina Batista de Oliveira[a*], Luciana Hazin Alencar[a**], Ana Paula Cabral Seixas Costa[a***]
[a]Universidade Federal de Pernambuco, Recife, PE, Brasil
*elainecjz@gmail.com, **alencarlh@gmail.com, ***apcabral@ufpe.br

Abstract

This study presents an integrated model to support the process of classifying projects and selecting project managers for these projects in accordance with their characteristics and skills using a multiple criteria decision aid (MCDA) approach. Such criteria are often conflicting. The model also supports the process of allocating project managers to projects by evaluating the characteristics/types of projects. The framework consists of a set of structured techniques and methods that are deemed very appropriate within the context of project management. A practical application of the proposed model was performed in a Brazilian electric energy company, which has a portfolio of projects that are specifically related to the company´s defined strategic plan. As a result, it was possible to classify the projects and project managers into definable categories, thus enabling more effective management as different projects require different levels of skills and abilities.

Keywords

Project managers. Project portfolio. Multi-criteria decision aid.

1. Introduction

Projects play a key role in implementing an organization's strategy. This also includes electric energy companies, in which, moreover, portfolios consist of a large number of different projects which seek to meet the needs and wants of a wide range of stakeholders such as shareholders, regulatory agencies, society at large, entrepreneurs and the end consumer.

In the literature on project management, there is a growing recognition that different types of projects demand different approaches to their management, namely, they require management procedures to be adapted to the needs of the project (Crawford et al., 2005). Shenhar & Dvir (2007) argue that in order to select the best way to manage a given project, there is a need to characterize projects into different categories. Nevertheless, models for classifying projects by their characteristics have not received much attention (Malach-Pines et al., 2009), and the scarcity of such studies is especially marked with regard to projects in the electric power sector.

Another aspect to be highlighted in the context of projects has to do with the role of the project manager. The importance that a project manager has for the success of projects has been widely studied (International Project Management Association, 2006; Project Management Institute, 2008; Meredith & Mantel Junior, 2003) and it is well known that this is a determining factor. To have project managers who are committed, prepared and qualified is something that organizations aim to ensure. Thus, it becomes important to develop a method that enables project managers to be classified in order to best match the different needs of a project to the skills and experience required of the project manager to be appointed to it.

Thus, this paper aims to address this gap by putting forward an integrated model to support the

Received: Jan. 29, 2014; Accepted: Mar. 26, 2015

process of sorting projects into different categories and classifying project managers, taking their competences into account, by using a structured process with the support of Multicriteria Decision Aid - MCDA methods.

A MCDA methodology seems very appropriate for this study since it is by using this methodology that various aspects of a project can be evaluated simultaneously: the size, complexity, resources, and so on, of the project itself and then what experience, training and knowledge of the tools and techniques of project management, etc., potential project managers have.

This paper contributes towards understanding and developing a classification of projects and project managers in the energy sector. In the review of the literature, no study was found on using multiple criteria to sort projects and classify project managers, in the context of an electric power company. The model proposed was applied in a private company that operates in the Brazilian electric energy sector.

This paper is structured as follows. Studies dealing with multi-criteria methods and PROMETHEE SORTING – PROMSORT, project types and the skills and abilities that project managers need are presented in Section 2. The proposed model is put forward in Section 3 and how it was applied in Section 4. Finally, conclusions are drawn in Section 5 and suggestions made as to the direction future studies might best take.

2. Review of the literature

This section presents a brief review of the literature on MCDA methods including the method used in the model, namely PROMSORT, types of projects and also on the skills and competencies required of project managers. Having identified the main factors identified in this review, the next stage was to set criteria for evaluating projects and project managers.

2.1. Multi-Criteria Decision Aid - MCDA

MCDA aims to assist decision-making against multiple criteria, which are often conflicting, by applying a set of structured techniques and methods. When choosing a multi-criteria method, consideration needs to be given to the context of the problem, the actors of the process, decision makers' preference structures and rationality (Mota et al., 2009). Moreover, MCDA methods can be distinguished from each other, according to Roy (1996), as there are four types of basic problematic: choice, ranking, sorting and description. This study aims to categorize projects and project managers. Thus it is a problem of classification which means it is a sorting problematic. This consists of identifying what aspects of decision making are causing problems, generating alternative solutions and subsequently distributing each alternative to a predefined category. These categories have some ordering implicit to the categories, relative to each other.

Classification methods can be distinguished into two categories. The first uses techniques based on questioning the decision maker (DM) directly and the second uses preference disaggregation classification methods (Doumpos & Zopounidis, 2002). Several methods have been developed for this type of problem, such as ELECTRE TRI (Yu, 1992), PROMETHEE TRI (Figueira et al., 2004) and PROMSORT (Araz & Ozkarahan, 2007), these being characterized by relying on questioning the DM directly; and UTADIS (Doumpos et al., 2001) and PAIRCLASS (Doumpos & Zopounidis, 2004), which are about preference disaggregation.

The PROMSORT method, a procedure based on Preference Ranking Organization Method for Enrichment Evaluations – PROMETHEE, is the one chosen to be used in this study and is described in the following section.

2.1.1. PROMETHEE sorting – PROMSORT

According to Araz & Ozkarahan (2007, p. 80) the PROMSORT is

> [...] an effective tool to assign the alternatives to the ordered categories. It provides reliable classification in terms of the preference relation between alternatives and valuable information to the decision maker about the weaknesses and strength of the alternatives and features of the categories [...].

It was chosen for this study since it is possible to guarantee the ordering of the alternatives also within classes unlike what happens with PROMETHE TRI and ELECTRE TRI (Araz & Ozkarahan, 2007).

According to Araz & Ozkarahan (2007) in sorting problems there are two ways to define *'a priori'* categories: using alternative references or using the profile limits of the categories. There are also two ways to categorize the alternatives: in a nominal or ordinal way. In its nominal form, there is no sorting of the classes and this is called a *nominal sorting problem.* For the other form, the classes are sorted in the order of from best to worst and this is called an *ordinal sorting problem.* This study will focus on the problem of pre-sorted categorization.

PROMSORT allocates alternatives to predefined sorted categories. To designate an alternative ***a*** to a certain category, results are taken from a comparison of ***a*** with the profiles that define the limits of categories and with reference to the alternatives in different phases.

Araz & Ozkarahan (2007) note that: G is a set of criteria g_1, g_2 ,..., g_n $\left(G=\{1,2,\ldots,n\}\right)$ and B a set of profiles that distinguish limits K +1 categories B (B = {1,2, ..., n}) wherein b_h represents the upper limit of category, C_h the lower limit of category C_h+1, h = 1,2, ..., k. Assume $C_2 > C_1$ means that category 2 outranks 1, and the set of profiles $\left(B=\{b_1,b_2,\ldots,b_k\}\right)$ should have the property: $[b_k P b_{k-1}],[b_{k-1} P b_{k-2}],\ldots,[b_2 P b_1]$. This property says that the categories should be ordered and distinguishable. Assuming this ranking is given from the most preferred to the least preferred, the following condition helps in obtaining orderly and distinct categories: $\forall j, \forall h=1,\ldots,k-1, g_j(b_{h+1}) \geq g_j(b_h) + p_j$. Comparison between two profile limits b_{h-1} and b_h which distinguish categories C_{h-1}, C_h *and* C_{h+1}, is defined using the PROMETHEE methodology.

PROMSORT allocates alternative categories by following the three steps recommended by Araz & Ozkarahan (2007): (1) determining an outranking relation using PROMETHEE I; (2) using the outranking relation to describe the alternatives in the categories, except in situations of incomparability and indifference; (3) finally designating alternatives based on a one to one comparison.

2.2. Classification and evaluation of projects

In the literature on project management, classifying projects has mainly been used to develop capability and has focused on (1) tailoring the management style to suit the project type or (2) prioritizing and selecting projects (Crawford et al., 2006). This study focuses on the first of these with a view to providing a classification so as to choose the best management approach given that the projects to be evaluated have been previously selected.

In this area, an approach widely used is the NTCP Model that evaluates the Novelty, Technology, Complexity and Pace of projects in order to classify them as set out in Shenhar & Dvir (2007). Other studies have used this model, for example, Dvir et al. (2006) and Howell et al. (2010). However this approach is very focused on research and development projects (R&D) besides which the model does not use a multiple criteria method .

A survey of different companies conducted by Crawford et al. (2006) found that 34% of organizations had developed their classification systems for projects in-house and ad hoc and that 45% had developed their systems in-house to meet organizational needs. This survey also found that companies listed the following as the attributes they used to evaluate projects: cost, benefits to the organization, complexity, strategic importance, level of risk, resources, size, application area, client and nature of work.

Also, the complexity of an organization and its activities, the criticality of the schedule and the quality requirements, the level of risk, innovation and the strategic importance of given projects should be used to evaluate and classify projects with a view to determining the management style each needs (Patanakul et al., 2007). These authors also include features of projects in terms of their size (budget), duration, their being underway or new, and their current phase (conceptual and planning, execution or termination).

Müller & Turner (2007) suggest that, when choosing a project management methodology, projects should be evaluated and classified, for which they too used a list of attributes: application area (engineering and construction, IT or organizational changes), complexity (high, medium, low), strategic importance (mandatory, repositioning, renewal contract type (fixed price, remediation, or alliance), life cycle stage and culture.

Although this paper does not focus on project selection, the attributes listed above can be used to draw up evaluation criteria for the model proposed. Moreover, a review of the literature shows that several studies tackle how to evaluate the alternatives better when compiling a portfolio, among which are some that identify various methodologies with the support of MCDA methods, especially used in the electric energy sector: Buchanan & Sheppard (1998) present a method to select and sort projects in the Electricity Corporation of New Zealand (ECNZ); Neves et al. (2008) one that sorts energy-efficiency initiatives; Aragonés-Beltrán et al. (2010) an approach to selecting investment projects in solar photovoltaic power plants; Smith-Perera et al. (2010) one for selecting a project portfolio in the company EDC (La Electricidad de Caracas); Perimenis et al. (2011) present a framework for a decision support tool to evaluate biofuel production pathways; Haurant et al. (2011) a model that was developed to evaluate projects in photovoltaic plants; Drupp (2011) one that compiles the best mix of projects to achieve Sustainable Development; project selection with economic-probabilistic variables (Dutra et al., 2014).

As a result of this brief review, it can now be seen more clearly what attributes and components must be taken into consideration for assessing projects, thereby enabling the criteria for assessing projects to be drawn up.

2.3. The fundamental skills and abilities of the project manager

A project manager must be familiar with, fully understand and apply the tools and techniques regarded as good practice in project management (Project Management Institute, 2008).

According to the International Project Management Association (2006, p. 22) "Competence is a collection of knowledge, attitudes, skills and relevant experience required for the successful exercise of a given function." Further, according to IPMA (International Project Management Association, 2006), the necessary skills for project management consist of technical skills, behavioral skills, and contextual skills.

Darrell et al. (2010) identified that in addition to technical skills, project managers must possess general management skills (namely, they must know how to delegate, how to lead, and how to draw up procedures), interpersonal skills (i.e. those to do with communication, conflict management, motivation) and skills in project management (specific knowledge in the project area about how to use specific tools and techniques). Also, the project manager must first have decision-making skills, communication, leadership and motivation and problem solving skills (Odusami, 2002).

The study of Zhang et al. (2013) explores a project manager´s attitudes about social competencies and soft skills. The results show that great importance is given to working with others and leading others competencies, also achieving project goals by working with others and by demonstrating efficient leadership. In the Chinese context, they found that there was a need for future improvement in the stakeholder management and social awareness competencies as these are seen as key components in the practice of project management.

Ahadzie et al. (2014) in a study conducted for Mass House Building projects (MHBPs) have found that, from the perspective of senior managers, on-the-job knowledge of the following competencies towards ensuring effective design management at the design phase of the lifecycle of projects were needed: mass contract packaging; the performance characteristics of materials for the design of MHBPs; the technical quality of strategies for managing the design process; assessing thermal comfort assessment and provisions in the design of MHBPs and thus of relevant design codes, legislation and regulation for MHBPs.

The selection of a project manager is also a multiple criteria problem (Hadad et al., 2013). Also the project manager must be evaluated in terms of experience and personal skills (Jazebi & Rashidi, 2013). In the context of project allocation the management skills and project assessment must be considered (Xu & Yeh, 2014). As to skills in project management, other studies can be consulted include (Ahadzie et al., 2014), (Zhang et al., 2013) and (Bredin & Soderlund, 2013).

Although no studies using MCDA with the same goal as this study by have been found, it was possible to identify other studies in the area of project management, such as: on project management selection and activities priorization (Zavadskas et al., 2008; Hadad et al., 2013; Dodangeh et al., 2014; Mota et al., 2009; Gurgel & Mota, 2013); team decision-making (Collier, 2013; Alencar & Almeida, 2010); portfolio management (Arasteh et al., 2014; Almeida et al., 2014;); and project management competencies analysis (Chipulu et al., 2013).

As a result of this brief review of studies, it can now be seen more clearly what skills and abilities project managers are required to have, thereby enabling the criteria for assessing project managers to be drawn up.

3. Integrated system to classify projects and project managers: a model proposed

3.1. Research approach

The model proposed in this research is based on the MCDA approach which is a modeling method that is widely used in Operational Research. In this context Ackoff & Sasieni (1975) present five steps for modeling a problem. What stands out in this paper is the structure of the problem and how the models are constructed. Thus a multicriteria decision model was developed with a view to providing an additional tool for project management processes which should be adapted to each decision context, organization and line of business.

To determine the stages of the model and the evaluation criteria to be used for classifying projects and project managers, a further review was undertaken of highly relevant, recent publications on the subject.

The proposed model was validated in a company that operates in the Brazilian electric energy sector to whom the authors are grateful for the data provided data and to their staff who interacted with the researchers during the process of choosing the MCDA method, which included determining the evaluation parameters that would be used to define the classes and evaluate the results. In the interaction with the company, it was arranged to carry out interactions with a decision maker. The organization chose their project manager officer PMO, as, in their opinion, he would best represent their values in the context of this research. During the process of applying the model, there were several interactions with the PMO so that he could explain his preferences. As instruments for collecting data, questionnaires, completing worksheets, research databases and business brainstorming were used. This entire procedure will be presented in detail in Section 4 of this article.

3.2. Model proposed

Thus with a view to filling this gap in the literature, the model proposed sets out to enable projects and project managers to be classified according to their characteristics and abilities. It is hoped that this proposal will be regarded as making a major contribution to the management of projects, both in academic terms and in organizations that can make use of a systematic process such as this.

The issue of classification seeks to assign alternatives (in this case, projects and project managers) to pre-existing categories in accordance with the evaluation of these alternatives on a set of criteria, which are determined by classes which have specified limits. The methodology proposed in this research which ends with the classification of projects and project managers is presented in Figure 1.

This model comprises two main phases from the time of launch of the project. The following steps will generate the information needed for classifying projects and project managers and can be performed in parallel. In multicriteria modeling, the first stage is to identify the decision maker (DM). He/she will interact with the analyst to establish the parameters of modeling and evaluate alternatives. The DM is essential to establish the company's values and goals and doing so enables consistent decisions to be made. The stages of the model may then be followed always with the participation of the DM and his/her interaction with the analyst. The model is described below.

1. The process begins with a kick-off meeting in which the projects selected for execution will be managed by the project management office. At this moment the PMO should retrieve information about projects and project managers from the database and also data on strategic planning. These data will serve later to evaluate alternatives against the criteria chosen. As to the project, this includes identifying the selected projects on a detailed Project Charter, major resource constraints on resources and assumptions. Also the project managers available should be properly identified, as should restrictions. It is noteworthy that different companies may be placed in various situations on the structure for allocating project managers. It is often the case that project managers are organized in the form of a pool under the responsibility of the project management officer and so too is the fact that they are made available by the various functional departments to carry out an activity temporarily.

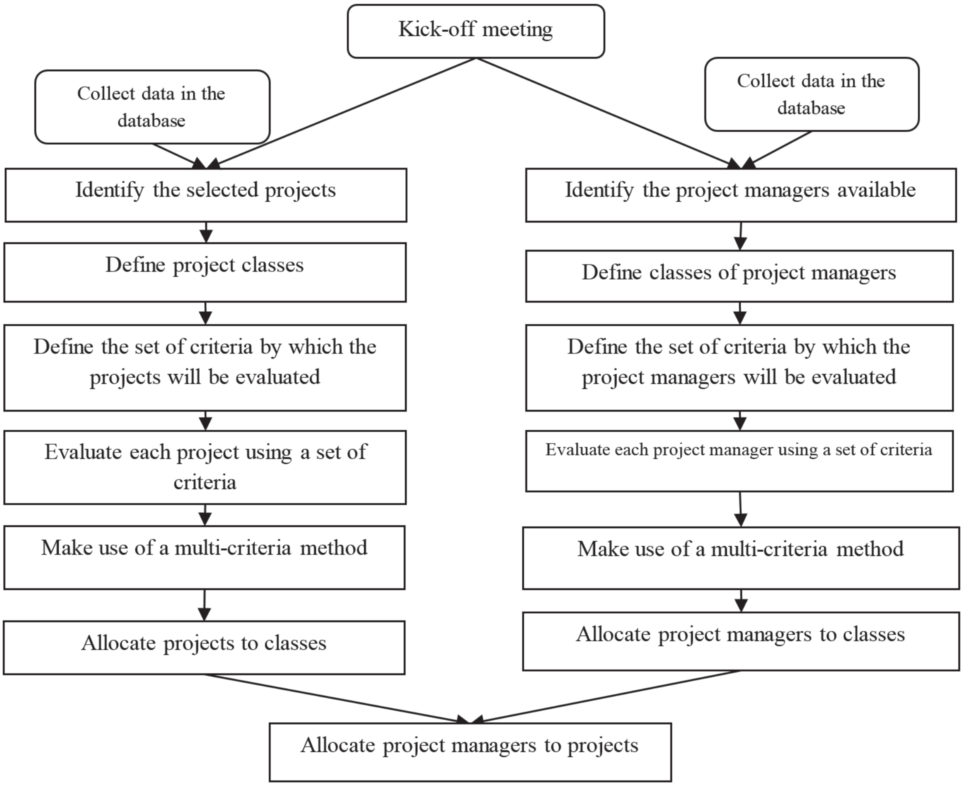

Figure 1. Model for integrating the allocation of projects and project managers into classes. Source: the authors.

II. In the stage of defining the classes in the organization, an analysis should be conducted on what different categories are needed so as to separate projects in order to better tailor the routines of project management, the frequency of reporting and the monitoring of the structure. In defining the classes of project manager, an analysis must be made of what and how many categories should be created so as to enable a diagnosis and distribution of this important resource, since doing so will provide greater insight into project managers' abilities and vulnerabilities.

III. In the steps which define the set of criteria by which projects and the project managers will be evaluated, it is assumed that the DM will establish criteria. However, on the basis of what was identified in the literature, some criteria to consider can be proposed. However, our proposal is not to impose a set of criteria, because it is well understood that the ideal is that the set of criteria that will be compiled must be the one that best represents the company's values and goals. The literature shows that the criteria which are most important for this decision context for projects are as follows: complexity, resources, application area, rate of growth, contribution to achieving organizational strategy and technology. project managers should: have experience, be knowledgeable about and have previously used project management techniques and tools, focus on customer needs and possess problem-solving skills. Thus, the criteria commonly used in the context of research articles, classifying projects and evaluating project managers are included in the model proposed. It is important to mention that, in MCDA, criteria refer to the degree to which objectives are achieved (Keeney, 1992) and are basically of three types: natural, built and proxy.

IV. Evaluating each alternative: next, each alternative is evaluated for each criterion. In this model most of the criteria are qualitative in nature, making it necessary to build rating scales. Many organizations already evaluate their projects and project managers within their own specific criteria and parameters of measurement and these can be used in this evaluation. On applying the model in an organization, item 5, how these scales can be constructed is shown. When selecting the MCDA method to be used, the following should be taken into account: the characteristics of the problem, in this case the problematic of classification; the characteristics of the alternatives; the set of criteria; and the structure of the DM's preferences and goals. As summarized in Section 2.3 several methods are available from which the DM should choose.

V. The model must be applied in line with the method selected in the previous step such that different models will require different parameters. These methods usually require the following to be defined: inter-criteria information, which is the importance of each criterion within the aggregate preferences formed by the criteria, taking the weight of each criterion into account. The higher the weight, the greater is the importance of the criterion (Brans & Mareschal, 2005). Also, depending on the method chosen, upper and lower limits of the classes must be set. These limits will determine to what class each alternative should be allocated (Mousseau & Slowinski, 1998). Similarly for the definition of thresholds, if any. When all the supporting information is held by the analyst, the method chosen can be applied.

VI. Having obtained the results from classifying projects and project managers, an analysis must be undertaken to assess the consistency of the classification. Thereafter, proceed to the next step, which is an integration of two main processes and provides decision support on allocating project managers to several projects, a process which is facilitated by categorizing projects and project managers. A crossover of information between classes of projects and project managers may be made. This is an important contribution of the proposed model for managing projects.

Having presented the model, the next item concerns applying it in a business situation.

4. Applying the model in a Brazilian electric energy company

In order to verify the validity of the model, real data from a company were applied to enable the proposed model to be evaluated. In order to maintain confidentiality, the names of projects and PMrs are encoded. The following items are presented to characterize the company, the application of the model and its results.

The model is built in order to allocate projects to classes as well as to sort PMrs, the set of criteria, the classes of projects, and the weights of the criteria, so as to evaluate alternatives and reach a final evaluation. In this application, the research considered the point of view of a single decision maker, the Project Management Officer – PMO.

4.1. Research environment

An application of the proposed model was carried out in a Brazilian electric energy company, which has defined the strategic plan of the organization in its portfolio.

This strategic plan lasts for three years, but the process is subject to revision every year so as to make adjustments in line with the needs arising from demand in the electricity sector or from internal changes.

The company´s programs are primarily based on the requirements of the electricity planning and regulating body but there are other demands on them which come from other areas such as IT, the needs and demands of research and development, strategic planning and customer contracts. The portfolio comprises an average of 50 projects annually.

At the beginning of the year, Kick-off meetings are held to present the portfolio that will be actioned. This moment will be the start of the proposed model, described in the following sections.

4.2. Applying the model

The steps of the model were followed and are described below.

I. This step occurred after the kick-off meeting which was held with the staff of the company's project management office. First of all, the PMO asked the analyst to give a brief presentation on the model proposed, the objectives and the expected results. Then, the analyst along with the DM evaluated the existing database and the possibilities of searching for information on this system. They identified that as the company was using a software support in an information management project, data about projects and PMrs could be easily retrieved as could other information needed for the classification process, such as strategic planning data and evaluations of PMrs' conduct of previous projects. This database has existed and had been constantly enhanced with information for the previous 5 years.

II. In a meeting with his team, the PMO gave the definition of classes and concluded that the projects can be subdivided into three classes: P1: "Very Critical"; P2: "Critical", P3: "Non-critical". According to his evaluation, project managers (PMr) can be subdivided into three classes: PMr1: "Senior"; PMr2: "Middle," PMr3, "Junior." It should be noted that this division into classes is dependent on the organizational context in which the model is being applied. It could be, for example, that more classes are required with or without different characteristics. Therefore, it should be tailored with this contextual need in mind.

For this step the analyst presented a brief review of the literature on project management, and through interviews with the PMO, interactions and adaptations drew up the set of criteria that best represent the organization's goals.

In this case, the following criteria to evaluate projects (alternatives) were considered:

g_1 : Complexity: A project can be considered highly complex when it is short-term (up to 1 year), High Cost (over U$1,5 million), and involves several departments (more than 4 departments); of Average Complexity: High Cost (over U$1,5 million) and involves several departments (more than 4 departments); and of Low Complexity: only one of these - short-term or High Cost or several departments.

g_2: Resources: represented by the number of man-hours needed to complete the project.

g_3 : Rate of development (pace) based on the model by Shenhar & Dvir (2007): the project can be said to be *regula*r if it is not critical to the immediate success of the organization, and infrastructure projects and delays are usually tolerated; *Competitive* (Fast) - when its aim is to seize market opportunities, for example, by carrying out maintenance services for other companies; *Critical* - when the project does not meet the deadline, it has failed, and when this involves non-compliance with deadlines established by the regulatory agency, there is, for example, a fine; *Urgent* - when it must be finished immediately because of security risks to people (e.g. replacement of structures where there is risk of injury or death arising from electrical faults) or loss of licence because the project did not meet the indices established by the regulatory agency (for example, projects to reduce the downtime of electric energy).

g_4 : Contribution to achieving organizational strategy: measures the degree to which the project contributes to fulfilling organizational goals, for example, for a program to reduce technical losses by 10%, how much the project will contribute to this total: Above 10% - high, Between 5% and 10% - Average, Below 5% - Low.

g_5 : Technologies (based on Shenhar & Dvir, 2007): When *Low*, the project uses well-established technologies; *Average*: Most of the technology is new. *High*: Completely based on new technologies.

For Project Managers: The same as defining the criteria for evaluating projects, with the PMO now choosing the set of criteria to be used to evaluate PMrs. The following were considered:

g_1 : Experience as a PMr: time measured in years of experience in conducting projects.

g_2 : Level of training: Technician, Graduate, Specialization, Master's degree.

g_3 : Knows and uses the techniques and tools of project management: measured by the length of training and for how long he/ she has been applying the techniques.

g_4 : Focus on clients' needs: percentage of successfully managed projects (time, cost and quality).

g_5 : Ability to Solve Problems: Number of problems solved / recorded in the system.

g_6 : Maturity of PMr: Number of projects managed in the last 5 years.

g_7 : Commitment: An average which rates the PMr´s degree of commitment with respect to meeting deadlines and carrying out the project management processes of the organization. Consists of participating in training and delivering reports to the PMO (data update time, cost issues of the projects, risks, and reporting monthly monitoring of the project - average previous year).

g_8 : Size of past projects: the most expensive project managed - Cost Range: Large: Projects above U$1,5 million; Medium: Projects U$ 500,000 to U$1,5 million; Small: Projects below U$500,000.

g_9 : Interoperability of previous projects: represents the maximum number of departments (involved) in previous projects, managed by the PMr.

g_{10} : Negotiation: this is a measure of the PMr´s negotiation abilities for which the number of experts in the technical team and the number of subcontractors performing project activities is used. A PMr´s negotiating experience is considered to be high when this number is greater than 6, average when 4 or 5, and low when less than 4.

III. The DM established, with the support of the analyst, the values for the weights of the criteria, which represent the relative importance of the criteria to each other. The analyst also helps the DM to define the scales for evaluating the qualitative criteria. All the criteria (quantitative and qualitative) should be maximized. All information is presented in Table 1.

Like the criteria for classifying projects, the weights and defining the scale for the qualitative criteria for classifying PMrs were reached in the same way, and are presented in Table 2. All of them are also maximized.

IV. Assessment of alternatives: The DM evaluated the projects in accordance with the criteria of Table 1 and Table 2 and this evaluation is presented in the Appendix A, while the evaluation of the qualities required of PMrs is given in Table 3.

V. Making use of a multi-criteria method: The PMO along with the analyst made an analysis of existing methods for classification, and the possibilities and goals being set by the PROMSORT method. Thus the DM's desire to ensure that he can later use this information to allocate PMrs into classes.

The profile limits of classes were defined as the parameters to be used for PROMSORT, and are presented in Table 4 for the projects and Table 5 for PMrs. It is important to emphasize that any decision made is dependent on a given issue and the DM's view, both of which change from case to case.

Next the results of classifications are obtained: Table 6 shows the classification of projects while the result of classifying PMrs is presented in Table 7. Where the DM is pessimistic, using PROMSORT, then s = 1 (as per the PROMSORT method, presented in item 2.3).

A sensitivity analysis was carried out on the weighting of the criteria which had a variance of +/- 10% and it was noted that there was no change with respect to the initial classification implying that the model is not sensitive to small variations. With the results from classifying projects and PMrs at hand, an analysis must be conducted to assess the consistency of the classification.

VI. After having divided the project into classes, the PMO can see what competencies are needed by the PMr who will be allocated to a given project

Table 1. Criteria for classifying projects.

ID	Criteria	Weighting	Verbal Scale	Numerical Scale
g_1	Complexity	0.2	High	3
			Medium	2
			Low	1
g_2	Resources (Man-hours)	0.2	_	Man-hours
g_3	Rate of growth	0.2	Urgent	4
			Critical	3
			Competitive	2
			Regular	1
g_4	Contribution to achieving organizational strategy	0.3	_	%
g_5	Technology	0.1	High	3
			Medium	2
			Low	1

Source: the authors.

Table 2. Criteria for classifying project managers.

ID	Criteria	Weight	Verbal Scale	Numerical Scale
g_1	Experience as project manager	0.1	-	Years
g_2	Level of training	0.05	Master's	1
			Specialization	2
			Graduate	3
g_3	Knows how to use techniques and tools of project management	0.05	-	Years
g_4	Focus on needs of the client	0.1	-	%
g_5	Ability to resolve problems	0.1	-	Ratio
g_6	Maturity of project manager	0.15	-	nº
g_7	Commitment	0.05	-	nº
g_8	Size of previous projects	0.2	Large	1
			Medium	2
			Small	3
g_9	Interoperability of previous projects	0.1	-	nº
g_{10}	Negotiation	0.1	High	1
			Medium	2
			Low	3

Source: the authors.

Table 3. Evaluation of the qualities required of the project managers.

ID	g_1	g_2	g_3	g_4	g_5	g_6	g_7	g_8	g_9	g_{10}
PMr1	3 years	2	3 years	60.0%	8	5	7	3	8	2
PMr2	5 years	3	5 years	80.0%	12	15	8	2	8	2
PMr3	3 years	2	3 years	62.5%	10	8	7	1	8	2
PMr4	1 year	1	1 year	66.7%	5	3	7	1	4	1
PMr5	2 years	3	2 years	70.0%	6	10	8	2	6	3
PMr6	3 years	2	3 years	60.0%	15	10	8	2	6	3
PMr7	4 years	2	4 years	66.7%	8	12	8	2	6	3
PMr8	4 years	2	4 years	80.0%	16	10	8	1	6	3
PMr9	4 years	2	4 years	100.0%	3	2	9	1	8	1
PMr10	5 years	2	4 years	87.5%	12	8	8	1	4	1
PMr11	3 years	2	3 years	100.0%	4	2	8	1	4	1
PMr12	3 years	3	3 years	66.7%	10	6	8	1	5	2
PMr13	1 year	1	1 year	66.7%	5	3	7	1	5	2
PMr14	2 years	2	2 years	50.0%	7	2	7	1	5	2
PMr15	2 years	1	3 years	66.7%	14	6	9	1	5	2
PMr16	4 years	3	4 years	62.5%	15	8	7	2	8	1

Source: the authors.

Table 4. Profile limits of the of the classes of the projects.

Profile	g_1	g_2	g_3	g_4	g_5
b_1	2	1200	2	2	2
b_2	1	600	1	1	1

Source: the authors.

and therefore the PMO can make the best match between classes of projects and classes of project managers. It is thus also proposed to allocate PMrs with different classes of skills and to take into consideration the criteria for the experience, training, knowledge of techniques and tools of project management, focus on customer needs, maturity in project management and commitment, etc that PMrs should have. Using these three groups of PMrs, a partnership can be achieved with the submitted project groups.

It is recommended that the organization should identify PMrs in terms of their availability, workload and constraints in order to obtain a more equitable distribution of projects. It is common for some PMrs not to focus exclusively on project management activities, since they accumulate other functional routines. Thus, there should be a survey on their availability by having them answer the question: for how long during the period under review will you be available to manage projects? Also the workload of PMrs should be diagnosed, in case they have accumulated

Table 5. Profile limits of the project managers.

Profile	g_1	g_2	g_3	g_4	g_5	g_6	g_7	g_8	g_9	g_{10}
b_1	2	2	2	80%	10	10	12	2	8	2
b_2	1	1	1	70%	7	8	10	1	6	1

Source: the authors.

Table 6. Results of classifying the projects.

CLASSES	PROJECTS										
CLASS 1 – PROJECTS VERY CRITICAL	P44,	P46,	P47								
CLASS 2 – PROJECTS CRITICAL	P1,	P2,	P3,	P4,	P5,	P6,	P7,	P8,	P9,	P10,	P11,
	P13,	P14,	P16,	P17,	P18,	P19,	P21,	P23,	P24,	P25,	
	P27,	P28,	P29,	P30,	P32,	P33,	P35,	P36,	P37,	P38,	P39,
	P40,	P41,	P42,	P43,	P47,	P48,	P49				
CLASS 3 – PROJECTS NON-CRITICAL	P12,	P15,	P20,	P22,	P26,	P31,	P34				

Source: the authors.

Table 7. Results of classifying project managers.

CLASSES	PROJECT MANAGERS							
CLASS 1 – SENIOR MANAGER	PMr2,	PMr7,	PMr8					
CLASS 2 – MIDDLE MANAGER	PMr1,	PMr3,	PMr5,	PMr6,	PMr9,	PMr10,	PMr12,	PMr16
CLASS 3 – JUNIOR MANAGER	PMr4,	PMr11,	PMr13,	PMr14,	PMr15			

Source: the authors.

projects and other functional activities. The PMO also reported that some other restrictions may also exist such as: The project should be allocated to project managers with training in a specific technical area, or; project B should be allocated to Y manager because he has knowledge of a specific technology employed in the project.

Reviewing the results obtained indicates that the PROMSORT projects marked "very critical" i.e. P44, P46 and P47 require PMrs of greater maturity who are fully-qualified and therefore PMrs with the greatest experience should be assigned to them. Therefore, PMrs allocated to Class 1 as "senior managers" PMr2, PMr7, PMr8, should be selected to manage these projects.

Projects P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14, P16, P17, P18, P19, P21, P23, P24, P25, P27, P28 , P29, P30, P32, P33, P35, P36, P37, P38, P39, P40, P41, P42, P43, P44, P45, P46, P47, P48, P49, which were assigned to class 2 and marked "critical" should be allocated to class 2 project managers, the 'middle managers': PMr1, PMr3, PMr5, PMr6, PMr9, PMr10, PMr12 and PMr16.

Using the aforementioned methodology, projects P12, P15, P20, P22, P26, P31 and P34 were allocated to Class 3 project "non-critical" and would be under the responsibility of project managers assigned to class 3, "junior managers".

With regard to "which" project to allocate to "whom", intra-class allocation should be taken into account as one of the post-qualifying criteria and should include the workload of each manager. On first analyzing what PMrs to assign to which projects, the PMO realized that some projects would need to be allocated to PMrs classed as meeting requirements at levels below or above such projects. Nevertheless, it was laid down that, whenever possible, projects should be allocated to PMrs of the corresponding, matching class. A survey should be conducted regarding the number of hours (historical or estimative) necessary to manage projects, but usually the number of projects to be managed is greater than the number of hours available to management. Therefore, it is very common for a PMr to manage more than one project simultaneously, depending on the size and complexity of the project. When there is not a sufficient number of PMrs available to do this and meet the requirements expected of a PMr for all such projects, PMrs may be allocated to a higher class, but while critical projects may be allocated to PMrs of the senior class, they must never be allocated to PMrs of the junior class. Another implication is that this company, whenever possible, wishes to allocate PMrs of the most appropriate class to projects. In other words, even when higher class PMrs are available, it sets as a priority that projects should be allocated to PMrs of the corresponding, appropriate class. Therefore, the PMO seeks to develop PMrs' skills with a view to creating continuous improvement cycles so that a greater, potential pool of PMrs above the level of the junior class is available for upcoming projects.

4.3. Analysis of results

The PMO examined the results of applying the model and found the results of the classification and allocation decisions reasonable, very coherent and a fair trial and that the final results were similar to those he had been hoping for. Another view expressed was that time would be saved in allocating PMrs to projects, an important outcome as this process had hitherto been very time-consuming.

From the PMO's point of view, the model provides a better insight into the projects and project managers' profiles and helps greatly in allocating projects, since it matches PMrs' sets of skills and experience levels to the characteristics of the project. The data set collected here in this study can be used to identify other variables that can be used when allocating projects e.g. mathematical programming to optimize PMRs' workload.

The model presented did not consider the question of allocating project A to PMr A for example, because this is a process that can be conducted more simply by agreement with the managers themselves or through other methods of operational research such as integer programming.

Having classified the projects, a better match for the managerial approach can be made, thus enabling the organization to evaluate the different categories and the need for structuring each project in line with its criticality. This establishes distinct levels of management approach for different categories of projects, e.g., those that deal with classified projects, a higher level of criticality, special policies, determining the inventory, prioritizing resources, having shorter intervals between follow-up meetings, further monitoring by the project management office.

Thus, the model proved to be efficient and effective given that the results of the application led to a complete analysis of the factors that strongly influence the policy of conducting projects, namely classifying projects and project managers as well as giving support in appointing PMrs more appropriately with regard to the needs of projects.

5. Conclusions

This study put forward a model that offers systematic integrated support to the process of classifying projects and project managers and allocating PMrs and includes a multi-criteria analysis and a flexible process. The results of application showed the efficacy of the model and that the PMO is satisfied.

By applying the model proposed, it was possible to classify projects and project managers into distinguishable categories, thus enabling them to be managed more effectively, as different projects require different levels of skills and abilities.

Using the model put forward in this study also enables PMrs to be chosen more carefully, thus assisting an organization to allocate its most critical projects to the best prepared professionals, especially when the organization is developing multiple projects simultaneously.

One characteristic of the proposed model that must be taken into consideration is that when each new cycle of planning projects and selecting PMrs is periodically re-evaluated, new projects and freshly-appointed PMrs must also be included in this assessment. Moreover, the criteria and other parameters of the model, which should be emphasized, are dependent on the context of the problem.

Thus, the model presented in this paper was applied to a company which operates in the electricity sector. Although the model was adapted to suit the needs of this company, it can also be used in various types of organizations, in both the private and public sectors, which work with a portfolio of projects. It has to be said that one of the greatest benefits of the model was derived from its using a method that provides MCDA analysis of many criteria simultaneously. This provides an opportunity to analyze any of the projects being carried out by the organization.

In addition, using the model enables an assessment of the organization's ability to manage its projects and find out what aspects can be improved with respect to PMrs' competencies and skills, thus leading to good prospects for investing in training which will result in PMrs being better able to perform this important function in their organizations.

Future studies should be undertaken in order to ensure a formal approach to allocating PMrs is being followed, as well as to explore other different methods for assessment, for example, by considering how a group decision might best be taken.

References

Ackoff, R. L., & Sasieni, M. W. (1975). *Pesquisa operacional*. Rio de Janeiro: Livros Técnicos e Científicos.

Ahadzie, D., Proverbs, D., & Sarkodie-Poku, I. (2014). Competencies required of project managers at the design phase of mass house building projects. *International Journal of Project Management*, *32*(6), 958-969. http://dx.doi.org/10.1016/j.ijproman.2013.10.015.

Alencar, L. H., & Almeida, A. T. (2010). A model for selecting project team members using multicriteria group decision making. *Pesquisa Operacional*, *30*, 221-236.

Almeida, J. A., Almeida, A. T., Costa, A. P. C. S. (2014). Portfolio selection of information systems projects using PROMETHEE V with C-optimal concept. *Pesquisa Operacional*, *34*, 1-25.

Aragonés-Beltrán, P., Chaparro-González, J. P., Pastor-Ferrando, J. P., & Rodríguez-Pozo, F. (2010). An ANP-based approach for the selection of photovoltaic solar power plant investment projects. *Renewable & Sustainable Energy Reviews*, *14*(1), 249-264. http://dx.doi.org/10.1016/j.rser.2009.07.012.

Arasteh, A., Aliahmadi, A., & Omran, M. A. (2014). Multi-stage multi criteria model for portfolio management. *Arabian Journal for Science and Engineering*, *39*(5), 4269-4283. http://dx.doi.org/10.1007/s13369-014-0987-9.

Araz, C., & Ozkarahan, I. (2007). Supplier evaluation and management system for strategic sourcing based on a new multicriteria sorting procedure. *International Journal of Production Economics*, *106*(2), 585-606. http://dx.doi.org/10.1016/j.ijpe.2006.08.008.

Brans, J. P., & Mareschal, B. (2005). PROMETHEE methods. In J. Figueira, S. Greco & M. Ehrgott (Eds.), *Multiple criteria decision analysis - state of the art surveys* (pp. 163-195). New York: Springer.

Bredin, K., & Soderlund, J. (2013). Project managers and career models: An exploratory comparative study. *International Journal of Project Management*, *31*(6), 889-902. http://dx.doi.org/10.1016/j.ijproman.2012.11.010.

Buchanan, J., & Sheppard, P. (1998). Ranking projects using the ELECTRE method. In *Proceedings of the 33rd Annual Operational Research Society of New Zealand Conference*. Wellington, New Zealand.

Chipulu, M., Neoh, J. G., Ojiako, U., & Williams, T. (2013). A multidimensional analysis of project manager competences. *IEEE Transactions on Engineering Management*, *60*(3), 506-517. http://dx.doi.org/10.1109/TEM.2012.2215330.

Collier, D. (2013). The human factors of project team decision-making for radioactive waste management. *Cognition Technology and Work*, *15*(1), 47-58. http://dx.doi.org/10.1007/s10111-012-0218-7.

Crawford, L., Hobbs, B., & Turner, J. R. (2005). *Project categorization systems*. Newton Square: Project Management Institute.

Crawford, L., Hobbs, B., & Turner, J. R. (2006). Aligning capability with strategy: categorizing projects to do the right projects and to do them right. *Project Management Journal*, *37*(2), 38-50.

Darrell, V., Baccarini, D., & Love, P. E. D. (2010). Demystifying the folklore of the accidental project manager in the public sector. *Project Management Journal*, *41*(5), 56-63. http://dx.doi.org/10.1002/pmj.20164.

Dodangeh, J., Sorooshian, S., & Afshari, A. (2014). Linguistic extension for group multicriteria project manager selection. *Journal of Applied Mathematics*, *2014*, 1-8. http://dx.doi.org/10.1155/2014/570398.

Doumpos, M., & Zopounidis, C. (2002). *Multicriteria decision aid classification methods*. The Netherlands: Kluwer Academic Publishers.

Doumpos, M., & Zopounidis, C. (2004). A Multicriteria classification approach based on pairwise comparisons. *European Journal of Operational Research*, *158*(2), 378-389. http://dx.doi.org/10.1016/j.ejor.2003.06.011.

Doumpos, M., Zanakis, S. H., & Zopounidis, C. (2001). Multicriteria preference disaggregation for classification problems with an application to global investing risk. *Decision Sciences*, *32*(2), 33-385. http://dx.doi.org/10.1111/j.1540-5915.2001.tb00963.x.

Drupp, M. A. (2011). Does the gold standard label hold its promise in delivering higher Sustainable Development benefits? A multi-criteria comparison of CDM projects. *Energy Policy*, *39*(3), 1213-1227. http://dx.doi.org/10.1016/j.enpol.2010.11.049.

Dutra, C., Ribeiro, J., & Carvalho, M. (2014). An economic-probabilistic model for project selection and prioritization. *International Journal of Project Management*, *32*(6), 1042-1055. http://dx.doi.org/10.1016/j.ijproman.2013.12.004.

Dvir, D., Sadeh, A., & Malach-Pines, A. (2006). Projects and project managers: the relationship between project managers' personality, project types, and project success. *Project Management Journal*, *37*(5), 36-48.

Figueira, J., Smet, Y., & Brans, J. (2004). *MCDA methods for sorting and clustering problems: PROMETHEE TRI and PROMETHEE cluster*. Brussel: Université Libre de Bruxelles. Working Paper.

Gurgel, A. M., & Mota, C. M. M. (2013). A multicriteria prioritization model to support public safety planning. *Pesquisa Operacional*, *33*(2), 251-267. http://dx.doi.org/10.1590/S0101-74382013000200007.

Hadad, Y., Keren, B., & Laslo, Z. (2013). A decision-making support system module for project manager selection according to past performance. *International Journal of Project Management*, *31*(4), 532-541. http://dx.doi.org/10.1016/j.ijproman.2012.10.004.

Haurant, P., Oberti, P., & Muselli, M. (2011). Multicriteria selection aiding related to photovoltaic plants on farming fields on Corsica island: a real case study using the ELECTRE outranking framework. *Energy Policy*, *39*(2), 676-688. http://dx.doi.org/10.1016/j.enpol.2010.10.040.

Howell, D., Windahl, C., & Seidel, R. (2010). A project contingency framework based on uncertainty and its consequences. *International Journal of Project Management*, *28*(3), 256-264. http://dx.doi.org/10.1016/j.ijproman.2009.06.002.

International Project Management Association. (2006). *ICB – IPMA competence baseline version 3.0*. Nijkerk, The Netherlands: IPMA.

Jazebi, F., & Rashidi, A. (2013). An automated procedure for selecting project managers in construction firms. *Journal of Civil Engineering and Management*, *19*(1), 97-106. http://dx.doi.org/10.3846/13923730.2012.738707.

Keeney, R. L. (1992). *Value-focused thinking*. Cambridge, Massachusetts: Harvard University Press.

Malach-Pines, A., Dvir, D., & Sadeh, A. (2009). Project manager-project (PM-P) Fit and project success. *International Journal of Operations & Production Management*, *29*(3), 268-291. http://dx.doi.org/10.1108/01443570910938998.

Meredith, J. R., & Mantel Junior, S. J. (2003). *Project management: a managerial approach* (4th ed.). New York: John Wiley & Sons.

Mota, C. M. M., Almeida, A. T., & Alencar, L. H. (2009). A multiple criteria decision model for assigning priorities to activities in project management. *International Journal of Project Management*, *27*(2), 175-181. http://dx.doi.org/10.1016/j.ijproman.2008.08.005.

Mousseau, V., & Slowinski, R. (1998). Inferring an ELECTRE TRI model from assignment examples. *Journal of Global Optimization*, *12*(2), 157-174. http://dx.doi.org/10.1023/A:1008210427517.

Müller, R., & Turner, R. (2007). The influence of project managers on project success criteria and project success by type of project. *European Management Journal*, *25*(4), 298-309. http://dx.doi.org/10.1016/j.emj.2007.06.003.

Neves, L. P., Martins, A. G., Antunes, C. H., & Dias, L. C. (2008). A multi-criteria decision approach to sorting actions for promoting energy efficiency. *Energy Policy*, *36*(7), 2351-2363. http://dx.doi.org/10.1016/j.enpol.2007.11.032.

Odusami, K. T. (2002). Perceptions of construction professionals concerning important skills of effective project leaders. *Journal of Management Engineering*, *18*(2), 61-67. http://dx.doi.org/10.1061/(ASCE)0742-597X(2002)18:2(61).

Patanakul, P., Milosevic, D., & Anderson, T. (2007). A decision support model for project manager assignments. *IEEE Transactions on Engineering Management*, *54*(3), 548-564. http://dx.doi.org/10.1109/TEM.2007.900797.

Perimenis, A., Walimwipi, H., Zinoviev, S., Müller-Langer, F., & Miertus, S. (2011). Development of a decision support tool for the assessment of biofuels. *Energy Policy*, *39*(3), 1782-1793. http://dx.doi.org/10.1016/j.enpol.2011.01.011.

Project Management Institute. (2008). *A guide to the project management body of knowledge (PMBOK GUIDE)*. Newtown Square: PMI.

Roy, B. (1996). *Multicriteria methodology for decision aiding nonconvex optimization and its applications*. Dordrecht: Kluwer Academic Publishers.

Shenhar, A. J., & Dvir, D. (2007). *Reinventing project management: the diamond approach to successful growth and innovation*. Boston: Harvard Business.

Smith-Perera, A., García-Melón, M., Poveda-Bautista, R., & Pastorferrando, J. (2010). A Project Strategic Index proposal for portfolio selection in electrical company based on the analytic network process. *Renewable & Sustainable Energy Reviews*, *14*(6), 1569-1579. http://dx.doi.org/10.1016/j.rser.2010.01.022.

Xu, Y. & Yeh, C.-H. (2014). A performance-based approach to project assignment and performance evaluation. *International Journal of Project Management*, *32*(2), 218-228. http://dx.doi.org/10.1016/j.ijproman.2013.04.006.

Yu, W. (1992). *ELECTRE TRI – aspects méthodologiques et guide d'utilisation* (Document du LAMSADE, 74). Paris: Université de Paris-Dauphine.

Zavadskas, E., Turskis, Z., Tamošaitiene, J., & Marina, V. (2008). Multicriteria selection of project managers by applying grey criteria. *Technological and Economic Development of Economy*, *14*(4), 462-477. http://dx.doi.org/10.3846/1392-8619.2008.14.462-477.

Zhang, F., Zuo, J., & Zillante, G. (2013). Identification and evaluation of the key social competencies for Chinese construction project managers. *International Journal of Project Management*, *31*(5), 748-759. http://dx.doi.org/10.1016/j.ijproman.2012.10.011.

Acknowledgements

This work is part of research funded by the Brazilian Research Council (CNPq).

Appendix A. Evaluation of projects.

ID	Application Area	g_1	g_2	g_3	g_4	g_5
1	Engineering and Construction	2	640	2	3	2
2	Organization and Business	3	480	2	2	1
3	Information Systems	3	640	1	3	2
4	Information Systems	1	720	2	2	2
5	Organization and business	1	160	3	3	2
6	Organization and business	2	160	2	3	2
7	Organization and business	3	620	2	1	2
8	Organization and business	2	640	1	2	1
9	Organization and business	1	320	2	3	3
10	Organization and business	2	320	2	3	2
11	Engineering and Construction	2	160	3	3	1
12	Engineering and Construction	1	160	1	1	2
13	Information Systems	2	640	3	3	2
14	Information Systems	2	240	3	3	2
15	Organization and business	1	160	2	2	1
16	Engineering and Construction	1	160	2	3	1
17	Organization and business	3	320	3	2	1
18	Engineering and Construction	3	640	2	3	1
19	Information Systems	3	960	2	3	2
20	Organization and business	1	160	2	2	2
21	Organization and business	2	640	2	2	2
22	Organization and business	1	160	2	2	3
23	Organization and business	3	1280	1	2	2
24	Engineering and Construction	1	320	3	2	2
25	Information Systems	2	160	1	2	2
26	Engineering and Construction	1	160	2	2	1
27	Engineering and Construction	2	1280	1	3	2
28	Engineering and Construction	3	640	2	2	2
29	Engineering and Construction	2	800	1	2	2
30	Organization and business	2	160	3	2	2
31	Information Systems	2	160	1	2	1
32	Engineering and Construction	3	320	1	2	2
33	Information Systems	2	240	2	3	1
34	Organization and business	2	320	2	2	1
35	Organization and business	1	120	2	3	1
36	Information Systems	2	160	1	3	1
37	Engineering and Construction	2	3200	1	2	1
38	Engineering and Construction	2	3200	1	2	1
39	Engineering and Construction	2	960	1	2	1
40	Engineering and Construction	2	3840	1	2	1
41	Engineering and Construction	2	2880	1	2	1
42	Engineering and Construction	1	1200	3	2	1
43	Engineering and Construction	1	1200	3	2	1
44	Engineering and Construction	3	7680	4	3	3
45	Engineering and Construction	1	2400	3	2	1
46	Engineering and Construction	3	5760	4	3	1
47	Engineering and Construction	3	2880	4	3	1
48	Engineering and Construction	2	7680	3	3	1
49	Engineering and Construction	1	7680	3	3	1