Project prioritization for portfolio selection using MCDA

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Abstract

This paper emphasizes the use of MCDA methods for project ranking and prioritization. In addition to providing researchers and practitioners with the relevant literature with regards to project portfolio prioritization and selection using MCDM in the last two decades, this paper also summarizes the most commonly used criteria for evaluating projects in multi-project organizations. The literature review synthesis is then used to propose a category-based project ranking process within the framework of project portfolio selection. The proposed process focuses on the importance of evaluating projects within appropriate categories based on which relative criteria are defined and used for assessing portfolio components. The suggested process is then illustrated through the ranking of 50 projects in the case of a company operating in the automotive industry. The main purpose of this approach is helping decision makers ensure a deep alignment of the potential project portfolio with strategic priorities.

Keywords
Project prioritization, project ranking, portfolio selection, MCDA

1. Introduction

In a dynamic but constantly evolving environment, organizations are actually required to plan, evaluate, and select project portfolios in accordance with their organizational mission, vision, and objectives. For that purpose, various projects and programs are suggested to address different strategic needs. These projects are generally competing for limited resources and are often subject to either internal or external constraints, which exhibit a combinatorial character to the portfolio selection problem and then complicates the decision situation. Indeed, the project portfolio selection problem is multidimensional as it is characterized by multiple criteria and conflicting goals (Stummer and Heidenberger, 2003; Medaglia et al., 2007; Carazo et al., 2010). Either qualitative or quantitative, these goals are imposed by the organization's market, socio-economic environment as well as business sustainability challenges. The decision process becomes much more complicated when the number of active and new candidate projects rises leading to high number of potential portfolios. In addition, interrelationships between projects hold another dimension of this complexity, when it comes to shared resources, complementary benefits and outcomes (Elbok and Berrado, 2017). The decision process usually involves different stakeholders, having different priorities and interests, who are requested to actively take part of the decision while having little amount of information and incomplete data available, thus adding imprecision and uncertainties to the process (Cooper et al., 2000; Archer and Ghasemzadeh, 2007).

In this background, the decision maker has to determine which new project proposals should be considered, which active projects should be stopped and which ones should be carried on. Various analytical methods, ranging from the simple weighted sum to complex mathematical programming have been proposed to evaluate and then select projects (Henriksen and Traynor, 1999; Ghasemzadeh and Archer, 2000; Cooper et al., 2001; Lawson et al., 2006; Archer and Ghasemzadeh, 2007; Meredith and Mantel, 2008; Verbano and Nosella, 2010). However, there is little guidance in the literature about their effectiveness and practicality in different project environments. Therefore most of proposed methods are perceived by decision-makers as complex and difficult to adopt while seeking to build the most optimal project portfolio.

For the purpose of project portfolio construction, evaluating and ranking projects according to specific criteria can be supported by MCDA methods (Dey, 2006; Tavana et al., 2015; Morton et al., 2016; Chatterjee et al., 2018) but, so far, no study has emphasized which methods are more appropriate to handle project prioritization for best portfolio selection. However, it is commonly assumed that the decision maker has to make a clear definition of the criteria and methods to be used to make appropriate decisions, by involving all the concerned stakeholders.

The rest of this paper is organized as follows: in Section 2, the MCDA literature related to project evaluation and selection is discussed. The evaluation criteria used for project ranking and selection are also presented. In Section 3, a category-based ranking process using MCDA is introduced. In order to demonstrate the applicability of the proposed process in a multi-project organization, an application is provided in Section 4 for the case of a company operating in the automotive sector. Finally, in Section 5, basic conclusions and further research directions are presented.

2. Literature review

The decision is the result of interactions between many actors in a specific context, influenced by political, cultural, socio-economic, environmental and other considerations and is then extending beyond the classical rational model (Guitouni and Martel, 1998). Multiple Criteria Decision Analysis (MCDA) have been increasingly used in such complex decision problems and have also been an area of rapid growth in operations research and management science. MCDA has also caught the attention of researchers in the project management field during the last two decades.

2.1 MCDA methods used in the context of project portfolio selection

MCDA techniques have proven their usefulness for evaluation, ranking, sorting as well as selection problems (Yoon and Hwang, 1995; Belton and Stewart, 2002; Hwang and Lin, 2012; Danesh et al., 2018). They can be grouped into utility-based (compensatory) techniques, outranking (partially compensatory) methods and interactive with trial-and-error approaches (Guitouni and Martel, 1998; Danesh et al., 2018). MCDA have also been increasingly employed when it comes to evaluation and selection of projects, either used individually or in a combined approach.

Dey (2006) developed an integrated project evaluation and selection model for industrial organizations using AHP (Analytic Hierarchy Process), because of its advantage of using in-group decision-making framework involving the concerned stakeholders. Dey's model analyzes projects with respect to market, technicalities, social and environmental aspects. Borjy et al. (2019) studied the ranking of investment projects, according to business field and investment type, using TOPSIS (technique for order by similarity to ideal solution) in a case study in agriculture sector, where AHP and Delphi were used for weighting the evaluation criteria. Acco Tives Leao et al. (2019) applied both AHP and PROMETHEE II in the evaluation and selection of research scholarship projects and highlighted both methods suitability for research projects classification and prioritization. Buchanan and Vanderpooten (2007) presented a decision support methodology based on ELECTRE III for ranking maintenance projects. Razi (2015) proposed a rank-based method for project selection based on Fuzzy ELECTRE. Liang and Lee (2008) introduced an ANP-based decision method for information system project selection with regards to benefits, opportunities, costs and risks. Büyüközkan and Öztürkcan (2010) adopted an integrated decision framework based on DEMATEL (Decision Making Trial and Evaluation Laboratory) and ANP (Analytic Network Process) for selecting the most appropriate Six Sigma project alternative.

Considering the objective of ranking and prioritizing projects for best portfolios selection, the aforementioned MCDA methods, being consensus-building based, proved to be suitable and well accepted by Decision Makers. However, most of them require to be combined with mathematical models in order to handle complex portfolio selection problems (Padovani, 2007; Huang et al., 2008; Verbano and Nosella, 2010; Ahari et al., 2011; Khalili-Damghani and Sadi-Nezhad, 2013; Razi, 2015). In this regard, A specific variant of PROMETHEE for portfolio problems has already been introduced in the literature in the form of the PROMETHEE V (Vetschera and Teixeira de Almeida, 2012), which builds an optimal portfolio based on a PROMETHEE ranking of individual items, rather than entire portfolios. Resource requirements are not considered as evaluation attributes by the decision maker but as constraints. The study of Vetschera and Teixeira de Almeida (2012) consists in individually analyzing candidate projects using PROMETHEE where the individual net flow of each item is calculated with respect to other items, and then maximizing the net flow of all portfolio items using PROMETHEE V, by solving a binary optimization problem.

Other studies also emphasized the project portfolio selection as a whole considering constraints and limitations imposed by the organization strategy (Abu-Taleb and Mareschal, 1995; Mavrotas et al., 2008; Zheng et al., 2011; Tavana et al., 2015), including the budget, the maximum number of projects within a specific bucket and other logical constraints. Indeed when the decision maker has to comply with such limitations in addition to the multiple evaluation criteria, the use of a MCDA method alone is not adequate for providing the necessary assistance to the Decision Maker (Mavrotas et al., 2008). Therefore these studies have dealt with project selection problem by using hybrid approaches. Their main idea is first obtain a multicriteria project ranking using a MCDA method and then

use the obtained projects preorder in the objective function of a mathematical model that incorporates the portfolio constraints (Golabi et al., 1981; Abu-Taleb and Mareschal,1995; Mavrotas et al., 2006). In different business contexts, these hybrid methods aimed to select a satisfactory portfolio being as close possible to the Decision Maker preferences while trying to maximize the portfolio value under multiple constraints.
We summarizes in Table 1 the literature of the mostly employed MCDM methods in the context of project portfolio selection, according to the specific purpose they were used for.

Table 1. Mostly used MCDA methods in project portfolio selection context

MCDA	Method	Purpose	References
Used alone techniques	TOPSIS	Project evaluation and ranking	Acco Tives Leão, 2019; Borjy et al., 2019
	ELECTRE,	Project evaluation and ranking	Martel et al., 1988; Buchanan and Vanderpooten, 2007
	PROMETHEE, PROMETHEE II, V	Project evaluation and selection	Vetschera and Teixeira de Almeida, 2012; Acco Tives Leão, 2019
	Multi-Attribute Utility/Value Theory	Project evaluation and ranking	Wenstop and Carlsen, 1988; Duarte and Reis, 2006; Tervonen et al., 2017
	Analytic Hierarchy Process (AHP)	Project evaluation and selection	Cho and Kwon, 2004; Greiner et al., 2003; Hsu et al., 2003; Khorramshahgol et al., 1988; Kumar et al., 2009; Wang et al., 2005; Dey 2006; Acco Tives Leão, 2019
	Analytic Network Process (ANP)	Project portfolio selection	Liang and Li, 2008; Meade and Presley, 2002; Shang et al., 2004; Büyüközkan and Öztürkcan, 2010; Smith-Perera et al., 2010;
	Multi-Actor Multi-Criteria Analysis (MAMCA)	Project evaluation and ranking	Macharis and Beranrdini, 2015
Combined techniques	DEA, TOPSIS, Inter Programming	Project portfolio selection	Tavana et al., 2015
	AHP, Fuzzy Set Theory	Project evaluation and selection	Enea and Piazza, 2004; Huang et al., 2008; Tiryaki and Ahlatcioglu, 2009; Chatterjee et al., 2018; Ahari et al., 2011; Oztaysi, 2015
	ANP, Goal programming	Project portfolio selection	Lee and Kim, 2000; Lee and Kim 2001; Wey and Wu, 2007
	TOPSIS, Fuzzy Set Theory	Project evaluation and selection	Amiri, 2010; Tan et al., 2010
	TOPSIS, Fuzzy Goal programming	Project portfolio selection	Khalili-Damghani and Sadi- Nezhad, 2013
	ELECTRE, Fuzzy GRA	Project evaluation and selection	Razi, 2015
	ELECTRE, Fuzzy Set Theory	Project evaluation and selection	Rouyendegh and Erol, 2012
	MCDA, Integer Programing	Project Portfolio Selection	Golabi et al., 1981; Abu-Taleb and Mareschal,1995; Padovani, 2007 ; Mavrotas et al., 2008
	ELECTRE TRI, Mixed Integer Programing	Project Portfolio Selection	Zheng et al., 2011
	ANP, DEA	Project evaluation and ranking	Tohumcu and Karasakal, 2010

2.2 Definition of project evaluation and selection criteria

The first step for prioritizing and selecting projects to be included in the portfolio is to decide on the criteria that should be used for project evaluation. There is no consensus on which criteria should be considered as each organization tend to choose a set of criteria it thinks the most appropriate to its portfolio management context (Dutra, 2014). Simple methods considering multiple criteria, qualitative and quantitative, are more likely to be adopted by decision makers leading to more effective decisions (Liesiö et al., 2007; Meredith and Mantel, 2008). It is worth mentioning that criteria are well accepted by decision makers when the input information needed for their valuation is accessible and the calculation time required is acceptable.

The wrong choice of decision criteria can lead the organization to a failure in attaining its own and shareholders' strategic objectives (Padovani et al., 2008). Since all projects are not similar, an evaluation model should be applied according to project types. Indeed, all projects should not be thrown in the same bucket (Cooper et al., 2000). Basically comparing projects pertaining to different business needs, given similar evaluation criteria is more likely to lead to inappropriate project selection. Thus, it is required to determine the criteria used and their importance in each category of projects. Criteria might not have the same importance within a project category. Also the same criteria might hold different importance degrees among categories. In this way, project categorization can be considered as the first step prior to evaluating and prioritizing projects, it is also useful in balancing a potential project portfolio (Elbok and Berrado, 2018; Borjy et al. 2019).

In addition to the financial criteria, conformity to strategic goals and imperatives is highly requested for a project to be part of the future organization portfolio. The study of Khalili-damghani and Tavana (2014) considered sustainability (economic, environmental, and social) criteria while proposing a framework for a sustainable project portfolio selection. Cooper et al. (2000) highlighted the criteria used for ranking R&D projects including strategic fit, the product leadership or product advantage, the probability of technical success, the market attractiveness measured through growth and margins and the value to the company based on NPV. Dutra et al. (2014) studies presented a detailed literature of project selection criteria. The commonly used criteria in the literature can be classified into strategic, financial and technical criteria as summarized in Table 2. The strategic criteria includes qualitative aspects that describe and help evaluate the strategic fit of a portfolio component. The financial criteria are the most dominant in the portfolio management literature and are used to quantify both the investments required for and the benefits expected from realizing a project. As far as technical criteria are concerned, they are universally used as main descriptors of projects in terms of scope, time, resources and interrelationships with other projects.

Table 2. Project evaluation and selection criteria

Criteria type	Criteria name	Definition
Strategic criteria	Strategic alignment	Degree of project alignment with one or many strategic goals
	Competitiveness improvement	Ability of a project to improve competitive advantage
	Social benefits	Total benefits to society
	Environmental benefits	Total benefits to environment
	Meeting employees needs	Degree of fulfillment of employees' needs
	Meeting customers' needs	Impact on customer satisfaction
	Meeting shareholders vision	Level of alignment with shareholders' vision and objectives
	Market potential / growth	Estimated increase/decrease of product sales in a given market
Financial criteria	Total investment	Capital expenditure related amount
	Uncertainties	Difficulty of predicting outcomes because of limited or inexact knowledge
	Total Cost	All operating costs
	Internal Return Rate (IRR)	Discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero
	Net Present Value (NPV)	The difference between the present value of cash inflows and the present value of cash outflows
	Operating margin	A profitability measure that indicates how much revenues are left over after all the operating costs have been deducted
	Pay-back period (PBP)	The time required for benefits to match the total invested amount
	Accounting rate of return (ARR)	Ratio of average income expected on investment as compared to the initial investment amount
	Return On Investment (ROI)	Indicates the efficiency of an investment by measuring the amount of return on an investment relative to the invested amount
Technical criteria	Project complexity	Difficulty of executing the project scope
	Time involved	Project timeframe
	Degree of innovation	Either incremental or radical. Incremental innovation describes the significant enhancement on an existing product or service. Radical or breakthrough creates significant impact on the concerned market
	Compliance with the regulatory aspects	Conformity to laws and regulations
	Resources availability	Availability of human, technical or financial resources required by a project
	Interrelations with other projects	Degree of dependency with other projects in terms of resources, benefits or outcomes

3. Category-based ranking process for project portfolio selection

Considering the particularities related to different business fields, organizations tend to set the prioritization and selection models that best embody this particularity, by combining different methods and tools. Typical methods for project portfolio selection do not explicitly generate all possible portfolios, but try to directly build the optimal portfolio from the set of candidate projects (Vetschera and Teixeira de Almeida, 2012). Verbano and

Nosella (2010) provided a guidance to help managers choose R&D project selection models by classifying and comparing the existing methods and techniques in accordance with structural characteristics and method logic.

In this paper we introduce a category-based project ranking process as part of project portfolio selection framework (Figure 1). The main idea is that projects need to be individually evaluated then compared to each other within suitable buckets or categories, for which evaluation and selection criteria are particularly defined by decision makers and agreed upon with organization stakeholders. Assigning evaluation criteria per project category should also prevent unfair competition between project proposals and also helps increase the decision-making process transparency and consistency (Elbok and Berrado, 2018). Once the selection criteria are defined, relationships and potential compensation between them are investigated, an appropriate MCDA ranking method can be chosen to handle the project ranking operation within the project categories identified beforehand. Project portfolio selection should be thereafter initiated, at each category level, considering the obtained project preorder along with organizational constraints. The proposed project ranking process related steps are described below.

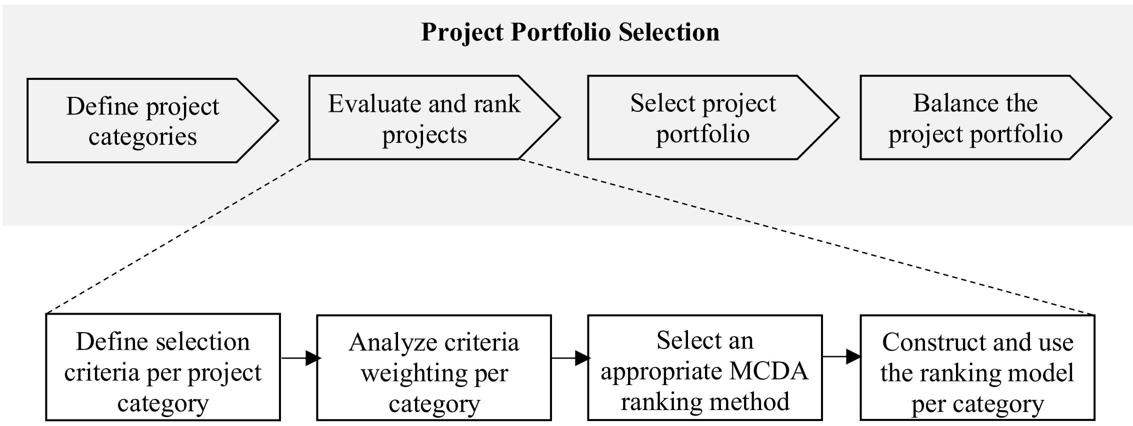

Figure 1. Category-based project ranking process as part of project portfolio selection framework

a. Definition of selection criteria : as highlighted in Section 2, evaluation criteria should be clearly and comprehensibly defined by the decision maker at project category level. The breakdown of criteria definition makes it easier for the decision maker to choose the appropriate filters and then avoid misalignment to strategic objectives. Evaluation criteria should generally fall within strategic, financial and technical types. The criteria and sub-criteria pertaining to strategic alignment measurement might be applicable to all project categories considering that each project is intended to fulfil a specific strategic need. From another perspective, project categories which serve qualitative benefits could not be evaluated based on financial criteria only. Examples include compliance projects, systems extensions and facilities upgrades.
b. Evaluation criteria weighting : At project category level, the degree of importance of applicable criteria might not be the same leading to different weights of criteria (with total equal to 1). In this case, a low performance in one criteria (less important) can be compensated by one or more other criteria (more important). When evaluating projects within a Customer focused category, meeting customers' needs can be considered as more important than profit related criteria. Therefore, decision makers should determine the criteria weights, if applicable, for each project category. Methods including experts judgment, Delphi or AHP can be used for this purpose.
c. Selection of an appropriate ranking method : as revealed through the literature review made in Section 2, MCDA methods are more appropriate to handle the ranking decision of portfolio components. In this regard, PROMETHEE, ELECTRE and AHP are the mostly employed techniques in the current project portfolio literature. The ranking method choice can be mainly guided by whether the decision maker is more comfortable with pairwise or straightforward techniques, the nature of the input information, the degree of criteria compensation allowed by the method as well as the availability of a suitable decision support system (Guitouni and Martel, 1998).
d. Construction of the decision model : consists first on the project sheet preparation including groups of projects with related multi-criteria input data. Based on whether the elucidation mode of the selected MCDA method is a direct rating or pairwise comparisons, the decision making evaluation matrix is modeled considering method's assumptions and hypothesis. The projects rating scale should also take into account the compensatory degree of the multiple criteria identified at each project category level. Once the ranking method is applied for each category, project candidates are rank-ordered within their respective buckets. Thus, the final project selection can be conducted using a suitable optimization technique with the aim of maximizing the project portfolio value considering multiple constraints.

4. Application of project ranking process in automotive industry

We will apply the project ranking process described in Section 3 in the case of an organization operating in the automotive industry aiming to rebuild its company portfolio. The latter is used to encompass sales, after sales and related business operations as well as all the ongoing projects and programs pertaining to business strategies. 50 candidate portfolio components will be first grouped into relevant categories based on which evaluation criteria will be defined and their relative weights will be examined. Trying to fill the gap on the use of MCDA methods for project prioritization, we will use TOPSIS for project evaluation and ranking in this case study.

4.1 Context definition

The organization selected is conducting its project portfolio review on yearly basis involving management and key associates. List of candidate projects and programs are prepared by project and operations teams based on the portfolio review sessions outcomes and the strategy updates, provided beforehand by the executive management. The project proposals are then categorized at the portfolio management office level using a categorization system based on machine learning techniques. This process resulted in three main categories for the case study including 50 candidate projects and programs, either ongoing or new initiatives (Table 3).

Category 1 includes projects and programs aiming to improve the profitability of Sales and After Sales business through innovative products and services. Category 2 groups all the customer-focused enhancements related to business operations and category 3 is employees satisfaction oriented, and includes initiatives pertaining to HR development and engagement. The budget, the complexity index and the expected benefit are the main attributes used to characterize the categories defined for this case study.

Table 3. project categories definition

Project category	**Strategic fit**	**Budget (K$)**	**Complexity**	**Expected Benefit**	**# Projects**
Category 1	Profitability Enhancement	>100	<8	Sales and profit increase	15
Category 2	Business Improvement	<60	>10	Customer satisfaction	25
Category 3	Human Capital engagement	<20	<5	Employees satisfaction	10

4.2 Criteria definition and weighting

Evaluation criteria, qualitative and quantitative, have been identified for each project category through group discussions. Criteria weights have been set based on 8 cross-functional experts' judgments and then the whole setting was validated by the Board of directors from Finance, Sales, Marketing, After sales, IT and Human resources departments (Table 4). All candidate projects were assessed according to the multiple criteria by project teams and management within each division. The project portfolio data sheet was finally reviewed by the portfolio management office.

Table 4. Criteria definition and weighting

Project category	**Selected criteria**	**Criteria type**	**Weight**
(1) Profitability enhancement	Strategic alignment degree Gross Profit Payback period Complexity index	Qualitative Quantitative Quantitative Qualitative	40% 40% 10% 10%
(2) Business Improvements	Impact on Customer satisfaction Compliance to standards Revenue increase Complexity index	Qualitative Qualitative Quantitative Qualitative	50% 20% 20% 10%
(3) Human Capital engagement	Strategic alignment level Impact on employees satisfaction Cost Complexity index	Qualitative Qualitative Quantitative Qualitative	40% 40% 10% 10%

4.3 Use of TOPSIS for project ranking

Because of its ease of use and convenience to the decision case, TOPSIS, as a direct rating method, was applied for each project category resulting in the preorders presented in Tables 5, 6 and 7. The basic idea of TOPSIS (Hwang and Yoon, 1981) is that the chosen alternative should have the shortest geometric distance from the ideal solution and the longest geometric distance from the anti-ideal solution. The proximity coefficient (Ci +) is the indicator used to calculate the similarity of an alternative (i) to the best solution . The higher this coefficient, the more attractive the project.

The resulting project ranking indicated the priority order for each project category. This outcome was seen by the decision makers as satisfactory and useful for building the upcoming project portfolio. Indeed the DMs were provided through this process with potential sub-portfolios aligned with the strategic directions, containing the organization's teams initiatives (bottom-up) and taking into account management preferences (Top-Down) in an interactive way.

As an illustrative example of the obtained ranking, the resulting preorder of category 1 shed the light on the top ten projects and programs for which the priority order got the unanimous consent of the Board of directors. New Service Workshops implementation (*Program 14*) was revealed as the high priority program (*Rank = 1*) followed by projects and programs aiming to introduce innovative up-selling products and new value-added services with direct impact on the business profit (*Ranks from 2 to 10*). The DMs also agreed that both operations and project teams have had enough expertise and knowledge to undertake these initiatives. The following candidates (*Ranks from 11 to 14*) were on-going programs being launched few years ago and were delivering quite good results. DMs then decided to carry them on in the upcoming project portfolio. However, they agreed to remove the project 12 (*Rank 15)* having the lowest priority from the project portfolio, considering that it has been challenged for more than 3 years but never delivered the expected outputs. In this way, the validation of the resulting priority order was also made for categories 2 and 3.

Considering the organization constraints related to human resources capacity, budget limits, corporate policies as well as dependencies between the portfolio components, the DMs could then proceed with the optimal portfolio selection based on the obtained sub-portfolios. The project portfolio selection techniques that can be used for this case study will be developed in a future work.

Table 5. TOPSIS ranking for category 1

Category 1	Component	Ranking
Profitability Enhancement	Program 14	1
	Project 15	2
	Program 2	3
	Project 3	4
	Program 4	5
	Program 8	6
	Project 5	7
	Program 9	8
	Project 7	9
	Program 1	10
	Project 10	11
	Program 6	12
	Project 11	13
	Project 13	14
	Project 12	15

Table 7. TOPSIS ranking for category 3

Category 3	Component	Ranking
Human Capital Engagement	Program 44	1
	Program 48	2
	Project 41	3
	Project 47	4
	Program 46	5
	Program 49	6
	Project 42	7
	Project 50	8
	Project 45	9
	Project 43	10

Table 6. TOPSIS ranking for category 2

Category 2	Component	Ranking
Business Improvement	Program 27	1
	Program 24	2
	Program 36	3
	Project 30	4
	Program 23	5
	Project 22	6
	Program 39	7
	Program 29	8
	Program 28	9
	Project 19	10
	Project 35	10
	Project 17	12
	Project 16	13
	Program 20	14
	Project 21	15
	Project 18	16
	Project 25	17
	Project 26	18
	Program 38	19
	Project 34	20
	Project 37	21
	Project 32	22
	Project 31	23
	Project 40	24
	Project 33	25

5. Conclusions

MCDA have been increasingly used for the purpose of evaluating and selecting project portfolios in different organization sectors. We provide in this work a synthesis of the literature related to the use of MCDA methods in the context of project portfolio selection. We also summarize the evaluation criteria commonly used in the literature including strategic, financial and technical criteria. Considering the importance of an appropriate project categorization in ensuring fair projects comparison and selection, this paper presents a category-based ranking process for portfolio selection using MCDA. Starting from the idea that all projects should not be thrown in the same basket as they are intended to address different business needs, project categories should be identified beforehand by the Decision Maker using a suitable method. The proposed ranking process begins by defining the evaluation criteria at each category level to allow for coherent assessment of projects towards the objectives they serve. Then the criteria weighting should be examined for each category by involving the organization's experts. The following step of the process consists of selecting an appropriate MCDA ranking method, taking into account the elucidation mode the Decision Maker might be comfortable with and also the decision's input parameters available. The evaluation model should be thereafter constructed according to the chosen method hypothesis. In order to illustrate this process, we provide an application of it in the case of an organization operating in the automotive industry, using TOPSIS. The obtained project preorder per sub-portfolio was satisfactory from the Decision Maker point of view and revealed the strategic priorities in place while building the ground for an optimal portfolio selection.

This work was limited to the use of TOPSIS for a portfolio dataset including 50 candidate projects, other ranking and selection methods would be of interest and will be experimented in a future research considering larger dataset or multiple case study.

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