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# CONSIDERATION ON PROJECT MANAGEMENT SPECIFICITY FOR SUSTAINABLE INVESTMENTS

Roxana Sirbu
Politehnica University of Timisoara, Romania
roxana.sirbu@upt.ro

**Abstract:**
With the purpose of facilitating stronger economies and sustainable economic growth, decisions on resource allocation in organizations require a systematic, analytical, and thorough approach, as well as clear judgment. Generally, investments include major capital spending and strategic budgeting allocation for product development, and acquisitions and divestitures that shape the future of an organization, or in the case of the public sector, large infrastructure projects. Investments generally include all expenditure for future benefit and include staff training and development, research and development, marketing and revenue enhancement activities, and other intangible expenditures. Decision making process regarding significant projects in all these areas is enhanced by systematic financial and sustainability analysis. The aim of this paper is to present the results of a theoretical research regarding de decision-making process in the case of sustainable investments development. First, some concepts will be defined and debate based on the reference research (e.g. socially responsible investing, green investments, and sustainable investments). Second, there are presented some important aspects of project management as key principles, processes and the stakeholders involved. These are considered as preliminary issues that are used for the decision-making method that is proposed. In addition, a case study will demonstrate the feasibility of the proposed method (for a company in the automotive field of activity).

*Keywords: management, sustainability, investments, projects, decision-making process, model*

# 1. INTRODUCTION

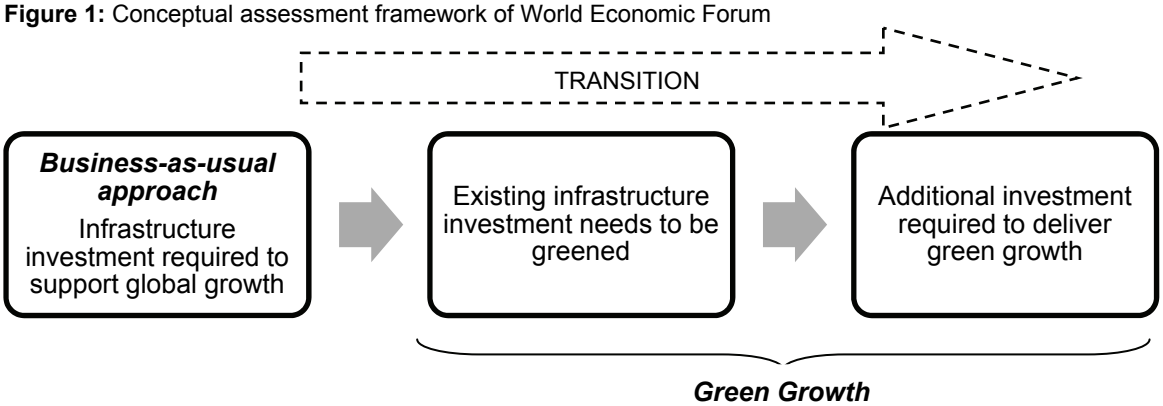
Sustainable development, sustainability are main concern of today's organizations. They are important because they address to the ecological strains and associated problems caused by resource-based economies (scarcity problem of the resources). Organizations operating in a global competitive market must take into consideration investments implementation in order to become green or sustainable (in order to up-date their products/services, processes, and their whole system). Investments could be defined as projects that include major capital spending and strategic budgeting allocation for product development, and acquisitions and divestitures that shape the future of an organization, or in the case of the public sector, large infrastructure projects (Draghici & Dobrea, 2009); (Keane, 2009).

*Eco-investment* concept is also, known as *green investment*. This concept is related to projects implementation having the target of social responsible investments, too. Such investments are developed and implemented in organizations in order to better align themselves to the sustainable development principles; they cover a large variety of topics and field from economics, social and environment (also, address to the improvement of one or two issues/components of the People – Planet – Profit model). The direct consequences (impact) of the green investments project can be associated to eco-products or eco-technologies, environmental products/services and practices (processes developed inside and outside the organization), but also, to social responsibility actions (support different social initiatives, community wealth and growth, disadvantage groups in the community etc.) (Burlea et al., 2013). On the other hand, *sustainable investment* represents an approach based on the effective management of environmental, social and governance aspects and that are fundamental for the value creating process. Responsible investors believe that organizations which are successful in avoiding environmental, social and governance risks (by capturing ESG opportunities) will outperform over the longer term (PricewaterhouseCoopers, 2012). In addition, *social responsible investment*, similar to sustainable investment, social or ethical investment is a strategic approach that aims to maximize both financial and social welfare (Dinu, 2012); (Dobrea & Serban, 2011).

In the last years a great influence on green and sustainable investments has been delivered from the actual norms, regulations and standards. The ISO 14000 series of Environmental Management System (EMS) certification followed the footsteps of the ISO 9000 series of Total Quality Management (TQM), both being linked also, with ISO 26000 series of Corporate Social Responsibility and Occupational Health and Safety (OHS) standards, as ISO 31000 (Wiengarten et al., 2013). This norms and standards have the role to change and influence organizations' behaviour in the sustainable development direction. In addition, "academics and practitioners assumed that TQM principles could be transplanted to the management of corporate environmental and social responsibility, from which the term Total Responsibility Management (TRM) is slowly emerging. In certain circumstances, the certification of a firm's EMS, for instance, would not only be a systematic way of managing risks, but would also have the potential to become a source of competitive advantage" (Orsato, 2006).

The World Economic Forum has published in 2013, The Green Investment Report 2013 (WEF, 2013) describing the green initiatives and investments state by using a framework that is described in Figure 1 (sectors assessed include water, agriculture, forestry, telecommunications, transport, power, buildings and industry).

**Figure 1:** Conceptual assessment framework of World Economic Forum




Source: Adapted from (WEF, 2013, p. 7)

The presented framework has inspired the present research and was adopted from the early stage of our microeconomic analysis on the decision making process regarding the green investments projects. The aim of this paper is to present the results of a theoretical research regarding de decision-making process in the case of sustainable investments development (microeconomic level). After the methodological framework description and the research scenario presentation there should be shown the calculations made using the ELECTRE method for the prioritisation of the green investments projects (collected and characterized using available documents and observations in the case of an automotive company located in the West Region of Romania, a multinational company).

## 2. ELECTRE METHOD USED TO SUPPORT THE DECISION MAKING PROCESS OF CHOOSING THE MOST ADEQUATE SUSTAINABLE INVESTMENT PROJECT

### 2.1. Methodological aspects

In the literature there are presented different aspects of the investments management (and their associated projects) at the macroeconomic level. Less papers, reports and studies are related to the microeconomic level of the analysis when the decision making process has to be supported by different methods and tools that have to be adapted for a particular organizational situation (scenario, case study).

In the case of the research done, there have been collected and characterized a number of 12 major green/sustainable investments projects in the context of the existing organizational infrastructure that need investment to be greened and other 8 major projects related to additional investment that are required to deliver green growth of the company (Table 1). For this selection there have been used the Materiality Analysis method (Figure 2).

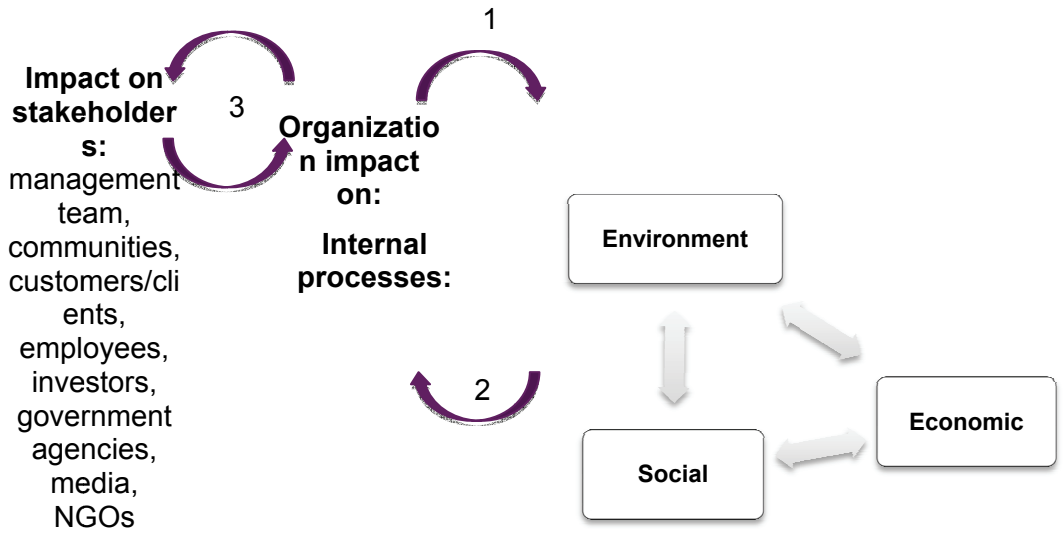
**Table 1:** The selected/Identified green/sustainable investments projects

| Description | Investments projects topics |
|---|---|
| Investments projects for greening the existing organizational infrastructure | 1. *Renewable energy (solar power – photovoltaic power station)*<br>2. *Reduce electric energy consumption (resource efficiency system implement)*<br>3. *Reduce fuel consumption (resource efficiency system implement)*<br>4. *Reduce $CO_2$ emissions (monitoring system implementation)*<br>5. *Pollutant emissions reduction (monitoring organizations emissions; system implementation)*<br>6. *Noise reduction (monitoring system implementation)*<br>7. *Water management project*<br>8. *Product/Services responsibility project (manufacturing processes reengineering; evidences and their dissemination)*<br>9. *Product eco-packaging and eco-delivered*<br>10. *Materials recycling unit development (internal unit)*<br>11. *Employee development and support (competitive labour costs and career development; training and education program; occupational health and safety)*<br>12. *Employee development and support (managing diversity – non-discrimination - and talent management system implementation)* |
| Additional investment projects that are required to deliver green growth | 1. Greening the procurement practices (suppliers environment assessment)<br>2. Greening the market presence (reengineering of marketing communication)<br>3. Product responsibility (customers health and safety, eco-labelling)<br>4. Greening the procurement practices (suppliers labour practices)<br>5. Public – private partnership with university (support a laboratory in Politehnica University of Timisoara)<br>6. Support local community initiatives (music festival)<br>7. Support local community in change transportation behaviour in the local community (use public transportation, bicycles for rent)<br>8. Support local protected area (Bega river channel park) |

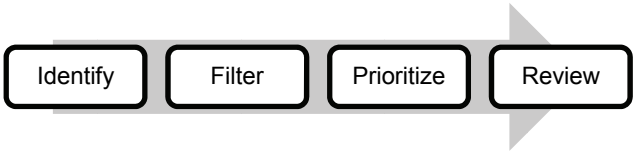
Source: Authors development

Materiality Analysis is an approach related to corporate responsibility reporting and it was used in order to prioritize the actions as green/sustainable investments projects), too. In the case studied, organization was supported to understand what green/sustainable investments projects have a direct or indirect impact on its ability to create, preserve, or erode economic, environmental, and social value for its own, for its stakeholders, and for the society at large (Figure 2a). These green/sustainable investments projects were collected (identified), filtered and prioritized (Figure 2b) in order to generate a global imagine of what should be the business strategy focus and to identify the corporate responsibility efforts. The result of a Materiality Analysis was the Materiality Matrix that shows the results of green/sustainable investments projects prioritization (Figure 3).

**Figure 2:** The Materiality Analysis framework

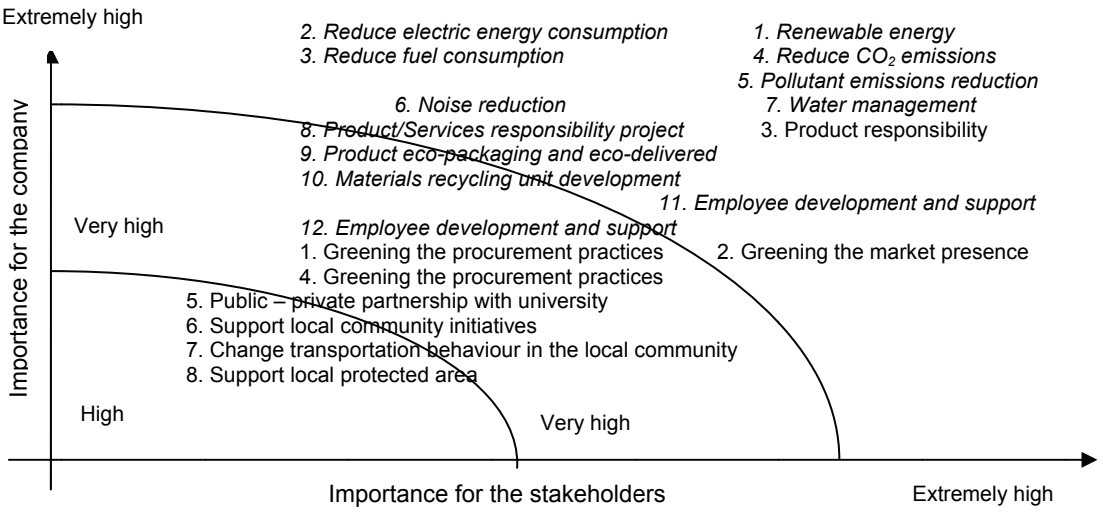



a. Impact aspects considered in the Materiality Analysis (assimilated with green/sustainable investments projects)




b. The main steps for green/sustainable investments projects prioritization
Source: Authors calculations and development

**Figure 3:** The Materiality Matrix




Source: Authors calculations and development

Taking into consideration the presented research context (motivation), and the results of several brainstorming session with managers, specialists and stakeholders (different users of the investment) that were developed from May 2013 to December 2014, there have been recognized that the decision making process of choosing (and implementing) the adequate green/sustainable investment project is a multi-criteria decision one, and this is made under conditions of certainty. The initial information about the projects are available and could be considered reliable; the cause and effect relationships are known regarding the activities, processes that should be developed in a limited period of time (according to the decision theory body of knowledge, the decision maker knows all possible alternatives, and can exactly described or estimate quite exactly at what probability each of them occurs).

The most important green/sustainable investments project for the chosen company is *Renewable energy (solar power – photovoltaic power station).* For the implementation of this investment project in this decision context, there have been used the ELECTRE method (Elimination et Choix Traduisant la Réalité). This method will support the scientifically approach of choosing the most adequate green/sustainable investment project from a pool of three project proposals. ELECTRE method (Elimination et Choix Traduisant la Réalité) represents a tool for optimizing decisions under certain conditions. ELECTRE is usually classified as an outranking method of decision making. After the first version ELECTRE I, the method has evolved into a number of other variants: ELECTRE II (Roy & Bertier, 1971); (Roy & Bertier, 1973); (Roy, 1978), ELECTRE III, ELECTRE IV, ELECTRE IS and ELECTRE TRI (ELECTRE tree); another variant of the ELECTRE approach is the TOPSIS method (Hwang, 1981). ELECTRE is based on the concept of upgrades for eliminate alternatives that are in some sense dominated. The notion of dominance, in the framework of the upgrades, means a generalization of classical dominance weights used to rank the criteria (some of them have more influence than others on the decision). ELECTRE methods allows deciders to choose a variant of a n number of possible options by taking into account all factors (criteria) of quantitative and qualitative influence - the decision base on favourable or unfavourable spaces of different alternatives. This method consists of two main procedures: (1) construction of one or several outranking relation(s) followed by (2) an exploitation procedure (Figueira et al., 2005). The main steps of a decision making process according to the ELECTRE method, are: the problem statement; decision criteria hierarchy establishment; mathematical model definition; optimal solution determination; optimal solution implementation. In the following there shall be demonstrate the decision making process of choosing the most adequate sustainable investment project, using ELECTRE method.

## 2.2. Case study – the decision making process for choosing the most adequate sustainable investments project

The investment projects are related to the *Renewable energy (solar power – photovoltaic power station).* The following calculations were done (based on the ELECTRE method) in order to indentify the most adequate, optimal solution to be implemented.

**Table 2:** Characteristics of the green/sustainable investment projects

| # | Indicators / Criteria | Unit | Project 1 (P1) | Project 2 (P2) | Project 3 (P3) |
|---|---|---|---|---|---|
| C1 | Electric energy unitary cost (related to power generating) | Euro/kw | | | |
| C2 | Quality/Efficiency of energy transport | - | good | weak | good |
| C3 | Required land expropriation | % from total needed | 41 | 35 | 42 |
| C4 | Total investment (Equipment costs including installation and site preparation) | kEuro | 200 | 180 | 230 |
| C5 | Distance to energetic sources | km | 85 | 70 | 50 |
| C6 | Distance from the solar power to the company | km | 30 | 20 | 60 |

Source: Authors calculations and development

1. Problem statement – In Table 1 are shown the characteristics of the three projects proposals (for the green/sustainable investment) that have been considered for the decision making process (they have been collected during the preliminary observation and documenting research phase done in an automotive company located in West Region of Romania). The indicators, criteria used in the decision making process were established based on the most relevant facts has to be taken into consideration (also, discussed as limitations; the number and type of criteria considered vary related to the complexity of the process or to the aims of the decider, the manager). It is can be seen in Table 2, these criteria can be: (a) quantitative one, when their expression is achieved by means of physical quantities, values and conventional; (b) quality one, when their expression is performed using qualifications. The weights associates to the criteria importance were p = {0, 1}.

2. Decision Criteria Hierarchy Establishment - After the decision matrix (Table 2) have been define, there were established the importance coefficients (Table 3). This is done using the selection matrix of the criteria and the comparison factors method. The calculations conduct to the rating matrix definition (Table 4). For each quantitative indicators or criteria were established ranks intervals according to the deciders interests (opinions delivered during a brainstorming sessions) (Table 5, Table 6).

**Table 3:** The importance coefficients for the established criteria

| # | C1 | C2 | C3 | C4 | C5 | C6 |
|---|---|---|---|---|---|---|
| C1 | X | 0 | 0 | 1 | 0 | 0 |
| C2 | 1 | X | 0 | 0 | 1 | 1 |
| C3 | 1 | 1 | X | 0 | 0 | 0 |
| C4 | 0 | 1 | 1 | X | 0 | 0 |
| C5 | 1 | 0 | 1 | 1 | X | 0 |
| C6 | 1 | 0 | 1 | 1 | 1 | X |
| $\Sigma K_j$ | 4 | 2 | 3 | 3 | 2 | 1 |

Source: Authors' calculations

**Table 4:** The rating matrix

| # | C1 | C2 | C3 | C4 | C5 | C6 |
|---|---|---|---|---|---|---|
| P1 | weak | good | normal | normal | weak | Very good |
| P2 | weak | weak | normal | good | weak | Very good |
| P3 | normal | good | normal | weak | normal | normal |
| $\Sigma K_j$ | 4 | 2 | 3 | 3 | 2 | 1 |

Source: Authors' calculations

**Table 5:** The marks given to each rate

| # | Very weak | Weak | Normal | Good | Very good |
|---|---|---|---|---|---|
| C1 | 4 | 9 | 14 | 19 | 24 |
| C3, C4 | 3.5 | 7 | 10.5 | 14 | 17.5 |
| C2, C5 | 2 | 4 | 6 | 8 | 10 |
| C6 | 1 | 3 | 5 | 7 | 9 |

Source: Authors' calculations

**Table 6:** The decision matrix with marks and rating calculations

| # | C1 | C2 | C3 | C4 | C5 | C6 |
|---|---|---|---|---|---|---|
| P1 | 9 | 8 | 10.5 | 7 | 4 | 24 |
| P2 | 9 | 4 | 14 | 7 | 4 | 24 |
| P3 | 14 | 8 | 7 | 10.5 | 6 | 14 |
| $\Sigma K_j$ | 4 | 2 | 3 | 3 | 2 | 1 |

Source: Authors' calculations

3. Mathematical Model Definition consist of the concordance *($C_{cik}$)* and discordance *($C_{dik}$)* matrix definition (Table 7). The concordance matrix is calculated based on the following relations:

$$C_{cik} = \frac{\sum_{N_i \geq N_k} K_j}{\sum_{j=1}^{6} K_j}; \qquad C_{dik} = \frac{max\,\Delta d}{\Delta h_{max}} \qquad (1; 2)$$

In the mathematical relations (1; 2), $\sum_{N_i \geq N_k} K_j$is the sum of the importance coefficient decided for the concordance criteria, when the mark given to the alternative *i* (investment project proposal) is bigger or at least equal to the mark given to the alternative *k*. In our case study, the sum of all importance coefficients allocated for all decision criteria is: $\sum_{j=1}^{6} K_j = 15$ (3)

**Table 7:** The concordance *(Ccik)*, discordance *(Cdik)* matrix and the matrix of differences *($M_{dif}$)*

| $C_{cik}$ | | | | $C_{dik}$ | | | $M_{dif}$ | | |
|---|---|---|---|---|---|---|---|---|---|
| | P1 | P1 | P2 | P3 | P2 | P3 | P1 | P2 | P3 |
| P1 | X | X | 0.15 | 0.43 | 0.8 | 0.4 | X | 0.65 | -0.03 |
| P2 | 0.86 | 0.17 | X | 0.21 | X | 0.26 | 0.69 | X | 0.05 |
| P3 | 0.73 | 0.43 | 0.43 | X | 0.73 | X | 0.30 | 0.30 | X |

Source: Authors' calculations

In equation (2), *Δd* is the discordant interval for a criterion in which the appreciation of the *k* variable is superior to variable *i,* $N_k > N_{ik}$, and $\Delta d = N_i - N_k$; $\Delta h_{max}$ is the maximum value of the difference between the maximum and minimum mark choose on the rating scale. The matrix of differences (Table 7) is the difference between concordance and discordance matrix: $M_{dif} = C_{cik} - C_{dik}$.

4. Optimal Solution Result - the matrix of investments projects hierarchy (Table 8) with coefficients 0 and 1, is build with respect of the formulae: $C_{cik}$ - $C_{dik}$ > $C_{cki}$ - $C_{dki}$ (4)

**Table 8:** The decision matrix of the investments projects hierarchy

| | P1 | P2 | P3 | Σ |
|---|---|---|---|---|
| P1 | X | 0 | 0 | 0 |
| P2 | 1 | X | 0 | 1 |
| P3 | 1 | 1 | X | 2 |

Source: Authors' calculations

As it can be seen in Table 8, the hierarchy of the investments projects is: P3 (optimal solution), P2 and last, P1. Based on the results of applying ELECTRE method, in the case of the decision making process for building a *Solar power – photovoltaic power station (using a source of renewable energy),* the company's management has reconsider the initial projects proposals from a different perspective. The final decision was taken by a deep analysis of the economic efficiency of the three projects proposals.

## 3. CONCLUSIONS

The paper presents a systematic approach on supporting the decisions of implementing green/sustainable investment project. It consists of combining the Materiality Analysis with ELECTRE method. Materiality Analysis has been used in order to identify, filter and prioritize company's investments in order to implement the sustainable development principles (and underling the efforts that should be made for corporate responsible improvement). The Materiality Matrix (as a graphical representation of the green/sustainable investments ideas) has shown the benchmark of the green/sustainable initiatives needed to be implemented by taking into consideration the different degrees of importance for the company itself and for its stakeholders (internal and external). In the case of each green/sustainable investment ideas shown in the Materiality Matrix (which are urgencies and of very high importance for company and for the stakeholders), there could be used ELECTRE method (a multi-criteria decision made under conditions of certainty) in order to better support the decision process of the most adequate investment project implementation (optimal solution). Finally, the hierarchy of the potential investments projects proposals (delivered by the ELECTRE method) have to be considered together with the results of the economic (eco-)efficiency indicators (analysis based on estimations and marginal analysis between projects) calculations in order to better decide on the optimal investment solution.

In future researches there should be re-considered the economic indicators and criteria used for the ELECTRE method calculations. This depends on green/sustainable type of investments projects and on the organization's type where the analysis in done (public body or company, small enterprises, big

enterprises). Furthermore, in the case of an organization there must be considered and analysed all the green/sustainable initiatives shown by the Materiality Analysis, at least with very high importance, in order to better support the green/sustainable investment strategy (optimizations have to consider organization's budget limitations). In addition, the extension of the indicators/criteria used in the ELECTRE method and increasing the number of green/sustainable investments ideas will need an informatics support for the calculations.

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