

Universidade do Minho

Assessment of companies practices concerning the evaluation of R&D investment project

Alexandre Amaro

Jorge Cunha

Enrique Ares

Madalena Araújo

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Aim of the paper

- This paper addresses part of the research conducted so far, focusing in particular on the private perspective, namely on the identification of the more appropriate methods for the evaluation of research and development (R&D) investments projects by companies.
- Several studies indicate that the use of traditional financial methods is not the most appropriate for evaluating R&D projects. (Chan, 2001, Proctor and Canada, 1992, and Mensah and Miranti, 1989).
- The use of these methods consists, basically, on discounting the expected future cash flows and the adoption of several methods for measuring its financial viability.

Aim of the paper

- For R&D projects the estimation of financial flows and the assessment of their risks tend to be different from general tangible investments.
- One of the objectives of this paper is to present an up-to-date state-of-the-art regarding the non-financial techniques that have been proposed to evaluate investment projects in research and development (R&D).
- This study discusses several non-financial criteria to be considered in the evaluation of R&D projects, which have been proposed in the literature related to products manufacturing, environmental, employment, users of the results of R&D, competitiveness of technology, relevance of technology, economic benefit, social benefit, quality of technical plan, availability of resource, technical risk, development risk, commercial risk, and return of investment.

Aim of the paper

- A second objective is to conduct an inquiry to a sample of metallurgical companies in northern Portugal and southern Galicia in order to assess which practices have been used to evaluate R&D investments .In fact, this would allow us to gain an insight concerning both the financial and non-financial criteria used and if they use software support, as well as the importance of certain non-financial criteria in the evaluation of projects.
- The ultimate goal of this research would be to propose an integrated methodology that can be applied to the evaluation of R&D projects, based on financial and non-financial methods using multi-criteria techniques.

2. Literature review

2.1 Financial Criteria:

- Over the years companies have generally based the assessment of their projects on financial criteria in order to achieve the best economic performance.
- Financial convenience to undertake an investment project can be analyzed in principle, according to their economic performance or expected profitability, that is, if the net cash flows generated during their lifetime (revenues minus costs and expenses) outweigh the initial investment.
- The translation of the economic realities to algebraic equations is always a delicate approach, and it is odd that a mathematical formulation may reflect the complexity and the uncertain nature of the problems.

2. Literature review

Financial methods: Do not take into account the time value of money:

▪ Payback period: PBP

- ✓ Calculates the number of years needed to recover the initial investment.
- ✓ Decision criterion is based on choosing the project that recovers the initial investment in a shorter period of time (Fernández, 2007).
- ✓ This method rewards liquidity over profitability (Mascareñas, 2008).
- ✓ Increase the security of investments since the time it would take to recover the investment would be known (Garcia 2007).

2. Literature review

□ **Financial methods:** Do not take into account the time value of money:

▪ **Payback period: PBP**

- ✘ It disregards the cash flows generated after the recovery period.
- ✘ Does not consider the time value of money (Vela, 2005).
- ✘ Tends to accept more projects with a shorter live over more profitable projects but with a longer period of time to recover the initial investment (García 2007).

2. Literature review

Financial methods: Do not take into account the time value of money:

▪ Accounting average rate of return: ARR

- ✓ Relates the average annual cash flow and the initial investment showing an average rate of return of the project (Fernández, 2007).
- ✓ This is an easy method to understand and to apply.
- ✓ The values used are the ones directly obtainable from accounting data. (García, 2007)
- ✓ Easy to obtain a term of comparison (García, 2007, Fernández, 2007).

2. Literature review

- **Financial methods: Do not take into account the time value of money:**
 - **Accounting average rate of return: ARR**
 - ✗ Ignores the time value of money.
 - ✗ It is based on accounting profits and not on the project cash flows.
 - ✗ It is necessary to set a standard reference for assessing a project (Fernández, 2007)

2. Literature review

□ Financial methods: Discounting cash flow methods:

▪ Net present value: NPV

- ✓ Consists of discounting all the expected future cash flows of an investment project, using a discount rate which is the opportunity cost of the capital employed in the investment project. After discounting all the future cash flows the value of the initial investment is subtracted. (Mascareñas, 2008).
- ✓ Eliminates the disadvantages of the two former methods in relation to the time value of money. (García, 2007)

2. Literature review

□ Financial methods: Discounting cash flow methods:

▪ Net present value: NPV

✘ Its calculation requires time, the understanding of this concept and also a discount rate for calculations (García, 2007).

✘ It is unable to properly assess investment projects that are flexible with time.

✘ It is implicitly assumed that the cash flows, which are generated over its lifetime, will have to be reinvested until its term at a rate identical to their opportunity cost of capital (Mascareñas, 2008).

2. Literature review

□ Financial methods: Discounting cash flow methods:

▪ Profitability index: PI

- ✓ Consists of dividing the present value of cash flows by the initial disbursement of the investment (Mascareñas, 2008).
- ✓ Is applied in situations where there are capital restrictions.
- ✗ It does not yield a period return which complicates their understanding.

2. Literature review

□ Financial methods: Discounting cash flow methods:

▪ Internal rate of return : IRR

- ✓ Represents the discount rate for which the NPV of the project is zero.
- ✓ Rate of capital is determined per period (Rocabert, 2007).
- ✓ This is a widely used criterion for project evaluation because it can be compared to the opportunity cost of capital.

2. Literature review

□ Financial methods: Discounting cash flow methods:

▪ Internal rate of return :

- ✘ Multiple IRR could appear when there are positive cash flows mixed with negative ones.
- ✘ Mutually exclusive projects could appear when NPV and IRR can lead to different conclusions about what project should be accepted.
- ✘ IRR it is implicit the assumption that the cash flows being generated by the project during its economic life are reinvested at the IRR.

There is a variant of the IRR called IRRM. This method of valuation takes into account that the reinvestment of cash flows generated by the project will have to be at the opportunity cost of capital, and therefore it always provides a unique

positive rate of return which is very useful for the completion of the projects (Chang, 1999).

2. Literature review

2.2 Non-Financial Criteria:

- Steuer (2003) argue that a modern enterprise is a complex organization in which different interests interact one another.
- Some authors (e.g. Henig and Katz, 1996, Linton *et al.*, 2000, Krupka *et al.*, 2005, Fernández *et al.*, 2008, and Huang *et al.*, 2006) have identified and gathered several criteria to be considered at the time of evaluating investment projects.

Katz (1996) propose the following set of criteria focused on PRODUCT such as the following:

Criteria	
Size of existing market	This criterion is determined from market research.
Competition	It would have to analyze the likelihood that competition could develop similar products.
Competitive advantage	It should also analyze the capacity of a new product to compete with existing ones.
Patentability	It is important to know the likelihood of a product or technological innovation can be patented as they would provide future revenues for the company.
Development capacity	The extent to which the company has the technology to develop the product.
Production	The total production cost of the finished product.
Development costs	The cost that leads to the fact of developing a project in a given year.
Time of Completion	When the product is put on the market.
Toxicity	We must also take into account whether the product is toxic to mammals, plants or other beneficial organisms

Krupka et al. (2005): Analyze the ENVIRONMENTAL CRITERIA: Creating a decision-making process for the environmental system is complicated, is difficult to define the environmental benefits of a project:

Criteria

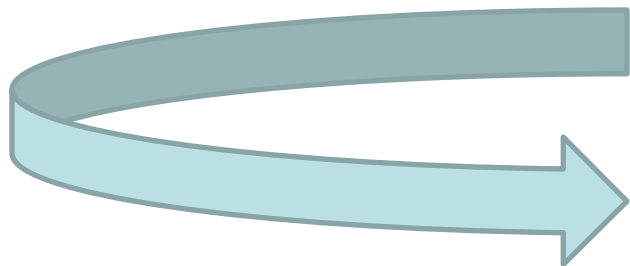
Minimize the emission of harmful substances

Increase in the value of the effects achieved by the unit of invested costs

The eco-efficiency

The valuation of environmental benefits

In a study undertaken by Fernández et al. (2008), they made a studio with some companies and they had the next criteria:



- ❖ Employment
- ❖ Users of the results of R & D
- ❖ Environment.

Criteria: Employment

Job Creation / Transformation / Removal in implementing the outcome of a project.

Job quality (improvements in working conditions: physical, psychological, etc.)

Level of employee training.

Collaboration between businesses, universities, etc.

Criteria: Users of the results of R&D

Improvement in meeting economic / social needs of end users due to unmet needs

Contribution to solving / creating social problems (relocation, discrimination, disabilities, etc)

Company social responsibility (CSR).

Knowledge dissemination through patents.

Criteria: Environment

Effects on the functioning of markets: structure, corporate behaviour, strategy, impact on suppliers, competition, creation of new businesses, outsourcing.

Huang *et al.* (2006) show a detailed study in the Industrial Technology Development Program in Taiwan.

Criteria	
Competitiveness of technology:	Proprietary technology, Key of technology, Innovation of technology, Advancement of technology.
Relevance of technology	Technological extendibility, Technological connections, Generics of technology.
Economic benefit	Technology spillover effects, The potential size of market, Improvement on research capability.
Social benefit	Improvements on QESIS, Coincidence with S&T policy, Benefits for human life, The contributions to the state of Knowledge.
Quality of technical plan	Content of technical plan, Capability of research team, Reasonableness for research period, Reasonableness for research cost, Environmental and safety consideration
Availability of resource	Technical resource availability, Technical support, Equipment support.
Technical risk	Opportunity of technical success, Evidence of scientific feasibility, Specification of technology.
Development risk	Risk for development cost, Risk for time cost, Timing for project.
Commercial risk	Opportunity of market success, Opportunity of project result implementation.

3. Research Methodology

□ 3.1 Questionnaire structure :

- In the present study, an electronic questionnaire was used. Then, in order to improve the response rate, a series of telephonic contacts were initiated.



- ✓ It is time and cost-efficient. (Afonso, 2008).
- ✓ Electronic surveys allow eliminating geographic barriers (Mahía, 2002).
- ✓ The data collected can, therefore, be handled much easier.
- ✗ The answers are the opinion of an individual person (Ryan and Ryan, 2002).
- ✗ Survey participants may not be representative of the defined population (Graham and Harvey, 2001).
- ✗ The response rate tends to be very low, (Mahía, 2002).

3. Research Methodology

3.1 Questionnaire structure :

- The questionnaire used in this research project was designed
 - To gather information on techniques and software used in the evaluation of R&D projects of metallurgical companies in the North of Portugal and in the South of Galicia.
 - To know the criteria used in the evaluation projects trying to discover the relative importance of each one of them.
- Most questions were measured using a five-point Likert scale. Likert scales are particularly useful for measuring the technique or level of use of the criteria.

Group	Window	Variables
Group 1	General information about the firm	Enterprise sector, position in the company, age, incomes, exports, number of employees, research and development projects
Group 2	Research and development projects	Budget, years
Group 3	Financial criteria	PBP, ARR, NPV, IRR, software
Group 4	Non-financial criteria	Jobs, social, technology, environmental, risk, economic and strategic
Group 5	Multicriteria methods	Methods, software

- Questions were grouped in different windows. This procedure allows respondents to have a higher focus on each particular issue, as they are not distracted by other questions.
- The use of several screens reduces the perceived length of the questionnaire.
- The use of a multi-window questionnaire is useful to ensure the validation of the answers in the data collection process.
- Additionally, the answer to a particular question can change the order or the evolution of the questions. This happens with the question of window 1 “Has your company invested in R&D projects?”

2.- Información a cerca de la empresa

A continuación se le van a realizar unas preguntas relacionadas con su empresa.

*1. Indique el cargo que desempeña dentro de la empresa

*2. Indique el sector al que se dedica su empresa

- Investigación y desarrollo
- Construcción de barcos
- Reparación y mantenimiento Naval
- Fabricación de piezas para Automoción
- Fundición
- Carpintería metálica
- Manipulación de mercancías
- Fabricación de depósitos de metal
- Tratamiento y revestimiento de metales
- Fabricación de herramientas.
- Otro (Por favor especifique)

*3. Indique el rango de años que lleva su empresa en funcionamiento

- 0-5 años
- 6-10 años
- 11 a 15 años
- 16 a 20 años
- 21 a 25 años
- Más de 26 años

*4. Indique el rango de ingresos de su empresa

- 0 - 1.000.000 €
- 1.000.001 - 10.000.000 €
- 10.000.001 - 20.000.000 €
- 20.000.001 - 30.000.000 €
- 30.000.001 - 40.000.000 €
- 40.000.001 - 50.000.000 €
- Más de 50.000.000 €

*5. ¿ Podría indicar qué porcentaje de sus ingresos proceden de las exportaciones ?

- No exportamos
- 0-20 %
- 21-40 %
- 41-60 %
- 61-80 %
- 81-100 %

*6. Indique el rango en el cual se encuentra el número de empleados de su empresa.

- 0-20
- 21-40
- 41-60
- 61-80
- 81-100
- 101-200
- 201-400
- 401-800
- Más de 800

*7. ¿ Su empresa realiza o realizó en algún momento proyectos de I&D ?

- SI
- NO

3.- INVESTIGACIÓN Y DESARROLLO

***8. Indique el rango del % del presupuesto que su empresa destina a I&D, o destinó en algún momento.**

- Menos del 1 %
- 1 - 5 %
- 6 - 10%
- 11 - 15%
- 16 - 20%
- Más del 20%

***9. Indique el rango de años que lleva su empresa invirtiendo en proyectos de I&D**

- 0-5 años
- 6-10 años
- 11-15 años
- 16-20 años
- 21-25 años
- Más de 25 años

4.- Indicadores financieros de evaluación de proyectos de I&D

***10. Indique la frecuencia con la que su empresa utiliza estos indicadores financieros a la hora de evaluar proyectos de I&D**

	Nunca	Pocas veces	Alguna vez	Bastantes veces	Siempre
Tasa interna de rendimiento (TIR)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Valor Actual Neto (VAN)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tasa de rendimiento requerida	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plazo de recuperación (Payback)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Análisis de sensibilidad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plazo de recuperación descontado	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tasa de rendimiento contable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Indice de rentabilidad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Otro	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. En caso de que su empresa utilizara otro indicador financiero indique cuál.

***12. ¿ Utiliza software de apoyo a la toma de decisiones para alguna de éstas técnicas ?**

- SI
- NO

13. En caso de utilizar software de apoyo ¿ Podría indicarnos el software utilizado por su empresa?

5.- Indicadores no financieros de evaluación de proyectos de I&D

14. Indique la importancia de los siguientes indicadores a la hora de evaluar proyectos de I&D por parte de su empresa, o en su opinión la relevancia que tendrían a la hora de la evaluación de proyectos.

PUESTOS DE TRABAJO

	Nada importante	Poco importante	Importante	Bastante importante	Muy importante
Eliminación de puestos de trabajo.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mejora en la calidad del trabajo.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mejora del nivel de formación para el puesto.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mantenimiento/Consolidación de empleos.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. Indique la importancia de los siguientes indicadores a la hora de evaluar proyectos de I&D por parte de su empresa, o en su opinión la relevancia que tendrían a la hora de la evaluación de proyectos.

SOCIALES

	Nada importante	Poco importante	Importante	Bastante importante	Muy importante
Conciliación actividad profesional y familiar.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Responsabilidad social de las empresas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Búsqueda de necesidades sociales insatisfechas, o mejoras en la calidad de vida.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reconocimientos sociales	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. Indique la importancia de los siguientes indicadores a la hora de evaluar proyectos de I&D por parte de su empresa, o en su opinión la relevancia que tendrían a la hora de la evaluación de proyectos.

TECNOLOGÍA

	Nada importante	Poco importante	Importante	Bastante importante	Muy importante
Avance de la tecnología existente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Derechos de propiedad sobre las patentes tecnológicas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mejora del proceso productivo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tamaño del mercado al que va dirigido la tecnología.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. Indique la importancia de los siguientes indicadores a la hora de evaluar proyectos de I&D por parte de su empresa, o en su opinión la relevancia que tendrían a la hora de la evaluación de proyectos.

AMBIENTALES

	Nada importante	Poco importante	Importante	Bastante importante	Muy importante
Reducción de la contaminación	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ayudas gubernamentales	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Impacto social	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducción del consumo energético	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. Indique la importancia de los siguientes indicadores a la hora de evaluar proyectos de I&D por parte de su empresa, o en su opinión la relevancia que tendrían a la hora de la evaluación de proyectos.

RIESGO

	Nada importante	Poco importante	Importante	Bastante importante	Muy importante
Tiempo que transcurre hasta la recuperación del dinero invertido.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Total del dinero a invertir en el proyecto	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Viabilidad del proyecto.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tiempo que transcurre hasta que se realiza el proyecto	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. Indique la importancia de los siguientes indicadores a la hora de evaluar proyectos de I&D por parte de su empresa, o en su opinión la relevancia que tendrían a la hora de la evaluación de proyectos.

ECONÓMICOS Y ESTRATÉGICOS

	Nada importante	Poco importante	Importante	Bastante importante	Muy importante.
Mejora de la competitividad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fomento de la colaboración con empresas, universidades...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Búsqueda de la diferenciación sobre el resto de empresas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Explotación de patentes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6.- Técnicas multicriterio

Hoy en día las empresas están interrelacionadas con el mundo que les rodea, es por ello en que en estos momentos no sólo se tienen en cuenta los criterios financieros a la hora de evaluar los proyectos de inversión, sino que también se tienen en cuenta criterios sociales, ambientales... es por ello que existen las técnicas multicriterio.

***20. Indique la frecuencia con la que su empresa utiliza estos métodos multicriterio a la hora de evaluar proyectos de I&D**

	Nunca	Pocas veces	Alguna vez	Bastantes veces	Siempre
Método de las ponderaciones	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Programación Multiobjetivo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teoría de la Utilidad Multiatributo (MAUT)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Proceso Analítico Jerárquico (AHP)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electre/Prométhée	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Otro	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. En caso de que utilizara otra técnica diferente, indique cuál.

***22. ¿ Utiliza software de apoyo a la toma de decisiones para alguna de éstas técnicas ?**

- SI
 NO

23. En caso de utilizar software de apoyo ¿ Podría indicarnos el software utilizado por su empresa?

7.- Final de la encuesta

Ha llegado al final de la encuesta. Muchas gracias por la atención prestada.

24. ¿ Desea realizar algún tipo de comentario acerca de esta encuesta ?

25. Si está interesado en recibir los resultados de la encuesta, indique su correo electrónico.

3. Research Methodology

3.2 Collecting the data:

- Before beginning collecting the data of the survey, it is necessary to design its structure, as well as to choose the addressees of the survey. First of all, we looked up the metallurgical companies in the Vigo area in a database from Vigo University. In the first selection, a total of 259 companies were chosen of the following sectors: research and development, metallurgy, manufacture of metal products, automotive and naval.
- Then a second selection was carried out. For this, companies with an income under 1,000,000 € and less than 20 employees were eliminated. From this selection, a total of 119 companies were obtained.

4. Empirical Analysis

- Every time it is more necessary the use of methodologies that permit to reduce or temper the risk of improvised conjectures or suppositions, in the eagerness to reach better levels of competitiveness of companies and industrial sectors.
- Contreras and Pacheco (2007) emphasised that when there are many intangible variables impossible to quantify with traditional measurements (e.g. political, social and environmental aspects), which have to be measured in a common scale and taken into account when evaluating the projects, and that those variables are difficult to measure, limits the use of traditional methods for evaluating projects.

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4. Empirical Analysis

- As a response to these problems we have multi-criterion methods, since one of the main characteristics of multi-criterion methodologies is the range of factors that we manage to incorporate into the process of evaluation.
- The purpose of multi-criterion methods is to break a complex problem into simpler parts, what allows the decision-maker agent to structure a problem with many criteria in a visual way, through the construction of a hierarchical model that basically contains three levels: aim or objective, criteria and alternatives. The model is built, two by two comparisons are made between these elements and numerical values are given to the preferences assigned by individuals (Rodríguez, 2008).

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4. Empirical Analysis

- The main advantages and disadvantages of multi-criteria decision models are discussed based on the following authors: Pacheco and Contreras (2008), Saaty (2008), Hogarth (1991), Berumen and Llamazares (2007), Ross (2007), Fernández and Escribano (2001), Fernández (1991).
 - ✓ Permits to simplify and find a solution to complex situations.
 - ✓ It is an understandable method given that the bases of the criteria selection and the marking of the results are often simple, understandable and determined by the group that leads the analysis.
 - ✓ It is a rational method due to the homogeneous and simultaneous study of a great number of factors.
 - ✓ Permits a sound assessment of the different elements included in the analysis, which allows to rationalise the process that leads to the decisions.
 - ✓ It is a useful negotiation tool in complex discussions.



4. Empirical Analysis

- ✘ It need to clearly define previous conditions and the corresponding agreement of all individuals involved in the process.
- ✘ Discussions about this process can be long, complex and difficult, since it is necessary to select the actions or alternatives of the study, to define the comparison criteria and to prepare the marking tables.
- ✘ The lack of reliable data in the needed period to establish and validate the methods can mean a problem.
- ✘ The length of time implied by the multi-criteria analyses. In fact, this is often based on long and iterant processes that may require an important and long negotiation period.
- ✘ The technical nature of the method: it is necessary to use computer tools and there are mathematical concepts involved.
- ✘ It is a subjective method.

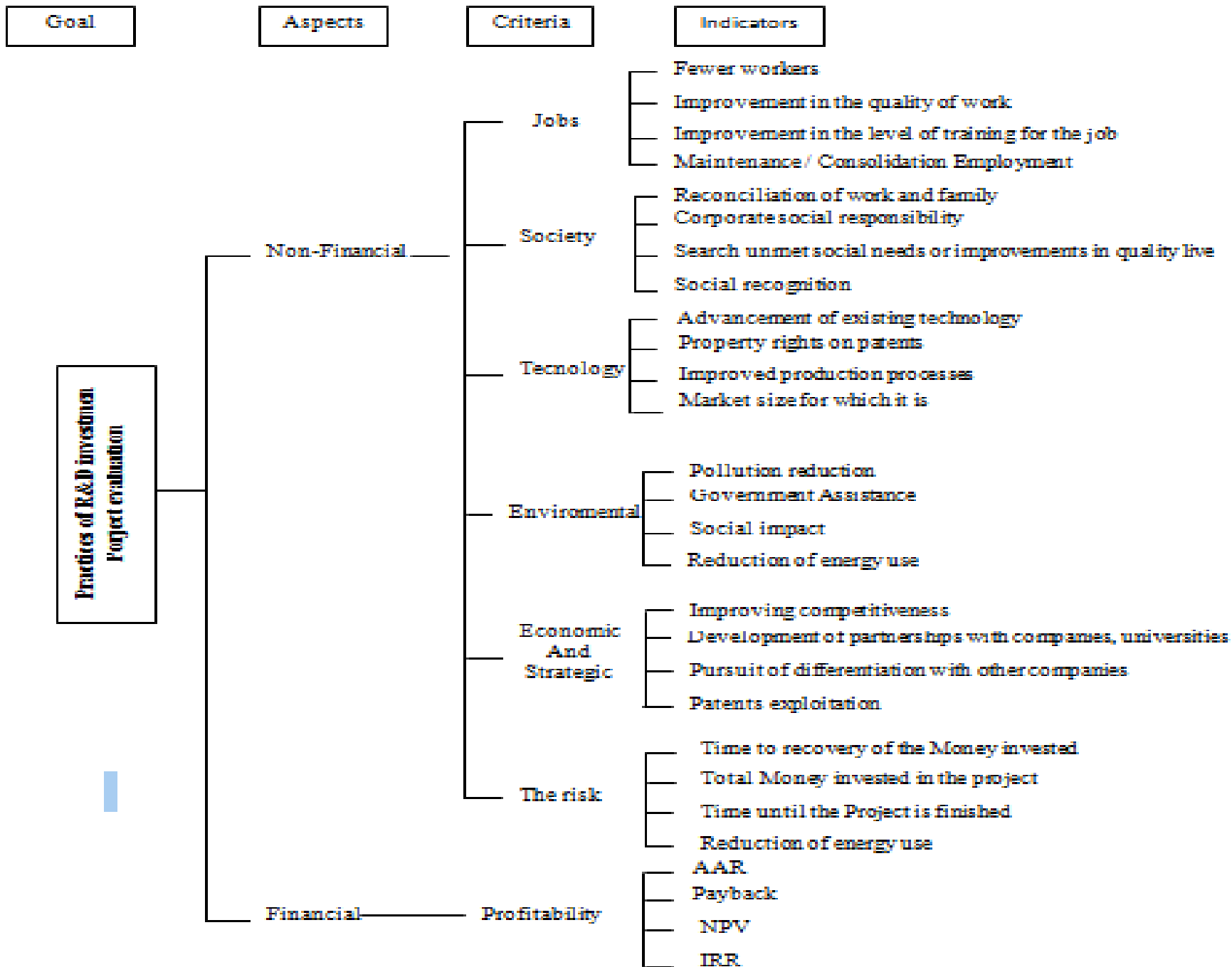
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5. Conclusions and further work

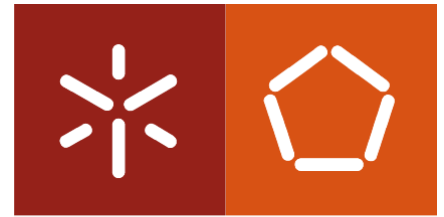
- ⊕ This study tries to explain and understand the criteria used by companies in the evaluation of R&D projects.
- ⊕ The use of both financial methods and non-financial ones would be recommended.
- ⊕ We explain the use of a questionnaire with the aim of knowing the criteria used by the companies of the metallurgical sector from the North of Portugal and the South of Galicia, as well as to identify the software used by companies as a means of supporting the decisions.
- ⊕ A hierarchy frame for evaluation of R&D investment projects was proposed. In this hierarchy frame
- ⊕ On the other hand, multi-criterion methods were presented as a solution to the problem of analysing several factors at the same time in the assessment of R&D projects.



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Universidade do Minho

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Alexandre Amaro

Jorge Cunha

Enrique Ares

Madalena Araújo