

Knowledge for Growth – Industrial Research & Innovation (IRI)

The Socio-Economic Return of the Research and Development (R&D) Support Programmes

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**CORPORATE R&D: AN ENGINE FOR GROWTH,
A CHALLENGE FOR EUROPEAN POLICY**

The link between corporate R&D, innovation, and employment

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Abstract

The results of a state of the art review conducted so far, make clear the relevance of addressing the socio-economic return of public investment, in particular the support provided by the European Union programmes to R&D projects at national or regional level. However, according to the theoretical and empirical literature survey and, based on the experience and studies made in different countries and institutions, it seems that a formal appraisal of the socio-economic added value of these support programmes is ultimately needed. Besides that, the consultation of relevant experts and competent authorities seems to be an essential element for the evaluation process. This research work aims to present a participatory methodology that may be used to assess the social impact of the R&D programmes and their contribution to the general social welfare. Based on the literature survey and on the empirical analysis, a hierarchical set of attributes and measurable indicators was chosen in order to characterise qualitatively and quantitatively the R&D programme goals and achievements. These indicators were then presented to a group of experts, chosen from companies and national organisms directly involved in public programmes or in charge of projects supported by these programmes. The final output of this research is a proposal of a final ranking, indicating the relative importance of each attribute and of each individual indicator as a measure for the socio-economic added value of an R&D programme.

Key words: Socio-economic return, Support programmes, Project evaluation.

JEL classification: O31 - Innovation and Invention: Processes and Incentives

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1 - Introduction

Here is an important question that can be raised: “Why do governments support R&D programmes?”

From the several possible answers, these can be enhanced: because R&D is expensive to the companies; because the return is uncertain and distant; the insufficient information available can drive consumers not to choose innovative products; the short term time lines are not compatible with the long term investments in R&D (Cozzarin, 2006).

This work aims to present a tool for analyzing funding programmes dedicated to support R&D projects based on published reports. To achieve this goal is necessary to select and organize indicators that characterize the programmes qualitatively and quantitatively. This will lead to the design of a structure of indicators. The obtained structure will be validated by experts in interviews. From the results of these interviews it is expected to find an ordering of the indicators and their weight. Then the structure of indicators may be used to evaluate funding programmes in terms of their socio-economic return.

The bibliographic research conducted reveals the Europe and Worldwide state of the art related with the analysis of the socio-economic return of the support programmes dedicated to R&D projects. The first conclusion achieved is that it is more interesting for companies and governments to analyze and compare the support programmes rather than the projects in separate. However it is very difficult to have information available, due to confidentiality issues and lack of organized data. The reviewed scientific articles indicate that these difficulties were experienced by all the researchers, regardless of the different processes and methods used for the analyses. These processes can differ from purely financial concepts, to empirical or mathematical approaches or to multicriteria methods.

The offer in terms of support programmes accessible to the companies is large, both from National and European sources. The process of analyzing, comparing and selecting these programmes is complex and requires constant updating. According the experts’ opinion, the projects must be adapted to the programmes objectives and not the opposite. So the companies must have an extra effort in the search of the best programme to apply, in order succeed in the submission process. To help in the submission process and in the follow-up of the supported projects, there are a few companies dedicated to this purpose.

The structure of the paper is presented subsequently. Following the introduction is section 2 dedicated to the selection of indicators. This section aims to design a structure of indicators that will be validated by experts in the interviews. In section 3 are the interviews. Here is present the

selection of the participants, the checklist overview and the results analysis divided in two parts: qualitative analysis and quantitative analysis. The conclusions and recommendations for future developments are presented in section 4.

2 - Indicators

The starting point for the indicators selection was the work that presently is being developed at University of Vigo with the title “*Análisis del “Retorno Social” de la financiación pública de la I+D+i*” by Ares et al (2008). This study aims to know the objective of the support policies to the R&D & Innovation activities with public funding. One of the expected results is the establishment of an index that will allow the identification, qualification and quantification of the social return of these policies in Spain.

The selection of indicators was based on the bibliographic research conducted and was supported on the following studies: Andersen e Molin (2007); Ares et al (2008); Baslé (2006); Cozzarin (2006 and 2008); European Commission (2001); Huang et al (2008); Niemeijer and Groot (2008); Roper (2004).

The selected indicators were identified as key-characteristics for the R&D projects evaluation and included: employment, work conditions, training, energy and environment, innovation, social and financial return. This selection was made always taking into account the need to chose indicators realistic, easy to understand and easy to measure. In the first phase the aim was to group the indicators in order to achieve a simple and hierarchic structure. In the next phase some indicators were added and some were changed or eliminated. This phase had the purpose of creating a homogeneous structure of indicators so it would be easier to use in the interviews. At the end a structure (similar to a tree) was established, comprising:

- 6 indicators categories;
- 2 primary indicators in each indicators categories;
- 4 secondary indicators in each primary indicator.

This indicators structure was designed with one final goal: the indicators categories will be used in all kinds of programmes to have a common base; then the primary and secondary indicators will be used according to the programmes objectives. This way the indicators structure will be applied to the support programmes in order to achieve a formal evaluation process that can be used in different types of support programmes. Just then it will be possible to analyse and compare the existing support programmes with one type of evaluation.

The final indicators structure is presented on Table 1.

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Table 1 – Structure of indicators.

| Indicators categories | Primary indicators | Secondary indicators |
|--------------------------------|-----------------------|--------------------------------------|
| Employment | New work places | Inside the company |
| | | Outside the company |
| | | Qualified |
| | | For exclusion groups |
| | Same work places | Consolidation |
| | | Change functions |
| | | Development of other capabilities |
| | | Equality |
| Work Conditions | Physical factors | Adjustment to the work place |
| | | Wages |
| | | Contract conditions |
| | | Mobility |
| | Psychological factors | Manage work life with family life |
| | | Work environment |
| | | Justice |
| | | Safety |
| Training | Inside the company | Scholarship |
| | | Experience obtained |
| | | Polyvalence |
| | | Adjustment to the work place |
| | Outside the company | Knowledge diffusion |
| | | Social responsibility |
| | | Creation of spin-off |
| | | Learning process |
| Social versus Financial Return | Social | Life conditions |
| | | Contribution to regional development |
| | | Stakeholders satisfaction |

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| | | |
|------------------------|----------------------|---|
| | Financial | Contribution to national, regional and european policies |
| | | Profit / Productivity |
| | | Market share |
| | | Companies' financial stability |
| | | Cost reduction |
| Energy and Environment | Environment impact | Waste reduction and improvement |
| | | Emissions prevention and reduction |
| | | Contribution to sustainable environmental systems |
| | | Preservation of the natural resources and cultural heritage |
| | Energetic efficiency | Use of renewable energy sources |
| | | Reduction of the energetic costs |
| | | Reduction of the energetic consumption |
| | | Contribution to energetic policies |
| Innovation | Bibliometrics | Publications / Citations |
| | | National and international patents |
| | | Creation of rules and standards |
| | | Product, service and process innovation |
| | Knowledge diffusion | Production of new knowledge |
| | | Strength and development of capabilities |
| | | Increase in R&D and/or technology transfer |
| | | Acceptation in the local community |

The indicators structure was presented to the experts during the interviews. They were asked to weight all the indicators in order to obtain an order representing the indicators relative importance according to each expert's opinion.

In the future, it will be relevant to apply this indicators structure to support programmes of R&D projects so that the programmes can be evaluated according to this process.

3 - Interviews

According to Yin (1994) there are several ways of doing research in the social sciences: experience, research, history, cases studies and data analysis. Each of these paths has its own advantages and disadvantages. According to this work's objective it was chosen the research based on interviews.

3.1 Selection of the participants

The selection of the participants was done with the aim of including experts involved on the appliance for programmes support schemes, others supporting R&D projects and other ones involved on the submission and follow-up process. The entities contacted and that participated in this study were:

- Astrale – European consortium of monitoring Life programme (*L'Instrument Financier pour l'Environnement*). The person interviewed is a project manager responsible for the follow-up of the environment projects in Portugal.
- CCDR-Norte – Decentralized body of the Portuguese government responsible to promote and monitor projects of regional development. In this entity two persons were interviewed: one in the Inter-regional and Cross-border Cooperation and other in the Strategic Planning, both dealing with submission of proposals, follow-up of projects and final reporting from Portuguese enterprises applying to public funding.
- Centro Tecnológico das Indústrias Têxteis e do Vestuário de Portugal (Citeve) – Private entity that participates in many funded R&D projects. The person contacted is a project manager responsible for the submission of proposals, follow-up of projects and final reporting from Portuguese enterprises applying to public funding. The R&D projects are a collaborative process between Citeve and each enterprise.
- Faculdade de Engenharia da Universidade do Porto (FEUP) – Public faculty that participates, make follow-up and promotes R&D projects with national and European funding. This faculty participate in R&D projects, consortiums and also promotes R&D projects. In this entity two persons were interviewed: one is a professor and researcher with active participation in several funded R&D projects and the other is the responsible for the Cooperation Department that gives support in the selection of the best programme for the faculty R&D projects.

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- Innovayt – Private consulting entity that gives support to other companies in the submission of proposal to public and European funding. The person interviewed is a project manager responsible for the follow-up of the submission process.
- Instituto de Soldadura e Qualidade (ISQ) – Private entity that offers technical inspection, training and consultancy services, supported by R&D activities and by accredited laboratories. The person interviewed is the Director of the R&D Department responsible for several projects with and without funding.

3.2 Checklist

The interview checklist was made in parallel with design of the structure of indicators. This checklist was made with the intention of trying to understand the kind of evaluation presently done to R&D projects; to identify the most relevant indicators in the evaluation of funding programmes and to quantify the structure of indicators proposed. The checklist had 4 main sections:

- Section 1 – General data (name, company name, function, etc) – for all the experts;
- Section 2 – Support programmes to R&D projects – only for researchers;
- Section 3 – Evaluation of R&D projects – only for experts related to the submission processes;
- Section 4 – Structure of indicators proposed – for all the experts.

3.3 Results analysis

3.3.1 Qualitative analysis

The qualitative analysis results from sections 2 and 3.

The programmes mainly used by the entities included in the analysis are: FP7 and Life from the European funding opportunities, QREN and INTERREG as national funding programmes and also grants from national organizations dedicated to Science, Technology and Innovation like, Fundação para a Ciência e a Tecnologia (FCT) and Agência de Inovação (AdI).

One important note in the selection of the best support programme, in the experts' opinion, is that the projects must be adapted to the programmes objectives and not opposite. This is the only way for a success submission of proposals and projects approval.

The rate of approved projects is 30% in the European funding programmes and 100% of the approved projects are executed.

According to the experts answer all the projects are evaluated. However there is no common evaluation process between the different entities interviewed and even between the different

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projects submitted by the same entity. The methods used to analyze the performance of the funded R&D projects can be the ones imposed by the supporting programmes or can be internal methods created by each entity. This makes the task of comparing the projects extremely difficult.

3.3.2 Quantitative analysis

The qualitative analysis results from section 4.

This analysis gives answer to two specific goals of this work: to achieve an ordered structure of indicators and to obtain the weight of each indicator, according to the experts' opinion (see Table 2).

The relative weights of the indicators are based on aggregation of the experts' opinion using a simple arithmetic mean. The percentage showed in Table 2 was calculated by dividing the mean of each indicator for the sum of all the means. The weights presented (in value and %) are significant because they represent the relative importance of each indicator, according to this group view. In the future, the work will proceed with the application of these indicators to the evaluation of R&D support programmes and with creation of a common index to evaluation and compare each programme, based on the obtained relative weights.

Table 2 – Ordered structure of indicators and relative weights.

| Indicators categories | Primary indicators | Secondary indicators |
|-------------------------------------|---|--|
| 1. Training Weight 5,33 (22,86%) | 1. Inside the company Weight 1,80 (56%) | 1. Adjustment to the work place Weight 3,40 (31%) |
| | | 2. Experience obtained Weight 2,80 (26%) |
| | | 2. Polyvalence Weight 2,80 (26%) |
| | | 4. Scholarship Weight 1,80 (17%) |
| | 2. Outside the company Weight 1,40 (44%) | 1. Creation of spin-off Weight 3,20 (30%) |
| | | 2. Knowledge diffusion Weight 3,17 (29%) |
| | | 3. Learning process Weight 2,40 (22%) |

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| | | |
|---|---|---|
| | | 4. Social responsibility Weight 2,00 (19%) |
| 1. Work Conditions Weight 5,33 (22,86%) | 1. Psychological factors Weight 1,80 (60%) | 1. Safety Weight 3,40 (31%) |
| | | 2. Manage work life with family life Weight 2,80 (26%) |
| | | 2. Work environment Weight 2,80 (26%) |
| | | 4. Justice Weight 1,80 (17%) |
| | 2. Physical factors Weight 1,20 (40%) | 1. Adjustment to the work place Weight 3,00 (28%) |
| | | 2. Contract conditions Weight 2,80 (26%) |
| | | 3. Mobility Weight 2,60 (24%) |
| | | 4. Wages Weight 2,40 (22%) |
| 3. Energy and Environment Weight 4,17 (17,86%) | 1. Environment impact Weight 1,83 (55%) | 1. Emissions prevention and reduction Weight 3,33 (29%) |
| | | 2. Waste reduction and improvement Weight 3,20 (28%) |
| | | 3. Contribution to sustainable environmental systems Weight 3,00 (26%) |
| | | 4. Preservation of the natural resources and cultural heritage Weight 2,00 (17%) |
| | 2. Energetic efficiency Weight 1,50 (45%) | 1. Reduction of the energetic costs Weight 3,00 (27,3%) |
| | | 1. Reduction of the energetic consumption Weight 3,00 (27,3%) |
| | | 3. Use of renewable energy sources |

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| | | |
|---|---------------------------------------|--|
| | | Weight 2,67 (24,2%) |
| | | 4. Contribution to energetic policies |
| | | Weight 2,33 (21,2%) |
| 4. Social versus Financial Return Weight 3,67 (15,71%) | 1. Financial Weight 1,67 (56%) | 1. Profit / Productivity Weight 3,80 (33%) |
| | | 2. Cost reduction Weight 2,83 (25%) |
| | | 3. Market share Weight 2,40 (21%) |
| | | 3. Companies' financial stability Weight 2,40 (21%) |
| | | 2. Social Weight 1,33 (44%) |
| | | 1. Contribution to national, regional and european policies Weight 3,67 (34,9%) |
| | | 2. Contribution to regional development Weight 2,67 (25,4%) |
| | | 3. Life conditions Weight 2,33 (22,4%) |
| | | 4. Stakeholders satisfaction Weight 1,83 (17,5%) |
| | 5. Employment Weight 3,00 (12,86%) | 1. New work places Weight 1,83 (61%) |
| 2. Outside the company Weight 2,83 (25,53%) | | |
| 3. Qualified Weight 2,40 (21,62%) | | |
| 4. For exclusion groups Weight 2,20 (19,82%) | | |
| 2. Same work places Weight 1,17 (39%) | | 1. Development of other capabilities Weight 3,50 (32%) |
| | | 2. Consolidation Weight 3,17 (29%) |
| | | 3. Change functions |

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| | | |
|--------------------------------------|---|--|
| | | Weight 2,80 (25%) |
| | | 4. Equality |
| | | Weight 1,60 (14%) |
| 6. Innovation Weight 1,83 (7,86%) | 1. Knowledge diffusion Weight 1,80 (56%) | 1. Production of new knowledge Weight 3,67 (34,4%) |
| | | 2. Increase in R&D and/or technology transfer Weight 3,00 (28,1%) |
| | | 3. Strength and development of capabilities Weight 2,60 (24,4%) |
| | | 4. Acceptation in the local community Weight 1,40 (13,1%) |
| | 2. Bibliometrics Weight 1,40 (44%) | 1. Product, service and process innovation Weight 3,50 (31%) |
| | | 2. National and international patents Weight 3,40 (30%) |
| | | 3. Creation of rules and standards Weight 2,33 (20%) |
| | | 4. Publications / Citations Weight 2,20 (19%) |

4 - Conclusions and Recommendations

Although this work is only an exploratory study with a small group of experts it is possible to present some conclusions and recommendations for future work.

From the bibliographic research done, it is possible to conclude that the papers production in the area of socio-economic return of support programmes to R&D projects is already relevant. This shows the need for the creation of a simple, independent and effective formal structure that may be used to evaluate R&D support programmes.

Presently the evaluation process of R&D projects is usually based on internal methods or on methods required by the supporting programmes. This makes the comparison of the projects

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evaluation impossible or extremely difficult. Also, the type of evaluation presently done does not properly address the socio-economic factors.

This work presents the results of seven interviews conducted with experts involved in R&D projects or related to the submission or follow-up process of support programmes to R&D projects. From these interviews an ordered structure of indicators was obtained, characterizing the programmes qualitatively and quantitatively, along with and their relative weights. Another important conclusion of interviews is that the experts showed interest, motivation and sensibility for the creation a formal structure to evaluate R&D programmes. This puts in evidence the importance of this theme and emphasises the need to proceed further with this research.

However throughout the development of this work some difficulties were found.

The evaluation was based on the personal experience of the experts and was not an opinion of what should be done. The persons interviewed were mostly involved with the submission of proposals or were in charge of R&D projects proposal and execution. On possible solution to this problem is choosing another type of experts, selecting top decision makers and policy makers in this area. This way it would be possible to reach a more widespread and strategic view over the evaluation of R&D programmes.

The next steps to be followed include: more data research, standardisation of the indicators, application of the proposed ordered structure of indicators to a set of funded projects in order to evaluate the support programme performance and to create some case studies in this area. As the future research process will necessarily involve participative methods, the assignment of more human and financial resources is fundamental to proceed with the research. Also, the involvement of top decision makers and central policy makers in the proposed research would be a great benefit.

It is expected that the proposed tool and results offers guidance to decision makers and presents a clear path to support:

- The selection of R&D projects submitted to National or European programme calls, based on more sustained decisions and ensuring the improvement of the community general social welfare, and;
- The evaluation of the effectiveness and social added value of R&D programmes, based on well identified indicators and recognising the importance of participative methods for value judgment.

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