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# Financing R&D Projects in Southern Italy: The "Technological Vouchers and Cooperative Research" Program

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## Abstract

The paper deals with the evaluation and financing of research and innovation projects. The paper analyzes and discusses the "Technological Vouchers and Cooperative Research" program in the Calabria Region (Southern Italy), as a program for financing R&D projects in a geographical area far behind in development. Three real cases of R&D projects are described. The program was effective as regards the stimulus to realizing R&D activities by Calabrian SMEs and furthermore in relation to the improvement of cooperation between SMEs, research centers, universities and technological laboratories. The weak points of the program mainly regard the evaluation phase that made it impossible to get a feedback useful for policy and for driving future agenda.

**Keywords:** research and development (r&d), financing r&d projects, regional development, developing areas, european policy for r&d, financial evaluation methods, southern italy.

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## Introduction

The importance of industrial research for growth and development of economic systems is unanimously recognized. Firms had a fundamental role in the path toward the so-called knowledge economy that now characterizes our economic system. The firm that invests in creation of knowledge can acquire a competitive advantage that derives from the impossibility for competitors to repeat the stock of knowledge in the short period (Senge, 1990; Zack, 1999). Nevertheless, the lack of well consolidated methods to measure the level of knowledge of a firm and to evaluate R&D investments is evident. This can lead to a weakness in the evaluation of public programs for stimulating innovation.

This paper can be framed at the intersection between two research fields: (i) the theory of regional development and (ii) the models for the evaluation of public policies.

The economic policy of the European Union (EU) has recognized the central role of innovation since the European Council of Lisbon in 2000, where the objective to become the most competitive and dynamic knowledge-based economy was established (European Commission, 2000). In this context the role of regions as reference areas for constructing innovation strategies has been recognized. With reference to the models for evaluating public policies and more specifically the research and innovation projects, it has to be observed that there is a lack of suitable tools for the measurement and evaluation of intangibles (Lev, 2001). The lack of tools for properly evaluating intangibles produces problems regarding the evaluation and financing of innovative activities of firms, and particularly R&D investments, typically finalized to the creation and renewal of knowledge.

This research discusses the "Technological Vouchers and Cooperative Research" program carried out in the Calabria Region (Southern Italy), as a program for financing R&D projects. Three real cases of R&D projects within the program are described. The paper is organized as follows: next section introduces the research framework; then the methodology is described. After, the "Technological Vouchers and Cooperative Research" program and the three real cases are described. The Discussion and conclusion section concludes the paper.

Research framework: regional development and innovation projects evaluation and financing

The economic policy of European Union (EU) has considered the Region as the geographical territory of reference for implementing the Science, Technology and Innovation (STI) policies. In order to promote R&D and innovation, EU launched the Regional Innovation Strategies (RISs) as the most important instruments for stimulating development. RISs were carried out by several regions, as studied by many authors (Henderson, 2000; Kyrgiafini and Sefertzi, 2003; Morgan and Nauwelaers, 2003; Zabala-Iturriagagoitia et al., 2008). Building on the strategic role of regions in the knowledge-based economy, Cooke and Leydesdorff (2006) elaborated the concept of "constructed advantage" versus the competitive advantage and the comparative advantage. The constructed advantage is based on the development of: (i) Economy, (ii) Governance, (iii) Knowledge infrastructure, (iv) Community and culture.

As regards firms and in particular SMEs, there has been a very high growth in the use of external networks for the innovation activities. SMEs addressed R&D expenses towards R&D collaborations more than large firms (Narula, 2004). Successful SMEs have been competitive by managing well the non-internal R&D, mainly building on outsourcing rather then alliances with larger firms. Alliances with larger firms are not preferred because of higher risks and costs for managing such a partnership and also because the partnership with a larger firms can lead to a loss of technological competence (Narula, 2004).

With reference to the models for evaluating investments and firms, many studies have been carried out concerning firm evaluation and financial reliability (Altman and Sabato, 2007; Iazzolino and Fortino, 2012). As regards evaluation of research, innovation and intangibles, several works have addressed the topic of innovation, intangibles and impact on business performance and firm evaluation (Cabrita and Bontis, 2008; Carnevale et al., 2012; Corvello et al., 2013; Iazzolino et al., 2013a; Iazzolino et al., 2013c; Maditinos et al., 2011). Nevetheless, literature converges towards the idea that there is a general lack of tools for rightly evaluating intangibles and in particular R&D investments. This lack produces many problems. The problems identified in different studies mainly concern the following aspects:

1. identification of the mean results of technological innovation activities, primarily represented by new knowledge and other intangible activities. Despite the fact that there are different types of "intangibles", particular attention must be turned to technological knowledge capital (Nelson, 2003). The complexity of such knowledge, that is incorporated in "containers" (persons, procedures, systems) makes it impossible to define indicators able to identify the mean results of the technological innovation activities;

2. measurement of intangibles and inadequacy of their representation in the balance sheet. The international accounting principles require that R&D investments are not capitalized, but registered in the income statement. Therefore, it often becomes difficult to get quantitative information concerning innovative activities of the enterprise;

3. uncertainty on the expected rate of return of R&D investments. Particularly, Encaoua et al. (2000) distinguish three types of uncertainty:

- technological uncertainty, related to the real ability of research projects for producing new knowledge;

- strategic uncertainty, related to the fact that the enterprise that invests in R&D is not sure of being the first one to launch a new product;

- uncertainty connected to market evolution and the real presence of potential customers when the new product has been launched;

4. indeterminateness of causal relations linking R&D investments to business performance. R&D investments represent a measure of input, and not of output, of the innovation processes and, in most cases, do not produce results directly observable or easily predictable.

The traditional models for evaluating the economic value of an investment, based on the discounted cash flow (in particular the most used method, the Net Present Value – NPV) have several problems when applied to the evaluation of a research and innovation project. The possession of dynamic capabilities (Cohen and Levinthal, 1990; March, 1991; Teece et al., 1997) can allow the enterprise to achieve a dynamic competitive advantage, if it will operate in coherence with the changed environmental variables. A method for the evaluation of innovative projects that seems to resolve some problems connected to the use of NPV is the so-called Real Options Approach (ROA). The method is founded on the logic of evaluation of the financial options (Oriani, 2004).

The evaluation of research and innovation projects is very strictly linked to the problem of financing innovation projects. The problems regarding the financing of projects of research and innovation are bound to four essential aspects:

1. the appropriateness of the economic value of knowledge: to this aspect the contribution of Arrow (1962) for instance expresses the idea that the use of knowledge is not exclusive and that, therefore, processes of imitation can reduce or cancel the advantage of the innovator;

2. the gap between social returns and private returns of R&D investments, shown since the contribution of Nelson (1959). Such a problem is born from the observation that the social returns of the R&D investments are greater than the private returns;

3. the information asymmetries, arising from the fact that the knowledge of the nature and the probability of success of innovation by the inventor is better than the knowledge of external subjects who should finance the firm. A financier could require a rate of return higher than the one required by internal financial resources;

4. the moral hazard, tied to the theory of agency and the theory of separation between ownership and control, whose fundamental idea is that managers are more risk-adverse than shareholders.

Such problems, particularly the agency ones, could be partly recomposed from the recourse to debt through limitations at the discretion of management, but such financial instrumentation results in the general inadequacy of financing innovation. Instead, more efficiency can result by using equity, since: (i) it doesn't require collateral guarantees from the enterprises; (ii) the rate of return of shareholders doesn't have a superior limit as in the case of debt; (iii) the additional financing through equity doesn't increase the risk of failure (Oriani, 2004).

## Methodology

In order to evaluate the "Technological Vouchers and Cooperative Research" program in the Calabria region, a methodology has been elaborated in this research, made up of some specific indicators constructed starting from the main literature on the subject and of some issues related to the context specificity.

Many approaches were carried out in the literature to evaluate innovation policies and programs. The "ideal" methodology does not exist, as situations differ from each other and then every policy or instrument has to be evaluated through a specific evaluation method. Nevertheless, it is generally accepted that it have to be considered both quantitative and qualitative indicators (Lawrence, 2004). Todtling and Trippl (2005) assert that the evaluation methodologies can strongly differ depending on the subject that is implementing the innovation: the peripheral regions, weakly developed because of a lack of dynamic clusters and support organizations; the old industrial regions, with the opposite problem of too strong clustering and overspecialization in mature and often declining industries; the fragmented metropolitan regions, with highly developed organisational infrastructures of public research but in which the lack of networks and interactive learning can be a strong barrier for innovation. According to the European Commission (2000), two main types of goals for RISs (Research and Innovation Strategies) can be identified: methodological/procedural (e.g. involving stakeholders, carrying out self diagnosis) and behavioural (e.g. promoting innovation culture and networking). Zabala-

Iturriagagoitia et al. (2008) examined the RISs implemented by different European regions, evaluating the main phases through which the innovation programs are carried out: the consensus phase, with the aim of involving the main actors; the analysis phase, characterized by the self diagnosis and the benchmarking process; the elaboration/implementation phase, that regards the implementation of a monitoring and evaluation system.

Building on the works above cited and on other items concerning the specific context, the following indicators are defined in this research that are able to assess the validity of the program discussed:

1. Consensus building: this item is the first important precondition to allow the program to be effective. It regards the involvment of the main actors in the process, e.g. universities, research centres, firms, politic institutions;

2. Identification of innovation needs of firms: this is an important diagnosis step that can assure the program would be conducted according to the specificities of context and firms. Those specificities can be enhanced by clearly identifying the innovation needs;

3. Benchmarking activities: benchmarking is intended in two types of meaning. At first it regards the study of international trends in the sectors of firms involved in the innovation program; secondly, benchmarking is related to other firms belonging to both the same region or others, in order to identify best practices;

4. Robust selection process of firms' innovation projects: the process of selection of the best innovation projects is very important to assure that only ideas really able to generate and to "diffuse" innovation are funded and then that the overall program can be effective;

5. "Basic" financial evaluation techniques of firms' innovation projects: traditional financial evaluation methods for evaluating investment projects are based on the monetary cost-benefit comparison. The classical methodology is the Net Present Value;

6. "Advanced" financial evaluation techniques: advanced techniques are the ones that are able to treat uncertainty more than the traditional methods. One of the most important is the Real Options Approach (ROA) or similar (decision trees, etc.). Other methods were proposed by Campisi and Costa (2008) and Iazzolino et al. (2013b);

7. "Non-financial" evaluation techniques: the value of an innovation project cannot be reduced to a single monetary criterion. The use of qualitative indicators to capture and observe the effects is essential, as well as the need to obtain information directly from the beneficiaries and intermediate organizations (Diez, 2001). The qualitative instruments regard personal interviews, panel and group sessions, score criteria.

For each indicators above mentioned, in the following it will be discussed whether the program "satisfied" (implemented) them or not. In the following table, the indicators used for evaluating the innovation "Technological Vouchers and Cooperative Research" program are shown.

| No. | Indicator | Description |
|---|---|---|
| 1 | Consensus building | Involvement of the main actors (universities, research centres, firms, politic institutions). Precondition to allow the program to be effective |
| 2 | Identification of innovation needs | Important diagnosis step able to enhance specificities of context and firms |
| 3 | Benchmarking activities | Study of international trends of sectors; identification of best practices |
| 4 | Robust selection process of projects | Important to assure that only ideas really able to generate innovation were funded |
| 5 | Basic financial evaluation techniques | Monetary cost-benefit comparison. "Classical" methodology: Net Present Value (NPV) |
| 6 | Advanced financial evaluation techniques | Methodologies able to treat uncertainty, such as the Real Options Approach (ROA) or similar (decision trees or others) |
| 7 | Non-financial evaluation techniques | Qualitative instruments able to capture the effects in terms of innovation culture creation (personal interviews, panel sessions, score criteria) |

Table 1. The indicators used for evaluating the program

## The "Technological Vouchers and Cooperative Research" program: characteristics and objectives

Calabria was a region "Objective 1" of the EU for the planning period 2000-2006 and has been included in the "Convergence and competitiveness" objective (ex obj 1) for the period 2007-2013. Among the specific objectives of the Regional Operational Program of Calabria, there is the promotion of research and technological development in the region through actions aimed to:

- facilitate the realization of activities of Research, Technological Development and Innovation (RTDI) from the Calabrian SMEs;
- encourage the cooperation between SMEs, research centers, universities, and technological laboratories for the realization of projects of RTDI;
- increase the ability of the Calabrian SMEs to adopt process and product innovation to improve the level of competitiveness on markets.

Within this framework, a specific program named "Technological Vouchers and Cooperative Research" for the Calabrian SMEs has been issued a few years ago. The specific objective of the program was to stimulate the demand of research and innovation of the Calabrian enterprises and to assist them in setting up qualified industrial research projects, bringing the enterprises closer to the research system. To

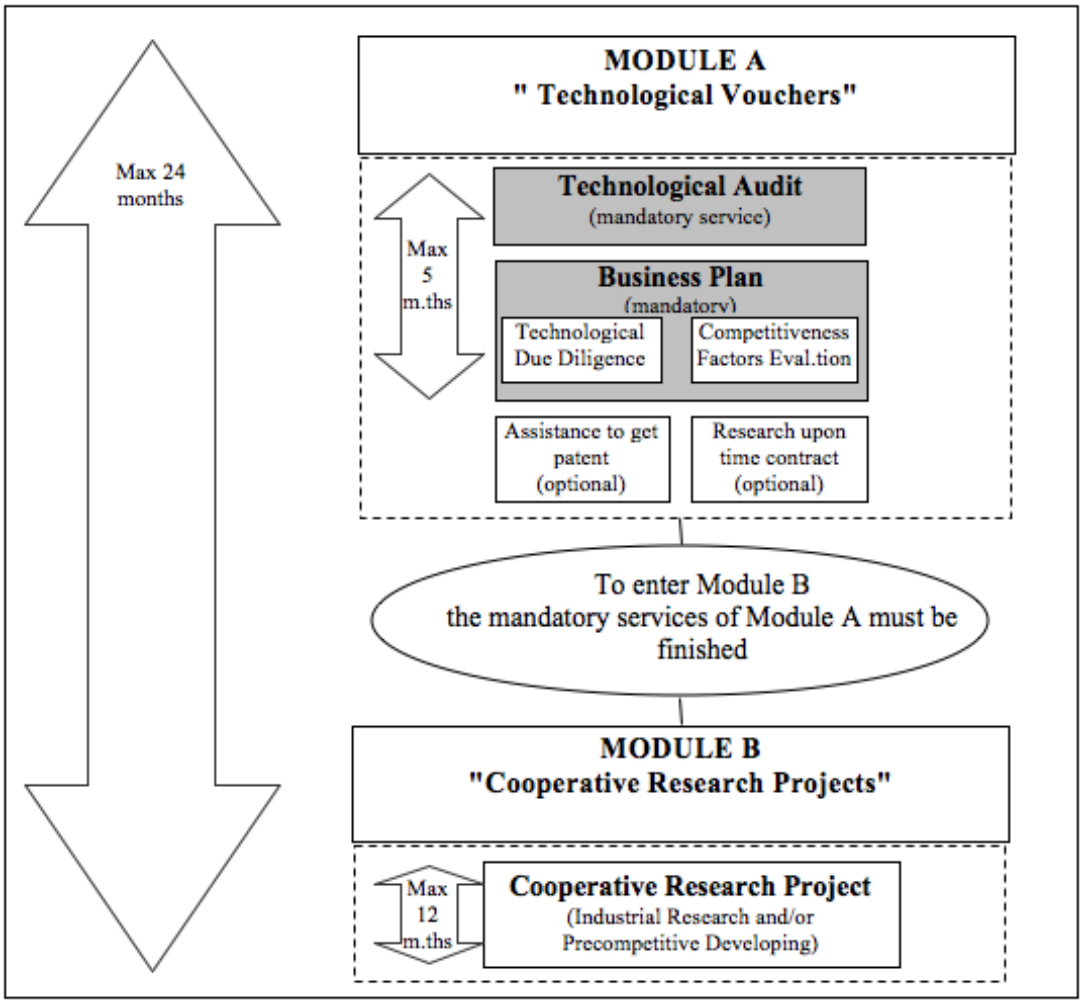


Figure 1. The general scheme of the program

these ends the program foresees a course of selection and development of the best ideas articulated in two Modules:

• Module A: Technological Vouchers, oriented toward the analysis of needs and the opportunities of innovation for the proponent firms and, optionally, to set up a cooperative research project. Module A allows the acquisition of services and the realization of studies and researches according to a default scheme that includes the following types of activity:

a. Technological Audit, finalized to the analysis of innovation needs of proponents and to the elaboration of an action plan for increasing competitiveness through the introduction of organizational, product and process innovations;

a. Business Plan, aimed to verify the technical-scientific and economic feasibility of a specific research and innovation project through the implementation of: (i) the Technological Due Diligence and (ii) the Competitiveness Factors Evaluation;

b. Assistance to get a patent, finalized to get national patents and/or extend a patent to European or international level;

c. Technical-scientific research upon time contract, finalized to starting up a research concerning an interesting theme for the firm, and realized by one or more young people with attitudes to research.

• Module B: Cooperative Research, oriented toward the realization of a research project by the proponent firms in cooperation with Universities and research centers, on the basis of the results attained in the Module A. Module B – Cooperative Research can include activities of:

a. industrial research, i.e. research finalized to acquire new knowledge with the objective to set up or improve products, productive processes or meaningful services;

b. precompetitive developing, i.e. activity aimed toward the implementation of the results of the industrial research in a project for products, processes or new services.

Module B is accessible only by firms that have obtained a high score in the Module A. Figure 1 illustrates the structure of the program and the general organization of activities.

## Three real cases of R&D projects

In this section three real cases of innovation projects proposed within the "Technological Vouchers and Cooperative Research" program are briefly described. For privacy reasons the names of the firms are omitted and replaced with general or fancy names. The firms have already been financed within Module B of the program, having successfully passed the first phase (Module A).

## The innovative project of "Mariculture"

Mariculture operates in the high value-added service industry, in which it supplies a complete and flexible range of services for environmental management and protection, and in the sector of fishing (aquiculture). In this second sector the firm operates in the biological production of breeding fish like gilthead breams, bass and sargoes. The research project proposed concerns the "Characterization and breeding of new strains of Mediterranean photosynthetic micro-seaweeds for improving food chains used in precious fish production".

The research project concerns the set up of an "advanced system for breeding of vegetable planktonic microorganisms" (in the Mediterranean sea) to be realized through an equipped ship, by drawing such unicellular organisms from dysphotic areas. The final objective is constituted by an intervention in the aquiculture sector aimed mainly to resolve, with an advanced technology, the problem regarding the food chain in the first stadiums of growth. The research products are aimed to facilitate an increase in the productivity of the firms of the sector, by reducing mortality in the juvenile stadiums of reared fish. Furthermore, the possibility to isolate and to breed new seaweed strains created the basis for the potential development of the coming mining industry of "good molecules" that Mariculture is realizing. In fact, it is well known that there exist micro-seaweed strains that have a high content of Ω3 (Omega 3): the possibility to be able to rear these micro-seaweeds under controlled conditions put the same micro-seaweeds in the position of "better raw materials" for the mining industry as a totally renewable source that doesn't damage the biomasses present in nature. In synthesis, the characteristic activities of the wide research project may be decomposed in two different Business Ideas:

• Business Idea 1: "Improving the technology", by patenting new photo two-phases reactors;

• Business Idea 2: "Extraction of Ω3 molecules" from a part of the reared sea-weeds.

For each of the two considered Business Ideas, two different specific corresponding types of target customers were targeted.

For realizing the two Business Ideas (Business Idea 1 and Business Idea 2), both having a common root, a global investment of around 8 MLs € (million of €) is planned. The investment has the final objective of setting up a mining industry (new machineries, photoreactors, etc.). The financial planning has been conducted over a 5 year period beginning from the phase following start up. Planning has involved the estimation of turnover, costs, the income statement and finally, the cash flows. Both a pessimistic and an optimistic scenario have been hypothesized. The most interesting Business Idea, but also the most complex from the evaluation point of view, is Business Idea 2. The results of the Net Present Value in the two scenarios of Business Idea 2 are summarized in the following table.

The difference between the pessimistic and the optimistic scenario is quite high because of the difficulty to correct estimate the parameters of evaluation, due to the project uncertainty. Anyway the NPV is positive in both cases.

**The innovative project of "Hitech Systems"**

The mission of Hitech Systems is the development of technologically advanced systems. The technologies developed by Hitech Systems arise from the specific knowledge and experiences that the firm matured in different sectors: electronics, computer science, and plant engineering.

The project presented within the program regards the development of SmartControl, an innovative electronic device used against intrusion. The device is based on digital technology, has high integration level and allows the analysis and control of different types of events in different ambits through the sensing of any kind of image, macro or microscopic, static or in motion, in illuminated or dark environments. The system is based on a miniaturized electronic device able to autonomously survey, without a connection to a PC, any event, that can be defined in a personalized manner by the user, and that may appear in the monitoring area. It is provided with local intelligence and is able to elaborate the received visual data and to supply different kind of information, besides a real time vision of the monitoring area. The device is programmable on demand, with specifications personalized by the user. Given its characteristics, SmartControl can be put on the market at a more competitive price with respect to the existing technologies. The system is constituted by an "intelligent optic sensor" that takes the images and processes them; then it autonomously makes a decision on the level of alarm to adopt in case of intrusion. This is possible because of the software developed by Hitech Systems. SmartControl allows for the reception and sending of information and images from remote wireless and without physical connections at pre-definite slots. The system is simple to use and offers a wide range of new applications through the technologies GPRS, MMS, UMTS. The intrusion prevention systems have applications in various sectors. The following principal segments are targeted: (i) Residential sector; (ii) Business; (iii) Schools; (iv) Antique and art institutes; (v) Banks; (vi) Plants.

For realizing the business idea an initial investment of € 420.000 is planned. The financial planning has been conducted over a 5 year period. Planning has concerned the estimation of turnover, costs, the income statement and the cash flows. A pessimistic and an optimistic scenario have been hypothesized. The results of the Net Present Value in the two scenarios are summarized in the following table.

Also in this case there is a high gap between the two evaluations (pessimistic vs optimistic), but also in this case both NPVs are positive, i.e. the project creates value.

| Evaluation of the Business Idea 2 of Mariculture | |
|---|---|
| Initial Investment | € 8.000.000,00 |
| Net Present Value (pessimistic scenario) | € 10.486.850,00 |
| Net Present Value (optimistic scenario) | € 165.210.161,00 |

Table 2. Financial evaluation of the innovative project of Mariculture

| Evaluation of the Business Idea of Hitech Systems | |
|---|---|
| Initial Investment | € 420.000,00 |
| Net Present Value (pessimistic scenario) | € 51.228,00 |
| Net Present Value (optimistic scenario) | € 1.007.339,00 |

Table 3. Financial evaluation of the innovative project of Hitech Systems

## The innovative project of "Physics Lab"

Phisics Lab, an academic Spin-Off of the University of Calabria, was born as a company for the exploitation of the results of research activity. The company plans, develops and produces advanced technology equipment for university and business research laboratories.

The proposed industrial research project is geared toward the development of a new portable laser concept. This innovative device consists of a source only laser. The product is compact, highly efficient, stable, low cost, but with a very high adaptability for the whole visible spectrum and also on the near ultraviolet (UV) and infrared (IR) spectrums. In practice, a source only portable guarantees the emission of laser light on all the wavelengths, from 300 nm to 1000 nm, with the possibility to select every line of the spectrum. This source can be adapted to numerous spectroscopic applications. However the project is focused on a medical application for the precocious diagnosis of the breast tumours. The mission is to create a digital optic system with the purpose of replacing the traditional analysis of microscopic biopsy with the laser optic biopsy, setting the basis for a new diagnostic standard for the identification of the nature of tumours. The spectroscopic analyses can be a very powerful tool in numerous fields of application; nevertheless, until now their development often remained interned in academic research, because high precision, low cost and low size spectroscopes are not available on the market. Therefore, this instrument can be used to satisfy a latent need and has much potential for other uses. Some of the application fields can be:

- Medical field, in the analysis of cancer nature, as well as for dermatologic use to characterize moles;
- Agroindustry field, in the agricultural products traceability;
- Environmental field, in the survey for the presence of air, land and water pollution;
- Arts field, in the analysis of origins and the preservation of the artistic heritage.

For realizing the business idea two different cases are planned. The first case concerns the concession of license from Physics Lab to a partner. In this case the earnings for Physics Lab are the takings deriving from the percentage on the proceeds of sales that the partner will have to give to Physics Lab. In this case the initial investment is € 339.000. The second case concerns the production of the Microlaser, the innovative heart of the system. In this case, given the necessity to also acquire an automated system for liquid crystal display assembly, the initial investment is € 389.000. The financial planning has been conducted over a 5 years period. Planning has concerned the estimation of turnover, costs, the income statement and the cash flows. For both cases a prudential forecast has been implemented. In practice, a pessimistic scenario has been formulated for both cases. The results of the Net Present Value in the two cases are summarized in the following table:

The positive evaluation made for prudential cases highlights the convenience of the project (at least using the NPV methodology).

## Discussion and conclusions

Regarding the research methodology (and then to indicators selected for evaluating the effectiveness of the "Technological Vouchers and Cooperative Research" program), it has to be observed that:

1. the consensus building was realized: a wide activity of "dissemination" of the program, of its objectives and of pre-requisites for participating by firms was carried out by involving a lot of actors, such as universities, research centres, institutions, firms and business associations;

2. the identification of innovation needs of firms was successfully carried out: a specific step within the Module A, called Technological Audit, was finalized to the analysis of needs and to elaborate a specific Action Plan for the innovation project of the firm;

3. the benchmarking activities were not implemented: neither the study of international trends of sectors nor the identification of best practices concerning other firms or projects were realized. This was an important weakness point;

| Evaluation of the Business Idea of Physics Lab | |
|---|---|
| Initial Investment Case 1 | € 339.000,00 |
| Net Present Value Case 1 | € 126.429,00 |
| Initial Investment Case 2 | € 389.000,00 |
| Net Present Value Case 2 | € 632.991,00 |

Table 4. Financial evaluation of the innovative project of Phisics Lab

4. the selection process of firms' innovation projects was robust: the selection was robust depending also on the intrinsic structure of the program. It included two phases (Module A and Module B) and various steps within them. Module B was entered only by firms that obtained a high score in Module A. This competitive approach assured that the program was selective but effective;

5. the "basic" financial evaluation techniques of projects were implemented: every project was evaluated, from a quantitative/financial point of view, using the NPV (Net Present Value) technique;

6. the "advanced" financial evaluation techniques of projects were not implemented: no advanced techniques for evaluating the innovation projects were used. Neither the ROA (Real Options Approach) nor other methods were used (decision trees or others);

7. the "non financial" evaluation techniques were not used: no qualitative instruments were used, in order to evaluate ex-post the quality of the project especially in terms of promotion of the innovation culture. There were not used score criteria, personal interviews, or panels and group sessions. This was another very important weakness point, as more broadly discussed below.

In the following table the evaluation of the research methodology indicators is shown.

The "Technological Vouchers and Cooperative Research" program discussed in this paper was a program based, in the first phase (Module A), on the assignment of technological vouchers, or in other words research coupons. They are credit instruments drawn by the regional administration in the form of free grant contributions assigned to recipients having specific requisites, for the acquisition of innovative services from qualified suppliers. Thanks to this initiative the public administration was able, through a voucher (an instrument comparable to a cheque), to simplify the phase of disbursement of contributions in favour of firms. In the specific case of the Technological Vouchers of the Calabria region, making two types of services mandatory, the Technological Audit and the Business Plan, it produced a robust process of selection. The Technological Vouchers program has represented in Calabria an attempt to act on the principal critical points of the regional research and innovation system, and in particular on:

- the poor amount of investment of firms in research and technological development and their low propensity toward innovation (product or process);

| No. | Indicator | Description | Implemented/Not implemented |
|---|---|---|---|
| 1 | Consensus building | Involvement of the main actors (universities, research centres, firms, politic institutions). Precondition to allow the program to be effective | Yes |
| 2 | Identification of innovation needs | Important diagnosis step able to enhance specificities of context and firms | Yes |
| 3 | Benchmarking activities | Study of international trends of sectors; identification of best practices | No |
| 4 | Robust selection process of projects | Important to assure that only ideas really able to generate innovation were funded | Yes |
| 5 | Basic financial evaluation techniques | Monetary cost-benefit comparison. "Classical" methodology: Net Present Value (NPV) | Yes |
| 6 | Advanced financial evaluation techniques | Methodologies able to treat uncertainty, such as the Real Options Approach (ROA) or similar (decision trees or others) | No |
| 7 | Non-financial evaluation techniques | Qualitative instruments able to capture the effects in terms of innovation culture creation (personal interviews, panel sessions, score criteria) | No |

Table 5 Application of the methodology for evaluating the program

- the isolated collaborations between universities, research centers and enterprises that make it difficult to transfer knowledge and technologies inside the regional industry;

- the difficulties of stimulating the demand for research, technological development and innovation (RTDI) of firms and the consequent misalignment between supply and demand of innovation;

- the research activity, conducted by research centers and universities, in general not oriented to the real needs of enterprises;

- the lacking of collaboration between the regional research centers with consequent duplications of activity and propensity toward de-specialization.

The main limit of the program was in the evaluation of projects. There was not a phase of real ex-post evaluation. The lack of "non-financial" evaluation techniques (indicator 7 of the methodology) made it impossible to get a feedback useful for policy and for driving the future agenda. In general all the evaluation phase was missing. This result confirms one of the outcomes of the work of Zabala-Iturriagagoitia et al. (2008), who examined the RISs implemented by different European regions. They found that Calabria is one of the Italian regions that did not consider monitoring and evaluation of programs as central to their innovation policies (Zabala-Iturriagagoitia et al., 2008, p. 1156). The main reasons can be (Zabala-Iturriagagoitia et al., 2008):

- There is a general lack in innovation-related indicators that would enable innovation activities to be evaluated;

- Policy makers are often reluctant to undertake evaluations of their activities.

The first reason determines that, not only in Calabria but also in other Italian or European countries, the monitoring and the evaluation phase is often not formalized and systematic. The second reason is particularly true for Calabria.

The development of a set of robust indicators would require a benchmarking activity not only at intra-regional but also at inter-regional level, in order to define a shared methodology within the European Union. With respect to the benchmarking acitivity this research already found that the program discussed was completely lacking in benchmarking exercises (indicator 3 of the methodology). Some authors (Diez, 2001) have proposed a participatory approach for evaluating regional innovation policies. In this approach the evaluation "is not imposed from outside but gradually takes shape through the collaboration of all the stakeholders and their active participation in the analytical evaluation process" (Diez, 2001, p. 916). The evaluation is build up on a process of interactive learning that can become a social instrument for stimulating innovation in turn.

The issue of learning and innovation from a "social" point of view has been treated by several studies in the recent years (De Carolis and Corvello, 2006; Carlsson et al., 2009; Corvello and Iazzolino, 2013). Within this participatory approach, the evaluation process can also become a tool for promoting collaboration and driving the regional community towards the economic and social future of the region itself. Region is viewed as a "learning region" or an "intelligent region". Even if I think we are not at this level now, this approach is a good lens through which the regional economic development can be driven.

**References**

ALTMAN, E.I. and Sabato, G. (2007). Modelling credit risk for SMEs: Evidence from the U.S. Market. Abacus, 43 (3), 332-357.

ARROW, K.J. (1962). Economic Welfare and the Allocation of Resources for Invention. In: Groves, H.M. (1962). The Rate and Direction of Inventive Activity, Princenton, N.J., Princenton University Press.

CABRITA, M. and Bontis, N. (2008). Intellectual capital and business performance in the Portuguese banking industry. International Journal of Technology Management, 43 (1-3), 212-237.

CAMPISI, D. and Costa, R. (2008). A DEA-based method to enhance Intellectual Capital management. Knowledge and Process Management, 15 (3), 170-183.

CARLSSON, S., Corvello, V. and Migliarese, P. (2009). Enabling open innovation: Proposal of a framework supporting ICT and KMS implementation in web-based intermediaries. Proceedings of the 17th European Conference on Information Systems, ECIS 2009, Verona, Italy, June 8-10.

CARNEVALE, C., Mazzuca, M. and Venturini, S. (2012). Corporate Social Reporting in European Banks: The Effects on a Firm's Market Value. Corporate Social Responsibility and Environmental Management, 19 (3), 159-177.

COHEN, W.M. and Levinthal, D.A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. Administrative Science Quarterly, 35 (1), Special Issue: Technology, Organizations, and Innovation, 128-152.

COOKE, P. and Leydesdorff, L. (2006). Regional Development in the Knowledge-Based Economy: The Construction of Advantage. Journal of Technology Transfer, 31 (1), 5-15.

CORVELLO, V. and Iazzolino, G. (2013). Factors Affecting the Practices of External Problem Solvers in Broadcast Search. Journal of Technology Management and Innovation, 8 (2), 166-177.

CORVELLO, V., Iazzolino, G. and Ritrovato, V. (2013). Evaluating Technological Innovations: A Method Based on Comparable Transactions. European Journal of Economics, Finance and Administrative Sciences, Issue 56, January, 37-50.

DE CAROLIS, M. and Corvello, V. (2006). Multiple competences in distributed communities of practice: The case of a community of financial advisors. Proceedings of the European Conference on Knowledge Management, ECKM 2006, Budapest, Hungary, September 4-5, 116-125.

DIEZ, M.A. (2001). The Evaluation of Regional Innovation and Cluster Policies: Towards a Participatory Approach. European Planning Studies, 9 (7), 907-923.

ENCAOUA, D., Laisney, F., Hall, B.H. and Mairesse, J. (2000). Economics and Econometrics of Innovation. Amsterdam, Kluwer.

EUROPEAN COMMISSION (2000). Presidency Conclusions: Lisbon European Council, 23 and 24 March 2000. Bruxelles.

HENDERSON, D. (2000). EU Regional Innovation Strategies. Regional experimentalism in practice? European Urban and Regional Studies, 7 (4), 347-358.

IAZZOLINO, G. and Fortino, A. (2012). Credit Risk analysis and the KMV-Black and Scholes model: a proposal of correction and an empirical analysis. Investment Management and Financial Innovations, 9 (2), 167-181.

IAZZOLINO, G., Migliano, G. and Gregorace, E. (2013a). Evaluating Intellectual Capital for supporting Credit Risk Assessment: an Empirical Study. Investment Management and Financial Innovations, 10 (2), 44-54.

IAZZOLINO, G., Bruni, M.E. and Beraldi, P. (2013b). Using DEA and Financial Ratings for Credit Risk Evaluation: an empirical analysis. Applied Economics Letters, 20 (14), 1310-1317.

IAZZOLINO, G., Migliano, G., Forgione, R. and Girimonte, M. (2013c). Capital Efficiency and Market Value in Knowledge and Capital Intensive Firms: an Empirical Study. Investment Management and Financial Innovations, 10 (2), 147-157.

KYRGIAFINI, L. and Sefertzi, E. (2003). Changing regional systems of innovation in Greece: The impact of Regional Innovation Strategy initiatives in peripheral areas of Europe. European Planning Studies, 11 (8), 885-910.

LAWRENCE, B.S. (2004). Levels of analysis and the qualitative study of quantitative data. In: Yammarino, F.J. and Dansereau, F. (eds). Multi-Level Issues in Organizational Behaviour and Processes (Research in Multi Level Issues, vol. 3), Emerald Group Publishing Limited, 231-250.

LEV, B. (2001). Intangibles: Management, Measurement, and Reporting. Washington D.C., Brookings Institution Press.

MADITINOS, D., Chatzoudes, D., Tsairidis, C. and Theriou, G. (2011). The impact of intellectual capital on firms' market value and financial performance. Journal of Intellectual Capital, 12 (1), 132-151.

MARCH, J.G. (1991). Exploration and Exploitation in Organization Learning. Organization Science, 2 (1), 71-87.

MORGAN, K. and Nauwelaers, C. (eds) (2003). Regional Innovation Strategies. The Challenge for Less-Favoured Regions. Routledge. London.

NARULA, R. (2004). R&D collaboration by SMEs: new opportunities and limitations in the face of globalisation. Technovation, 24, 153-161.

NELSON, R.R. (1959). The Simple Economics of Basic Scientific Research. Journal of Political Economy, LXVII (3), 297-306.

NELSON, R.R. (2003). On the Uneven Evolution of Human Know-how. Research Policy, XXXII (6), 909-922.

ORIANI, R. (2004). Innovazione tecnologica, valore economico e mercati finanziari. Il Mulino, Bologna.

SENGE, P.M. (1990). The Fifth Discipline. Doubleday Currency, New York.

TEECE, D. J., Pisano, G. and Shuen, A. (1997). Dynamic Capabilities and Strategic Management. Strategic Management Journal, 18 (7), 509-533.

TODTLING, F. and Trippl, M. (2005). One size fits all? Towards a differentiated regional innovation policy approach. Research Policy, 34, 1203-1219.

ZABALA-ITURRIAGAGOITIA, J.M., Jimenez-Saez, F. and Castro-Martnez, E. (2008). Evaluating European Regional Innovation Strategies. European Planning Studies, 16 (8), 1145-1160.

ZACK, M.H. (1999). Developing a Knowledge Strategy. California Management Review, 16 (3), 125-145.