International Journal of Business and Management; Vol. 11, No. 6; 2016
ISSN 1833-3850 E-ISSN 1833-8119
Published by Canadian Center of Science and Education

Innovation & Performance Measurement: An Adapted Balanced Scorecard

Rosanna Spanò[1], Fabrizia Sarto[1,], Adele Caldarelli[1] & Riccardo Viganò[1]

[1] Dipartimento di Economia, Management, Istituzioni, Università degli Studi di Napoli Federico II, Italy

Correspondence: Rosanna Spanò, Dipartimento di Economia, Management, Istituzioni, Università degli Studi di Napoli Federico II, Campus Universitario Monte S. Angelo, via Cinthia 26, 80126 Napoli, Italy. E-mail: rosanna.spano@unina.it

Received: February 19, 2016 Accepted: April 5, 2016 Online Published: May 22, 2016

doi:10.5539/ijbm.v11n6p194 URL: http://dx.doi.org/10.5539/ijbm.v11n6p194

Abstract

The aim of this paper is to offer an adaptation of the Balanced Scorecard (BSC) to improve performance measurement within research-intensive network. The paper employs the case study of the network Campania Bioscience to develop an innovation-oriented BSC to show the practical potential of this integrated theoretical approach to innovation, measurement, and control. The study develops specific key performance areas and indicators to enrich each of the four perspectives with the innovation elements (only implicitly considered in the original model). The paper shows the potential of the BSC to achieve a practical and effective interplay between innovation and control. The value of the paper lies in its ability to propose a new innovative-oriented BSC, capable to act as a means of dialogue and mediation in complex organizations, such as research-intensive networks.

Keywords: performance measurement, innovation, research-intensive network, balanced scorecard

1. Introduction

Over the last 20 years, organizations, particularly those characterized by strong innovative approaches, have been prompted to redefine their boundaries, undertaking collaborative relationships with external subjects, to reinforce their strategies (Powell et al., 2005). The involvement of a number of different actors for the development of the same project is regarded as an essential element to support innovation, because of the increasing complexity of external economic environments, and the variety of tangible and intangible resources needed to develop new knowledge (Kale & Singh, 2007). From this perspective, the importance of networks lies in their role as mechanisms enabling participants to access more easily and less costly external and heterogeneous knowledge resources that can be effectively combined with the existing ones, or alternatively used to create new expertise (Yli-Renko et al., 2001).

Despite the well-known advantages related to network relationships, it is undeniable that these latter profoundly influence the aspects of strategic planning and control that consequently need a broader attention (José Alfaro Saiz, 2007; Spanò et al., 2016). In this regard, it is important to highlight that when innovation is pursued going beyond the organizational boundaries it is essential to correctly understand how inter-organizational relationships should be managed, in order to promote collaboration and knowledge sharing within the network. Thus, the provision of adequate performance measurement systems, able to ease the information flows and to enhance the fiduciary dimension among the actors involved, assumes a vital importance (Franco-Santos & Bourne, 2005).

In this regard, literature clarifies that the implementation of performance measurement systems plays a central role to support effective R&D activities, and innovation in general (Pearson et al., 2000). Research in this domain has to date mainly focused on the R&D activities of the individual organization (Agostino et al., 2012; Chiesa et al., 2007a, 2007b; Chiesa et al., 2007; Chiesa et al., 2009; Drongelen et al., 1997; Janssen et al., 2011; Nilsson et al., 2012; Nixon, 1998), while the issues relating to networks seem quite neglected. However, the complexity, multidimensionality and uncertainty that characterize innovative processes render the design of performance measurement systems within networks particularly critical, because it is difficult to identify what should be measured and how measurement and evaluation have to be carried out (Murray & Blackman 2006; McCarthy et al., 2006).

Since literature is far from providing clear and definitive answers to these problems, there is the need to further investigate the above-mentioned problems, from both the theoretical and the practical point of view. On this ground, the purpose of this paper is to suggest the adoption of a multidimensional performance measurement tool within innovative networks, in order to achieve an effective interplay between innovation and control. To this aim, building on previous literature on the interplay between performance measurement and innovation, the paper recommends an adaptation of the Balanced Scorecard, through the development of specific key performance indicators to enrich each of the four perspectives with the innovation elements (only implicitly considered in the original model). The model was developed by referring to the network Campania Bioscience – which operates in the field of biotechnologies and represents a good example of open innovation – to show its potential.

The remainder of the paper is organised as follows. The second section briefly reviews the literature on performance measurement systems with especial reference to the issues relating to innovation. The third section focuses on the Balanced Scorecard highlighting its limitations for the applicability in complex and innovative contexts, and possible areas for improvement. The fourth section describes the application of an adapted BSC for the network Campania Bioscience. The fifth section offers some concluding remarks.

2. Performance Measurement and Innovation

Over the last decades networks have assumed a pivotal role for organizations to achieve innovation. The involvement of several actors for the same project is regarded as an essential element to support innovation, because of the increasing complexity of external economic environments and the variety of tangible and intangible resources needed to develop new knowledge (Kale & Singh, 2007). Thus, the relevance of networks lies in their role as mechanisms enabling participants to access heterogeneous knowledge resources more easily and less costly. On this ground, copious literature investigated the key role played by networks for innovation processes, highlighting their positive effects on firms' performance (Podolny & Stuart, 1995; Powell et al., 1996; Gomes-Casseres et al., 2006, Mowery et al., 1996; Owen-Smith & Powell, 2004, Soh, 2003). However, despite the advantages relating to network relationships, when innovation is pursued going beyond the organizational boundaries it is essential to understand how inter-organizational relationships should be managed, in order to promote effective collaboration and knowledge sharing within the network. In this context, the provision of adequate performance measurement systems (PMS), able to ease the information flows and to enhance the fiduciary dimension among the actors involved, assumes a vital importance.

PMS are usually used to allocating responsibilities and decision rights, setting performance targets, and rewarding the achievement of targets (Merchant & Van der Stede, 2007; Lee & Yang, 2011; Otley, 1999) to support the strategic process (Broadbent & Laughlin, 2009). Literature enlightens that to ensure effectiveness of the PMS, these have to be developed by taking into account the peculiarities of the organisations (Chenhall & Langfield-Smith, 1998; Ittner & Larcker, 1998b; Kaplan and Norton, 1996, 2001; Libby and Waterhouse, 1996; Lillis, 2002; Bourne et al., 2000). For this reason, the lack of studies focusing on PMS suitable for innovative, complex, multidimensional, and unpredictable processes (Murray & Blackman 2006; McCarthy et al., 2006) is absolutely critical.

In such contexts, given the presence of multifaceted aspects hardly observable in quantitative and objective terms, it is very challenging to develop PMS capable to foster an effective R&D (Pearson et al., 2000). Indeed, if the object of measurement is innovative-related, specific requirements should be determined about what and how to measure. This is even more important if we consider not only the complexity of the innovation processes but also the complexity of the organization itself, that emerges within research-intensive networks.

This debate has been the focus of several contributions in the field (Frattini et al., 2006; Driva & Pawar, 1999; Kerssen-van Drongelen & Cook, 1997). Some authors argue that a first set of problems is related to the identification of the objectives, given that the purposes for which the PMS are adopted significantly influence the design of PMS elements (Baglieri et al., 2000; Driva et al., 2000; Pearson et al., 2000; Bremser & Barsky, 2004; Guidi, 2005). Other researches highlight that the choice of the dimensions on the basis of which innovative performance should be assessed is affected by different factors, such as the business strategy (Griffin & Page, 1996), the environmental uncertainty (Calantone et al., 2003) the organizational level (Rogers et al., 2005), and the kind of innovative process put in place (Nillson et al., 2012; Chiesa et al., 2009). These dimensions can be operatively measured only if an appropriate set of metrics is selected and associated to each of them (Pappas & Remer, 1985; Werner & Souder, 1997; Sandstrom & Toivanen, 2002; Ojanen & Vuola, 2006).

More specifically, the metrics used for innovative activities can be quantitative objective measures (i.e. numeric metrics obtained from the application of a definite algorithm that brings to the same evaluation independently

from the person responsible for the measurement), quantitative subjective measures (i.e. numeric metrics based on the personal judgment of an expert, whose subjective evaluation is however translated into a numeric score through alternative techniques), and qualitative subjective measures (i.e. metrics not expressed numerically, but through the personal judgment of the evaluator). Furthermore, literature shows that an effective PMS for innovation needs to be appropriately structured. It involves the selection of control objects such as researchers, teams, projects or R&D functions, whose performance have to be monitored, and for which it is necessary to identify the specific dimensions and indicators they are responsible for (Schumann et al., 1995; Hauser, 1998; Nixon, 1998; Poh et al., 2001; Sandstrom & Toivanen, 2002; Bremser & Barsky, 2004).

An effective performance measurement system should encompass a multidimensional approach, by considering financial and non-financial indicators, historical and forward-looking measures, as well as leading and lagging metrics (Collins & Smith, 1999; Kaplan & Norton, 2001; Bremser & Barsky, 2004). The PMS should be able to identify causal relationships between the various dimensions considered and the metrics developed, to logically map the whole of the activities carried out and their direct and indirect effects (Bremser & Barsky, 2004; Gama et al., 2007; Kaplan & Norton, 2001; Sandt et al., 2001; Wong, 2001). Another essential element of PMS especially conceived for research-intensive networks is the ability to take into account the various interests of both external and internal stakeholders (Franco-Santos et al., 2007). Such an approach also favours an effective implementation of the tool (thanks to a wide sharing of its objectives), that otherwise may be resisted or only formally relied upon.

On this ground, the following section addresses the issues relating to the Balanced Scorecard to highlight how a few modifications can enhance its potential for networks, despite the limitations recognized by literature.

3. Balanced Scorecard and Innovation

The Balanced Scorecard is a management tool that a number of firms use to measure the performance of their business, especially with regard to the strategies implemented (Lawrie & Cobbold, 2004). This tool is useful to integrate the strategic management and to communicate to all organizational levels the innovative measures adopted and to enhance the development of shared objectives and practices (Magalhães, 2004). Despite this, it is well-argued that the traditional BSC is not fully able to properly capture the value added of innovation. Indeed, innovative projects are usually characterized by intangible values that are not easily measurable from the financial/quantitative perspective.

The first model of BSC already contemplated the innovation as a dimension of the traditional "learning and growth perspective", which was used to measure the company's ability to innovate, improve and learn (Kaplan & Norton, 1992). Subsequently, the authors realised that innovation was an internal process (Kaplan & Norton, 1996), treating it as an issue to be included in the "internal processes perspective" (Kaplan & Norton, 2004). What should be noted is that the BSC originally elaborated by Kaplan and Norton in 1996 has been developed when the innovation was not achieved through collaborative processes. Indeed, at the beginning, the four perspectives were elaborated by considering the firm as a closed entity (Al-Ashaab et al., 2011). For this reason this first tool cannot reflect that nowadays most of the innovation processes take place in collaboration with external partners, such as universities and research centres, as well as entities outside the corporate boundaries.

However, in innovative processes innovation and collaboration are much more of strategic issues. Innovation is a strategic objective, a way to create a competitive advantage that is usually achieved through collaborative initiatives aimed at favouring knowledge co-creation and sharing, when the aim is not only to increase profit. Innovation can be achieved not only thanks to the development of new products/services through changes in management, the business model, marketing, organizational structure, processes, products, services, supplies or strategic objectives (Hamel, 2006). What the BSC allows to obtain, unlike other measurement system, is the translation of strategic objectives and intangible results into operational measures that everyone in the firm should follow in order to achieve an increase in the performance (Al-Ashaab et al., 2011). Hence, the introduction of innovation metrics in each of the perspectives renders it possible to better evaluate such a performance, which is not merely financial, and that usually is made of intangible and not easily measurable aspects.

In fact, although the focus of each perspective is different, there is a common thread that provides a logical causal link between all the perspectives of the BSC. If a company invests in learning and growth to improve the skills, expertise and know-how of its employees, then those results will translate into an improvement of internal business processes by leveraging the best practices or programs of change as Six Sigma, Just-in-Time and TQM. These activities will result in higher quality products and services to consumers, that on the other side will lead to an improvement in sales and profit. So if a company innovates its business model, the impact will be on all the

perspectives and thus innovation must be treated in each perspective and not just in that of the internal processes (Gama et al., 2007).

On these grounds, BSC can definitely be called as a useful tool to measure the performance of innovative and collaborative processes, but only if there is a proper attempt to change the typical model by ensuring that innovation metrics are contained in each of the perspectives. Thus, the following section proposes an adaptation of the BSC, through the development of specific key performance indicators to enrich each of the four perspectives with the innovation elements (only implicitly considered in the original model).

Thus, the following section proposes a model developed by referring to the network Campania Bioscience – which operates in the field of biotechnologies and represents a good example of open innovation – to show its potential.

4. An Adaptation of the BSC for Research-Intensive Networks: The Case of Campania Bioscience

4.1 Methods and Data

This section proposes an adaptation of the Balanced Scorecard to the Campania Bioscience network, located in Campania and created in 2013. The data were collected over an eight-month period in 2013-2014. At first, a relationship was established with the Chairman. He was briefed about the research project and the authors asked to be introduced to the managerial group. Subsequently, the authors personally interviewed some of the managers. The informal interviews, which were later transcribed, followed an agenda of topics to be covered rather than a structured set of questions. This approach allowed a full coverage of the issues and resulted in a detailed picture of the practices and issues involved in the management of the network. The interviews aimed to build up a deeper picture of the structure of the network and its characteristics, how the interviewees felt about their roles, what they thought about the network's role in the context of reference, the practices and management tools available within the network, and which were the aspects that they regarded as crucial to assess the impact of their activities.

The interview strategy was mostly informed by a balanced consideration of the approach suggested by Scapens (1990), and Ahrens and Chapman (2006). Each of the interviews lasted around one hour and most of them took place with two of the researchers. Over the study period interviews with 10 individuals, some of which repeated, were held at the study site, amounting to a total number of 17 interviews. These were digitally recorded and then transcribed for analysis soon after the event.

These data were supplemented by an examination of other documentation, policies and digital videos for strategies and practices, publicly available for the Region and the network considered, as well as some internal documents. Information was collected and triangulated with data drawn from the direct interviews in order to enhance research reliability.

For a purpose of clarity the following sub-section briefly describes the peculiarities of the network under investigation.

4.2 The Structure of the Network

The process to create the network Campania Bioscience started in 2011 to benefit from the national and regional initiatives for funding (Europe 2020 and PON "Research Competitiveness") and also in the light of the opportunities and constraints imposed by Regional Plan for research, innovation and ICT (Regional Council Decree April 29, 2011). The network Campania Bioscience actively operates within the Campania Region since the beginning of 2013. It has been created in the wake of an increasing attention within the Region for the issues relating to innovation and the need to find appropriate ways, such as the creation of networks, to support innovation on the territory and to enhance the previous-existing abilities and skills. In the South of Italy Campania Bioscience represents the first example for the biotechnology sector of a structured and organised model of cooperation capable in terms of size and skills available to compete on the international scene. The funds made available to constitute the network and to fund the operations for the first three years of activities amount to 50 million Euros, provided by both private and public funders. The investments within the network are primarily directed to the development of innovative projects with especial priority for the testing of new therapies. Furthermore, over the first three years, the focus is not only limited to the development and testing of new therapies, but attention is also devoted to the production of nutraceuticals and cosmeceuticals, diagnostics, biosensors and innovative technologies for the biomedical industry.

The legal form of Campania Bioscience is a limited liability consortium (SCARL: Società Consortile a Responsabilità Limitata). The consortium has a capital of 1,7 milion and is distributed among 47 companies (44%), 7 research institutes (44%) and 3 firms for knowledge and technological transfer (12%). The network

adopts a traditional governance model with the Assembly, Board of Directors (with an equal participation of representatives of public entities and private companies), Chairman, CEO, and two committees (executive committee, internal audit committee), as well as an external assessment organism (voluntarily adopted).

Given the multifaceted nature of the innovative projects that the network is developing, in addition to the above-described structure, five thematic tables were created to closely monitor each of the projects, and also the transfer of knowledge within the network. These tables define the programs to achieve the strategic objectives and are involved in the realisation of several projects. They are composed by three thematic round tables responsible for industrial research and experimental development in the three thematic areas of interest of the network. The first group deals with the development and production of nutraceuticals and cosmeceuticals; the second is involved with diagnostic systems, biosensors and innovative technologies for the biomedical industry; the third focuses on the development and testing of new therapies. In addition to these thematic tables, there are two transverse tables related with the advanced training, and the promotion/internationalisation/diffusion/transfer of technology.

4.3 The BSC for Campania Bioscience

In order to adapt the BSC to the case of the Campania Bioscience network the first step was to identify the perspectives of the tool and the key performance area (KPA) and indicators (KPI) to adopt for each of these.

To this aim we took into account the characteristics of the network examined above and the strategic and information needs expressed by the interviewees. More specifically, on the basis of extant literature we employed the typical four perspectives of the BSC, by integrating in each of these four specific objectives, KPAs and KPIs able to capture the innovation dimensions (see Figure 1).

As for the *economic and financial dimension*, the improvement of competitiveness of the network is regarded as a primary goal. On this ground, it was possible to elaborate a first set of KPIs that allows us to assess the effectiveness of the investment strategies, by measuring the ability of the network to develop and implement new business models, new projects funded by external sources, as well as tools and methodologies that favour the improvement of the internal procedures to enhance competitiveness. Also, the ability to effectively use the resources and to finalise projects in terms of commercialization of patents and product is took into account as a crucial element, and measured through reference to the market share, the net cash and the ROI.

As for the *stakeholder perspective* (that basically coincides with the client perspective of the traditional BSC, but modified in view of the characteristics of the network), a primary goal is to assess the impact of the network from the sustainable development point of view. Hence, attention is devoted to KPIs capable to capture the ability of the network to positively contribute to the well-being in the region. This is assessed not only by referring to the activities aimed at improving/preserving the environmental conditions, but also with respect to the social elements in terms of stakeholders' engagement and growth of the communities of reference.

As for the *internal processes perspective*, the main aims refer to innovation improvement. This is mainly assessed by considering two crucial elements. Innovation is regarded as the capacity to develop new procedures to mitigate risks, thus reducing the occurrence/impact of adverse events. Moreover, innovation is intended as the ability to foster the elaboration of projects and models able to enhance the degree of knowledge sharing, the health safety and the use of alternative materials, to also reduce pollution and environmental impacts.

Finally, with reference to the *learning and growth perspective*, the main goals are identified in terms of enhancement of the intellectual, human and relational capitals. More specifically, the KPIs are developed by considering the need to take into account the ability to favour the creation of effective information flows and relationships based on trust of the strategic partnership that characterizes the network and human capital protection and improvement.

PERSPECTIVE	*OBJECTIVES*	KPA	KPI LEAD	KPI LAG
Economic and financial	***Improvement of Competitiveness***	**Investments**	(i) Annual budget invested in the network project (ii) Average expenditure per project (iii) Number of projects funded per year	Number of new business models or frameworks developed and implemented through collaborative projects per year to support the business and IT evolution in the network
		Finalization of projects	Number of commercialized patents and products	(i) ROI of realized patents and products (ii) Royalties of commercialized patents and products (iii) Net cash generated by commercialized patents and products (iv) Number of firms adopting the commercialized patents and products (v) Market Share of firms adopting the commercialized patents and products
Stakeholder	***Sustainable development***	**Environmental implications**	Number of projects with social and environmental relevance for the Campania Region	(i) Pollution reduction (ii) Improvement in the use of alternative energy/material
			Number of Procedures to mitigate risk (operational risk, compliance risk, environmental risk)	Reduction of adverse events impact
		Social implications	Number of key internal and external stakeholders integrated in the network projects to improve sustainability concerns in the construction value chain.	(i) Stakeholder satisfaction rate (ii) Involvement of local SMEs (iii) Improvement in the occupational rate of Campania Region (iv) Innovative firms birth rate (v) Number of Knowledge Transfer Sessions (KTS) organised to present Sustainability trends, novel technologies, etc
Internal processes	***Improvement of Innovation***	**Improvement of network practices**	Number of projects that developed new models, methods and/or standards to improve practices in the network	(i) Use of information systems for sharing data (e.g. Skype, Dropbox, Icloud) (ii) Health safety rate (iii) Pollution reduction (iv) Improvement in the use of alternative energy/material
		Reduction of Risk	Number of Procedures to mitigate risk (operational risk, compliance risk, environmental risk)	Reduction of adverse events impact
Learning and growth	***Intellectual and human capital***	**Human Capital**	(i) Sharing of Strategic Planning among researchers and employees (ii) Number of joint training programs for researchers and employees (iii) Involvement of Researchers and employees to the Thematic Tables	Improvement of Employees and Researchers Satisfaction
		Intellectual Capital	(i) Number of meeting among partners (ii) Presence of Thematic Tables	(i) Number of publications in scientific journals or conferences (ii) Number of European Patents (iii) Number of new intangibles per year (patents, licenses, copyrights, trademarks, etc.) (iv) Number of projects funded by external organisations (e.g. EU)
	Relational Capital	**Internal communication**	Development and sharing of strategic plans	(i) Parties awareness of strategic plans rate (ii) Number of information systems implemented for sharing data (e.g. Skype, Dropbox, Icloud)
			(i) Presence of Thematic Tables (ii) Percentage of attendance to the meeting	Number of new co-created skills and Knowledge
		External communication	Number of events	Social engagement in Campania Region

Figure 1. The innovation-oriented BSC for the network Campania Bioscience

Moreover, following the BSC logic a further step of the project involved the realisation of a strategic map to render explicit the causal relationships between the KPIs identified. The map is represented in Figure 2.

On better interpret the map, we provide several examples of the above-cited relationships. Looking at the economic and financial perspective, the investments level (KPA - investments) depends on the social impact of the finalized projects on the community (KPA - Social implications), that is, the economic and financial performance influences and is influenced by the stakeholders perspective. Indeed, an improvement in the local

community's satisfaction, the involvement of local SMEs, as well as the improvement in the occupational rate of the territory, leads to the ability to attract new funds from both private and public subjects, thus increasing the investment level. Moreover, the effectiveness of the investments also depends on the development of new practices and procedures (KPA - Improvement of network practices), and in turn allows to fund any initiatives within the network to create new and more efficient practices, thus confirming a double causal relationship between the economic and financial perspective and the internal process perspective. Yet, an improvement of internal practices (KPA-Improvement of network practices) favours the implementation of mechanisms to support actors' engagement in decision-making (KPA-Internal communication), which also improves the intellectual capital (KPA-Intellectual capital). Then, the intellectual capital is linked to the finalization of projects and to the income/cash-flow deriving from these latters (KPA-Projects finalization). In the end, the external communication (KPA-External communication) supports and enhances the social and environmental impact of the activities carried out (KPAs - Social and Environmental implications).

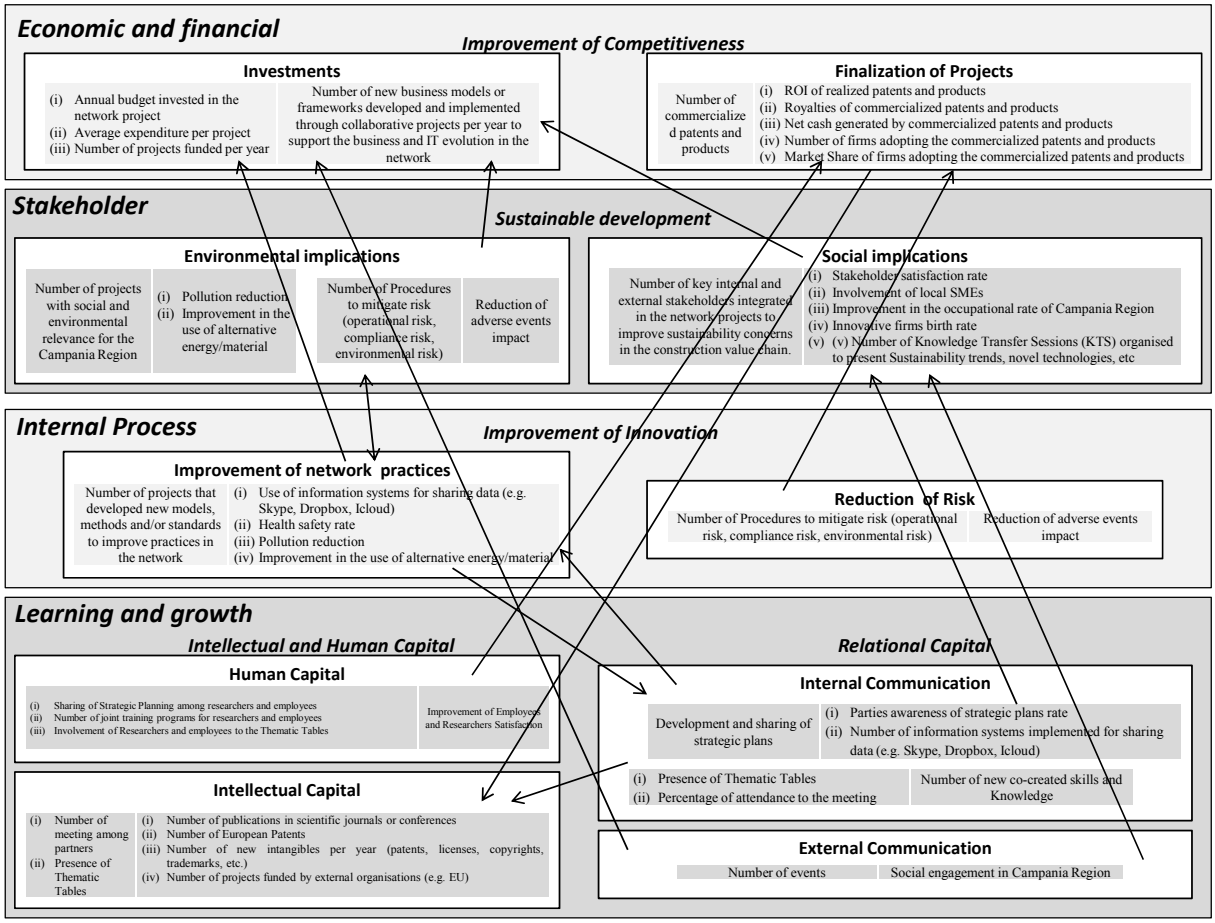

Figure 2. The strategy map

5. Concluding Remarks

It is well argued in literature that the Balanced Scorecard is a management tool that a number of firms use to measure the performance of their business, to integrate the strategic management, and to communicate to all organizational levels the innovative measures adopted, and to enhance the development of shared objectives and practices (Magalhães, 2004). Despite its relevance a BSC model capable to measure the impact of research-intensive networks is still lacking in extant literature. This seems to be a crucial gap, as networking relationships are increasingly acquiring relevance in the majority of the innovative fields. Thus, given that in these complex contexts there is the need to foster effective innovation projects and there are great difficulties in measuring and assessing collaborative innovative performance, a proper adaptation of the BSC is of great importance.

On these grounds this study proposed an adapted BSC, with especial reference to the network Campania Bioscience, by combining the traditional BSC with innovation metrics, in order to encompass in the tool the specific issues essential to evaluate the performance of this network and to strategically drive the management decision-making at all levels.

The BSC elaborated is clearly based on the specific strategic and informational needs of the studied network. Despite this, it has a broader relevance for a twofold reason. First, it has theoretical relevance in that it proposes newer metrics that can capture multidimensional aspects of the value created by a research-intensive network, that if properly adapted are applicable also to different contexts. In fact, the metrics proposed here can be generally regarded as a possible way to communicate the strategy, evaluate investment proposals, align projects to strategy, understand the sources of value, measure the value created by projects, and identify the most innovative employees. Such a BSC represents a comprehensive management tool for measuring and managing many different aspects of innovation.

Furthermore, the project has practical relevance, in that it represents a potentially useful practical adaptation of a tool, always called to be too theoretical and far from business practice, to a real-world case study. Such an experience shows that a key aspect to consider when the issues relating to the design of the BSC are addressed is that innovation metrics can be effectively developed and implemented only if strategic objectives are clearly identified and shared throughout the organisation.

However, before concluding it is important to stress that to date this tool is not yet in use in the study network. This represents one of the main limitations of the paper as it may at least partially challenge the real feasibility of the tool in practice. Nevertheless, this limitation does not compromise the theoretica/explicative relevance of the model proposed. On the contrary, it highlights that further research could observe the effects of its implementation, focusing on any difficulties, resistances, or changes needed. Another weakness of the paper may resides in the specific focus on a biotech network which, despite its broad approach to innovation, represents a very peculiar setting. Thus, for future developments of the study it could be of interest to compare different contexts or to try to apply this tool to other settings.

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