The Propensity to Innovate in a Company: from Theoretical Models to Case Studies to Simulation

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Abstract

The purpose of this paper is to delineate a set of useful variables able to show the level of propensity to innovate in a company. In order to evaluate innovation, the authors have built a model in which different variables that can help management to measure the level of innovation in their company are taken into consideration. The created model is based both on theories about innovation and on the authors' expertise.

A questionnaire was put together by the authors with the aim of understanding the strength of the model and measures the level of innovation present in the company. The questionnaire was sent to 100 companies belonging to different Piedmont industries

1. Introduction

Numerous surveys seem to demonstrate that innovation is fundamental for a company aiming to be competitive but, innovation is not the same for every sector: there are many variables influencing the results. First of all, innovation is affected by the sector and, secondly, among companies belonging to the same sector, by both structural and organizational factors (Arthur D. Little, 2004. After the Second Word War economists began to take an interest in the cause of growth (Harrod, 1949; Domar 1946). One of the most important influences on innovation seemed to be industrial research and development. A series of studies on innovation were undertaken in the 1950s on the internal characteristics of the innovation process in the economy. In particular these studies revealed that firms behaved differently (Simon, 1954; Woodward 1965; Carter and Williams, 1959). This led to the development of a new theoretical framework that attempted to understand why some firms appeared to be more successful than others. Later studies in the 1960s were to confirm this difference in organisational characteristics (Myers and Marquis, 1969; Burns and Stalker, 1961; Cyert and March, 1963). The new framework placed more emphasis on the firm and its internal activities: the firm and how it used its resources was then seen as the key influence on innovation. Neo- Classical economics is a theory of economic growth that explains how savings, investments and growth respond to population growth and technological change. Moreover, neo-classic economy theory tends to concentrate on industry or economy- wide performance. It tends to ignore differences among firms in the same line of business: any differences are assumed to reflect differences in the market environment that the organizations face. The Schumpeterian looks at a firm in the way it manages its resources over time and develops capabilities that influences its innovation performance. The overview of innovation includes economy perspective, business management strategy perspective and organisational behaviour which attempts to look at the internal activities. It also recognises that the firms form relationships with other companies and trade, compete and cooperate with each other. It was Shumpeter who argued that modern firms equipped with R&D had become the central doer of innovation. Since his work, others have contributed to the debate (Chandler, 1962; Nelson and Winter, 1982; Choen and Levinthal, 1990; Prahlad and Hamel 1990; Pavitt, 1990; Patel and Pavitt 2000). This emerging Schumpeterian or evolutional theory of dynamic firm capabilities is having a significant impact on the study of business and management today.

2. Theory: Propensity for Innovation

There are some parameters that a company has to consider for the evaluation of innovative products and services; parameters can change depending on the sector and the company structure but, generally, can be described as follows. Thanks to the theory of innovation, the authors created a model that shows the most important parameters to evaluate the propensity for innovation (Figure 1).
Parameters can be both qualitative and quantitative: qualitative parameters are an indicator of the propensity to innovate within a company while

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quantitative parameters are useful to understanding what the company is doing in the field of innovation. As shown in figure no.1, for every single function present in the company, there are a number of actions that have to be evaluated. In this way, it is possible to better understand the role of the different functions in the process chain. This literature presents a related theoretical view that centres around an organisation's ability to develop scientific capabilities. These skills tend to be dependent on the organisation's incremental and cumulative historical activities. Certainly, if management is open to new opportunities and favourable to taking some risks in the company, it will be easier to be innovative. To this purpose, some authors (A. Muller, L. Valikangas and P. Merlyn, 2003) considered the role covered by resource, capability and leadership fundamental. Let's take into consideration the "leadership view", clearly defined by the authors in three points:

Percentage of executives' time spent in strategic innovation rather than day-to-day operations;

Percentage of managers with training in the concepts and tools of innovation;

Number of times during the past 5, 10, and 20 years in which senior management has redefined the company's core business.

Apart from management, the marketing department - the strategic part of a company - also plays an important role. Today, companies must exploit their innovative capabilities to reach new markets and successfully confront the disruptive effects of emerging technology, empowered customers, geopolitical instability and market globalization. The marketing department, as well as having good ideas and a predisposition to innovate, has to investigate the market and, in particular, focus its attention on customers, do research to monitor the innovation carried out by companies both in the same sector and in other sectors. In this way it becomes easier to find good solutions and ideas to become a market leader.

Obviously, to support ideas and processes, companies have to have a team dedicated to innovation and an excellent R&D department. R&D has a special economic significance, apart from its conventional association with scientific and technological development. In fact, R&D investment generally reflects an organization's willingness to forgo current operations or profit in order to improve future performance or returns, and its abilities to conduct research and development. The importance of R&D is developed by Cohen and Levinthal (1990) in the context of the management of research and development. In their study of the US manufacturing sector Cohen and Levinthal reconceptualise the traditional role of R&D investment, which was viewed simply as a factor aimed at creating specific innovations. They see R&D expenditure as an investment in an organisation's absorptive capacity. They argue that an organisation's ability to evaluate and utilise external knowledge is related to its prior knowledge and expertise and that this prior knowledge is driven by prior R&D investment. The issue of an organization's capacity to acquire knowledge was also addressed by Nelson and Winter (1992) who emphasised the importance of "innovation routines"

Finally, the ICT includes the examination of the technology present in the company, the connection between technology and product characteristics and, the influence of technology on the company organization. ICT looks at how a company can control, evaluate and make previsions based on the evolution of technology. . It will be necessary to consider where, inside the company, technological skills are allocated to evaluate vulnerability with respect to the human factor. Thanks to the ICT department it is possible to create a repository in which everyone can easily find information about best practices, investments made and results obtained. It was in the 1980's that governments around the world started to recognise the potential opportunity that technology transfer could bring. This was based on a theory that explained how technology, which had already been produced, and hence paid for by someone else, could be used and exploited by other companies to generate revenue and economic growth.

Considering the quantitative part of the model, more practical aspects and numbers are analyzed in order to understand, from another perspective, the level of innovation present in a company.

The first element that has to be taken into consideration is production and, in particular, the number of radical innovations in products, services and processes made in the last years. This is an important indicator to understand how often a company translates ideas into concrete products or services and, it is also useful to understand if all the elements (management, marketing, R&D, ICT) involved in the process are working well.

Moreover, it is important to remember that industry is changing fast and firms must continually revise their designs and range of products. This is necessary due to continuous technological change and development as well as other competitors and changing customer preferences. For this reason it becomes essential to consider the amount of incremental innovation (used when a product hits the decline phase and needs to be changed to regain market share) in products, services and processes.

Finally, finance has an important role to play in monitoring the value investments in innovation have on revenue.

Generally speaking, finance can have a strong impact on innovation, above all in companies where financial control is emphasized and managers are evaluated on objectives based on financial criteria such as ROI. There are different ways to achieve

objectives: for example ROI can be increased in the short- term by reducing long- term expenditures, such as investments in R&D. This behaviour is risky for the company because managers who reduce or postpone long-term investments are unlikely to be present when the outcomes of these actions emerge.
In contrast to corporate executives, business unit managers do not have the chance to diversify their employment risk. In fact, when business unit managers take some risks they have to remember that wrong investments can compromise their future career because the results come out in the shortterm (A. Hitt, R. E. Hoskisson, R. A. Johnson, D. D. Moesel, 1996).

3. Model to Evaluate the Propensity to Innovate

The model is divided into the four macro areas considered the most important for helping companies to self-analyze and understand their propensity to be innovative and where it is possible to improve their capabilities (figure no.1
In the next paragraphs the authors will explain each macro area.

Management

The management area includes all the actions considered fundamental to obtain a general evaluation of the company/ organization as a creator, maker and, manufacturer of a "real culture of innovation".
The "company culture" embodies the non-written rules, the values, the habits and the styles that can have an influence on the expectations and behaviour of people involved in an organized area.
In small and medium companies, the values and style of the entrepreneur have a strong influence on the organization while, in bigger companies the values and expectations are shared in the vision of the firm.
The relationship between the formal organization of the company and the human factor (including all the different aspects such as creativity, flexibility, capability to interact, know-how and professional skills, etc.) are decisive for understanding how a company can make innovation.

Marketing

The marketing area includes all the exchange relationships existing between the company and its market in terms of products, services, information, communication, etc.
How companies detect changes both in the world and the external market (e.g. using benchmarking, strategic plans, etc.) and how they adapt their structure to them (e.g. product portfolio and consequent logistic organization and distribution) will be examined further on The ability to be pro active and favourable to improving services and lead time to customers' needs will also be investigated.

Organization

The organizational area includes all the processes that characterize the internal structure of the company.
How companies have defined their organizational model, allocation of resources, type of processes and mechanism of benefits for achieving the set objectives will be looked at later.

Ict

The ICT area includes the investigation of: technologies present in the company, connection between technologies and product characteristics and, reflection of technologies on the company's organization.
How companies value, make prevision for and control the evolution of the technology already present in the company as well as where technological skills are placed inside the company and who is responsible for them will be looked into further on .

4. Questionnaire

Methodology

The approach used to reach the targets is divided into different steps.
Firstly, the authors created a model to structure the propensity to innovate in a company. Secondly, a part of the existent literature was used to support and integrate the model.
Finally, to mark the passage from theoretical model to case studies, it became essential to prepare a questionnaire to be sent to several companies, operating in different sectors, in order to understand the extent of the applicability and veracity of the new model.
Questionnaires, with the support of some interviews, are expected to confirm and lead to a deeper analysis.

Objective of the questionnaire

The objective of the questionnaire was to analyze a sample of companies, operating in different sectors, with the aim of:
Validating the model created by the authors;
Analyzing the propensity to innovate of the selected companies;
Analyzing the existent gap between companies and the results of the "average company"

Target

The questionnaire was sent to 100 selected companies belonging to different sectors1 in Piedmont. . Because of the lack of data further and more detailed analysis will be done in other future studies.

Approach

The questionnaire is structured according to the principles of the Balance Scorecard Technique. The Balance Scorecard was developed by Robert Kaplan, professor at Harvard Business School, and David Norton, management consultant, and was presented for the first time in 1992 in an article published in the Harvard Business Review. The Balance Scorecard uses a concept of measurement which has the objective of clearly defining the meaning of strategic aspects such as quality, customer satisfaction and growth. Once a detailed Scorecard is developed describing the adopted strategy, it will become the organizational context for the management system (P. Pisano, M. Pironti, Balance Scorecard, "Un caso concreto").

Insert table n°.1 about here

The questionnaire that was sent to companies (table n°.1) is structured in the following way:
The mainstay includes:

- macro area
- details of each macro area
- description
- weight given to each factor
- total score obtained for each element

Each macro area has the same weight on the final score.
A percentage is given to each element representing the weight assigned inside the macro-area.
The evaluation for each factor is given using a scale from 0 to 4, avoiding the use of intermediate values, in order to better understand if the company is closer to lower or higher values.
There are two types of score:

- qualitative score
- quantitative score

The time-frame used is 5 years: in this way it is possible to decrease the economic differences between the different sectors taken into consideration.

5. Conclusion

A questionnaire was sent to 100 companies in the Piedmont area and, almost 70% responded. Companies were requested to give a score to each area analyzed and evaluate the macro areas.
At the moment of writing it was not possible to elaborate and analyze the data received from the sample.
The first evidence sustain the importance of the four area of study. More of the company spend money and time for management and IT. R&D is not so linked with innovation as we though at the beginning.
A more detailed analysis will be provided in a future study. The data will be examined with the support of a graph through which it will be possible to:
- compare different companies;
- compare the values of each company with those of the "average company" and evaluate the existent gap.
This method is useful to understand a company's propensity to innovate and, individualize the macro area in which the company is weak.
Apart from the analysis of the sample, the next study presents a virtual system (currently in a test phase) able to simulate the market situation and the behaviour of companies. By putting the data in the model it will be possible to analyze how companies react if some variables change or some values are modified. The virtual model will be a further support to the theoretical model created by the authors. The objective is to understand if, by modifying some variables, companies increase or decrease their propensity to innovation.

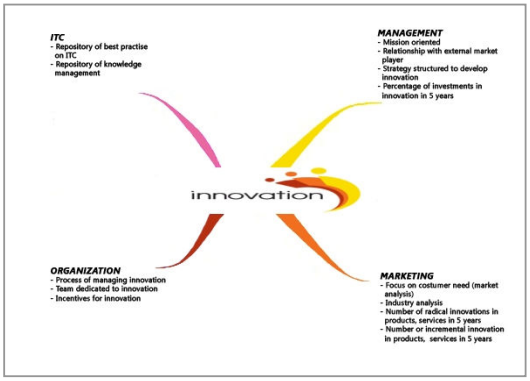

Figure 1 The model

[1] Thanks to the collaboration of the "Osservatorio Piemonte" it will be possible to analyze a larger sample of companies operating in the Piedmont area.

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APPENDIX – RESULTS

Table 1. Company Questionnaire

COMPANY QUESTIONNAIRE				
Macro area	***Detail***	***Description***	***Weight***	***Score***
MANAGEMENT				
	Mission oriented to innovation			
		Existence of innovation in the company mission statement	10%	Q.A.S.[2]
	Relationship with external market players			
		Existence of structured relationship with external players[3] and companies	40%	Q.A.S
	Strategy structured to develop innovation			
		Existence of innovation objective in strategy	20%	Q.A.S
	Percentage of investment in innovation over 5 year period		30%	
		Innovation investment <0% of revenue		0
		0%<Innovation investment <1% of revenue		1
		1%<Innovation investment <2% of revenue		2
		2%<Innovation investment <3% of revenue		3
MARKETING		Innovation investment>3% of revenue		4
	Focus on consumer needs (market analysis)		30%	
		Consumer target analysis		Q.A.S
		Structure process for consumer interaction in the creation of services and products		Q.A.S
	Industry analysis		20%	
		Innovative competitor analysis		Q.A.S
	Number of radical innovations in products, services in the last 5 years		20%	Q.A.S
		N° p/s[4] = 0		0
		1<= N° p/s<3		1
		3<= N° p/s <5		2
		5<= N° p/s<8		3
		N° p/s>8		4
	Number or incremental innovations in products, services over last 5 years		30%	
		N° p/s[5]= 0		0
		1<= N° p/s<3		1
		3<= N° p/s<5		2
		5<= N° p/s<8		3
		N° p/s>8		4
ORGANIZATION				
	Process of managing innovation		30%	
		Existence of managing innovation process		Q.A.S
	Team dedicated to innovation		30%	
		Number of people dedicate to innovation		
	Incentives for innovation		40%	Q.A.S
ITC				
	Repository of best practice on ICT		40%	
		Existence and use of best practice repository		Q.A.S
	Repository of knowledge management (intranet)		60%	
		Existence and use of best practice repository		Q.A.S
		Existence and use of intranet		Q.A.S

Source: Model created by authors

Table 2. Qualitative area score

QUALITATIVE AREA SCORE	
Score	Level of viability
0	There is no innovation capability in the company
1	Capability to react (in a disorganized way) to events
2	Presence of an operating area not well organized and, with a limited number of programming instruments
3	Presence of a stable operating area, ready to react and advance customers' needs
4	Presence of an organized operating area able to gather in time all the weak signals coming from the external scenario

Source: Model created by authors.

[2] Qualitative area score
[3] In the external player we include: clients; suppliers; other companies; University; Consultancy Company.
[4] N° p/s: represent the number of innovative products/ services in a year
[5] N° p/s: represent the number of innovative products/ services in last year // over a 1 year period