FINANCIAL STRATEGY OF INNOVATION IN NANOTECHNOLOGY

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Abstract:
Changes in the techno-economic point of view are associated to revolutionary technological opportunities that take time to diffuse through the economy. During the advent and diffusion of a new techno-economic paradigm, both private and especially public policies are essential to internalise the benefits of its new and optimized costs. There has been a significant change about innovation theory and practice in the last two decades. It’s possible to observe huge interest in innovation implementation. Innovation has been perceived as an activity involving almost entirely individual actors, including inventors and enterprises. This article presents the financial aspects of innovation strategy implementation in nanotechnology enterprises. The data research was conducted for years 2009-2012.

Keywords:
Nanotechnology, innovation, finance, strategy.

1. INTRODUCTION

Nanotechnology is recognized as a revolutionary new field of science and technology, comparable to the introduction of electricity, biotechnology, and digital information. Research into nanotechnology is a broad-based, multidisciplinary field with discoveries that are leading to new products and applications projected to reach mass use by 2020, significantly changing and improving many aspects of human life.

Nanotechnology has been regarded as an emerging general-purpose technology with multiple possible applications and thus affecting several technological domains such as advanced materials, biotechnology and pharmacy, electronics, scientific tools and industrial manufacturing processes. Over the past decades, developments in nanotechnology have drawn the attention of governments, industry, academia and the public as to the potential industrial benefits. Because nanotechnology is still an emerging technology, it is required a wider understanding of its new scientific and technological phenomena in order to better exploit its possibilities. The perception that a technology promises important changes, advocating for its early exploitation, holds a rare opportunity, despite the risks and uncertainties involved in the process. In this context, understanding the innovation process in nanotechnology represents a key factor in order to design and implement relevant innovation policy.

The aim of this paper is to propose that indicators that focus not only on the innovative behaviour of the companies, but also on the technological innovation itself, on the number and characteristics of individual innovations, might be more adequate in order to shed some light on the nanotechnology innovation processes. [1]

2. FINANCIAL ASPECTS IN MANAGING COMPANIES

An enterprise is a business entity that’s main target is to create a profit. Mainly it means to gain money, but social entities would for sure define their profit as e.g. the activation of unemployed, gaining funds for a surgery, etc. However most of enterprises are not of a social type, but they are focused on winning new customers and by satisfying their needs – gaining funds for a further development.
The enterprise’s most common aims are to [2]: maximise a profit and sales; reach assumed market share, maintain or increase a level of an employment, and stabilise an income.

Nowadays, due to the altering internal and external circumstances, a business entity may keep its position and grow only if the board of managers is able to adjust its volatility to the market volatility. Table 1 shows comparison of traditional and new paradigms description.

Table 1. Difference between historical and present paradigms in an enterprise

<table>
<thead>
<tr>
<th>Traditional paradigm</th>
<th>New paradigm</th>
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<tbody>
<tr>
<td>Direct product cost reduction as a main objective of an enterprise</td>
<td>Indirect cost reduction, meanwhile improvement of competitiveness</td>
</tr>
<tr>
<td>Operations characterised and analysed as stable</td>
<td>Flexibility of operations, constantly improved</td>
</tr>
<tr>
<td>Production line based on one, main technology; long product life cycle</td>
<td>Production line based on multiple technology, short product life cycle</td>
</tr>
<tr>
<td>Manager is a decider, employee only executes the orders</td>
<td>Manager is a coach who facilitates work, employees are well trained</td>
</tr>
<tr>
<td>Global market is divided to national markets, domestic entities dominate on the national markets</td>
<td>Market is global - attention is focused on international political and economic structures</td>
</tr>
</tbody>
</table>

Source: own based on A. Mazurkiewicz, Paradygmy zarządzania we współczesnym przedsiębiorstwie (wybrane aspekty), http://www.univ.rzeszow.pl/pliki/Zeszyt19/33.pdf

Every enterprise needs money to function – at the beginning the condition sine qua non is to acquire necessary equipment (e.g. an office, machines, raw materials, etc.) and during its further existence a managing board is obliged to constantly count and compare the profits and the expenditures.

There are three types of decisions that have to be made in a financial management process: investment, financial and dividend. The first one includes investment in fixed and current assets (capital and working capital decisions) that are necessary to provide a business. The financial decisions relate to gaining funds to finance abovementioned assets, they depend on source’s type, a period of financing, and its costs and on the return thereby. The finance manager has to make a decision how to distribute the net profit, which is divided into: a dividend for the shareholders, with its rate to be defined, and refinance the rest. All of aforesaid processes are of the same importance, but there exist a defined time sequence. The first that occur is an investment decision that is further verified by financial possibilities, a dividend process occurs only if a net profit occurs.

3. MANAGING INNOVATIONS IN NANOTECHNOLOGY COMPANIES

Innovation has been considered an essential force propelling economic growth and development, innovation process is normally misunderstood. It is claimed in this paper that traditional innovation indicators are not suitable to comprehend innovation process in nanotechnology for two main reasons: a) innovation process is usually regarded as a linear process; and b) innovation surveys are normally carried based on the “subject approach” in which the innovation process is analysed from the firm’s innovative behaviour as a whole, not its innovative behaviour concerning the specific technology. Considering that innovation policy is based on the system of innovation approach, where policy making attempt to understand the interactions amongst economic, social, political and organizational spheres that influence pattern of innovation and use them to inform effective policy making. [1]

There has been a significant change about innovation theory in the last two decades. Innovation had been perceived as an activity involving almost entirely individual actors, including inventors and firms. It was viewed linearly, starting with fundamental research and proceeding successively to applied research,
development, prototyping, pilot production, market entry, and continuing through the diffusion of new products and production processes. More recently, there has been significant progress in delineating the multiplicity of resources required for innovation, involving a non-linear process of implementing.

This process generally occurs within a dynamic institutional context which includes policy institutions and actions. Thereby, the understanding of the innovation process is closely connected to the effects within the policy systems. The process of policy cannot be separated from the development of the field of innovation itself, so that theory and policy are best seen as co-evolving [3].

In this context, the new understanding of the innovation process, especially with the advent of the innovation system’s perspective, ushers in the widening of innovation policy [4], moving beyond (but also encompassing) science, research, technology and development policy, as well as expanding the role of governments. Such perspective is broader than before, not only because of the institutional and evolutionary perspective but also to the wider view of innovation as a social and economic phenomenon.

Therefore, in this perspective, innovation is regarded as the main element of the dynamic of capitalism, seen as a process rather than an act. And this dynamic justifies the participation of the State as an active policymakers to foster innovation [5], where its role goes far beyond designing science, technology and industrial policies but also, and most importantly, encompass development strategies. Hence, policies once directed to innovation are now seen directed to systems of innovation. A system of innovation refers to the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge [6], encompassing a set of organisations and institutions that contribute to the development of innovation and learning capacity. In other words, it constitutes a series of elements that relate production, assimilation, use and diffusion of knowledge. [7]

System of innovation approaches to policy making attempt to understand the interaction between the economic, social, political, and organisational ‘rules of the game’ that influence patterns of innovation, and use them to inform effective policy making. The core idea within systems of innovation approach is that by understanding how institutions influence technical change it should be possible for policy makers to more effectively intervene to influence the direction of innovation towards the goals socially desired. [6, 8]

By referring innovation policy to the concept of system of innovation, a fundamental aspect of innovation policy becomes to review and redesign the linkages between parts of the system as well as to put stronger emphasis on ‘institutions’ and ‘organisations’ than do science and technology policy. It includes elements of research and development (R&D) policy, technology policy, infrastructure policy, regional policy and educational policy, going beyond science and technology (S&T) policy [9, 10]. Hence, innovation policy is public action that influences technical change and other kinds of innovation, paying special attention to the institutional and organisational dimensions of innovation systems.

The system of innovation approach, therefore, provides the context in which development economics should be based on, with a strong possibility of a convergence between science, technology and innovation (STI) policy. [11]

It is with this perspective of innovation process and innovation policy in mind that this paper attempts to show that such characteristics and differences within the policy sphere are strongly related to the nanotechnology policy in Brazil. It is argued that nanotechnology innovation policy in Brazil is still based on a linear rather than a systemic approach of the innovation process, where the direct relation between science and technology plays an important role in the design of these policies. In other words, the policies designed to nanotechnology are strongly based on the relation (nano)science→(nano)technology, not taking into consideration that to go effectively from science to technology and innovation is necessary many other different activities that are related to and influence one another.

Poland’s market-based economy is one of the fastest growing within the EU. It was the only country in the EU to avoid the 2009 global recession. The GDP of Poland was $771 billion in 2011. Its economy has been helped by the government’s move to privatize many small and medium state-owned companies. The laws
relating to establishing new firms have been relaxed, thereby allowing the development of a strong private sector. [12]

Poland has a couple of organizations and networks committed to promoting and exploring nanoscience. Nanotechnology, being a versatile field, finds applications in a myriad of industries. There is a vast scope for companies in Poland to use nanotechnology and make an impact in the country. Some of the nano-based companies in Poland are: Aerogels Poland; Nanotechnologia; Amepox Company Ltd.; Dental Nanotechnology (DNT); Ertec; Ammono Ltd.; OPTICON Nanotechnology Ltd.; LaboSoft; and Nanotech Group. Poland is home to several universities offering research and educational opportunities in nanotechnology. [13, 14, 15]

In October 2011, Daunpol of Warsaw was the first company to start applying metallic nanoparticles in its chemicals- NanoClean chemical products. Experts believe that this move is likely to gain global recognition for Poland and further the development of nanotechnology.

In August 2012, a team of Polish researchers from the Institute of Physical Chemistry synthesized high purity aligned nitrogen doped multi walled carbon nanotubes using the catalytic chemical vapour deposition method involving pyridine and Fe/Co (2:1 volume ratio) as the single C/N precursor and catalyst material. The average diameter of the synthesized tubes was in the range of 29-57 nm and the nitrogen content of the tubes reached a maximum of 9.2% nitrogen. Their study will aid in providing further insight into nitrogen doping effects and the relation between type of nitrogen inclusion and nitrogen doping levels.

While he Polish economy weathered the global financial crisis well, the business sector innovates very little and the academic system is weak. Furthermore, links between industry and academia are poor meaning that only a small proportion of public research is funded privately. In 2010 GERD (government expenditure on research and development) equated to 0.74% of GDP having grown a respectable 10.3% a year between 2005 and 2010. Their aim is to reach a GERD of 1.7% by 2020 and they also have long term plans to help a move towards a knowledge-based economy based on current strengths, emerging technologies and smart specialisation. [16, 17]

If Poland executes this long-term plan well, sectors such as nanotechnology could come to the fore. However, to be really successful, stronger ties need to be forged between industry and academia to help drive applied research aimed at commercial outcomes.

4. CONCLUSIONS AND RECOMMENDATIONS

The development of concepts of entrepreneurship management is constantly changing. The old-fashioned paradigms and methods have to be developed in order to adopt them to the new style of life, which is based on progress and constant development of employees [18]. The aim of this elaboration was basically to systematise approaches of handling the new types of problems in an entrepreneurship - focused on financial aspects – as well as large business entities' financial situation analysis.

Special attention should be paid on trying to identify enterprises somehow related to development or usage of nanotechnology, as well as what their activities are, the nature of the technology developed/used, and the efforts made in order to being able to carry on their nanotechnology activities [19]. The study case carried by OECD showed that important issues related to nanotechnology innovation process and, consequently, to innovation policy should be examined more carefully by policy makers: the difference between nanoscience and nanotechnology; top-down and bottom-up approaches; supply and demand sides; incremental and disruptive innovations; size of the enterprises; and their age, if they are start-ups or established companies.
REFERENCES


