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Innovation policies in Brazilian and Dutch aerospace industries: How sectors driven by national procurement are influenced by its S&T environment

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ABSTRACT

To stimulate the development of new technologies is nowadays one of the main goals of public policies in developed and emerging countries. However, certain high-tech sectors are mainly driven by government procurement, increasing the active role of government in investments and research. In this sense, this paper aims to identify, compare and discuss mechanisms used to foster innovation in specific high-tech sectors in which government is the main client. This research analyses the innovation mechanisms in the space industry in an emerging country and a developed country, taking Brazil and The Netherlands as contrasting examples. A case study research was conducted, in which representatives in companies and research centres with space related activities were interviewed, comprising twelve organizations in both countries. Results of the Dutch space industry demonstrated the role of committees involving government, industry and researchers in space technology. These committees discuss which the technological pathways of space industry are, aligning scientific research with companies' needs. In Brazil, the introduction of the Innovation Act in 2004 began to stimulate interaction between university, industry, and government. However, these relationships are mainly informal and incipient. As a conclusion, it could be observed that while in The Netherlands different agents join efforts in order to plan the sector's technological development; in Brazil such relationships are still incipient. This difference could be explained by a modest technological development of Brazilian companies and research institutes, which mainly import products from foreign companies. Learning from the Dutch experience, in order to improve the Brazilian space sector it is necessary to foster S&T activities through joint activities between universities, companies and government.

1. Introduction

Technological innovation incentives are among the main policies governments in general try to organize and promote. Implementation of national innovation systems policies, development of science and technology (S&T) infrastructure, support of innovative activities which narrow the gap between research institutes and companies are examples [1]. Governments also provide funds for such relationships, stimulating joint research activities [2]. In emerging countries where productive infrastructure is not mature enough to develop advanced technologies, government may be a catalyst to promote an evolving institutional arrangement [3,4].

Investments in innovation by countries and organizations have increased 6.5% in 2011, while in 2012 it is expected to grow 5.3% [5]. This report also shows that public resources have partially complemented budget cuts performed by private investment in more vulnerable economic moments. Adding to this, the strength of emerging economies has already demonstrated a recovery scenario after the 2008 global financial crisis [5].

However, the increasing speed of technological complexity followed by a reduction in research investments by companies has emerged the need for investments in research partnerships [6], complemented by governmental investments in R&D. Maintenance of companies' high-tech laboratories has become too expensive, while the need of interdisciplinary research groups led these

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activities to become impracticable to be sustained on an internal basis only [4]. In this scenario, the absence of long term planning of governmental investments in science and technology may jeopardize companies' R&D activities, especially in industrial sectors where government is the main client.

Certain high-tech industries driven by government procurement, which are characterized by the development of differentiated, high value-added and technology intensive products, aimed at solving complex problems, present constant economic risk for businesses [7]. Defense and aerospace industries, among others, are commonly developed by direct governmental investments, depending on public resources to sustain their activities. These sectors require access to specific sources of technological knowledge, described by qualified personnel, interaction with other organizations and know-how, demanding specific policies.

There are some differences between developed and developing countries in terms of R&D management, innovation, and sectoral systems. In developed countries, there is normally a national innovation structure in place [8]; university–industry relations are described by the university conducting basic research, leaving the role of developing technology applications to companies. Here universities develop a body of knowledge in new technologies, and companies use this knowledge to improve products and processes. Government plays an important role in this structure, by offering subsidies for joint research and stimulating relations between companies and research institutes.

On the other hand, in emergent countries, national innovation systems may be incipient, where most companies do not have internal capabilities to develop innovative activities [9], and universities are mainly used to solve technical problems [10] or to develop technological applications based on companies' needs. Government policies may be recent and have limited reach.

Thus, public policies and investments in R&D are important for the development of innovative activities, in particular in those sectors which are driven by public procurement. However, it is unclear which are the main mechanisms used to foster innovation in specific high-tech sectors in which government is the main client. How do these innovation transactions effectively occur? What are the mechanisms to foster innovation in specific sectors in which the State is the main client? In order to answer these questions this article aims to identify, compare and discuss public mechanisms to foster innovation in industrial sectors driven by public procurement. This research will analyze emerging and developed countries, taking Brazil and The Netherlands as contrasting examples.

This article comprises additional four sections. Initially, the theoretical framework is reviewed, followed by section three in which the research method used to conduct this research is presented. The fourth section describes the main results, while the last section highlights the main differences between policies in Brazil and in the Netherlands, evidencing best practices from both countries.

2. Theoretical framework

Innovation is the main driver of socio-economic development, being described in many ways by different authors [11–13], among others. According to [14], innovation must not be seen as a linear process, induced either by demands or technologies, but as a complex interaction between potential users and new developments in science and technology. As a matter of fact, the innovation process consists of a new combination of ideas, skills, abilities and resources. It can be understood as a process in which organizations or companies create and define problems and then actively develop new knowledge to solve them [15].

Earlier models of innovation defined that companies should generate their own ideas, from prototypes to serial production, originating new commercial products or services [16,17]. However, the growing importance of R&D activities, adding to rising research costs and technological complexity, has emerged a network of research laboratories from universities, companies and government, building up an R&D industry with open innovation practices [14,18,19].

The transition from closed to open innovation practices can be observed in many industrial contexts, driving companies to unleash their research activities beyond internal resources [20]. Due to the evolution of current technological standards, companies may need external sources and cognitive skills to complement their own. The existence of interorganizational knowledge connections may open companies to new kinds of expertise, improving the development of products, processes or services [15].

In open models of innovation, the premise is that useful knowledge is diffused. Even companies with the most sophisticated R&D structures need to be well connected to external sources. R&D activities in collaboration with outside partners are a growing trend [21]. For companies which follow a more offensive innovation strategy it is becoming less interesting to concentrate all R&D activities internally, especially when it concerns the generation of competitive advantage.

In order to foster the development of knowledge connections, government act as a stimulating agent. As mentioned by Etzkowitz' Triple Helix [2], providing funds for scientific and technological research is one of governments' main roles, stimulating partnerships between companies and universities. Governmental financial support is also important for basic research, while companies invest in applied research internally and in partnerships with universities [22].

However, the development of a knowledge connection through research partnerships requires a well structured network of universities, research centers and companies. As mentioned by Ref. [1], innovation doesn't depend solely on firms' technological capability, but also on national innovation systems policies. A favorable environment of S&T must be created in order to promote and stimulate research partnerships [23].

This environment is normally promoted by the implementation of national innovation systems, which foster integrated activities, stimulate and encourage the innovative process of companies in a specific country [8,1]. It describes the relationships between companies, universities and government, identifying characteristics of partnerships between actors in order to optimize national performance and competitiveness [5]. In an open innovation environment, national innovation policies should encompass different ways to assure intellectual property rights, principally in joint research projects or patent licensing [24].

Following the governmental need of fostering a S&T environment, a framework of national policy guidelines related to open innovation was proposed by Ref. [3]. The authors describe companies' behavior in this new environment (regarding cluster formation, R&D partnerships, corporative entrepreneurship, and proactive intellectual property management) and the key conditions to ease open innovation practices (as basic knowledge, high qualified workforce and easy access to funding). As a result [3], propose seven main areas for national policies: technological R&D; interaction orientation; entrepreneurship; science; education; labor market and competition policies.

Complementarily, sectoral systems of innovation focus on national barriers and on organizations and institutions inside a specific sector [14,8,25]. Different industries have specific demands for technologies, knowledge structures and funding, besides the nature of clients and competition. Consequently, countries have distinct