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Science, technology and innovation policies in small and developing economies: The case of Central America

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ABSTRACT

In the last decade, there has been an increasing recognition among Central American policy makers of the central importance of science, technology and innovation (STI) for inclusive and sustainable economic growth, based on higher productivity. This paper aims to study current STI policies in those countries and explore whether this increasing acknowledgement has come along with new and more active policies. Empirical evidence collected through questionnaire-based interviews with high-level government officials in each country shows that Central American governments have built public organisations and institutions to support STI, such as laws, national plans and a wide variety of policy instruments. Yet available science and technology indicators illustrate that the results are still meagre. This paper identifies eight barriers faced by these governments when designing and implementing STI policies.

1. Introduction

In the 1980s and 1990s, Central American countries implemented far-reaching economic reforms, opening up to foreign direct investment (FDI) and international trade. The State reduced its size and expenditures. Industrial policies were radically reoriented, leaving behind sector-specific programmes, and favouring instead neutral, horizontal policies and the role of markets. Science, technology and innovation (STI) policies followed a demand-led approach, focusing on tackling market failures, that is the priority of public policies was merely correcting information asymmetries and addressing externalities. Intermediate and capital goods imports, FDI, and technology licensing were seen as the main sources for technological knowledge (Cimoli et al., 2005).

During the last decade, however, there has been an increasing acknowledgement among Central American policy makers of both the central importance of STI for long-run economic and social development[1] and the crucial role of STI policies.

Three main factors have contributed to this change of course. First, after more than two decades of market-oriented reforms, Central America's economic growth rates are still generally moderate, and productivity growth remains low. Annual GDP growth between 1990 and 2011 was 4.1% on average (3.7% leaving Panama aside) and labour productivity expanded at an annual average rate of 2.1% (ECLAC, 2012a). Exports and FDI have not proved to be the robust growth engines they were supposed to be. Second, the unfolding of the 2008–2009 global crisis made it clearer that markets by themselves do not lead to inclusive long-run economic growth and that active public policies are needed (ECLAC, 2010; Stiglitz, 2012). Third, policy makers are nowadays more open to empirical evidence supporting the central role of STI policies for sustainable economic growth.

This paper aims to study current STI policies and to explore whether their increased acknowledgement has come along with new and more active policies. It focuses on the six Central American countries as a case study of small developing economies: Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama. Over the last decade, these countries have built institutions and public organisations to foster STI. However, research and development (R&D) expenditures are still low and innovation activity is limited, even in comparison to other Latin American countries. Therefore, this paper also aims to identify the main barriers faced by Central American governments when designing and implementing STI policies. Within-firm innovation barriers have been widely studied (e.g. D'Este et al., 2012; Madrid-Guijarro et al., 2009; González

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[1] Empirical evidence on the positive correlation between research and development (R&D) expenditures and productivity growth abounds (IADB, 2010; ECLAC, 2010; OECD, 2010; Crespi, 2010).

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et al., 2005; McAdam et al., 2004), but the literature on STI-policy barriers is scarce.

It should be said that the present paper is not aimed at evaluating Central American STI policies. These countries do not conduct periodic assessments, while public information on STI indicators and the results of STI policies is scant. Rather, this research examines the approach and scope of STI policies in force.

The empirical evidence is based on a comprehensive questionnaire designed by the authors to be answered by high-level representatives of Central American governments through face-to-face interviews. The interviews were conducted between the last quarter of 2011 and the first quarter of 2012. This paper also benefits from an extensive empirical analysis of Central American innovation systems by the authors.[2]

This paper is divided into four sections, apart from the introduction. The second section addresses the literature on STI policies and develops a framework to study them in Central America. The third section gives a brief overview of Central American countries and in particular their technological capabilities. It also discusses the collected empirical evidence on STI policies. The fourth section identifies barriers encountered by governments when designing and executing STI policies. The fifth section presents the conclusion.

2. Science, technology and innovation policies

Innovation is an interactive and gradual process. It is based on communication and knowledge exchange. Over time, organisations and individuals improve their ways of interacting, develop closer relationships and accumulate knowledge. The conceptual framework of innovation systems, broadly disseminated over the last two decades, acknowledges that innovation activities are characterised by such features. This framework has been used to study countries, regions, sectors, technologies and cross-border regions.[3] It has been adopted by international organisations such as the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), the Organisation for Economic Co-operation and Development (OECD) and the Inter-American Development Bank (IADB) to examine the dynamics of technological change in countries and regions, as well as national and subnational public policies.[4] The framework has also been used by policy makers in both developed and developing countries to design, execute and evaluate public policies.

National systems of innovation (NSI) are understood as systems that encompass the relationships both within and between organisations, institutions and socio-economic structures, which determine the rate and direction of innovation and technological capability building (Lundvall et al., 2009). Innovation systems are made up of components (private enterprises, universities, research centres and government, among others), the relationships among them and institutions. The concept of a system does not suggest a structure designed and built in a formal and conscious manner. It includes a set of individuals, organisations and institutions whose interaction determines their overall innovative performance. It does not assume either that the system components happen to work in a joint, coordinated and coherent form. Rather it emphasizes the importance of interaction among them in the innovation process.

Governments play a central role in innovation systems through two main activities. First, they generate and disseminate new knowledge through public research centres, universities and enterprises. Second, they create and modify institutions (such as laws, regulations and policies) that support STI activities, including funding.

There is a wide array of policy instruments that governments are able to implement to strengthen innovation systems: trade policies, public investment, support for small and medium-sized enterprises (SME), education and training, regional development and STI policies. The present document focuses on the last set of policies.

STI policies can be studied and classified through diverse approaches. Three of them are described here to illustrate the wide variety of policy instruments. First, Lundvall and Borrás (2005) argue that STI policies have a dual nature: there are policy instruments that are better suited to promote specific areas (that is, science, technology or innovation), but their design and implementation should be done by following a systemic strategy. Science policies are oriented to create scientific knowledge and support scientists' formation and research by universities, public research centres and R&D laboratories. Technology policies focus on developing and commercialising technological knowledge, which commonly is sector-specific, while innovation policies are generally oriented to promote innovation processes and commercialisation and diffusion.

Second, Elder and Georghiou (2007) developed an alternative approach to distinguish between supply and demand policies. The former comprise finance and services support, such as tax incentives, support for public research, training and personnel mobility, technical assistance to SMEs, grants for industrial research, knowledge sharing and networks formation. The latter include regulation, public procurement and private-demand support.

Third, some other authors distinguish between linear and non-linear STI policies. In turn, linear policies may be supply-push or demand-pull (Cimoli et al., 2005). The former are characterised by a strong governmental role through active policies, by previously singling out innovation priorities and providing direct support for STI activities. The latter does assign a key role to private actors and markets in driving and defining main technology and innovation strategies. Demand-pull policies focus on tackling market failures; therefore, their priority is merely correcting information asymmetries and addressing externalities.

Non-linear or co-evolutionary policies are not exclusively based on either private technology demand or public technology supply. Rather they are characterised by adopting a systemic approach to innovation processes. Interaction among actors of innovation systems determines the technology strategy to adopt. Governments play a key role in coordinating and articulating the system's strategy, along with enterprises and academia. Yet, none of the actors is able to assume the system's leadership (Cimoli et al., 2005).

The above-described STI policies' taxonomies exhibit some inadequacies for studying the Central American case. The development degree of Central American STI policies does not allow a clear identification of instruments either to fit the dual approach or to distinguish between demand-pull and supply-push policies. The distinction between linear and non-linear policies is useful when analysing STI policies overall approach, not so for a careful examination of instruments used by governments. Therefore, this paper proposes a new taxonomy to classify them into three areas according to the aim of each policy instrument. A review of the empirical literature was made to build a comprehensive list of STI policy instruments.[5]

[2] See Padilla-Pérez et al. (2012).

[3] See, for instance, Freeman (1987), Lundvall (1992), Nelson (1993), OECD (1999), Iammarino (2005), Malerba and Mani (2009) and Trippl (2010).

[4] See, for instance, Buitelaar et al. (1997), ECLAC (2002), OECD (2009), Llisterri and Pietrobelli (2011) and Padilla-Pérez et al. (2012).

[5] See, for instance, Hadjimanolis (1999), Hadjimanolis and Dickson (2001), Lundvall and Borrás (2005), Trajtenberg (2005), Segarra-Blasco et al. (2008), OECD (2009), and World Bank (2010).

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