Technological capabilities and learning in small countries: the case of Cape Verde islands

Dr Alexandre Veras-Cruz
Dr Gabriela Dutrénit
Dr Arturo Torres
Universidad Autónoma Metropolitana

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1. Introduction

In the last decade, the concept of national innovation system (NIS) has been used as an analytical tool to understand the development process. According to this approach, and in the context of the knowledge economies, the most important input is knowledge, thus, the most important process is learning, which allows to generate and acquire that knowledge.

The firms are at the center of the NIS, and their level of technological capabilities, the dynamics of accumulation, and the learning affect the structure and performance of the NIS.

Over the last three decades, an important body of literature devoted to the analysis of the processes of learning and accumulation of technological capabilities in industrial firms from developing countries has been built up. On the basis of these studies, a meaningful theoretical framework has been structured for understanding how firms develop their technological capabilities.[1] However, most works have focused their attention on the experience of Latin American and East Asian countries, and limited attempts have been made to assess these issues in Africa.[2] Moreover, most studies have focused on large firms from large countries and not much is known about the characteristics of these processes in

[1] Katz (1986 and 1987), Lall (1992) and Bell and Pavitt (1993 and 1995).
[2] Biggs, Shah and Srivastava (1995), Mengistae and Teal (1998), Tyler (1995), Lall and Pietrobelli (2002), Muchie, Gammeltoft and Lundvall (2003).

SMEs, and even much less is known about the SMEs located in small African countries, as in the case of Cape Verde islands.

Cape Verde is a small country conformed by 10 islands. Its context is characterized by: a very small local market, limited endowment of natural resources, very few industrial firms, basically micro and small, big dislocation from the sources of technology supply, a poorly developed surrounding industrial and technological infrastructure, lack of national universities, few research institutes and other educational institutions. The private sector is reduced in size and, in spite of the economic reforms in 1990, the government continues to play an important role in the economic development.

Until the independence in 1975, Cape Verde was essentially an agricultural country, based on a subsistence production. The industrial activities were the extraction of salt, the production of Rum, the desalinization of water, the cooling industry for fish conservation, a firm of canned fish that was created by 1930, and a few other facilities. The commerce was the most important activity, and it was based on import products. The independence brought new activities and a concern for the development of the industrial sector.

This study is the first attempt to assess technological capabilities and learning processes at firm level in the industrial sector of Cape Verde Islands. Despite their crucial importance for the country, not much is known about these issues in the Capeverdian industrial sector.

The aim of this paper is to discuss the problems that Capeverdian firms confront in the process of building up technological capabilities. This paper focuses on a number of broad issues related to the patterns and determinants of this process, the nature of technological efforts being undertaken by firms, and the constraints they face in enhancing such endeavors. Particular attention is paid to the links between the private sector and the government, and its impact on the capability building process of the firms. This paper also attempts to generate insights to design a more effective policy to accelerate the capability building processes.

This work is based on a case study methodology. The main sources of information are in-depth interviews with the SMEs' founders and personnel. This is supplemented by interviews with equipment suppliers, consultants, industry associations and firms' printed materials. The cases analyzed are two SMEs located in two sectors: (i) Software, and (ii) Food processing (fish). This selection allows analytical comparisons between firms pertaining to sectors with distinct technological complexity and market orientation.

The content of this work is as follows: Section 2 discusses the literature on learning and technological capabilities, Section 3 describes the research designs and methods; Section 4 describes a set of key features of the country, Section 5 describes and discusses the empirical evidence, two systems of innovations: the software and the canned fish, Section 6 compares the results and finally sections 7 contains some final reflexions.

2. Learning and technological capability accumulation

There is a growing consensus about the centrality of scientific and technological advance in driving economic progress, and that increasing national investments on innovation are essential to ensure the countries' economic growth (Schumpeter, 1942; Solow, 1956; Abramovitz, 1956 and 1986; Romer, 1990). In fact, technological and institutional change, and national technological capabilities are seen as major determinants of economic growth and economic development. (Freeman, 1987; Fagerberg, 1988)

However, it is not clear how science and technology, which appear to be the key for industrial development in advanced economies, can be effectively used for economic and social development in today's developing countries. To a large extent, this depends on the ability of these countries to build up a trajectory of learning and innovation. In particular, the process of learning generates the conditions for the knowledge creation process, thus, in the knowledge economies, it becomes a key issue to foster the development process in the less developed countries.

In which sector of economic activity should the countries build this trajectory of learning? Besides the specificities, the important role played by the industrial development and particularly the acquisition of industrial skills in economic development are commonly recognized (Lall and Pietrobelli, 2002).

Today, it is quite clear that the structure of linkages at local, regional, national and international levels, and the construction of national systems of innovation contribute to that success (Freeman, 1987; Lundvall, 1992; Nelson, 1993; Edquist, 1997; Kim, 1997; Niosi, 2000; Cassiolato and Lastres, 2003). Even though there are some common features related to the role played by some agents and the key links, there are some specificities related to the role played by the government in the overall performance of the innovation system.

The innovative activity of firms depends strongly on technological learning and technological capability creation processes. These processes are influenced by the national system of innovation and by the type of linkages created between the agents in specific contexts.[3]

Referring to the technological capabilities building process at firm level, over the last three decades an important body of literature devoted to the analysis of the processes of learning and accumulation of technological capabilities in industrial firms from developing countries has been built up. This literature studies the learning processes involved in the gradual build-up of a minimum basis of technological knowledge that enables them to carry out innovation activities.[4] It has focused on firms in developing countries, and documented how these firms are technologically immature, learn through time, and accumulate knowledge. Based on that, these firms are capable of progressively carrying out new activities and acquiring new technological capabilities.

Learning is defined as a process that involves repetition and experimentation, which enables to carry out tasks in a better and faster way, and to identify new production opportunities. Learning processes have a gradual, accumulative, systemic and idiosyncratic character.

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[3] Freeman (1987), Lundvall (1992), Nelson (1993).
[4] Dahlman and Westphal (1982), Katz (1987), Lall (1992), Bell and Pavitt (1995), Kim (1997).

There is rich empirical evidence about the processes of technological accumulation in different industries and different types of firms, as well as about the technological strategies followed by different types of firms

Most works have focused their attention on the experience of Latin American and East Asian countries, and on large firms from large countries.[5] The constraints faced firms in developing countries are fairly recognized, particularly those associated with the fragility of the innovation systems.

Although the referred literature has focused mainly on the processes of technological capability building, some works have shown that managerial capabilities, particularly the characteristics of the firms' owners, are crucial to understand how firms deploy strategies to learn and build technological capabilities.[6] Also, this literature has focused on the role played by the technical functions centered on processes and products to analyze the firms' capability building processes. Some cases suggest that the technical function of linkages with suppliers has greater relevance. These issues are relevant in the case of the SMEs.

However, not much is known about the characteristics of these processes in SMEs,[7] and limited attempts have been made to assess these issues in Africa,[8] particularly in small countries' contexts.

This paper discusses the problems that Capeverdian firms confront in the process of building up technological capabilities. This paper focuses on a number of broad issues related to the patterns and determinants of this process, the nature of technological efforts being undertaken by firms, and the constraints they face in enhancing such endeavors.

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[5] Katz, 1996; Dutrénit, 2000; Torres, 2004; Figueiredo, 2001 and 2003; Vera-Cruz, 2000; Ariffin, 2000; Kim, 1997 and 2000; Hobday, 1995 and 1999; Kim and Nelson, 2000; Krishnan (2003).
[6] Vera-Cruz and Dutrénit (2005).
[7] Vossen (1998), (1998), Freel (2000), Kalantaridis and Phelby (1999), Storey (1994), Hoffman, Parejo, Bessant and Perren (1998).
[8] Biggs, Shah and Srivastava (1995), Mengistae and Teal (1998), Tyler (1995), Lall and Pietrobelli (2002), Muchie, Gammeltoft and Lundvall (2003), Marcelle (2005).

Particular attention will be paid to the links with other agents of the innovation system, particularly with the government, who continues to play a key role in the economic development.

3. The country specificity

10 islands integrate Cape Verde, covering 4,030 km2. It was a Portuguese colony until 1975, when it got its independence. The population is 463,000 habitants, 55.9% is urban population.

Until the independence in 1975, Cape Verde was essentially an agricultural country, based on a subsistence production. The industrial activities were basically the extraction of salt, the production of Rum, the desalinization of water, the cooling industry for fish conservation, a firm of canned fish that was created in 1930, and a few other facilities. The commerce was the most important activity, and it was based on import products. The independence brought new activities, and a concern for the development of the industrial sector.

During the first independent years, the nationalist government built a planned economy supported on a strong intervention of the State in the economy, which was funded by external aid. Several public firms were created in the key sectors. A strong effort was made to build the most basic institutions and the infrastructure of the modern country.

In 1990, the nationalist party lost power and the new government implemented a liberal model of development. Economic reforms were introduced, which meant a change in the development model led by the State. Three characteristics of the new development model are: (i) tight control over the public expenditure to ensure a limited budget deficit, (ii) an economic management approach with a market orientation instead of a central planning approach, along with trade liberalization, and (iii) a reduction of the participation of the State in the direct economic operations and privatization of public assets.[9]

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[9] Wangwe (2003) for the case of the economic reforms in Tanzania.

The privatization of public assets, such as light and phone (telecom) services, brought different kinds of problems; the high prices for the services and irregularities have affected the population and the firms performance.

Since the economic reforms, the private sector is considered as the engine for national development. However, the State couldn't avoid its participation in the direct economic operations. For instance, in 1993 it created the interinstitutional commission for innovation and the information society (CIISI), whose mission was to implement the electronic government and the information society. It promotes the use and development of the ICT in Cape Verde. In the case of the Fishing sector, the State possesses and has increased its participation in the fishing infrastructure (modern fishing boats, pier with a cooling system, facilities for cooling).

At present, Cape Verde is implementing a development strategy based on growth, reduction of poverty and good governance. The private sector is still seen as the engine for economic development in the government's plans and programs. However, this is still a weak sector and Cape Verde lacks an incentives structure that would facilitate the growth and strengthening of the private sector to be able to play the role assigned.

The country is characterized by a weak industrial sector; the industry and energy sectors together only contribute with 6.6% of the GDP, its contribution has actually decreased from 8.7% in 2001, as listed in table 1. In contrast, the commerce and the transport and communications contribute with almost 20% each. Agriculture is also a weak sector, explaining only 9.4% of the GDP.

Table 1 Cape Verde: Gross Domestic Product, 2003 (% of the GDP)

Sector	**1999**	**2003**
Agriculture, forestry and livestock	11.3	9.4
Fishing	2.3	1.5
Industry and energy	8.7	6.6
Construction	7.8	8.4

Commerce	17.7	19.6
Hotels	2	2.6
Transports and communications	19	18.6
Banks and insurance	4.9	4.3
House renting	5.3	5.3
Public service	13.4	12.9
Other services 3/	7.6	10.7
GDP/ total	100	100

Source: IMF (2005)
3/ Includes “Intermediary banking services” and “Taxes and duties on imports”

Table 2 contains some indicators which reveal a better economic performance, human capital development and reduction of poverty than the average of Sub-Saharan Africa. This result contributes to explain the compliments received by Cape Verde from the IMF.

Table 2 Some indicators of Cape Verde

	1999	**2003**	**SSA, 2002/2003**
A. Economic performance			
GDP per capita in current U.S. dollars	1379.3	1768.3	632
Real GDP growth	8.8%	5%	
B. Population			
Population	423,000	470,000	
Urban population (%)	52.4	55.9	
C. Human capital			
Youth literacy rate	85 (1995)	89.1 (2002)	63.2
Scholl enrolment, primary (rate)	99.4 (2001)		63.7
Secondary enrollment (rate)		69.7	31.8
Tertiary Level (rate)	3.6 (2000)	4.6	
D. Effort in Human capital Development			
Public expenditure on education as % of GDP		7.9	
Public expenditure on education as % of total government expenditure		17.0	
E. Poverty			
Incidence of absolute poverty 1/	49 1990	37	
Under-five mortality rate (per 1,000)	60 1990	36	

Sources: IMF (2005a), IMF (2005b), World Bank (2005), UNESCO (2005).

http://devdata.worldbank.org/edstats/SummaryEducationProfiles/CountryData/GetShowData.asp?sCtry=CPV,CapeVerde

1/ Absolute poverty measures the number of people in 1988 and 2002 whose income is below the 1988 national poverty line, indexed for inflation.

The data also indicates that Cape Verde has carried out an important effort to develop their human capital, reduce the poverty, and improve the life conditions in the last decade.

The Capeverdian context can be characterized by:

- Very small local market.
- Limited endowment of natural resources.
- Well-trained human resources, as compared with Sub-Saharan Africa, and a young population (e.g. high rates of Scholl enrolment at secondary and tertiary levels as compared to Sub-Saharan Africa).
- There are only 483 industrial firms, most of them micro and small firms; the industrial firms have 10 employees in average.
- Big dislocation from the sources of technology supply
- The surrounding industrial and technological infrastructure is poorly developed, lacking suppliers in engineering and technological services.
- There is no national university , there are three private universities -a campus of the Portuguese Instituto Jean Piaget (the Universidad Jean Piaget de Cabo Verde), the Instituto Superior de Ciências Económicas e Empresariais (ISCEE), and the Instituto the Ensino Superior Isidoro Graca; there are a few research institutes that also train in higher education, like the Instituto Superior de Engenharia e Ciências do Mar-ISECMAR, the Instituto Nacional de Administração e Gestão-INAG, and the Instituto Superior de Educacao-ISE; and other research Institutes (the Instituto Nacional Das Pescas-INDP, the Instituto Nacional da Investigacao e Desenvolvimento da Agriculture-INIDA.
- A poor and expensive transport infrastructure (cooling tracks, fishing boats with cooling system, etc.)
- Tight dependence of the international aid under project finance, which contributed to the macroeconomic stability and to develop the infrastructure, but limited the national capacity to design a development strategy.
- The external aid and the emigrant remittances give an important contribution to the payment balance and the national income.
- It is in an early stage of the institutional building. With the independence process, many of the old institutions were disarticulated and new institutions were created Even though Cape Verde has a number of technically well trained human resources,

they do not have skills for creating and consolidating the new institutions that Cape Verde needs for the development process.

- There is an entrepreneurial culture more oriented towards the commerce than the industry, which limits the long-term investments, the assumption of risk, etc.
- It lacks a culture of learning and creation of solutions, which is associated with the norms, values and attitudes of the actors.
- There is a limited incentives structure to strengthen the private sector: (i) Incentives for the generation of employment for youth people, (ii) Incentives for telecommunications and Internet, and pharmaceutical firms, (iii) Fiscal incentives for new firms. No incentives are been designed for export or productivity gains.

4. Research designs and methods

This research is based on a case study methodology. We used a multiple-case research design that follows replication logic. Each individual case study consisted of a whole study, with a specific set of evidence and conclusions, and at the end cross-case analysis and conclusions were drawn. The cases were selected to predict similar results and make the findings more robust (literal replication), (Yin, 2003). The selection included a set of two cases with exemplary outcomes. The exemplary outcome was the accumulation of technological capabilities. A set of open-ended interviews with policy makers allowed us to identify five cases with these exemplary outcomes. We selected two for this research, regarding the accessibility, importance in the locality, and main sector of activity. Based on that, this research focused on how and why these outcomes were achieved, in other words how the accumulation process was carried out, and what are the determinants and constraints to the accumulation process.

A pilot case study (Software) was carried out, which provided empirical observations and insights into the basic issues being studied. Based on that we improved the initial research design, particularly refining the data collection plans. Afterwards, we conducted the first case study (Software), and then we conducted the second (Frescomar). A report was written for each individual case and finally the cross-case report was elaborated.

The unit of analysis was defined as the firms. Three sources of evidence were used: open-ended and focused interviews, casual meetings and informal conversations, and documentation. Interviews were the main source of information.

The cases include interviews with the managers and owners of the firms. Interviews were also carried out with policy makers and researchers of research centers.

The main topics of the interviews were: evolution of the product lines, type of clients, type of links with suppliers, evolution of the technological activities carried out locally, links with educational institutes and research centers, and links with the government and the local environment in general.

5. The empirical evidence

In this section two systems of innovation are described and analysed: the System of Innovation in Software (SIS) and the System of Innovation in Canned Fish (SIF). Each case contains a description of the main agents, their links and the characteristics of the accumulation process of a representative firm. Particular attention is given to the role played by government agencies in the system functioning.

5.1 The case of the software industry

5.1.1 The system of innovation software

The System of Innovation in Software (SIS) is incipient and is integrated by 3 key agents: NOSI (a government agency), higher education institutions and firms.

<u>1. NOSI: a government agency</u>

After the economic reforms, the government decided that Cape Verde should be integrated in the information society. In this context, in 1993 the interinstitutional commission for innovation and the information society (CIISI) was created. It’s target was to implement the electronic government and introduce Cape Verde to the information society. CIISI created NIOSI (Núcleo Operacional de la Sociedad de la Información -- Operational nucleus of the information society), an operational group for promoting both the use of ICT and the development of ICT in Cape Verde. NOSI has to propose policies, diffuse them in the civil society and participate in their implementation.

NOSI has two financial supports: the World Bank and the European Union. It is a flexible organization with a project structure. It has 50 technicians, 40 of which have a university degree in Engineering in Telecommunications, Electronics and informatics and a certification from Microsoft or Oracle.

NOSI concentrates the critical mass of technicians of the SIS in Cape Verde, and contributes to the human resources training in this area by different ways: they hire training courses for its personnel, they invite personnel from other agencies to their courses, and, they have students from educational institutions who carry out short stays at NOSI.

NOSI runs 3 large projects: (i) the system of financial management of the government (Millennium Challenge Account); (ii) the electoral management; and (iii) the house of the citizen. NOSI is in charge of the conception and development of the informatics systems. They carry out R&D activities for the development of the systems; basically they have to generate integral solutions for the problems, which is largely adaptive R&D.

2. Higher education Institutions

Instituto Superior de Engenharia e Ciências do Mar (ISECMAR)

The ISECMAR was created in 1996. It is a polytechnic institute that initially offered careers in the areas of Engineering and Sea Sciences, later it diversified its offer to include Informatics Engineering and Automation, Electric and Electronic Engineering, and Telecommunications Engineering.

Universidade Jean Piaget de Cabo Verde

The Instituto Piaget is a Portuguese higher education institute. It has 3 campuses in Africa: Angola, Mozambique and Cape Verde. The Universidade Jean Piaget de Cabo Verde was created in 2001. Two careers related to software are offered: Engineering of Systems and Informatics, and Communications Sciences, both at technical and university degree levels.

The students carry out a practice at NOSI and the firms at the end of their studies and develop some research activities.

3. The firms and the market

Even though there are several firms that sell computers, there are only 10 firms that are oriented to software development. They are SMEs with shortage of capital.

Four types of agents compete in the market: freelancers, the 10 local firms, foreign firms and NOSI. The demand is quite high but the supply is reduced; in addition the market is not structured. Local firms are largely oriented to carry out services in informatics and do not have qualified personnel. For this reason they have lost market share, and at present there is a strong dependence on foreign firms and technicians for the most basic activities of software development. Even though there are trained human resources in Cape Verde, with university degrees, they are isolated and there are difficulties to incorporate them in an entrepreneurial project.

Nature of the links

NOSI-firms. This is an unequal link in terms of the technological capabilities of both agents. NOSI considers that the existent firms are insufficient and do not have enough maturity of their technological capabilities that is why it believes it has to attend the market demand to ensure the accomplishment of its mission. NOSI is working with some firms largely for the installation of local networks and not for the web design. It transfers to the firms those activities that it considers they are capable of carrying out. Even though the strategic plan includes activities oriented to foster the creation of new firms, these activities are neglected or at least not prioritized.

NOSI-Higher education Institutions. NOSI has signed a protocol with the Instituto Piaget for the creation of a SISCO academy. It also signed a protocol with Microsoft for the certification of human resources in this platform, and is looking to transfer this project to an education institution for the organization of the courses and the follow up of this project. These two cases illustrate that NOSI is opening spaces to develop the SIS in Cape Verde, and is looking to transfer some of the new activities to other institutions. To accomplish its mission, NOSI needs to develop the market, and is only interested in maintaining the activities related to the design of the informatics policy.

At present, NOSI faces a dilemma, on one hand, it is necessary to create a market, transfer some activities to it and thus eliminate one of the activities it is carrying out. On the other hand, it is difficult to evaluate its efficiency if one of its targets should be to generate conditions to eliminate some of its own current activities.

5.1.2 The case: TERA

5.1.2.1 Profile of the firm

The firm was created in February 2002. The owners are two young people with university degrees from Brazil, one in business administration, and the other in Communication Sciences. This latter has previous experience in another firm of the same sector in Cape Verde.

TERA is a micro-firm, it only has 3 workers, the 2 owners and 1 employee that is a technician in informatics. The firm has the flexibility to hire more personnel for specific projects. During 2004 the average number of people hired was 6.

At present TERA has 4 areas of specialty:

- Informatics consultancy (e.g., maintenance of computer equipment, management of informatics parks in desk environment, Cyber coffee, etc., this is a continuous service)
- Managerial consultancy (e.g. business plans, market research, data analysis and processing)
- Web development (e.g. development of a virtual work environment and web pages)
- Development of software solutions

The firm uses open technology (open software like Linux, php, apache, mysql), which reduces uncertainty in the long-term by not generating technological dependency. It uses open tools and multiplatform. TERA is in a process of migration towards a better technology (not completely open). It has not certified its processes, but the firm is aware of the certification needs, thus it carries out a set of activities to ensure the quality of its processes and services.

Its clients are largely other SMEs. It has had 25 clients, 5 of which are regular. TERA has experience in the international market and its long-term market strategy includes obtaining a position in the Portuguese speaking countries (PALOPs).

5.1.2.2 Characteristics of the learning processes and the accumulation of technological capabilities

The first activities carried out by the firm were web development, which included the concept, the development of the design for the site, the montage of the site, and maintenance of the site; after that they incorporated the informatics consultancy. Gradually the firm was evolving toward the 4 areas of specialty that it has at present. The 4 areas are integrated to offer an integral solution.

The innovation activities are focused on the development of new products. The firm has acquired experience of developing solutions, and it has also adapted several sites. The most important development project is a dynamics site designed for a firm, which is a FM radio in internet. The site has a dynamics nature because the client firm can upgrade it. This is a new concept for Cape Verde. This project meant a technological challenge for TERA, and it was a marketing challenge for the client firm because it allowed it to open new options to increase its market (e.g. e. commerce).

The main motivations for developing new products were own initiative and the clients' suggestions. The innovation activities have allowed to increase the scope of the products, increase the product quality, increase the market share, open new markets and reduce the costs.

TERA acquires knowledge largely from internal sources (through the development projects) and external sources (through the clients and the specialized publications).

Networks and informal contacts with technicians from NOSI and local and foreign firms are important. In terms of the learning mechanisms, TERA learns through own experience in development projects, the students from higher education institutions who carry out a practice in the firm at the end of their studies, and the interaction with the clients. In the case of the Global FM radio project, they have been interacting in the last 3 years. The proximity has allowed TERA to react quickly to the client needs, and it has also facilitated the feedback from the client.

TERA maintains cooperation links with NOSI, and they are partners in one project. In contrast, the links with other firms in the sector are limited.

Even though the firm is aware of some incentives schemes offered by the government for the firms, it could not apply because the call for application is not opened on a regular basis. The scheme was suspended the year it wanted to apply.

The firm's strategy is to develop a set of models to offer solutions for the clients along their value chains. The still limited experience in development projects did not allow it to generate the minimum knowledge base to be able to have a set of standard products (like the radio). This could enable the firm to offer their clients a range of products, provide quick answers to the queries, and grow.

TERA considers that Cape Verde offers: availability, quality and low cost of human resources; proximity with the clients; infrastructure of services; and lack of local competitors with a similar profile (there are no other firms with the same 4 areas of specialty).

However, the firm also considers it's growth to be hampered by a set of problems:

- <u>The characteristics of the market</u>. There has been a high demand for routine services, and a shortage of demand for qualified work. This pushes the firm to dedicate most of the employees' time to elementary services, and leaves limited space for developing new ideas, and for learning and innovating, which in turn require to dedicate time to R&D activities. Currently the demand is growing, above all in web pages. But the main competence in this area is with foreign firms. Capeverdian firms have limited visibility in the market, therefore clients tend to rely more on foreign firms. Additionally, clients, competitors and technicians have developed an immediate mind-set, in the sense that they want to reach their objectives immediately. This puts a lot of pressure and makes it difficult for the firm to plan its actions and be involved in a trajectory of learning.

- <u>The price policy of CVTelecom</u>. CVTelecom is the telecommunications firm. Originally it was a public firm, and it was privatized to Portuguese capital in the 1990s. This firm has a monopolistic position in a key sector for development. This firm's prices for internet access (ADSL) are too high, which increases TERA's costs to access the web and reduces the potential clients. In this sense, this policy prices limits the development of the ICT.

- <u>The functions assumed by NOSI in the SIS</u>. NOSI was created to sort out the government's informatics needs and promote the introduction of the ICTs. It has played a key role in the creation of the SIS, but it has created conditions for the development of the private sector. The government's purchases are important because the market is small, but they are not orienting the development of the private sector. NOSI carries out 4 activities: specify, buy, implement and control. If the SIS was mature, it could concentrate on the control activity and leave the other activities to the private sector. But the government's needs for modernization push NOSI to become engaged in a trajectory of development more consistent with a private firm. NOSI has difficulties in transferring these activities to the private sector, as it has not yet reached the capabilities to assume them. In fact, NOSI competes with the firms, even though that is not its purpose. At present, NOSI is reducing its participation in system administration and informatics consultancy, but it is keeping the applications area.

- Lack of an adequate incentives structure. Even though there are some fiscal incentives for private firms, they are more oriented to attract ETNs than to stimulate local firms. The credits are expensive and the procedures very bureaucratic, thus the firm uses mostly its own resources for investment. There are some financial schemes for punctual projects, which are used largely by commercial firms. These are not sought to promote technological development.

5.2 The case of the canned fish industry

5.2.1 The system of canned fish

The System of Innovation in Canned Fish (SIF) is incipient and is conformed by 5 key agents: the secretary of environment, agriculture and fishing; Interbase, a research center; a higher education institute; and the firms.

1. Secretary of environment, agriculture and fishing

The Secretary is directly involved in the economic activity of this sector in four ways: (1) through a promotion function, that consists of negotiating and channeling external aid for the fishing sector, (ii) acting as an intermediary between different agents, (iii) regulating the market and signing international agreements, and (iv) controlling the national resources.

The State possesses a set of facilities related to fishing that are important for the industry. As a result of an external aid, in 2001 the State acquired 8 new and modern large tuna fishing boats, and built a pier for small fishing boats that includes a freezing tunnel for fish conservation and an ice machine to provide ice for the small boats that generally lack a freezing system.

2. Interbase S.A.

This is a public firm that provides freezing service and commercializes frozen fish. This firm is rooted in the colonial period, it was founded in the 1960s. Interbase provides the freezing service for the traditional fishing and for the industrial firms of canned fish.

3. Research center: Instituto Nacional de Desenvolvimento das Pescas, INDP

The INDP is the national institute for the development of fishing, it was created in 1992 for the research in the sciences of the sea. It has two main areas of activity: scientific research and diffusion of new fishing technology, and fish technology.

Regarding fishing technology, the main tasks are: experiment and diffuse, among the operators of the sector, improved and adapted techniques of capture according to the conditions of Cape Verde; experiment and diffuse techniques for increasing the concentration of fish in certain areas; carry out experimental fishing of non-exploited species; etc. Regarding the technology of fish technology, the tasks are: experiment and diffuse new conservation and processing techniques; explore new fish based products; support the national operators in the market forecast for their products; etc.

It is also oriented to advice on how to improve the economic and social impact of fishing in Cape Verde, and to promote actions for the development of fishing technology. The INDP is conformed by 60 researchers and technicians.

4. Higher education institute: Instituto Superior de Engenharia e Ciências do Mar (ISECMAR)

As it was mentioned above, in 1984 the Centro de Formação Náutica (CFN) was created to offer careers in the areas of Engineering and Sea Sciences. These areas were strategic because Cape Verde was planning to acquire a merchant and fishing float. Even though the ships were bought, the project did not go further largely because of Cape Verde’s low volume of international trade. In 1996 the CFN became ISECMAR, a polytechnic institute that apart from the careers in the areas of Engineering and Sea Sciences, diversified its offer to include other areas.

5. The firms and the market

The production of canned tuna fish has some tradition in Cape Verde. The first firm started up in 1930 in the island of Sal. A few years later another firm was established in the island of San Nicolau. Both firms were founded by Portuguese entrepreneurs and were equipped with old machinery from Portuguese plants. In spite of using out of date equipment and technology, it seems that the quality of the products was good because they were very well accepted by the market.

There are two markets for Capeverdian canned fish: the domestic market and export. The domestic demand is high and absorbs more than 80% of the total production. Even though the product has been well accepted in the export market, the percentage of export is low because of a chronic shortage in shipping supply.

At present, there are three firms of canned fish: Frescomar S.A.; J.A. Nascimento & Filho, Lda; and the Sociadade Ultramarina de Conservas, Lda. They are located in different islands.

<u>The nature of the links</u>

INDP-firms. These links are very weak, and the agents do not interact. Actually, the firms perceive the INDP as a research center linked to fishing and less involved in the fish processing technology.

Between the firms. The firms participate in the same domestic market, but the rivalry seems to be low. This is partially due to the fact that the firms are located in different islands and their fish suppliers are local. The firms do not have joined projects nor do they cooperate. Links with the government also appear to be weak. It seems that the firms are not able to send the government clear messages regarding their needs.

In general, the system is not integrated; the links between the agents are very weak.

5.2.2 The case of Frescomar S.A.

5.2.2.1 Profile of the firm

Frescomar SA was legally founded in 1997, but it started operations in 2000. It is located in the island of São Vicente. Initially, the social capital of the firm was private; however, due to the financial difficulties that the firm is confronting, the State is going to acquire a small part of the social capital to contribute to its survival. The State's participation will provide a better access to the conservation infrastructure and fishing agreements.

The firm employs directly 100 workers, but, all in all, about 200 employees work on and for Frescomar. It has 10 graduated employees y 1 with a masters degree.

Frescomar SA manufactures 3 types of fish: tuna, melba and mackerel, and has 6 products (fillets and slices). Fish is the main input, but it also uses malagueta, oil and cans. The firm is largely equipped with second hand non-automated equipment, it integrates different vintages of equipment technology. Since 2001, Frescomar is certified by the U.S. Food and Drug Administration (FDA).

Frescomar produces for the domestic market, but it also exports to the US and the European Union, namely Italy, Holland and Portugal; being the Capeverdian communities the main consumers.

5.2.2.2 Characteristics of the learning processes and the accumulation of technological capabilities

Frescomar was created to produce canned tuna fish for the European market. According to the original business plan, the firm was only supposed to produce tuna fish in small cans. To penetrate the European market, Frescomar underwent the required certification processes. An important supplier was Interbase, who provided the tuna. This supplier is the unique option to supply the required infrastructure to freeze the fish according to the quality norms of the European Union in 2001.

Shortly after operations were initiated, Interbase had a problem of amonia liquing, so the European Union introduced an embargo for the fish related products of Cape Verde. Consequently, Frescomar could not export to its original target-market and had to redefine its market strategy towards the domestic market, US, Brazil and Central Africa.

In the case of the US, there is a market niche conformed by the Capeverdian and Portuguese communities. Even though the firm could rely on the Agora agreement to penetrate the US market, a new problem emerged. The agreement requires a direct connection between the export country and the US. As Cape Verde does not export an important volume of products, there are no regular maritime liaisons with the US, in fact, there is only one ship that makes the liaison between Cape Verde and the US, thus the frequency is limited and non-regular. In other words, problems related to the maritime infrastructure of the country limit the export capacity of the firm. As a result, in spite of the focus on exports since the beginning, 90% of the firm's production had to be oriented towards the domestic market.

Not being able to rely on Interbase, it looked for other local suppliers of tuna fish. However, Cape Verde does not have a float dedicated to tuna fishing, there are only small boats that fish for the local market (each island), and they do not have the capacity to supply for the industry. There are problems regarding volume and quality, because they do not have equipment for industrial fishing and conservation. This is another problem related to the maritime infrastructure. As a result, the firm had to stop frequent production, thus only utilizing a maximum of 30% of its production capacity.

To sort out this problem, the firm had to undergo a process that started by the diversification of its product mix, first by incorporating new varieties of fish (melba, mackerel and sardines), and second by introducing larger sizes of cans. This diversification process reveals that the firm not only acquired production capabilities to be in the market, but it also acquired some innovative technological capabilities. Meanwhile, the European Union was opened again and the firm to diversify even more its product mix by introducing glass containers and shellfish.

The firm has used different learning mechanisms to acquire its technological capabilities. Learning from experience has been very important, particularly in the area of maintenance and plant operation. Training has been another important learning mechanism. The firm uses in-house training and also sends its personnel to be trained in other firms abroad, particularly in fish processing. For instance, before introducing the shellfish production line, the firm sent some technicians to be trained in large shellfish firms in Europe.

Even though Frescomar seems to gradually be acquiring more capabilities, as revealed by the diversification activities and the penetration of new markets, the firm's survival faces risks due to problems that overcome its decision capacity. The problems are related to the supply of input (fish) and the transport system. The supply of fish is associated with the fishing infrastructure, the freezing infrastructure and the fishing agreements with countries that fish in the Cape Verde economic area.

The fishing and freezing infrastructure are spaces for private sector activity; however the private sector has not yet found them economically attractive. Thus, the government has had to become involved in these activities. The case of the acquisition of 8 new and modern large tuna fishing boats, and the building of the pier with an associated freezing facility illustrates this involvement.

The government has also signed an agreement with the European Union that implies giving Cape Verde 5% of the fish captured in the Capverdian economic zone. According to the firm, the government should sort out two problems to solve the problems of lack of fish by means of the agreements: (i) signing good agreements with other countries for the fishing activities, and (ii) control the agreements. At present, the government does not control the volume of fish caught and the problem of the lack of supply still persists.

The difficulties of the lack of fishing and freezing infrastructure and control over the international agreements make it difficult for the firm to engage in a continuous process of learning from either the foreign or the domestic market, and steady growth.

6. The determinants and restrictions of the accumulation

The last session analyzed the characteristics of two Capeverdian systems of innovation. Both are incipient and observe limited links between the agents; in fact they are in the first stage of the building process. The problematic of the learning and technological capability accumulation processes of a representative firm of each system was discussed. Both firms are small and are building and consolidating the routine production capabilities and the most basic innovative technological capabilities. This stage is particularly critic in the case of the small firms.

A set of factors that stimulate the accumulation in both firms were identified:

- Well-trained human resources. This is associated with an important effort made by the country in higher education.
- Incipient but growing market. The market is very small, but it is in expansion and there is a substantial amount of uncovered needs.
- Market niche both in Cape Verde and in the emigrant community. In fact, Capeverdian products are well accepted in Cape Verde and in the Capeverdian communities abroad.

In the case of TERA, the software firm, the proximity with the client and the quick response to the client requirements is also a factor that stimulates the accumulation.

In contrast, the two cases suggest the existence of a set of factors that constraint the accumulation process:

- High costs due to the lack of local suppliers of inputs.
- Weak and expensive infrastructure, as illustrated by the costs of the CVTelecom services in the case of TERA and the lack of a maritime float in the case of Frescomar.
- Limited links with other agents of the SID, as revealed by the limited links of TERA with NOSI and Frescomar with ISECMAR.
- Lack of entrepreneurship and first generation of entrepreneurs.
- Lack of an industrial fabric and industrial culture, in contrast there is a commercial tradition and culture that led to focus more on buying than on doing, thus hampering the innovation. In this direction, the Capeverdian Commerce and Industrial Association is integrated largely by commercial firms dedicated to export and

import activities. In the case of the software, most of the firms are focused on selling computers instead of on software development.

- Unclear boundary between the functions of the government and the private sector in the economic activities. As illustrated in the case of NOSI and in the acquisition of the fishing boats. Facing a weak private sector and the need of modernizing the economic structure, the government assumes functions of the private sector, but no clear mechanisms are being established to gradually transfer those functions as the private sector evolves.

In the case of Frescomar, high transport costs and difficulties for accessing foreign markets also hamper the accumulation process.

Even though there is evidence that, for many micro firms in Cape Verde, the lack of market and of capital constitute the major problems for the creation and development of the business, the two cases suggest that these factors are important but are not outstanding to explain the constraints for the accumulation process.[10]

Based on the evidence of the two cases, this paper suggests that there is a set of issues that hamper the learning processes:

- The limitations imposed by the technology import capacity (which are associated with the commercial tradition, low industrial culture, limited access to capital for the industry and particularly for investment in technology)
- The limitations to link imported technologies with targets of local technological development.
- The limitations of the firms to be engaged in a long-term learning trajectory due to the particularities of the market and the conditions imposed by the external aid, largely associated with specific projects.

[10] Galvao, 2003, Factores Determinantes das necesidades de financiamento Inicial das microempresas em Cabo Verde, Tesis de Maestria, Universidad de Evora, Portugal).

7. Some final reflexions about the role of the State in the economy

This document is a first approach to the analysis of the problems that the Capeverdian firms confront in the process of building up technological capabilities. Particular attention has been paid to the links between the private sector and the government, and its impact on that process. The two cases were the bases to explore some final reflections.

- The system of innovation approach is an useful analytical tool as it focuses on the learning process and allows to understand the links between the capability building process of the firms and other agents that can contribute to the innovation activity. However, it is worth mentioning that the systems of innovation in Cape Verde are still in a very incipient stage, still lacking the key agents.
- Cape Verde is a small country conformed by 10 islands. These characteristics bring a set of structural problems described in this document (i.e. very small domestic market, high dependence on import products, low volume of exports, remoteness from the foreign markets, etc.) that are difficult to tackle by the private sector. This calls for an intervention of the State to create the minimum conditions for the survival of the firms in a context of globalized economies.
- After the independence, Cape Verde started with a strong intervention of the State in the economy combined with a good management of the macro indicators. During the 1990s it turned to a more liberal model based on the introduction of economic reforms. This led to the privatization of public firms in strategic sectors, but the success in the macro was less impressive. Recently, even keeping a liberal philosophy, the State has had to come back to a more selective intervention in the economic activity, as it was illustrated in the case of NOSI and the fishing sector. This could be done with a successful management of the macro indicators.
- However, there is still an open debate about the direction and amount of the intervention of the State in the economy. On one side, the government's intervention in the economic activity is required to accelerate the modernization of the economy, but on the other side, it is necessary to create and consolidate the private sector to become the engine of the economic development. Thus, the State needs to participate directly in the economic activity, but at the same time it should generate incentives and spaces for

the participation of the private sector. Problems emerge because as the government participates, it reduces the opportunity areas for the participation of the private sector. The need of the State’s intervention is still more acute due to the limited density of the industrial fabric, the predominance of a commercial culture, the early stage of the industrial development, and the infant stage of the firms.

- Following an approach of NIS, the State should find mechanisms to work hand by hand with the private sector to evolve at the same pace. For instance, in the case of NOSI, it could promote the development of spin-off and the entrepreneurship to create more private firms and gradually transfer some activities to them.
- The State should take full responsibility on the generation of conditions for an open competition in the domestic market. Based on the NIS as an analytical tool, it would be more reasonable to focus on specific sectors that can be an option for Cape Verde, e.g. software and canned fish. The evidence suggests that these sectors need a better intervention of the State: (i) to regulate Telecom, which calls for a clear competition policy; (iii) to define a clear software policy, and (iii) to regulate the fishing float and have a clear fishing policy.

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