ANALYZING THE SOFTWARE SECTOR IN BAHIA BLANCA (ARGENTINA) USING THE STRUCTURE-BEHAVIOR-PERFORMANCE AND CAPABILITIES APPROACH

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Abstract. From the emergence of the techno-economic paradigm of ICTs, numerous clusters of Software and Information Services (SIS) are consolidated in developed countries. In developing countries, and particularly in smaller cities, the growth of this sector constitutes a potential path of economic-productive diversification. The study aims to explore the origin and current performance of the SSI sector in the city of Bahía Blanca (Argentina). Empirical findings show that the local SSI presents an embryonic development, with a limited capacity for innovation and export, conditioning its role as a factor of economic growth.

Keywords: software; behavior; performance; capabilities; Bahía Blanca (Argentina)
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1. Introduction

Towards the last quarter of the 20th century, two convergent processes produced transformations in the material base of society with an accelerated rate: the emergence of a new model of sociotechnical organization ("informational development mode") and the restructuring of capitalism as a fundamental matrix of the economic and institutional organization in society (Castells, 1995). In this scenario, technological transformations began to gain relevance and positioned themselves at the center of the scene globally.

A new techno-economic paradigm emerges and the Information and Communication Technologies (ICT) not only constitute tools at the service of productive activity, but also become products and processes that have consequences on the ways in which society manufactures, consumes, and organizes itself. Following Castells (1995, 1999), the relationship between technological change and economic restructuring are two processes that occur as a consequence of a historical relationship. These two processes enable the birth of a new mode of economic development, the informational one, which became globally conforming towards the early 21st century.

With the consolidation of the new technological and productive paradigm associated with ICT, within the framework of a growing internationalization of capital, knowledge and technical progress are at the center of the production process. Software and Information Services (SIS) constitute one of the most international dynamic activities and one of the sectors with the highest growth in recent years (Barletta et al., 2013).

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Its emergence, consolidation, and expansion take place within the framework of the advancement of the informational development model. The information model is a phenomenon that has affected all countries since the mid-1970s. As a result of this new techno-economic paradigm, numerous ICT clusters are formed in developed countries, such as those located in the metropolises of San Francisco in the United States or Tel Aviv in Israel. Although each of these clusters presents specific characteristics, in all of them the existence of dynamic, innovative firms with great capacity to export their production can be observed as a success factor. These companies are strongly articulated with each other, with the scientific-technological sector, and have significant state support.

Regarding developing countries, Argentina is ranked number thirty among exporters of SIS. With a 0.4% share of the total exports (1,295 million dollars on average between 2014 -2016), Argentina is the Latin American country with the best performance in this area (López and Ramos, 2018). The Argentina specialization in the SIS segment involves the production of custom software (CRM and ERP)[1], together with mobile applications and video games for various platforms. The sales of the sector are around 23,283 million dollars, with the level of employment generated by this activity being in the order of 101,700 registered jobs (CESSI, 2018). In turn, this segment of economic activity comprises 4,894 companies, which are mainly established in tow large cities in the country: Buenos Aires and Córdoba (CESSI, 2018).

The proliferation and growth of the SIS sector in these large urban centers is no accident. The possibilities of better exploiting economies of agglomeration, scale and scope, the existence of an expanded labor market, and the presence of an extensive scientific-technological environment constitute dynamic competitive advantages that are difficult to reverse. However, in recent decades, the birth and location of SIS firms has been taking place in cities of relatively smaller size, such as Tandil or Bahía Blanca. For this type of medium-sized cities[2], traditionally specialized in the production of goods and services with a lower technological content, the growth and expansion of the SIS sector constitutes an interesting way of economic-productive diversification and the generation of highly qualified employment. Furthermore, it means a path towards greater integration into the circuits of global accumulation, in the context of an increasingly informational capitalism.

Based on these considerations, the study of the software and computer services sector in the city of Bahía Blanca is of interest: its origin, current performance, and evolutionary trajectory. To date, the previous studies carried out on the sector in the city are marginal and seminal in nature, without a complete knowledge of its behavior and dynamics (Diez et al., 2020; Diez and Scudelati, 2016; Girolimo, 2018). Bahía Blanca constitutes a city-port of 300,000 inhabitants. It is a transhipment center for national production of grains and fuels to the world market. The city has an industrial development of an intermediate nature,

[1] Business management systems. ERP: Enterprise Resources Planning. CRM: Customer Relationship Management.

[2] For Argentina, Vapñarsky (1995) defined localities that range between 50,000 to 500,000 inhabitants as medium-sized cities. Qualitative criteria are also used (Bellet and Llop, 2004) when identifying these cities in specific territories, paying more attention to the role that a city plays in its more or less immediate environment and its role in the urban hierarchy, that is, its role as a potential "intermediary" between higher-ranking cities and rural spaces (Michellini and Davies, 2009).

highlighting the presence of a petrochemical pole and several SMEs belonging to different sectors. In addition, it constitutes a node of specialized services, particularly in education and health, which is complemented by an important commercial activity.

For the fulfilment of the research objective, a survey was carried out among 26 firms of the SIS sector. This survey constitutes 80% of the universe of companies existing in the city. The sampling technique used was simple random. For the survey activities, the collaboration of the Bahía Blanca Technological Pole was requested. The questionnaire applied was structural in nature and assessed different dimensions of the business activity: nature of the market, characteristics of the services provided and the products manufactured, existing capacities within the firms, and links with other territorial actors. The questionnaire was built in collaboration with different researchers from the country specialized in SIS. Prior to conducting the questionnaire, awareness-raising activities were carried out, with the aim of disseminating the scope and characteristics of the research among local entrepreneurs. After applying the questionnaire, a round of interviews was conducted in order to complement the timely data collected with qualitative information. The proposed study applied descriptive statistics as a way of evaluating the general performance of the sector. Due to the fact that the universe of existing firms in the city is limited and the sample is small, using complex econometric analyses was not possible[3].

The paper is divided into four sections. The first section contains the theoretical approach used. This theoretical framework involves the structure-conduct-performance contributions (Bain, 1956) and the capabilities approach from the neo-Schumpeterian perspective (Yoguel, 2000; Diez, 2010).

The second section exhibits a description of the historical trajectory of the software sector in Argentina, also highlighting the beginnings of this activity in Bahía Blanca city. This section aims to provide the main features that allow understanding the evolution that the SIS sector has had over the years, both at the national and local level.

The third section shows the results of the fieldwork carried out. Here, the current situation of the local sector is summarized, considering the characteristics assumed by the target market of the firms and the endogenous and relational capabilities developed by them.

Finally, the conclusions are presented. This section lists the main evidence collected and attempts to construct a general diagnosis as integral and complex as possible on the situation of this sector in Bahía Blanca city.

1. Theoretical framework

1.1. The structure-behavior-performance paradigm and the neo-schumpeterian approach

Studying the performance of any sector of economic activity requires making compatible at least two types of approaches. One theoretical framework destined to deepen in the characteristics of the market in which firms operate, and another approach in order to

[3] Given that the sample size (n) is small, there are not enough degrees of freedom to allow the use of econometric techniques. This situation cannot be corrected by expanding the sample, since the universe of existing companies in the city (N) is also very limited. In fact, as stated in the introduction, 80% of the total existing firms belonging to this sector were surveyed.

identify the fundamental features and capabilities of the firms that comprise the sector. This conceptual effort involves linking two different theoretical perspectives: the structure-behavior-performance paradigm and the Schumpeterian approach to the firm. Both approaches seem to be antagonistic in nature. However, both perspectives are complementary in order to achieve a complete and comprehensive sectoral diagnosis.

The structure-behavior-performance paradigm was developed by Bain (1956). The author postulated that the structure of an industry determines the behavior of a firm and this behavior, in turn, conditions the way in which the market works. The industry structure refers to the number of producers in a market, their degree of differentiation, their cost structure, the degree of vertical integration, among other issues.

For its analysis, it may also be relevant to study the historical trajectory of the sector. The firm's behavior can be observed in the setting of prices, the level of research and development (R&D), the level of investment or advertising. In addition, performance refers to efficiency, related to the degree of market competition and social welfare and is compared with theoretical references of a structural nature such as monopoly or perfect competition.

Regarding the neo-Schumpeterian approach, this paradigm focuses on studying the competencies or capabilities of firms, which are generated from attributes or available factorial resources. These resources are human capital, equipment and machinery, among other issues. From this perspective, the appropriate combination and use of the factors and resources allows firms to develop capabilities that can be classified in two types: those of an intrinsic or endogenous nature and those of a relational nature.

Based on Yoguel (2000), endogenous capabilities involve the reactions of firms towards devising, planning, and conducting productive activities, promoting the development of new products and processes, and introducing changes in the organization. The purpose of these reactions is to strengthen the insertion of their products in the markets.

The relational capabilities are assumed as the ability of the firm to develop links and interactions with the environment. These links are channels to obtain knowledge, information, new resources, and develop new skills. These constitute assets that the company would not be able to generate by itself and that contribute to enhance its economic performance (Diez, 2010).

In contrast to the structure-behavioral-performance paradigm, the neo-Schumpeterian approach assumes that the firm's capabilities define behaviors and these set a structure for the market. As argued previously, these approaches from the theoretical point of view can be opposite. Nevertheless, it should be noted that business capabilities might alter the structure of a market (for example, with a disruptive innovation).

Usually, market conditions define the type of competition and, therefore, set the entrepreneurial capabilities (for example, when there are barriers to entry). In the specialized literature, various attempts have been made to align both approaches through both approaches compatible through meso perspectives such as the notion of a national innovation system (Lundvall, 1992; Nelson, 1993), a sectorial innovation system (Malerba, 2002) or a local innovation system (Yoguel et al., 2009).

1.2. The particular characteristics of the software industry: between the weight of the structure and the entrepreneurial capabilities

Two well-differentiated productive segments or niches can be recognized within the software market. In this context, a segment refers to the manufacture of standardized or universal products and a niche concerns the design of customized products or services. The first segment is characterized by the presence of few firms, which make significant investments in R&D (high sunk costs), associated with the design, coding, and development of the software. Usually, this segment takes the form of an oligopoly. The cost structure of this segment (high fixed and low marginal) supposes the presence of significant returns to scale, acting as a dissuasive instrument for the entry of new firms to the market. These barriers to entry facilitate the commercialization of products at a global scale.

In addition, the high level of R&D (based on the use of complex languages and many programming hours per product) constitutes an element that favors the development of radical innovations that guarantee the establishment of a dominant position. In turn, the trend towards concentration is reinforced by the presence of network externalities (Katz and Shapiro, 1985). This being the case in which the utility of a user grows when the product also is consumed by the rest of the users. In other words, the consumer finds it more profitable to purchase a product when its use is more widespread.

According to Chudnovsky et al. (2001), in standardized software products this phenomenon is explained since: i) people who use the same software have greater facilities to exchange information; ii) there are complementarities between different products (and also in relation to hardware) that mean that the more general the platform, the higher the number of applications for it; iii) there are learning costs that reduce the incentives to switch products once some skills and training have been obtained.

The second segment (of tailored products and services) is characterized by the presence of several firms that compete with each other, seeking to exploit certain specific skills and abilities. These firms face high marginal costs (since each project is unique and different) and low sunk costs (linked to R&D).

From a strictly theoretical point of view, such a structure could resemble monopolistic competition. In this type of segment, the positioning of firms is mostly local/regional and/or national, since physical proximity to the customer is a key element for the accurate design of the product and after-sales service. Given that investment in R&D is lower (less complex languages and fewer programming hours per product are used) the nature of the innovations carried out is usually incremental.

Operational flexibility to satisfy the needs and technical requirements of customers, meeting deadlines, quality of service, reputation, and price are the main factors of competition. Knowledge of culture, language, customs, laws, reputation, and personal contacts are added competition subjects (Bitzer, 1997). Given these characteristics, for this type of competition, entrepreneurial skills seem to be more significant than market structure. Below, Table 1 summarizes the main features of each of the segments described above.

Table 1. *Main features of software industry segments*

	Standardized products	Customized products
Type of competition	Oligopoly	Monopolistic competition
Barriers to entry	High	Low
Cost structure	High fixed costs Low marginal costs	Low fixed costs High marginal costs
Economies of scale	High	Low
Network	Yes	No
Marketing	Global	Mostly local/regional/national
Investment in R&D	High	Low

Source: Own elaboration

2. The historical path of the software sector

2.1. The development of the sector at the national level

Informatics in Argentina began in the late 1950s, based on a public policy that promoted import substitution and financed state investment in sectors with strategic potential. In those years, the first computer was installed at the University of Buenos Aires (UBA). The initial investigations were started to develop basic software through applied mathematics, peripherals, and interfaces (Aguirre, 2004). As a consequence of this evolutionary path, towards the first half of the 1960s, this sector became a leader in Latin America (Erbes et al., 2005). During the first years of the 1970s, some significant developments in the information technology area in Argentina were made by large national companies and direct foreign investment (Zubieta and Díaz, 2016). The advances promoted in the sector found a breaking point in 1976, when the open economic model of the military dictatorship proposed a pattern of economic specialization for the country centered on agricultural livestock production. The economic model was characterized by the absence of industrial proposals as Azpiazu et al. (1986) argued.

After the debt crisis (1982) and with the advent of democracy (1983), there was a government attempt to recover local technological capabilities through different sectoral public policies. In the field of computer services, a clear policy guideline for the sector was formulated for the first time. In 1984, a National Computing Commission was formed in order to promote the integral development of the sector and to achieve technological autonomy (Azpiazu et al., 1990; Yoguel et al., 2007). Throughout the Menem administration (1989-1999), a vision of importing capital and knowledge-intensive goods predominated. The significant increase in imports of hardware and software during this stage relegated the development of local firms, which specialized in adapting foreign products. In addition, the existence of closed standards and proprietary platforms limited the possibilities of national learning and deepened technological dependence. Despite this discouraging context, some market niches emerged. Software packages were developed to meet business management needs of SMEs belonging to the industrial, service, educational, health, financial sector and the privatized public services. Later, in the 2000s, the growth of the video game industry and mobile applications created conditions for the expansion of the local industry. Thanks to the boom and huge growth of the mobile industry, this niche proved to be one of the most profitable and constituted an excellent opportunity for business development for the coming years (Camio et al., 2016). Simultaneously with the expansion

of the sector since the 2000s, is possible to register a set of public policies to promote the software sector (MINCYT, 2009; López and Ramos, 2009).

As a corollary of the sector specialization and the promotion instruments, in the last decade the Argentine SIS sector has shown a significant growth in terms of its sales, employees, and new firms (CESSI, 2018). Therefore, Argentina is the Latin American country with the best performance in this area (López and Ramos, 2018). A favorable element for the better performance of the sector throughout this period was the existence of a high exchange rate, which encouraged export development. Since salaries and other expenses associated with personnel mainly represent the sectoral cost structure, devaluations decrease their value in dollars and improve competitiveness. Despite these advances, the future of the SIS sector is still unknown. It presents an open end depending on the degree of development reached by local firms and the continuity (or not) of the public policy to support the industry that, as we have seen, has been extremely erratic throughout the history of the country.

2.2. The historical development of the sector at the local level

Based on the information available, a stylized analysis allows us to indicate that the dynamics of the local SIS sector seems to be parallel to the national trajectory. Almost simultaneously with the emergence of the first computer prototypes in Buenos Aires city, the Department of Electrotenia of the National University of the South (UNS), located in Bahía Blanca, was also developing its own. In fact, from its origins, this university unit was strongly internationalized, reaching the frontier of sectoral knowledge. Later, with the arrival of the military dictatorship (1976-1982), the Department of Electronics suffered layoffs of personnel such as other public universities in the country, notably affecting scientific production in the areas of circuits, electronics, and control and digital systems.

However, from the advent of democracy, the scientific production of the dependency recovered prestige and status at the international level. During those years, this Department was linked to the Chemical Engineering Pilot Plant (PLAPIQUI, as per its initials in Spanish) (with the purpose of designing control panels for the plants of the Bahía Blanca petrochemical complex.

The interactions took place within the framework of the international PIDCOP program and constituted a very fruitful technology transfer experience. Nevertheless, in the mid-1990s, this interaction experience was interrupted since President Menem (1989-1999) decided to privatize the complex's plants. Despite the fact that, during this period, there was an unfavorable context for the national manufacture of knowledge-intensive goods, the National University of the South decided to create the Department of Computer Sciences in 1994. The department was based on the scientific capabilities and competencies accumulated by local teachers in the fields of electrical engineering, electronics, and applied mathematics.

Currently, the Department of Computer Sciences and Engineering (DCIC-UNS, as per its initials in Spanish) offers three undergraduate careers, three postgraduate degrees, and service courses corresponding to careers administered by other Departments. In addition to teaching tasks, there are research activities on various current issues in the discipline. It also has six Laboratories of Research and Development, each one comprises research professors from the National University of the South and from other scientific organizations

such as the National Council for Scientific and Technical Research (CONICET, as per its initials in Spanish), the Commission for Scientific Research of the Province of Buenos Aires, and the National Agency for Scientific Promotion. The laboratories are also composed of Ph.D. students in Computer Science and Master's in Computer Science. Every year the laboratories participate in national and international conferences and congresses. Hence, DCIC-UNS is among the academic units with the highest rates of scientific productivity in Argentina.

In this way, by the year 2000, Bahía Blanca already presented itself as a relevant center for generating knowledge and training human capital for the software industry at the national level. Similar to other university cities in the country, those first graduates of the academic unit DCIC-UNS that decided to stay in the city specialized in ERP and CRM applications, developing specific software and adaptations for automotive dealerships, logistics companies, hospitals and banks, among other relevant clients.

There are also ventures that offer a wide variety of services, such as network design and website construction. Currently, due to the absence of relevant sector information, the actual dynamics and dimension of the sector is unknown, a situation that is intended to be reversed through successive investigations.

3. The software sector in bahia blanca nowadays

3.1. Structure of the Target Market

The 26 companies comprising the sample of the software sector of Bahía Blanca city are mainly dedicated to the development of custom software (integral solutions) and offer their own products and associated services. To a lesser extent, companies offer programming services, while a small proportion of these firms is dedicated to offer products developed by others and associated services, technical support, hardware sales, and other services (training, mentoring) (Table 2).

Table 2. *Types of products and services offered by firms*

	Nb firms[a]	**%**
Custom software development (integral solutions)	19	73.1%
Own products and associated services (including SaaS: software as a service)	14	53.8%
Third-party products and associated services	8	30.8%
Programming services (coding)	9	34.6%
Provision of other resources (training, mentoring, design, QA)	4	15.4%
Technical support	7	26.9%
Hardware	6	23.1%
Total	26	

(a) Multiple choice answers. Source: Own elaboration based on surveys. Nb firms= Number of firms.

Most of the firms declared that the industry constitutes their main demanding sector, followed by the financial sector. The third place is occupied by the primary sector, computer services, public administration, and final consumers. The local SIS sector concentrates its sales on the domestic market: 66.7% of the firms do not export (Table 3).

As Girolimo (2018) argued, local firms are largely limited to meeting the software needs of Bahía Blanca and its area of influence.

Table 3. *Percentage of exports over total billing in 2015*

	Number of firms	%
0%	16	66.7%
Between 1% and 50%	4	16.7%
More than 50%	4	16.7%
Total	241	100%

Two firms did not answer this question. Source: Own elaboration based on surveys.

Among the companies that export, the main destinations change over the years. Based on the periods surveyed corresponding to the years 2013, 2014, and 2015, it is identified that the United States constituted the main destination during the first year, followed by Uruguay, Mexico, Colombia, and Spain (Table 4).

For 2014, the firms pointed to Brazil and Uruguay, while in 2015, Colombia emerged as the primary destination. Regarding the main export products/services, most firms indicated the development of custom software (integral solutions). The possibility of exporting seems to be closely linked to time zone, the level of the exchange rate, and the absence of significant language barriers between the supplier and customer.

Table 4. *Export: Destinations, products, clients according to productive sector*[a]

Main export destinations 2013			Main export products/services 2013			External costumers by productive sector 2013		
	Nb firms	%		Nb firms	%		Nb firms	%
USA	6	66.7%	Custom software development (comprehensive solutions)	8	72.73 %	Primary sector	1	9.09 %
Uruguay	1	11.1%	Own products and associated services (including SaaS)	1	9.09%	software	6	54.5 %
Mexico	1	11.1%	Third-party products and associated services	1	9.09%	Audiovisual	3	27.3 %
Spain	1	11.1%	Programming services (coding)	1	9.1 %	Others	1	9.1%
Total	9	100 %	Total	11	100 %	Total	11	100 %

(a) Data corresponding to the year 2013, the period investigated in which the largest number of responses was recorded. Source: Own elaboration based on surveys. Nb firms= Number of Firms.

3.2. Size and Resources of Firms: Number of Staff, Level of Training, and Languages Used

Based on Table 5 and 6, the local software sector comprises relatively young firms. These companies have no participation of foreign capital and were mostly founded between 2000 and 2010. Most of the firms are SMEs, only two (Globant and Hexacta) are large, with numerous offices in Argentine cities and abroad. One of these large firms registers a staff of more than 500 employees (Table 6).

Table 5. *Year of foundation and foreign capital participation*

	Year of company foundation		Participation of foreign capital in the company (%)		
	Nb firms	%		Nb firms	%
Decade 70	2	7.7%	0%	22	84.6%
Decade 80	2	7.7%	100%	1	3.8%
Decade 90	4	15.4%	NA	3	11.6%
Decade 2000	8	30.8%			
Decade 2010	10	38.5%			
Total	26	100%		26	100%

Source: Own elaboration based on surveys.

Given the 26 companies comprising the sample, 21 firms (80%) have fewer than 20 employees. Most of them have at least one person with a university degree on their roster, showing the knowledge-intensive nature of the activity (Table 7). Regarding this, 21 companies stated that they have employees with complete university training, while a total of 10 (38% of the sample) have staff with postgraduate degrees.

Table 6. *Number of employees in the main office - Year 2017*

	Number of firms	%
From 0 to 50[a]	22	84.6%
From 51 to 100	2	7.7%
From 101 to 500	1	3.8%
More than 500	1	3.8%
Total	26	100%

(a) Defined strata based on Chudnovsky et al. (2001). Source: Own elaboration based on surveys.

Table 7. *Maximum level of training achieved by the firm staff - Year 2017*

Employee training	Number of firms	%
No university education	5	19.2%
Academic	11	42.3%
Postgraduate	10	38.5%
Total	26	100.0%

Source: Own elaboration based on surveys.

The programming languages constitute the fundamental tool for software development. In consequence, the domain of next-generation tools allows the development of applications of a higher level of sophistication. In the case of Bahia Blanca firms, 80% of them use HTML and 42% of these firms use Java (Table 8)[4]. The two mentioned languages are

[4] Middle-level languages are those that, based on the available instruction sets (chip set), allow the use of arithmetic-level functions, but, at a logical level, they depend on assembly literals. These languages are oriented to procedures, which are in turn composed of processes. They result being

linked to Internet development, object-oriented, and respond to a medium level of sophistication.

Table 8. *Languages used*

	Nb firms[a]	%
HTML/CSS/JavaScript	21	80.8%
PHP	11	42.3%
Ruby	4	15.4%
C, C++	7	26.9%
Objective-C, Swift	4	15.4%
Java	11	42.3%
.NET (C#, VB.NET)	10	38.4%
Phyton, LUA	4	15.4%
Assembly	1	3.8%
Other	6	26.8%
Total	26	

(a) Multiple choice answers. Source: Own elaboration based on surveys.

Except for the two firms that are subsidiaries of transnational firms, local companies develop autonomous production processes. This means that decisions about what to produce and how to do it are made within the production unit itself. On the contrary, in the case of Globant and Hexacta, these firms develop heteronomous production processes, that is, their techno-productive decisions are subject to strategic guidelines from their head office (Dughera et al., 2012).

3.3. Endogenous Capabilities: Innovation Indicators

During the 2013-2015 period, the analysis of customer requirements constituted the main innovation activity among the firms of the local SIS sector (Table 9). Two aspects stand out here: 1) a few firms declared carrying out other types of activities, and 2) only three firms indicated that they develop internal R&D activities.

Table 9. *Innovation activities - Period 2013-2015*[a]

	Number of firms	%
Analysis of customer requirements	16	66.7%
Internal research and development	3	12.5%
Acquisition of hardware to develop new products and services	2	8.3%
Acquisition of software to develop new products and services	1	4.2%
Training for the introduction of new products and services	1	4.2%
Software development for internal use	1	4.2%
Total	24	100%

(a)Two firms did not answer this question. Source: Own elaboration based on surveys.

less complex than assembly languages (e.g., Assembly) or Machine Languages, which the CPU can execute directly. From a technical point of view, programming in mid-level language is easier than in assemblers, because it requires less capacity for abstraction.

Although almost half of the firms of the sample have R&D laboratories (Table 10), practically all declared obtaining innovation results during the period 2013-2015 (Table 11). It is observed that only one firm declared not to have innovation results in the analyzed period and one chose not to answer this question, considering it sensitive to their interests (Table 11).

Table 10. *Companies that have a R&D laboratory*

	Number of firms	%
Yes	11	42.3%
No	15	57.7%
Total	26	100.0%

Source: Own elaboration based on surveys.

Table 11. *Companies that obtained innovations - Years 2013-2015*

	Number of firms	%
Yes	24	92.3%
No	1	3.8%
NA	1	3.8%
Total	26	100%

Source: Own elaboration based on surveys.

However, firms obtained innovations only for the domestic market. This result is replicated for the different types of innovation, except for new marketing channels and organizational improvements (Table 12). This indicates that these are innovations with a low degree of complexity, which do not allow firms to massively reach new export destinations and capture extraordinary rents in world markets.

Table 12. *Degree of novelty by type of innovation - Period 2013 - 2015*

	New for the company		New for the domestic market		New for the international market		TOTAL	
Firms	N°	%	N°.	%	N°.	%	N°.	%
New products	7	35.0%	10	50.0%	3	15.0%	20	100.0%
Products with significant improvements	4	25.0%	10	62.5%	2	12.5%	16	100.0%
New comprehensive solutions	4	25.0%	11	68.8%	1	6.3%	16	100.0%
New services	8	44.4%	9	50.0%	1	5.6%	18	100.0%
Services with significant improvements	5	33.3%	9	60.0%	1	6.7%	15	100.0%
New marketing channels	4	40.0%	4	40.0%	2	20.0%	10	100.0%
Organizational improvements	8	57.1%	5	35.7%	1	7.1%	14	100.0%

Source: Own elaboration based on surveys.

Finally, most local firms developed new or improved products and new comprehensive solutions based on solutions developed and/or introduced in the market in the past (Tables 13 and 14). In turn, it is recorded that there is a predominance of firms that used previous codes in the design of new products, as a way of saving time and effort and exploiting small economies of scale.

Table 13. *Have your new or improved products been developed on the basis of comprehensive solutions created in the past?*

	Number of firms	%
Yes	18	69.2%
No	8	30.8%
Total	26	100%

Source: Own elaboration based on surveys.

Table 14. *Do new integral solutions and new products reuse codes developed for solutions introduced in the market in the past?*

	Number of firms	%
Yes	14	53.8%
No	10	38.5%
NA	2	7.7%
Total	26	100%

Source: Own elaboration based on surveys.

In this sense, it can be affirmed that the innovations obtained by SIS firms located in Bahía Blanca are mainly incremental and are fundamentally based on processes of learning by doing, learning by using, and learning by interacting with costumers (Lundvall, 1992). Local firms create value built on existing products or services, through learning processes.

This type of innovation allows firms to preserve markets, protecting them from external competition and redefining positions on a local/regional scale. According to this behavior, only in rare occasions it is possible to export products or services on massive scale.

3.4. Relational Capacities: Associativity and Links with Science and Technology Organizations

When associative links between firms in the sample are considered, the analysis of the data collected shows that 12 of the 26 firms surveyed (46.15%) claimed to have developed a product or service jointly with another surveyed firm (Table 15).

Table 15. *Development of joint products/services with another surveyed firm*

	Number of firms	%
Yes	12	46.1%
No	14	53.8%
Total	26	100%

Source: Own elaboration based on surveys.

Table 16. *Demand for technical assistance from science and technology organizations*

	Number of firms	%
Yes	9	34.7%
No	17	65.3%
Total	26	100%

Source: Own elaboration based on surveys.

Specifically, a total of 7 collaboration actions were detected, which involved the manufacture of a parking meter, consulting and computer engineering actions, the development of mobile applications, the design of a management system, and hosting activities. Firms interviewed declared that they did not interact with universities and science and technology institutions at the local level. In this sense, only 9 (34.62%)

demanded technical assistance from this type of entities, while 17 (65.38%) did not (Table 16). When inquiring into the causes of the lack of interaction between firms and this type of organizations, the fact that the developed products or services are not highly complex stands out as a first cause. Therefore, no technological advice was required (8 mentions). Among the relevant factors appears the distance between the research lines of science organizations and the needs of firms, the ignorance by firms of the research fields of universities and scientific and technological centers, and the existence of bureaucratic obstacles that hinder building fluid ties between industry and science (Table 17).

Table 18. *Why is the firm not linked to science and technology entities?*

	Number of firms	%
Distance between research lines and the needs of firms	4	23.5%
Lack of knowledge about the research fields of the S&T centers	4	23.5%
Slow and complex bureaucratic procedures	4	23.5%
Previous unsuccessful linked experience	2	11.8%
Manufactured products or services do not require technological assistance	8	47.0%
Total	17[a]	

(a) Number of firms that did not demand technical assistance services. Multiple choice answers.
Source: Own elaboration based on surveys.

4. Conclusions

The analysis of the information collected regarding the software sector in Bahía Blanca shows that it follows a similar trajectory to the one registered at the national level. According to the information provided by the surveyed firms, most of the SIS firms located in Bahía Blanca specialize in custom software design (comprehensive solutions for business management). These products are intended to meet the needs of the industrial, commercial, and financial system of this city and its area of influence.

A profile with these characteristics implies specialization in a local-regional niche activity, protected from external competition by the need for certain proximity between the supplier and customer. In this sense, the main competitiveness factor of local firms is given by the ability to adapt to the specific requirements of the demand and by the quality of the after-sales service. Only nine companies (9) carry out export activities, but their destinations are being erratic.

This situation shows the lack of consolidation of this profile in the universe of companies surveyed. Although no specific questions were registered regarding this issue in the original form, subsequent interviews with the entrepreneurs seem to show that the erratic behavior in exports comes from the fact that local firms work as contractors for foreign firms, since the destination has always been the software sector itself, mostly from Spanish-speaking countries.

The export limitations of the analysed firms seem to be in line with Stamm (2000). The author stated that the barriers to software exports in Argentina are related to the following factors: i) need to adapt the software developed for the local environment to the requirements of third markets; ii) lack of financing; iii) lack of advice, technical assistance,

and incentives for exports; iv) existence of quality standards in developed countries that are little known in Argentina; v) difficulties in establishing commercial contacts abroad; vi) difficulties in entering into subcontracting relationships with companies from other countries.

With regard to the general characteristics of Bahia Blanca firms and their resources, the sample shows that most have a small size (they have less than 20 employees) with highly trained personnel (university education). As stated above, the products/services offered are mostly comprehensive tailor-made solutions, which can be classified as medium/low complexity depending on the type of languages used. In terms of competencies and skills, the surveyed firms do not show significant levels of innovation, predominantly the analysis of customer requirements.

Thus, in the best of cases, the innovations achieved are significant exclusively for the target market that the firms serve. Nor is it the presence of disruptive innovations observed by the companies in the sample, since most of them claimed to have developed new or improved products based on source codes or solutions introduced in the market in the past. This only supposes the presence of incremental innovations within the universe studied, which arise through processes of learning by doing, learning by using, or learning by interacting (Arrow, 1971; Lundvall, 1992) with clients.

Regarding the relational capabilities of the studied firms, an interesting level of articulation between them is observed. A total of 12 of the 26 studied (46.15%) stated that they had developed a product or service jointly with another firm from the group studied. Specifically, a total of 7 collaboration actions were detected that involved the design/manufacture of products/services with different levels of complexity, ranging from hosting activities to the integral production of a parking meter. However, this degree of interaction is not replicated for science and technology organizations at the local level. Entrepreneurs stated that the type of products/services manufactured do not require the construction of strong ties with entities of this nature.

Deepening research on this point through round of interviews remark that the technical assistance can be satisfied through formal/informal contacts with colleagues. These informal contacts do not necessarily lead to the development/provision of a joint product/service. In this sense, the construction of links arises from a purely operational perspective (solution of a specific problem) and does not come from a medium-long-term strategy (aiming, for example, at the realization of a radical innovation that significantly changes the type of product been fabricated). In other words, building strong ties with S&T institutions requires an investment in time, effort, money, and a level of planning that firms would not be willing to assume.

Moreover, there are other limitations that would condition this type of links: the distance between lines of scientific research and the fields of application of the firms; the ignorance of some research areas of the scientific field by companies surveyed and, finally, the presence of bureaucratic obstacles that limit the evolution of these ties among time.

In this way, the software sector in Bahia Blanca presents an embryonic development, with a limited capacity for innovation, low levels of articulation with science sectors, and a lack

of presence in international markets. These features limit its role as possible dynamizer sector for capital accumulation in the city on a significant scale.

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