Interorganizational knowledge sharing in a science and technology park: the use of knowledge sharing mechanisms

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Abstract

Purpose – This paper aims to uncover the combinations of knowledge sharing mechanisms that organizations in a science and technology park in Brazil use to share managerial and technical knowledge.

Design/methodology/approach – This research adopts a qualitative approach that uses a fuzzy set qualitative comparative analysis to analyze data that are gathered from 51 managers of organizations in a science and technology park.

Findings – The results show that knowledge sharing happens regardless of the type of knowledge. There are more alternative paths that lead to knowledge sharing than to its absence. Regarding the type of knowledge shared, there are more alternative configurations that lead to managerial knowledge sharing than to technical knowledge sharing. Only the older organizations in the science and technology park abstain from knowledge sharing.

Research limitations/implications – Due to the qualitative nature of the study, no generalization is possible. Additionally, the study's limitation is that it involves organizations from a single science and technology park.

Practical implications – The results offer managers of organizations in science and technology parks to choose from alternative combinations of mechanisms to either boost their knowledge sharing or to promote knowledge protection.

Originality/value – The paper provides an original contribution by identifying the combinations of mechanisms that organizations in a science and technology park use that leads to the sharing of specific knowledge types. The findings also identify the combination of mechanisms that older organizations use that prevents them from sharing knowledge.

Keywords Science and technology parks, Knowledge sharing, Knowledge sharing mechanisms

Paper type Research paper

Introduction

Globalization has increased the competition between organizations, resulting in their need to improve their logistics, inventory, schedule, quality, and operations (Dey *et al.*, 2010). An alternative for organizations is to differentiate themselves from their competitors through the application of knowledge (Lawson *et al.*, 2009; Spinello, 1998). Knowledge is a primary strategic organizational resource (Alavi and Leidner, 2001; Naim and Lenkla, 2016) that fosters the creation of organizational value (Davenport and Prusak, 1998; Mohanty, 2003). Organizations that actively seek new knowledge can identify opportunities that can lead to the entry into new markets with greater efficiency (Villar *et al.*, 2014).

The current context makes knowledge sharing – a dynamic and interactive process in which people, units, groups or organizations influence each other to create new knowledge (Argote and Ingram, 2000; Carmeli *et al.*, 2013) – essential in the construction of the modern

world (Shariq, 1999). To benefit from knowledge sharing, organizations must use mechanisms to promote this sharing among their employees (Cummings, 2004; Wang et al., 2008). Mechanisms enable the conversion of tacit and explicit knowledges (Oliveira et al., 2014) that allow their flow through the organization (Nonaka and Takeuchi, 1995). The mechanisms are also needed to share knowledge with sources outside the organization, such as the market, clients or even competitors (Aktharsha, 2011; Lawson et al., 2009). Interorganizational knowledge sharing can bring many benefits, such as new products, lower costs, better manufacturability and better quality products (Lawson et al., 2009), but can also lead to knowledge spill overs and leakages (Ritala et al., 2018; Ahmad et al., 2014).

Some organizations adopt knowledge protection strategies, especially in contexts of cooperation and coopetition (Estrada et al., 2016; Rivette and Kline, 2000). Contexts of cooperation are a fertile ground for knowledge sharing. Science and technology parks (STPs) are one such context (Montoro-Sánchez et al., 2011). STPs are sets of organizations that are geographically close and subject to an entity in charge of building and managing common areas. This entity forms a park to better collaborate in the development of the organizations (Bellavista and Sanz, 2009). Many STPs are linked to one or more universities or research centers that allow their organizations to use their physical resources, such as laboratories and libraries, and to promote the interaction of their professors and researchers with the organizations' employees (Vedovello et al., 2006; Squicciarini, 2007). The STP of this paper is a member and meets the criteria to be a member of the International Association of Science Parks (IASP, 2018).

According to the IASP (2018), there are 336 areas of innovation worldwide, and 12 of them are STPs in Brazil. The number of companies hosted on STPs vary from more than 680 (HKSTP, 2018) to less than 60 (Medeon, 2018). The number of companies hosted on Brazilian STPs varies from 9 until more than 300, and each of these companies focuses its business in one or more of the following 32 business areas: agriculture and forestry; agrobusiness; audiovisual; biothecnology; chemistry and chemicals; computer science and hardware; cultural industry and humanities; design; education and humanities; electronics; employee education and training; energy; environment; environmental, social and human technologies; food sciences; health and pharmaceuticals; human resources; ICT and communications; industrial automation; logistics; management technologies; manufacturing and automation technologies; materials; microtechnology; micromachines and nanotechnology; off-land transportation; photography and image capturing systems; physics; security technologies; services for business and industry; and software engineering and space technology (IASP, 2018).

Choosing an STP to study inter-organizational knowledge sharing is interesting because it is a collaborative context (Martins, 2016), where knowledge sharing is encouraged (Bellavista and Sanz, 2009). In addition, with the growing importance of regional development and knowledge economy, there is an emphasis on the role of universities and their interaction with the local business community (Clauss and Kesting, 2017; McAdam, Miller, McAdam and Teague, 2012). The interface between university and organizations is still unclear, despite the importance of this relationship both for the performance of the parties involved and for society in general (Chau et al., 2017). The study of STPs located near the university helps to understand this interface, as the STP helps to disseminate the knowledge of the university to the organizations and to the society in which it is inserted (Aragonés-Beltrán et al., 2017).

There is evidence in the literature that younger firms have more advantages in terms of knowledge of STP, while older companies tend not to share knowledge (Diez-Vial and Fernández-Olmos, 2017), but there is no evidence of how this affects the managerial and technical knowledge sharing of STP organizations, nor how it is operationalized as to the mechanisms used to share knowledge. More than that, though several studies have already shown the importance of mechanisms for knowledge sharing (Centobelli et al., 2018a, 2018b;

Fisher *et al.*, 2018; Olaisen and Revang, 2017; Steffen *et al.*, 2017; Tan and Thai, 2014), none of them shows which combination of mechanisms is used in organizations to share different types of knowledge (managerial and technical).

The purpose of this research is to identify the alternative combinations of mechanisms that organizations in an STP use to share managerial knowledge and technical knowledge with each other and the combinations of mechanisms that lead to the absence of such knowledge sharing. To reach this objective, we conduct a qualitative study with organizations from an STP in Brazil. The results show that younger and older organizations share both managerial and technical knowledge. Further, they show that there are more alternative paths that lead to knowledge sharing than to its absence. The findings also show that only the older organizations in the STP abstain from knowledge sharing.

The next sections are as follows: The next section contains the literature review on knowledge sharing, knowledge mechanisms and STPs. The following section presents the methodological procedures adopted in this research, and in the next, we analyze the data and discuss the results. The concluding section contains a discussion of the results and the study's limitations, implications and suggestions.

Knowledge sharing in a science and technology park: the use of knowledge mechanisms

Knowledge is a rationalistic entity and is a process (Hannabuss, 2001) that combines information with experience, context, interpretation and reflection (Davenport *et al.*, 1998). It is "the understanding, awareness, or familiarity acquired through study, investigation, observation, or experience over the course of time" (Bollinger and Smith, 2001, p. 9). Knowledge exists at all organizational levels and is an intangible that is very difficult to imitate (Alavi and Leidner, 2001; Wasko and Faraj, 2005). Knowledge pertinent on organizations can be of two types: managerial, regarding functional areas such as sales or human resources (Gomes *et al.*, 2018); and technical, related to the core of the company, such as project details, scope, requirements, lessons learned, technological details, product or services development (Joe *et al.*, 2013; Gomes *et al.*, 2018; Steffen, Oliveira and Balle, 2017). Knowledge can come from different sources, such as the employees of the organization, the customers and the suppliers (Darroch, 2003). Organizations can use knowledge to differentiate itself with aggregate value in today's globalized market, developing exclusive, complex and innovative products and solutions (Raudeliūnienė *et al.*, 2016). Therefore, organizations need to have well-developed knowledge management: a series of processes that take place in organizations (Bagnoli and Roberts, 2013) with the objectives of increasing competitive advantage (Schultze and Leidner, 2002). Organizational knowledge strategies and competitive strategies should be aligned to achieve the best fit and pursue the best results (Bagnoli and Giachetti, 2015).

Knowledge management is the process of managing the intangible assets of an organization to create value (Chiu and Chang, 2009). Knowledge management is composed by several stages (Davenport and Prusak, 1998; Lee and Yang, 2000): knowledge creation, knowledge storage and recovery, knowledge sharing and knowledge application (Alavi and Leidner, 2001; Heisig, 2009). Several authors point to knowledge sharing as the most important part of knowledge management (Naim and Lenkla, 2016; Ramayah *et al.*, 2013; Razezadeh and Khalili, 2016a, 2016b; Velmurugan *et al.*, 2010). Knowledge sharing is a process where units influence each other through their experiences (Argote and Ingram, 2000), exchanging tacit and/or explicit knowledge (Cavaliere *et al.*, 2015). The origin and destination of knowledge can be in the same organization (intra-organizational knowledge sharing) or in different organizations (interorganizational knowledge sharing). Interorganizational knowledge sharing involves two or more organizations that can be from the same branch, from complementary branches or even competing organizations (Lawson *et al.*, 2009). Companies that have

access to a large breadth of heterogeneous external knowledge sourcing tend to have greater product innovation (Ardito and Petruzzelli, 2017).

Organizations should create mechanisms to encourage employees to share their knowledge because of the importance of knowledge sharing for organizational results, (Alavi and Leidner, 2001; Cummings, 2004). Mechanisms are processes, methods, procedures or any deliberate interventions that organizations provide to employees to stimulate and facilitate knowledge sharing (Chai *et al.*, 2003; Oliveira *et al.*, 2014). These mechanisms can involve technology (also called tools), be completely non-technology (also called practices) or involve both technology and non-technology (Bollinger and Smith, 2001; Centobelli *et al.*, 2018a, 2018b). Some mechanisms for knowledge sharing identified on the literature are e-mail, social network, systems, meetings, trainings, telephone, contracts, informal conversations, communities of practice, etc. (Andreeva and Sergeeva, 2016; Centobelli *et al.*, 2018a, 2018b; Fisher *et al.*, 2018; Larkin, 2014; Olaisen and Revang, 2017; Ravindran and Iyer, 2014; Steffen *et al.*, 2017; Tan and Thai, 2014; Wiewiora *et al.*, 2014). Although all the aforementioned mechanisms can be used to both on intra or inter-organizational knowledge sharing, in inter-organizational relationships, meetings, work groups and events with the participation of all the organizations that are part of the process are considered some of the good ways of sharing knowledge (Lawson *et al.*, 2009).

Inter-organizational knowledge sharing reflects the social network theory in action: firms represent the nodes within the system, whereas knowledge sharing flows provide the ties to the system (Baggio and Cooper, 2010). Such structure creates the inter-organizational knowledge network and influences firms' performance (Dong and Yang, 2016; Wang, Chen and Fang, 2018). Knowledge sharing can lead to knowledge spill overs and leakages, especially in contexts where there is a high degree of knowledge similarity, cooperation and coopetition (Ahmad *et al.*, 2014). These accidental knowledge spill overs can impair innovative capabilities and damage the competitive advantage and performance of organizations (Estrada *et al.*, 2016; Lhuillery and Pfister, 2009; Nieto and Santamaría, 2007). Therefore, protection is important to secure the interests, creativity, legal rights and patents of the knowledge's owners (Lee and Yang, 2000). Knowledge protection is an organizational capability that enhances the competitive advantage of the organization through formal or informal mechanisms to protect innovation against imitation (Lee *et al.*, 2007; Hurmelinna-Laukkanen, 2011). Some organizations implement processes, structures or use of some mechanisms to help secure their knowledge sharing, especially in inter-organizational contexts (Charterina *et al.*, 2017; Flores *et al.*, 2014). Formal mechanisms of knowledge protection (contracts, patents, industrial designs, trademarks, and copyrights) are especially important in cooperation and coopetition settings (Ahmad *et al.*, 2014; Charterina *et al.*, 2017; Estrada *et al.*, 2016).

The context in which the knowledge is shared is important (Grover and Davenport, 2001), and some environments can stimulate knowledge sharing or protection behaviors, making contingencies of inter-organizational knowledge sharing relevant to address (Loebbecke *et al.*, 2016). A context that is linked to knowledge sharing, cooperation and coopetition are STPs. STPs are an area of innovation that emerged in the 1950s at Stanford University in California (Basile, 2010). The idea was to place organizations in a geographic area close to the university with the aim of fostering relationships with organizations to encourage innovation (Ismail and Sarif, 2006). The initiative to bring the organizations closer to the universities has spread, and today, STPs are a reality in many countries (Koh *et al.*, 2003) that contributes to the development of the economy (Link and Scott, 2007). STPs are knowledge-intensive environments with a dual nature that foster research and support new firms while having a network like a business structure (Romano, Catalfo and Nicotra, 2014). The network of contacts and relationships created from the installation of an organization in an STP contributes decisively to the development of the organization itself (Lindelof and Lofsten, 2002). STPs stimulate knowledge sharing among companies and universities

(Vedovello *et al.*, 2006), being a way to fulfill the university's "third mission" to disseminate knowledge to society (Aragonés-Beltrán *et al.*, 2017). Further, universities with a higher number of strong inter-organizational ties have a greater knowledge mobility in terms of capability to establish collaborative R&D relationships, which can bring benefits both to the university and to the partners (Petruzzelli *et al.*, 2010).

STPs facilitate the access to an innovation ecosystem and encourage the development of knowledge-based business by fostering a collaborative environment (Martins, 2016). Companies that are part of a network perform more exploration and exploitation of knowledge (Agostini *et al.*, 2017; Nicotra *et al.*, 2014) because the creation of bilateral ties facilitates knowledge sharing and the mutual stimulation of the network firms (Nicotra, Romano and Del Giudice, 2013). The work of Westhead and Storey (1995) shows that the geographical proximity between organizations and universities is the most important factor in deciding to host an organization in an STP. One reason for that importance is that collaborations between universities and companies can promote the creation of partnerships to leverage the joint development of new technologies and innovative solutions (Petruzzelli, 2011). Although proximity is an important factor, this closeness between organizations is not enough for knowledge sharing take place among STP organizations (Albahari *et al.*, 2013). In STPs, more than 70 per cent of the companies engage in inter-organizational knowledge sharing, and this number tends to grow if there is a greater amount of organizations from the same industry located on the same park (Koçak and Can, 2014).

One of the functions of the STP management (STPM) is to promote interactions between the STP members (Mian, 1996). The STPM should be the link between the organizations and the university by identifying the needs of the former and seeking to find the resources they need from other organizations in the STP or the university (Bellavista and Sanz, 2009). Knowledge sharing happens when the barrier of mistrust between the parties is overturned (Isabelle, 2013). Thus, another function of the STPM is to organize formal and informal events to bring together and generate trust between people (Cooper *et al.*, 2012). These events form the networks of relationships that are the basis for the sharing of knowledge between organizations in the STP (Koçak and Can, 2014; Steffen *et al.*, 2017).

The benefits that a firm can gather by being located on an STP are not static: they evolve over time and are dependent on the age of the organization on the SPT. Young organizations benefit from knowledge spillovers on the STP, have more interest in learning and have more flexibility to incorporate changes, which impact positively in their capacity to grow and innovate (Diez-Vial and Fernádez-Olmos, 2017; McCann and Folta, 2011). Older organizations, on the other hand, find more difficulty to introduce new products and processes, and the proximity of other organizations that might be rivals make them fear knowledge spillovers, so it can result in an impairment on knowledge sharing (Diez-Vial and Fernández-Olmos, 2017; McCann and Folta, 2011).

Method

The first methodological step of this research was a structured literature review. A search was made in the Web of Science database with the terms "knowledge sharing" AND ("mechanisms" or "science and technology parks") in the abstracts of articles published between 2014 and 2018 to identify articles with the current state on the topic of research. A total of 93 articles were identified. The abstracts of the identified articles were read, some articles were excluded because their subject was not according to the subject of this study. After that, 58 articles were added through references. With this, 86 articles were analyzed for the literature review.

In the empirical part of the analysis, this research adopts a qualitative approach by using a fuzzy set qualitative comparative analysis (fsQCA) that Ragin (1987, 2000, 2008) developed

to analyze complex causality through the identification of the sufficient and necessary conditions for the occurrence of a phenomenon. According to the configuration theory, there are combinations of causal conditions that lead to the outcome, which in this case is interorganizational knowledge sharing: those are the causal configurations. The fsQCA technique is based on Boolean logic, respecting the logical combination of conditions after considering alternatives for objective analysis of selected cases (Freitas and Neto, 2014). fsQCA exceeds previous versions (crispy-set QCA and multi-value QCA) because it considers causal conditions calibration based on the degree of membership rather than on categorical memberships (Roig-Tiernoa et al., 2017). Using fsQCA detects the causal configurations leading to the presence or absence of the outcome, which is an improvement compared to traditional quantitative statistical methods that merely deliver an estimated solution to the outcome (Rihoux and Ragin, 2009). On the contrary, the fsQCA (Fiss, 2011) accepts that more than one combination leads to the outcome (and also to its absence); alternative combinations can produce the same outcome (equifinality); and causal conditions of the outcome can differ from causal conditions of its absence.

The fsQCA identifies alternative combinations of causal conditions that lead to an outcome. Causal configurations reflect nonlinear relations of conditions leading to an outcome. Causal configurations exceeding the cut-off consistency score are categorized as sufficient; on the other hand, causal configurations not respecting such cut-off value are not considered sufficient (Schneider et al., 2010). To address the sufficiency of the causal configurations, we use the analysis of the truth tables respecting the thresholds for raw consistency (0.80) (Ragin, 2006). This study addresses two outcomes: the sharing of managerial knowledge and technical knowledge. The causal conditions used to identify pathways that lead to these outcomes (as well as their absence) are knowledge sharing mechanisms and the organization's age. The conditions are the following:

■ Managerial knowledge sharing regards the extent to which organizations share their management related knowledge.

■ Technical knowledge sharing regards the extent to which organizations share their technical knowledge.

■ Technological mechanisms are the extent to which organizations share their knowledge using technological mechanisms.

■ Social mechanisms are the extent to which organizations share their knowledge using social mechanisms.

■ Documental mechanisms regard the extent to which organizations share their knowledge using documental mechanisms.

■ Events are the extent to which organizations share their knowledge using events.

■ Youth of organizations regards the date the organizations started operating in the STP.

Other conditions were tested (e.g. organizational characteristics like the existence of venture capital or not, being a resident in the park or not, being incubated or not), but they did not contribute to acceptable solutions respecting consistency and coverage thresholds; as a result, they were not considered in the final solutions presented in the study.

The data came from 51 semi-structured interviews with managers of organizations in an STP in southern Brazil. The STP is focused on IT, engineering, energy and health business areas and holds four types of organizations: incubated, graduated, resident and entities. Incubated are small organizations supported by the STP that provides help to face the market by themselves. Such help includes low-cost leased space, mentoring in a variety of areas and assistance in accessing potential clients. After the maximum of two years, the companies graduate from incubation and can decide whether to stay in the STP or leave. The ones that decide to stay are classified as graduated organizations. Residents are

organizations that started their activities outside the STP and then moved into the park. Finally, entities are nonprofit organizations that are headquartered in the STP and provide training or represent and assist organizations within and outside the STP. The STPM entity provided the names and contact information of the managers of the STP organizations. All the 81 organizations in this STP were invited to participate in the survey, and 51 accepted: 17 incubated organizations, 6 graduated organizations, 23 resident organizations and 5 entities. There are companies in the park with two people and others with thousands of employees.

The interviews were based on a script aimed at uncovering the type of knowledge shared among the organizations and the mechanisms they used to share such knowledge. The managers were asked if the organization shares knowledge with other organizations in the STP and what kind of knowledge the organization shares with other organizations in the STP. The interview guide used a set of questions based on Nonaka and Takeuchi (1995), Gomes et al. (2018), Joe et al. (2013) and Carmeli et al. (2013). The interview questions also covered the activities done and technologies used by the organizations to share knowledge with other organizations in the STP. These questions were based on Alavi and Leidner (2001), Bartol and Srivastava (2002), Chai et al. (2003), Cummings (2004), Carmeli et al. (2013) and De Long and Fahey (2000). The interviews were recorded with the permission of the managers and later transcribed. Interviews lasted 33 min on average. The transcripts served as a database for the study. The interviews provided data that aligned with the conceptual associations in the literature review. Appendix synthetizes the data from the organizations and the interviews. The transcriptions were analyzed according to the thematic content analysis technique, as described by Bardin (1977), and used MaxQDA software.

Qualitative data from the interviews were transformed into conditions and organized in a table. Each line represents an organization, and each column indicates the year that the organization started operating in the STP, the absence or presence of the knowledge sharing types and the absence or presence of the sharing mechanisms for the analyzed organization. The fsQCA requires the calibration of the conditions into values between 0 and 1, with 0 being full non-membership in the group and 1 being full membership (Ragin, 2008; Crilly et al., 2012). The calibration procedure implies theoretical and empirical knowledge on the analyzed variables (Ragin, 2008) and so we have done. This work adopts the indirect method of calibration that "relies on the researcher's broad groupings of cases according to their degree of membership in the target set" (Ragin, 2007, p. 4). To do so, both the outcomes (the types of knowledge shared) and the conditions (knowledge sharing mechanisms and the youth of the organization on the STP) were grouped into categories and data were calibrated. The calibrated data were analyzed by using fs/QCA 2.5 software (Ragin et al., 2006).

Details about the data, calibration and interpretation are presented on Table I.

Figure 1 shows a flowchart of all the methodological steps adopted in the study.

Analysis

To start, we examined the transcriptions of the interviews with a thematic content analysis. This step was necessary to uncover the types of knowledge and the mechanisms through which the organizations shared them. After this examination, we identified two different knowledge types: managerial knowledge (e.g. knowledge on call notices, product management, general management and opportunities) and technical knowledge (e.g. knowledge about process, product and services and technical knowledge in general), following the knowledge types indicated by Gomes et al. (2018). Regarding the sharing mechanisms, the analysis identified both technological and non-technological mechanisms, as previously defined by the literature (Bollinger and Smith, 2001; Centobelli, Cerchione and Esposito, 2018a, 2018b). So, the first group obtained by selective analysis was:

Table I Data details, calibration and interpretation

Outcomes and conditions	Calibration	Interpretation
Youth (youth)	1 = 2014 0,75 = 2013 0,5 = 2011-2012 0,25 = 2007-2010 0 = 2003-2006	youth = new firm on the STP ~youth = old firm on the STP
Managerial Knowledge Sharing (mks)	1 = shares 1 or more types of managerial knowledge 0 = does not shares managerial knowledge	mks = shares knowledge about management practices ~mks = does not share knowledge about management practices
Technical Knowledge Sharing (tks)	1 = shares 1 or more types of technical knowledge 0 = does not shares technical knowledge	tks = shares technical knowledge ~tks = does not share technical knowledge
Technological mechanisms (tm)	1 = uses 1 or more technological mechanisms 0 = does not uses technological mechanisms	tm = uses technological mechanisms to share knowledge ~tm = does not use technological mechanisms to share knowledge
Social mechanisms (sm)	0 = does not uses social mechanisms 0,5 = uses 1 social mechanisms 1 = uses 2 or more social mechanisms	sm= uses social mechanisms to share knowledge ~sm = does not use social mechanisms to share knowledge
Documental mechanisms (dm)	0 = does not uses documental mechanisms 0,5 = uses 1 documental mechanisms 1 = uses 2 or more documental mechanisms	dm = uses documental mechanisms to share knowledge ~dm = does not use documental mechanisms to share knowledge
Events mechanisms (em)	0 = does not uses events mechanisms 0,33 = uses 1 event mechanism 0,66 = uses 2 events mechanisms 1 = uses 3 or more events mechanisms	em = uses events mechanisms to share knowledge ~em = does not use events mechanisms to share knowledge

Figure 1 Flowchart of the methodological steps
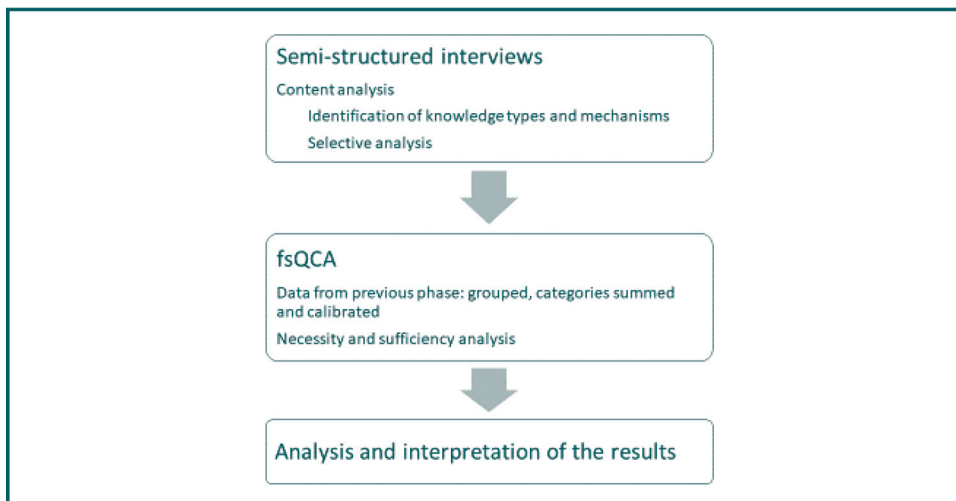
- technological mechanisms, such as sharing via email, electronic folder, social network, organizations' websites, system and incubator website; many non-technological mechanisms were identified, so we grouped them into three categories by using a selective analysis;

- social mechanisms, regarding all mechanisms with direct human interaction, such as lunches, coffee breaks, telephone calls, STP tour, organizations' workshops, card exchange and file exchanges;

- documental mechanisms, regarding mechanisms in an explicit, written and well-defined form, such as sharing business contracts, confidentiality contracts, agreements, documents, newsletters and proposals; and

- events, mechanisms that require previous organization and the meeting of larger number of people, such as sharing STP coffee meetings, incubator training, entity training, STP training, talks, incubator meetings and other meetings.

Other mechanisms identified on the literature, such as communities of practice, were not cited on the interviews and therefore are not part of the categories analyzed in this study. We then calibrated the data based on how many types of knowledge and what mechanisms each organization used. Table II provides examples of excerpts to justify the calibration of both the outcomes and the mechanisms.

After the completion of the calibration, we used the fsQCA to analyze the data. Causal conditions are assessed for necessity and sufficiency. The causal condition's degree of necessity indicates the degree to which that condition is necessary to achieve the outcomes (Fiss *et al.*, 2013). For a condition to be necessary, it should present a consistency score that exceeds the threshold of 0.90 (Rihoux and Ragin, 2009). As no condition has a score above 0.9, there are no necessary conditions for any of the outcomes: managerial knowledge sharing or technical knowledge sharing.

We report the solutions that present the causal configurations that lead to the outcomes (Tables II and IV) and the causal configurations that lead to the absence of the outcomes (Tables III and V). Following best practice, we report the core and peripheral conditions: core conditions are in parsimonious and intermediate solutions, while peripheral conditions are only part of intermediate solutions (Fiss, 2011; Fiss *et al.*, 2013; Ragin, 2008). There are 32 different combinations of logical remainders allowed by the variables in the study. There are only 12 combinations present in each of the truth tables for each outcome.

Table II	Examples of excerpts that support the calibration	
Outcomes and conditions	*Calibration*	*Examples*
Managerial knowledge sharing (mks)	1	Firm 32: "Yes, it would be in that sense . . . Especially when it has some *call notice* of innovation"
	0	Firm 11 does not have excerpts for management knowledge
Technical Knowledge Sharing (tks)	1	Firm 34: "So the firms end up talking, knowing a little more about their *products* and *services*, and . . . arising some idea of development, research or a project between firms of the STP"
	0	Firm 3 does not have excerpts for technical knowledge
Technological mechanisms (tm)	1	Firm 18: "Ah, sometimes we use *email* . . . or even *Facebook chat* because of the distance"
	0	Firm 8 does not have excerpts for technological mechanisms
Social mechanisms (sm)	1	Firm 29: "There are *lunches, coffee breaks*, encounters here" "I think we consume a lot of the *newsletters* they send"
	0,5	Firm 37: "I always respect the channel that the person chose, if he *calls* me, I'll answer him on the *phone*"
	0	Firm 28 does not have excerpts for social mechanisms
Documental mechanisms (dm)	1	Firm 31: "When it is a project, we work with all the *documentation*, formalization" "I think we consume a lot of the *newsletters* they send"
	0,5	Firm 16: "no, no, we have a *contract*"
	0	Firm 13 does not have excerpts for documental mechanisms
Events mechanisms (em)	1	Firm 36: "With the STP firms we interact . . . on the *events from the STP* and the incubator" "We participated on the *STP trainings* and *incubator trainings*"
	0,66	Firm 5: "The *incubator meeting* and the *STP coffee meeting* are examples of activities that had the intention to promote this talk . . ., to foment the exchange of ideas"
	0,33	Firm 10: "We had some *meetings organized by the STP*"
	0	Firm 12 does not have excerpts for events mechanisms

Table III Causal configurations leading to managerial knowledge sharing

						coverage		consistency
				$mks = f(youth, tm, sm, dm, em)$				
Config	youth	tm	sm	dm	em	raw	unique	
1	●	○	●	○	°	0.083333	0.083333	0.846154
2	○	●	●	○	●	0.095455	0.095455	0.926471
3	●	●	°	●	●	0.035152	0.035152	1.000000
4	○	○	°	●	°	0.020303	0.020303	1.000000

Solution coverage: 0.234242
Solution consistency: 0.911557

Notes: Youth = youth of firm considering date of establishment, tm = the use of technological mechanisms, sm = the use of social mechanisms, dm = the use of documental mechanisms, em = the use of events mechanisms; full black circles (●) indicate the presence of a condition, and white center circles (°) indicate its absence. Large circles indicate core conditions, and small circles indicate peripheral conditions. Blank spaces indicate the condition does not contribute to the configuration

The following are the interpretations of Tables III-VI: the consistency shows how much the organizations that share a combination of conditions agree in the outcome (Ragin, 2008), and the coverage reflects the degree to which the variation in the outcome is explained by a condition or a combination of conditions (Ragin *et al.*, 2006). All the configurations (and their reported intermediate solutions) regarding the presence (or absence) of the outcomes in this study present consistency levels above the 0.80 threshold suggested by Ragin (2008), Crilly (2011) and Fiss (2011).

Table IV Causal configurations leading to technical knowledge sharing

						coverage		consistency
				$tks = f(youth, tm, sm, dm, em)$				
Config	youth	tm	sm	dm	em	raw	unique	
1	●	●	°	●	●	0.050435	0.050435	1.000000
2	○	○	°	●	°	0.029130	0.029130	1.000000

Solution coverage: 0.079565
Solution consistency: 1.000000

Notes: Youth = youth of firm considering date of establishment, tm = the use of technological mechanisms, sm = the use of social mechanisms, dm = the use of documental mechanisms, em = the use of events mechanisms; full black circles (●) indicate the presence of a condition, and white center circles (°) indicate its absence. Large circles indicate core conditions, and small circles indicate peripheral conditions. Blank spaces indicate the condition does not contribute to the configuration

Table V Causal configurations leading to the absence of managerial knowledge sharing

						coverage		consistency
				$\sim mks = f(youth, tm, sm, dm, em)$				
Config	youth	tm	sm	dm	em	raw	unique	
1	○	○	°	°	°	0.138889	0.138889	1.00000

Solution coverage: 0.138889
Solution consistency: 1.00000

Notes: Youth = youth of firm considering date of establishment, tm = the use of technological mechanisms, sm = the use of soical mechanisms, dm = the use of documental mechanisms, em = the use of events mechanisms; white center circles (°) indicate the absence of a condition. Large circles indicate core conditions, and small circles indicate peripheral conditions. Blank spaces indicate the condition does not contribute to the configuration

Table VI	Causal configurations leading to the absence of technical knowledge sharing							
				$\sim$tks = f(youth, tm, sm, dm, em)				
Config	youth	tm	sm	dm	em	coverage		consistency
						raw	unique	
1	O	O	°	°	°	0.089286	0.089286	1.000000

Solution coverage: 0.089286
Solution consistency: 1.000000

Notes: Youth = youth of firm considering date of establishment, tm = the use of technological mechanisms, sm = the use of social mechanisms, dm = the use of documental mechanisms, em = the use of events mechanisms; white center circles (°) indicate the absence of a condition, and all conditions are core conditions. Blank spaces indicate the condition does not contribute to the configuration

Table III presents the four alternative configurations that lead to managerial knowledge sharing, which means that there are four different pathways managers use to share managerial knowledge among organizations at the STP. Likewise, Table IV presents the two alternative configurations that lead to technical knowledge sharing.

The findings show that younger organizations on the SPT share managerial knowledge by using social mechanisms. These mechanisms provide a way to share tacit knowledge in quick interactions (such as lunches and coffee breaks) in a personal and favorable way (Path number 1 in managerial knowledge sharing – Table III). Further, younger organizations might not feel a need to protect such knowledge because of its lack. Younger organizations are inclined to seek for more knowledge with other organizations on the STP (Diez-Vial and Fernández-Olmos, 2017), and it is natural that younger organizations search for knowledge to learn about new opportunities or simply better ways to manage themselves or products. This is probably the reason why younger organizations use technological mechanisms, documents and events to share knowledge with other organizations in the STP and to amplify their own knowledge base (Path number 3 in managerial knowledge sharing – Table III). Younger organizations also have a choice to make regarding alternative ways to share managerial knowledge: either using social mechanisms or an alternative combination of three other mechanisms. However, social mechanisms are the more common option; thus, young organizations can benefit more from being socially active in the STP.

By contrast, older organizations can use their larger knowledge stock and structure to share managerial knowledge through different mechanisms: technological, social and events (Path number 2 in managerial knowledge sharing – Table III). Older organizations should have a large network of partnerships, and thus, they may want to protect their knowledge from partners. Thus, older organizations might opt to use only documental mechanisms (Path number 4 in managerial knowledge sharing – Table III) that are very formal and structured. This result is in line with previous studies that show that organizations pursue knowledge protection when the contexts are similar and when they experience coopetition like in the STP (Diez-Vial and Fernández-Olmos, 2017; Vedovello, Judice and Maculan, 2006). In such environments, formal mechanisms to protect knowledge are the most common (Charterina et al., 2017; Estrada et al., 2016; Rivette and Kline, 2000). Older organizations also have a choice to make regarding alternative ways to share managerial knowledge: either using documental mechanisms or an alternative combination of three other mechanisms. The documental mechanisms are the more common option; thus, older organizations should opt to share managerial knowledge in a very formal and impersonal way, which is also in line with literature (Charterina et al., 2017; Diez-Vial and Fernández-Olmos, 2017).

Regarding technical knowledge, the two paths for sharing this type of knowledge are the same as Paths 3 and 4 for managerial knowledge, that is, the organizations benefit from two common pathways. Technical knowledge is closely related to greater value added and the

sustainability of a competitive advantage, as it is related to the development of new products, and services, and also to the lessons learned and refinements of technical projects (Gomes *et al.*, 2018; Steffen *et al.*, 2017). Thus, younger organizations naturally do not share their technical knowledge lightly through social mechanisms. As a result, they opt to share it through technological, documental and event mechanisms (Path 1 in knowledge sharing – Table IV). Older organizations, on the other hand, share such knowledge only by using documents (Path number 2 in technical knowledge sharing – Table IV), which are formal mechanisms (Charterina *et al.*, 2017; Estrada *et al.*, 2016; Rivette and Kline, 2000). The reasoning is that more experienced organizations tend to protect their most valuable knowledge and share it only when it is essential (Diez-Vial and Fernández-Olmos, 2017); therefore, they use a structured way to share it (general documents and newsletters). Typically, older organizations then require some written guarantees that establish the role of each party involved in the sharing process with the objective to avoid spill overs – with business contract, confidentiality contract, agreement and proposal, as identified on the literature (Charterina *et al.*, 2017).

The solution in Table IV also shows an interesting phenomenon regarding technical knowledge sharing: neither younger nor older organizations use social mechanisms to share this type of knowledge. Social mechanisms deal basically with tacit knowledge, which leaves little room for sharing a more explicit knowledge; the lack of use of this kind of mechanism for sharing technical knowledge is not surprising. Technical knowledge demands some structure to be shared, because it is mainly explicit knowledge. Documents are explicit by nature, although a formal structure is not necessarily needed to share technical knowledge. Technological mechanisms are used by organizations to deal with explicit knowledge (Oliveira *et al.*, 2014), and events can use demonstrations, presentations, cases studies and other tools to help the externalization and combination of this knowledge.

Table V presents the single configuration that leads to the absence of managerial knowledge sharing, which means that there is only one pathway that managers can follow that prevents them from sharing managerial knowledge with organizations in the STP. Similarly, Table VI presents the sole configuration that leads to the absence of technical knowledge sharing.

The results show that only older organizations opt not to share managerial or technical knowledge. In both cases, organizations that do not share knowledge (Tables V and VI) do not use any mechanism. This result agrees with the literature, which says that mechanisms are necessary for knowledge to be shared effectively (Alavi and Leidner, 2001; Chai *et al.*, 2003; Cummings, 2004) and that older organizations tend to avoid knowledge sharing in STP to avoid spill overs (Diez-Vial and Fernández-Olmos, 2017). As younger organizations do not follow such pathways, it seems they recognize the relevancy of sharing knowledge to develop and progress.

Further, the organizations in the STP have four alternative pathways to share managerial knowledge and two alternative ones that lead to sharing technical knowledge. These pathways mean that organizations have options for engaging in mutually beneficial interorganizational knowledge sharing. Such good news should motivate managers. Regarding the pathways that lead to the absence of knowledge sharing, there is a single option: abstaining from any use of knowledge sharing mechanisms. The organizations that do not share their knowledge in the STP are the older ones – the younger organizations do not use such a path, so they seem to really engage in knowledge sharing.

Conclusion

This study examines the combinations of mechanisms that lead to interorganizational knowledge sharing in STPs. It focuses on the paths that lead to managerial knowledge sharing and technical knowledge sharing among organizations in an STP. There are

more alternative configurations that lead to managerial knowledge sharing than lead to technical knowledge sharing. Further, the two configurations for technical knowledge sharing also exist for managerial knowledge sharing. These two pathways are used to share both types of knowledge (Paths 3 and 4 in Table III and Path 1 and 2 in Table IV). As a result, such pathways lead to knowledge sharing regardless of the type of knowledge that is involved. However, there are two more paths by which to share managerial knowledge than to share technical knowledge, that is, there are more possibilities of sharing managerial knowledge than technical knowledge. In addition, all the consistency indexes are highly consistent, which provide ample support for the conclusions (Ragin, 2007).

There is only one path that leads to the absence of knowledge sharing for both cases (Tables V and VI). This path involves the complete absence of sharing mechanisms (a result that finds direct support from theory). Although this result may seem obvious, it is only possible to report due to the qualitative comparative approach taken in the study that enables us to offer the pathways to the absence of the outcomes. Most empirical research following traditional quantitative statistical methods only provides the estimated solutions to the dependent variables (Rihoux and Ragin, 2009). By developing this analysis, a validation of the literature *a contrario sensu* is delivered. These findings raise the issue of older organizations' survival in the STP. How are older organizations going to survive if they are the only ones not sharing knowledge? By contrast, younger organizations have no available pathways that lead to the absence of knowledge sharing. The results paint an optimistic picture of potential development, growth and subsistence of younger organizations.

Theoretical implications

The research findings contribute to further expand the literature on the knowledge-based theory of the firms by integrating the social network theory perspective and offering evidence on the use of inter-organizational knowledge networks (Baggio and Cooper, 2010; Dong and Yang, 2016; Wang, Chen and Fang, 2018). Such contribution is made within a knowledge-intensive context, where such phenomenon is relevant to address (Loebbecke *et al.*, 2016). The inter-organizational dimension of knowledge sharing shapes the addressed knowledge network in an STP. The nodes in the network represent the firms in the park, whereas the ties or links between them are based on the conditions adopted in the study, the use of the different mechanisms. Such interactions result in two types of knowledge sharing among firms – the managerial and the technical knowledge.

This study's main contribution regards the disclosure of the complexity of inter-organizational knowledge sharing regarding the nodes and ties in knowledge networks: there are differences among patterns of knowledge sharing regarding the type of knowledge in the ties, and there are different profiles in the firms that share their knowledge. Regarding the ties in the knowledge network, there are more alternative pathways to share managerial knowledge than to share technical knowledge, which reflects a hierarchy of knowledge value, and thus, knowledge protection, as a result technical knowledge, is less shared. The theoretical contribution on the network ties respects the more numerous links based on managerial knowledge sharing than technical knowledge sharing. Regarding the nodes in the knowledge network, the younger firms differ from the older ones in the mechanisms used to share knowledge, even though they may use the same configurations to share the two types of knowledge. Younger firms at the STP share their knowledge using several mechanisms, whereas older firms at the STP opt to share their knowledge exclusively using documental mechanisms. The theoretical contribution on the network nodes regards the dependency of older firms on documental mechanisms to share their knowledge.

Regarding the nodes that are not connected through ties or links in the knowledge network (firms that do not share knowledge), there is a single and common profile to the ones that do not share managerial knowledge and technical knowledge: they are older at the STP and do not use any kind of addressed mechanism. Such evidence contributes to social network theory on the absolute dependency of mechanisms' use to establish a tie or link at the knowledge network. Considering the unconnected nodes in the knowledge network are the older firms in the park, our results contribute to question the dynamic capabilities building over time. Older firms should have developed capabilities to keep them connected, particularly when the study takes place in a knowledge-intensive context; thus, the theoretical debate is inevitable.

This study proposes theoretical advances on the phenomenon of sharing the strategic organizational resource that is knowledge (Alavi and Leidner, 2001; Naim and Lenkla, 2016). As firms pursue new knowledge to support both efficiency and effectiveness in reaching new markets (Villar *et al.*, 2014), having alternative combinations of mechanisms to share knowledge among STP members is beneficial (Cummings, 2004; Wang *et al.*, 2008). Having more alternatives to share knowledge than to abstain from sharing is a clear validation of previous literature establishing STPs as contexts of cooperation (Montoro-Sánchez *et al.*, 2011; Martins, 2016) where knowledge sharing is encouraged (Bellavista and Sanz, 2009). With regard to having more alternatives leading to managerial knowledge sharing than to technical knowledge, sharing may illustrate that STPs help to disseminate the knowledge (Aragonés-Beltrán *et al.*, 2017), however in different degrees: we propose it is easier to share managerial knowledge than technical one. Regarding the issue of firm age influence over knowledge sharing, our study shows older companies are the ones in the configurations leading to the absence of knowledge sharing confirming prior work (Diez-Vial and Fernández-Olmos, 2017), and it also expands previous literature because we propose that both young and old firms in the STP present similar number of alternative choices to share knowledge (either managerial or technical). A final original theoretical contribution regards the configurations that involve combinations of mechanisms used in knowledge sharing (managerial and technical) extending preceding research (Centobelli *et al.*, 2018a, 2018b; Fisher *et al.*, 2018; Olaisen and Revang, 2017; Steffen *et al.*, 2017; Tan and Thai, 2014).

Practical implications

This research provides managerial contributions: it offers detailed results about inter-organizational knowledge sharing in an STP; it provides alternative combinations of mechanisms that lead to managerial knowledge sharing and technical knowledge sharing; it presents the pathways leading to the absence of managerial knowledge sharing and technical knowledge sharing; and it identifies the practice of knowledge protection by older organizations in the STP. These results should be used as a way to align knowledge strategies and competitive strategies, especially in medium and large firms that could lack interactions between the segments (Bagnoli and Giachetti, 2015).

Results help managers of organizations that are in STPs to choose the combinations of mechanisms to boost their knowledge sharing or to prevent them from doing so. The results can be also used by STPs and governments to support the competitiveness of local systems and individual companies by encouraging and fomenting the use of inter-organizational knowledge sharing mechanisms, as development of knowledge sharing capabilities can contribute simultaneously to different types of performance of individual firms and local systems.

The results can be seen as a diagnostic for STPMs, which fosters the knowledge sharing among companies in the park, to dedicate special attention to older companies, because

the lack of knowledge sharing can hurt the innovation ecosystem that attracts many companies to STPs, a result that is aligned with Martins (2016). It has already been demonstrated that older firms gather less benefits from being in an STP (Diez-Vial and Fernández-Olmos, 2017), and that some companies seek knowledge protection in coopetition environments by using formal mechanisms (Charterina, Basterretxea and Landeta, 2017; Vedovello et al., 2006). The results of this research show that older companies can also be absent on inter-organizational knowledge sharing (which is one of the strategic pillars of STPs) added to the concerns identified on the literature and the following questions are raised:

■ What are the advantages for older companies to be located on the STP?

■ What are the advantages for the STP to host older companies?

These questions can lead to strategic changes on older companies and to changes on STP policies – by stablishing activities that can stimulate the inter-organizational KS of older companies and bring advantages to all involved parts (STP, the organizations and university, if that is the case). The management of the STP should have policies to strengthen the relations of the companies located there, creating trust among its employees (Bellavista and Sanz, 2009). Hold work events that bring together companies of all sizes and segments. Creating areas of common use such as a cafeteria or a maker space, stimulating informal meetings promoting lunches, sporting or cultural events are also ways to create and strengthen relationships (Basile, 2010).

The ecosystem of an STP provides business advantages. Being physically close to other companies contributes to knowledge sharing (Vedovello et al., 2006). In addition, parks associated with universities provide skilled employees, as well as access to teachers, researchers, laboratories and libraries. Companies can also associate their name with the university name to gain prominence with their markets and customers (Albahari et al., 2013). The older and the younger companies can get benefits from the STP, but in different levels. Also, maybe outside the STP, the older companies could be even more protective of their knowledge.

Limitations and future directions of research

Several limitations apply to this study. Given the qualitative nature of the research, it prevents generalization of results, although the study may be replicated in other settings. Second, the study was carried out at a single STP, which may reflect idiosyncratic characteristics of the park and the involved firms. Third, there are other causal conditions that could have been considered in the study – such as the kind of competition between organizations, the number of partners or the type of capital – but because some organizations preferred not to provide more complete data, we were only able to address a limited number of conditions. Fourth, we must acknowledge national cultural influences, and thus, we must recognize that results may reflect Brazilian national values in social organizational behavior. Last, the centrality of the firms in the inter-organizational knowledge network was not addressed and, so its relevancy to inter-organizational knowledge networks dynamics was not assessed.

The results show that there are more paths leading to knowledge sharing than to its absence; this result is possibly due to research taking place at an STP, which is a knowledge-intensive environment. Considering the setting for research, next steps in research could explore knowledge sharing between organizations from different STPs. Additionally, future advances of this study could replicate this research in other kind of environments. Considering the methods applied, future studies could develop multiple case studies and combine mixed-methods approaches for more complete results. Moreover, future longitudinal analysis can be useful to clarify how are the inter-organizational

knowledge networks structured among organizations in different contexts (both STP or not) and how do they evolve over time. We also invite quantitative approaches using surveys and structural equations analyses to test our results. Furthermore, future studies could explore other aspects of the nodes (organizational characteristics) in the knowledge network, such as the firm size, or sales performance, and carry out an fsQCA analysis to uncover how such conditions contribute, or do not, to inter-organizational knowledge sharing in both STPs and other settings.

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Further reading

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Appendix

						Interviewed		Interview
Table AI	Data from firms and interviews							

Firm	Type	Year	Partners	Colaborators	Industry	Interviewed Manager Gender	Venture capital	Interview Duration (min:sec)
1	Entity	2007	*	*	Electrical and electronic**	Male	No	18:20
2	Incubated	2011	2	6	Engineering	Male	No	21:26
3	Incubated	2014	2	3	Health	Female	No	28:25
4	Graduated	2013	1	1	Engineering	Male	No	19:39
5	Incubated	2011	2	8	Biology	Female	No	33:24
6	Entity	2003	*	*	Information technology **	Male	No	31:34
7	Graduated	2010	1	4	Communication	Male	No	27:02
8	Incubated	2014	2	3	Manufacturing	Male	No	15:17
9	Incubated	2012	3	3	Biology	Female	No	35:11
10	Resident	2010	1	45	Communication	Male	Yes	20:08
11	Resident	2013	2	2	Engineering	Female	No	32:03
12	Incubated	2010	2	9	Engineering	Female	No	33:36
13	Incubated	2013	2	6	Manufacturing	Male	Yes	44:15
14	Incubated	2013	2	2	Communication	Male	No	34:05
15	Resident	2008	2	60	Information technology	Male	No	42:23
16	Resident	2003	*	1,500	Information technology	Male	No	30:17
17	Resident	2013	2	6	Communication	Male	No	27:17
18	Resident	2012	2	7	Communication	Male	No	24:24
19	Incubated	2014	4	4	Information technology	Male	Yes	35:18
20	Incubated	2014	3	3	Information technology	Male	No	32:48
21	Resident	2003	*	1,500	Information technology	Male	No	31:11
22	Resident	2010	*	60	Information technology	Male	No	46:50
23	Incubated	2014	4	4	Information technology	Female	No	19:18
24	Resident	2006	3	6	Health	Female	No	28:57
25	Resident	2013	*	5	Health	Male	No	34:41
26	Resident	2013	2	6	Information technology	Male	No	44:06
27	Resident	2013	2	4	Engineering	Male	No	38:49
28	Resident	2012	2		Health	Female	No	26:31
29	Resident	2013	2	2	Communication	Female	No	46:39
30	Resident	2003	2	3	Engineering	Male	Yes	27:32
31	Graduated	2007	4	23	Information technology	Male	No	28:11
32	Resident	2013	2	4	Engineering	Male	No	49:29
33	Entity	2004	*	*	Project management**	Female	No	23:30
34	Incubated	2007	3	8	Health	Male	No	33:37
35	Incubated	2011	2	2	Information technology	Male	No	30:44
36	Graduated	2012	5	10	Engineering	Male	No	53:05
37	Resident	2012	*	110	Information technology	Male	No	39:23
38	Incubated	2011	2	2	Information technology	Male	No	44:34
39	Resident	2011	4	62	Health	Male	Yes	36:59
40	Entity	2013	*	*	Metal, mechanical and energy**	Female	No	01:12:04
41	Resident	2011	3	*	Communication	Male	No	31:43
42	Incubated	2014	1	1	Information technology	Male	Yes	21:27
43	Entity	2003	*	*	Information technology **	Male	No	23:42
44	Graduated	2010	3	6	Engineering	Male	No	46:13
45	Incubated	2012	2	2	Engineering	Male	No	22:36
46	Resident	2012	4	50	Engineering	Male	Yes	24:55
47	Resident	2009	1	180	Information technology	Female	No	27:12
48	Incubated	2014	2	6	Information technology	Male	No	18:19
49	Resident	2004	*	50	Information technology	Female	No	19:43
50	Resident	2008	5	14	Information technology	Male	No	35:21
51	Graduated	2011	2	4	Information technology	Male	No	42:38

Notes: *The information was not provided by the company; **representative entity of the companies and/or professionals of this industry

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