



PUBLIC SUPPORT AND PERFORMANCE OF ACADEMIC SPIN-OFFS - THE NEOTEC CASE

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SUMMARY

As a result of the combination of a series of factors, in the last decades, universities have gradually assumed an increasingly active role in the direct commercialization of the results of research produced within walls. One of the mechanisms concerns the creation of new companies that are responsible for the commercialization and translation of knowledge created in economic value, which in this study we call ASO (Academic Spin-Off).

These new companies are an important tool for knowledge transfer, but studies on this mechanism are still relatively scarce and need to be better understood.

Thus, this study focuses on the influence that public support can have on the performance of this type of companies throughout its initial stages. The public supports studied concern: financing through public subsidies, incubation, consultancy, drafting the business plan (PN) and proof of concept.

This study found empirical support for the positive and statistically significant correlation between public subsidies and consultancy and proof-of-concept support and ASO performance. Incubation support having a positive relationship with performance is not statistically significant and support for the preparation of the PN presents a mixed behavior.

Key words: performance, public policies, Neotec program, academic spin-offs, knowledge transfer.

1. Introduction

The academic entrepreneurship literature has addressed a wide range of topics, namely: (i) the role of universities in the knowledge transfer process; (ii) the creation of new companies (start-up), with different research aspects; (iii) the role of governments in spin-off processes, including ways to support their creation and development and mechanisms to transfer the knowledge produced.

These new companies are an important knowledge transfer mechanism, which needs to be understood in more depth. It is a complex, multidimensional phenomenon, of high risk and influenced by factors of different nature, which include factors related to the production and

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transfer of knowledge, financing, the constitution of the founding teams, or the support provided by organizations public institutions or institutions of origin, among others (BOZEMAN, 2000).

Between the research phase and the entry into the market, one of the most critical challenges is to ensure adequate resources and support for its development, both financial resources and support for the development of the business plan, consultancy, proof of concept, or incubation.

Public decision-makers and university managers have designed and implemented support programs with the aim of mitigating risks, whose intervention rationales are largely based on market failures or learning failures.

In this context, the central objective of this article is to study the influence that such support can have on the performance of ASO.

In methodological terms, the data refer to a convenience sample and were collected in two phases: first, we gathered information of a qualitative nature, through secondary sources; and, in a second phase, we collected quantitative information using a questionnaire applied by the method of interviewing the founders.

The article is organized into 8 points. In the first 5, in addition to the introduction, the literature on the importance of ASO, public support policies and programs is reviewed and the NEOTEC program is presented. In point 6 the hypotheses are formulated. In point 7 the methodology is explained and in point 8 the results are presented and discussed. At the end, some conclusions and limitations of the article are extracted and some suggestions for future studies are formulated.

2. ECONOMIC AND SOCIAL IMPORTANCE OF ASO

The central question about the economic and social relevance of ASO is to understand how they can contribute to the local and regional economies in which they operate (GRANDI & GRIMALDI, 2005).

This contribution is expressed through job creation and the creation of economic and social value, although its impact is small, due to the fact that there are few companies and small ones. Thus, its economic and social relevance stems, above all, from constituting a mechanism for converting the knowledge produced in universities into new products and services and contributing to the dissemination of knowledge to other companies (COLOMBO et al., 2010), increasing the diversification of the business fabric and the technological

advancement of a region (CHRISMAN et al., 1995), or to support the establishment of regional clusters of high-tech companies (MAINE et al., 2010).

In their initial stages, these companies tend to be located close to the organizations of origin, contributing to the development of the local economy (Di Gregorio & Shane, 2003). These links help to create new knowledge and technologies, often in joint research programs (AUTIO & YLI-RENKO, 1998), contributing to the enhancement of the region's image.

AGUIRRE et al. (2006) summarized the role of ASO in the following terms: (1) they facilitate joint work and collaboration between researchers; (2) they contribute for the knowledge generated to be transferred and applied in external companies; (3) maximize the performance of university research resources; (4) motivate researchers to respond to requests from companies and society, (5) create jobs for students and other university members; (6) help to develop regional high-tech clusters; and, (7) are relevant to open and strengthen relations with international networks.

It is these synergistic aspects that have led several governments, all over the world, to formulate public policies and programs to support their creation and development.

3. Public policies to support academic entrepreneurship

In terms of public policy, a central question that arises is to understand what drives governments to go beyond improving investment conditions to create and develop new companies, instead of leaving the competitive struggle to the free will of the market.

Since the need for state intervention to mitigate inefficiencies in the functioning of markets is relatively consensual, there are different views on the justification for this intervention, among which we highlight the neoclassical and evolutionary / structuralist approaches.

While the neoclassicals consider themselves to be facing a mere " information transmission process " (CARPENTER & PETERSEN, 2002), of high risk and averse to private initiative, giving legitimacy to the rationale regarding market imperfections and support of a nature more "hard" (eg support for incubation or public subsidies), the evolutionary approach conceptualizes the process as non-linear and interactive, where the entities involved have technical and organizational capacity to absorb and develop the initial knowledge and learn from each other and that justifies the use support instruments of a "soft" nature (eg consultancy to training) (SALTER et al., 2000; LARANJA, 2007).

Despite different perspectives and justifying frameworks in terms of public intervention, it is important to reconcile both perspectives in an integrated approach that leads to a mix of

measures and instruments, capable of supporting and valuing public resources in support of new academic-based companies. (ORANGE, 2007).

In this line of thought, we found that in the literature review, a set of multifaceted measures and instruments that influence academic entrepreneurship and ASO performance are identified: orientation of university policy for knowledge transfer; existence of offices to support the transfer of R&D and the registration of intellectual property; existence of incubators; access to technological and financial resources; access to support from specialized consultants, the preparation of the PN, management training or proof of concept, among others.

In view of this diversity of factors influencing the performance of ASO, the elaboration of public programs in the field of academic entrepreneurship can become complex and difficult to conceptualize (LUNDSTRÖM & STEVENSON, 2005).

Thus, according to STAM et al., (2008) the formulation of public support programs for new companies must ensure that only those entrepreneurs who fit the intended model benefit from them. However, LARANJA (2007) warns that, in the current scenario, the diversity of characteristics on the side of entrepreneurial projects, seems to contrast with a certain standardization of support instruments, which can reduce their efficiency.

Indeed, there are relatively few countries⁴ that have specific support for ASOs. In most cases, this support is included in generic programs aimed at SMEs, with very different levels of technological capacity. However, the analysis of the results of countries that have implemented specific incentives suggests that the targeting of support in ASO, especially in the case where there are counseling and monitoring services, contributes substantially to its success (De CLEYN, 2011).

Another key aspect in the scope of support for the creation and development of ASO is related to public policies for science, innovation and technology. The opportunities for creating innovative technology-based business projects depend, to a large extent, on the ability to produce new scientific and technological knowledge in a given context. However, being a necessary condition, it is not enough (Holcombe, 2007). Spending on R&D does not automatically produce more innovations or more entrepreneurs who start new businesses. This is only the first step in a systemic and interactive process of innovation and

⁴ They refer, for example, to the BTU and TOU programs in Germany, specifically targeted at small companies with high technological capacity, as well as the case of the support provided by NUTEK in Sweden, the SMART program in the United Kingdom or the SIBR program in USA.

commercialization. Without a well-functioning entrepreneurial economy, the potential for increased R&D may fade (BHIDÉ, 2003).

In summary, it can be said that between the initial stage and market entry, the process of creating companies has risks and uncertainties, the higher the higher the level of disruption of innovation, this being one of the rationales that justify public support. academic-based entrepreneurship that can play an important role in the conversion and exploitation of knowledge (LOCKETT et al., 2005; ROTHARMEL et al., 2007; GRILLI, 2014)

With regard to ASO, the operationalization of support is generally done through programs that provide certain instruments, which we will deal with in the next section.

4. Public programs to support the creation and development of academic spin-offs.

With regard to programs to support academic entrepreneurship, the literature review has identified several models and programs with different objectives and forms of action. For KLOFSTEN (2000), the first and main objective is to create spin-offs and support their survival and performance in the early years. However, they pursue other complementary objectives, such as the education of students, teachers and researchers who are interested in the creation of companies, or the diffusion of the entrepreneurial culture within the university. Although these three objectives are relatively common in practice, the actions they advocate are quite different (AGUIRRE et al., 2006).

VAN der SIJDE and RIDDER (2002) analyzed some ASO support programs in Europe and concluded that it is not possible to identify a model that synthesizes the purposes and actions developed by all. These authors divided the elements identified in these programs into two categories: the “soft” elements (consulting services, support for integration in social networks, business training, PN, intellectual property management or proof of concept) and, “hard” elements (incubators, science and technology parks or other tangible elements such as subsidies for the purchase of equipment or provision of guarantees for subsidizing interest on bank loans).

With regard to “hard” support instruments, incubation centers, in some cases associated with Science and Technology Parks, usually owned individually or jointly by public entities, universities or entities linked to support for qualified entrepreneurship, stand out (BATHULA et al., 2011; GANOTAKIS, 2012).

Incubators have been created all over the world as structures to support and stimulate economic activity (PHAN et al., 2006), aiming to support the commercialization of knowledge, through entrepreneurial and innovative initiatives and act as a stimulus to local

development or regional (FRITSCH, 2011). However, its effectiveness of its action is not consensual (AMIRAHMADI & SAFF, 1993).

Another form of support has been consultancy and monitoring, provided by home institutions, incubators or through KTO⁵(SCILLITOE & CHAKRABARTI, 2010). ASO's founders are academics from technological fields who often lack adequate management and business knowledge (MOSEY & WRIGHT, 2007). Thus, access to external sources of consultancy (in the parent organization, in the incubation center, etc.) reinforces human capital and provides an external, differentiated and specialized vision in addressing the company's problems (AABOEN et al., 2006) .

A third instrument is support for the preparation of the PN. However, the value of the PN has been the subject of much controversy over the last few years, with different studies investigating whether it is worth doing the PN before starting the business, that is, "look before jumping", an expression used by GRUBER et al. (2008), or simply jump over the plane and go ahead "just do it" (LANGE et al., 2007). These are two opposing perspectives associated with the so-called planning schools and the learning school.

Researchers linked to the first regard planning (in any circumstance) as a prerequisite for creating a successful new project. Critics, on the other hand, raise the question of whether writing a PN adds value to the company's development and performance (KARLSSON & HONIG, 2009; LANGE et al., 2007). Unlike the planning school, researchers linked to the learning school suggest a focus on lifelong learning and the search for flexibility to adapt strategies to face high degrees of uncertainty (HOUGH & WHITE, 2003).

BRINCKMANN et al. (2010), based on the analysis of 51 studies on the effects of PN on performance covering 11,046 companies, adopt an intermediate position. They suggest that divergence can be mediated through the introduction of context variables, that is, in addition to knowing whether an approach based on formal and detailed NP is beneficial, it is interesting to understand the conditions and contexts in which it shows increased efficiency. They concluded that the PN is more effective in established firms than in new ones and that it is also more effective in more stable business environments as opposed to environments where uncertainty is higher.

Fourthly, support for the pre-validation of business ideas and proof of concept gains relevance. AUERSWALD and BRANSCOMB (2003) consider that one of the most critical phases occurs between invention and development, when commercial concepts are being

⁵ KTO - Technology Transfer Office, are support structures for knowledge transfer and entrepreneurship created by universities and other knowledge producing entities.

created and tested, markets are identified and intellectual property must be promoted. Thus, according to KAKATI (2003), the creation of the new company must ensure the acceptance of the product by the market by developing at least one prototype. GUPTA et al. (2002) demonstrated that financiers favor projects with prototype and well-structured market tests, due to the mitigation of what they can provide.

In the case of ASO, “proof of concept” services are often associated with universities and provided by KTO, which can assist in the pre-validation of academic inventions. In other contexts, such as in the USA, there are structures aimed at pre-validating the idea, called Proof of Concept Centers (PoCCs). BRADLEY et al. (2013) found that the number of university start-ups in the USA increased in the years following the foundation of this type of centers, often with universities.

Fifth, another aspect of relevance within the scope of public support programs is related to financing. Numerous studies have identified the difficulty of accessing adequate financing as an obstacle to the creation and development of new companies (DAVIDSSON & KLOFSTEN 2003; Gregory et al., 2005; CLARYSSE et al., 2007). In the case of ASO, as a result of their strong propensity for the commercialization of innovative products and for internationalization, the financing needs are, in many cases, very high. In addition, there is a perception of high risk on the part of traditional lenders (commercial banking), and it is therefore necessary to use other sources of financing, namely venture capital or public subsidies (CLARYSSE et al, 2007; BRINCKMANN et al, 2011) .

In view of these difficulties and the recognition of the role of these companies in the transfer of knowledge, some governments have created public funds to finance technology-based companies in the initial stages of their creation and development process (MOSEY & WRIGHT, 2007; BATHELT et al., 2010). The cases of Finland, Holland, France or Germany (WRIGHT et al., 2006) can also be mentioned, as well as in the USA, Austria, Spain and the United Kingdom, programs of this type have been implemented and continue to be developed. In Portugal, the case of the NEOTEC program, specifically geared to the creation and development of ASO, can be mentioned. It is a program aimed at students, teachers and researchers, which aimed to promote the creation of new companies based on knowledge generated at universities and other institutions of knowledge production and which, we present in a generic way, in the following section.

5. NEOTEC Portugal Program - description and characterization

The companies surveyed in this study were created within the scope of the “INITIATIVA NEOTEC” program, which is why a brief description of the program is justified. The NEOTEC program was launched in 2005, with the period for submitting applications between 22 February 2005 and 31 October 2006. The main objective of the program was to support the creation of technology-based companies with growth potential, with a particular focus on students and researchers in higher education.

According to the launch document of the program “Framework for Applications to the NEOTEC Initiative”⁶, this aimed to fill a financing gap in the process of creating New Technology Based Companies with high growth potential.

It was aimed at students, researchers and professors belonging to institutions of the National Scientific System. The program included two lines of support. One line aimed at teams promoting business initiatives and the other aimed at entities in the Scientific System and National Entrepreneurship that aimed at valuing the knowledge generated in them.

With regard to the support line aimed at students and researchers, which most interests us in the context of this study, the program was divided into three sequential but distinct phases, with a maximum cumulative duration of 24 months, with each stage associated with a stage of the company's creation and development process. In phase 1, support was provided for the development of product, service or process concepts based on innovative technologies and the analysis of their potential acceptance by the market, with a duration of 6 months and maximum financial support of 15,000 euros. Phase 2 was devoted to the development of a model and a business plan, with a maximum duration of 6 months and maximum financial support of 15,000 euros. Phase 3 focused on supporting the formation and start-up of the company,

With regard to evaluation, the criteria set out in the implementing rules were of a very general nature, namely: technological basis and growth potential; contribution to growth and development of the region or sector in which they would be inserted; in phase 3, financing from private entities was considered an asset.

Regarding program results, updated to March 2012⁷, 227 projects were submitted, 116 approved, and 79 companies were created. Of these 51 are still active at different stages of development in April 2013.

⁶ Available at: <http://www.unic.pt/images/stories/NEOTEC/NEOTECenquadramentocandidatura.pdf>

⁷ Last update on the UMIC website - http://www.unic.pt/index.php?option=com_content&task=view&id=22&Itemid=62, accessed on February 26, 2016.

The analysis of the applications made it possible to extract some characteristics associated with the candidate projects, namely: a high level of human capital from the promoting teams; weak involvement of venture capital entities in ASO financing; the technological support of the project is the result of valuing R&D activities at universities; and, the ambition of high growth and internationalization.

With regard to the distribution by technological area, there is a predominance of the areas of Information and Communication Technologies and Biotechnologies with a very concentrated distribution on the Lisbon - Porto axis, also including Aveiro and Coimbra. These four centers represent 87% of the total applications.

The total amount of financing allocated was 5,996,469 euros and the average support value per company created was 71,387 euros, non-refundable.

In short, NEOTEC was a program specifically designed to encourage and support the creation of academic spin-offs with results that can be considered interesting not only by the number of companies created, but also by the survival rate after 5 years (65 %).

Having made the theoretical framework and presented the NEOTEC program, whose ASO created served as a sample of convenience for this study, we will, in the next point, proceed to the formulation of the starting hypotheses.

6. FORMULATION OF HYPOTHESES

The hypotheses were structured around five instruments of public support. The first concerns financial resources. Numerous studies have identified the difficulty of accessing adequate financing as an obstacle in terms of the performance of new companies (DAVIDSSON & KLOFSTEN, 2003; GREGORY et al., 2005; CLARYSSE et al., 2007). In the case of ASO, as they are a subgroup aimed at the commercialization of innovative products, the financing needs are, in many cases, very high. In addition, a perception of very high risk on the part of financiers, therefore, it is necessary to resort to other sources of financing, namely public subsidies (BRINCKMANN et al., 2011).

COLOMBO et al. (2011) concluded that public subsidies to support new technology-based companies can have a positive effect on job growth, but only when the project selection process takes into account the specificity of these companies.

Thus, despite the scarce literature on the subject, the arguments presented lead us to formulate the first hypothesis:

Hypothesis 1: Access to public subsidies positively influences the performance of ASO.

The second instrument includes support for incubation. The influence of incubators on the performance of the incubated companies is quite controversial. BATHULA et al. (2011) found that the support of incubators for science-based companies is fundamental to their performance. However, SIEGEL et al. (2003), for example, based on a broad review of the literature on the effect of science and technology parks on the survival and performance of incubated companies, concluded that incubation support would be insignificant. Although science and technology parks are more expensive and different from incubators, in many cases the services provided are quite similar. Bearing in mind that incubators in Portugal are very recent structures and therefore still inexperienced, with few services,

Hypothesis 2: Incubation support does not have a significant influence on ASO performance.

Thirdly, consultancy emerges. As emphasized in the literature review, ASO's founding teams are dominated by academics from technological fields, often lacking adequate management and business knowledge (MOSEY & WRIGHT, 2007). Access to external sources of business consultancy can become a complement to human capital and provide an external, differentiated and specialized vision in addressing the company's problems, influencing its performance (AABOEN et al, 2006). In view of the above, it can be conjectured that:

Hypothesis 3: Access to consultancy services positively influences ASO performance.

The consulted literature suggests that the effects of the business plan on the performance of new companies are contradictory, with authors considering it indispensable (DELMAR & SHANE, 2003, among others) and, others, a waste of time (CARTER et al., 1996).

A study carried out by LANGE et al. (2007) with new companies created by former students of Babson College between 1985 and 2003 concluded that there was no difference between the performance of new businesses launched with or without written business plans. Bearing in mind the difficulty in predicting the market's behavior towards products and services with a high level of innovation (as, as a general rule, it is the case of ASO's) and the dynamics of the external context in high-tech markets, we formulate the following hypothesis:

Hypothesis 4: The initial business plan has no significant influence on ASO performance.

One of the most critical phases in the process of commercializing new knowledge occurs between invention and product development (AUERSWALD & BRANSCOMB, 2003). GUPTA et al. (2002) demonstrated that the validation of the concept associated with the original idea is a factor that can influence the future performance of ASO and that financiers have less appetite for projects without this validation, which aims to expose the available

technologies to potential users, to collect your feedback and test value propositions (BRADLEY et al., 2013). One of the aspects that give importance to this factor and that can influence the performance of ASO, is the precocity with which they manage to validate the concept, reject it or lead to its reformulation, thus avoiding minimize the risks of market failure and the destruction of value (DAVIDSSON & KLOFSTEN, 2003). Taking into account the previous argument, the following hypothesis is considered:

Hypothesis 5: the proof of concept positively influences the performance of ASO.

Once the hypothesis formulation has been completed, we will, in the next section, explain the methodology followed for the choice of the sample and for the collection and treatment of data.

7. METHODOLOGY

In terms of performance indicators, after weighing the different arguments as to which can best fit performance measurement in ASO (DELMAR et al., 2003; WOO et al., 1989; CLARYSSE et al., 2011), we opted for sales volume, number of workers, weight in sales of products launched in the last two years and venture capital raised. One of the reasons that justify this choice is due to the fact that the consulted literature indicates that accounting and financial criteria are not the most appropriate, because many start-ups are unable to achieve positive results in the first years of activity (SHANE & STUART, 2002)

With regard to the sample, having found the lack of a properly structured database for this type of start-ups, we opted to use an intentional sample, that is, companies created under the NEOTEC program, as I had previously been referred to. This intentional selection was made with the conviction that the chosen ASO have typical or representative characteristics of the population, thus reducing the possible bias of the sample, as advocated by COLLINS et al. (2006).

The collection of primary data was done through a questionnaire completed through an interview with the founders of the companies. For the treatment of data we use several statistical tests. In order to assess the quality of the data, group information and test its reliability, the approximate normality of the variables was first tested. Then, the exploratory factor analysis technique was used on the correlation matrix, with extraction of the factors by the principal component method for grouping the questionnaire items into variables that were not directly observable. Cronbach's alpha coefficient (α) was also calculated to test the robustness of these constructs.

For data analysis, Pearson's correlation coefficient was used to assess the intensity and direction of the association or correlation between the variables under analysis (each of the factors mentioned and the performance of the ASO).

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) version 20.0 for Windows.

8. RESULTS ANALYSIS

The different hypotheses developed previously will now be analyzed. In parallel, the results will be discussed. Table 1 shows the results of the correlation between performance indicators and public support to ASO.

Table 1 - Correlation between public support and performance indicators

	Public subsidies	Sig	Incubation	Sig.	Consultanc y	Sig.	Business plan	Sig.	Concept proof	Sig.
Sales	,625 **	,000	,200	110	,360 *	,019	,250	110	,362 *	,018
Number of workers	,630 **	,000	146	104	390 *	,011	,306 *	,049	,429 **	,005
Weight in sales of products launched in the last two years	,667 **	,000	,257	109	,332 *	,036	,261	104	,434 **	,005
Venture capital	,404 **	008	242	123	,318 *	.40	347 *	,025	,426 **	,005
Global Performance	,698 **	,000	255	112	,423 **	007	,328 *	,039	,473 **	,002

** $p \leq, 01$; * $p \leq, 05$

Hypothesis 1 states that there is a positive influence of public subsidies on the performance of ASO. The conjecture underlying the formulation of the hypothesis can be translated into the idea that non-refundable public subsidies increase the intrinsic value of a company, allowing investments to be made in necessary equipment, qualified human resources, market studies, expensive marketing campaigns. or other eligible expenses, which may influence ASO performance.

The correlation between public subsidies received and overall performance is positive, strong and statistically significant. The results obtained and their analysis lead us to consider that hypothesis 1 is confirmed.

These results are in line with previous studies. Several authors have pointed out the positive effect of public subsidies, as they increase the initial credibility and intrinsic value of ASO, and can function as a confidence factor for potential investors (FINI et al., 2009).

Hypothesis 2 states that incubators have no positive influence on ASO performance. The conjecture for formulating the hypothesis is that these infrastructures are focused on offering physical facilities and administrative support, instruments of a more "hard" nature, to the detriment of other supports of a more "soft" nature which, according to the literature consulted, appear to be more important to the performance of ASO.

The results presented in table 1 suggest a positive association between performance and access to incubation, however it is very low and not statistically significant for all indicators, confirming hypothesis 2.

The starting guess for the formulation of hypothesis 3 was that consultancy can be one of the ways to fill the low training in management and in the commercial area of the founding teams of ASO. The analysis of the results in table 1 suggest a positive, moderate but statistically significant correlation between the consultancy and the different performance indicators confirming hypothesis 3. The results are in line with previous studies suggesting that the consultancy can provide an improvement in the performance of ASO (AABOEN et al., 2006). Hypothesis 4 refers to support for the PN. The consulted literature keeps the controversy alive as to its effects on the performance of new companies. In the present case, since the sample consists of companies that have operated in markets that are constantly evolving and undergoing very rapid changes, our guess was that the formal business plan would have little predictive capacity and therefore its influence on performance would be reduced.

The results presented show a positive, moderate and statistically significant correlation between the business plan and the overall performance. However, with regard to sales and the weight in sales of products launched in the past, the correlation, although positive, is not statistically significant. The results are in line with some previous literature that has been inconclusive with regard to the importance of formal business plans (LANGE et al., 2007).

Finally, hypothesis 5 states that the company's proof of concept positively influences its performance. The analysis of the results suggests the confirmation of this hypothesis given the positive, moderate, but statistically significant correlation between the proof of concept and all the performance indicators.

The results obtained are also in line with previous studies that suggest a greater probability of survival of ASO who previously tested the concept, evolution and market size (AUERSWALD & BRANSCOMB, 2003).

Conclusions

Governments and universities have encouraged the involvement of students, researchers and university professors in the creation of ASO, having created several support infrastructures (KTO, incubators, S&T parks...) and public programs directed specifically at this type of companies (eg NEOTEC) or others that have a more general scope, dedicate specific lines to this type of start-ups.

These companies, created to exploit the results of scientific research, are considered important because, on the one hand, they are an essential mechanism for the transfer of knowledge produced in academia that is crucial for innovation (Shane, 2004), on the other hand, because they contribute to the creation of some jobs and to the local economic development (FRITSCH & AMOUCKE, 2013).

With regard specifically to the results obtained in this study, it appears that the correlation between the factors considered and the performance indicators support most of the formulated expectations.

With regard to public subsidies, there is a positive and significant association with all indicators, but with less expression in terms of raising venture capital, suggesting some effect of substituting subsidies in relation to risk capital financing. In the remaining indicators, the results suggest that the ability to attract public subsidies is very important, since these reinforce the ability to make investments in R&D or marketing without interference from the financier in the management of the company or the taking of any position in the share capital. In the non-financial support dimension, the results show that the influence on performance varies depending on the instruments considered. In a first step, the results show that support for incubation has no influence on the performance of ASOs, suggesting that the management models of these infrastructures would not be aligned with the needs of ASOs.

The results regarding the influence of the PN on the performance of ASO, are in line with those found in previous studies showing that not having a significant effect on sales, in turn, has a positive and significant influence on the raising of risk capital. This duality of effects on those factors suggests that the PN will not have a predictive capacity on the evolution of the market, but it may be a necessary instrument for obtaining financing via venture capital and even public subsidies.

The consultancy has a positive and significant effect on all performance indicators. This type of support has been seen as one of the ways to fill any gaps in the skills of the founding teams (mainly in the commercial and management areas), additionally providing a learning effect with repercussions on the quality of the team's decisions, as advocated by the evolutionary approach . The results suggest that this type of support of a more "soft" nature oriented to enhance the learning effect reveals greater effectiveness than physical or even financial support of a more "hard" nature.

With regard to proof of concept, the results show a positive and significant effect on all performance indicators, suggesting that ASOs that have previously tested their products and services (eg, through a prototype) and that simultaneously have investigated the competition,

the evolution and size of the market and tests carried out on the target market should be more likely to survive.

In terms of implications, the results suggest that policy makers should try to rebalance support mechanisms, paying more attention to so-called “soft” support rather than “hard” support. With regard to entrepreneurs, they suggest that they should only legally constitute ASO after an assessment of the business model and market potential. Advancing early can negatively influence ASO performance.

With regard to universities, they suggest that they should invest in incentives that their researchers recognize as motivators in the use of the ASO creation mechanism and that they implement integrated policies for the production and conversion of knowledge into economic and social value, using different mechanisms but with special focus on ASO.

Like any other research work, this one too has limitations. The two most significant are related to the relatively limited number of cases and the statistical generalization of the results. Some generalization of the theoretical hypotheses was possible for the type of ASO analyzed, however, it was not possible to extend the analysis to other types of ASO, nor to other types of companies in the beginning of their life cycle.

Finally, it is suggested for future research to carry out studies that can integrate other dimensions influencing the performance of ASO in a comprehensive, integrated and longitudinal empirical model that allows deepening the dynamics of survival and long-term performance of ASO, since before its constitution legal until one of the possible "endpoints" (failure, merger, acquisition ...).

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