Business model analysis of technology based academic start-ups using resources based view: reflections from the case of COPPE/UFRJ in Brazil[1]

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Abstract

Research based academic start-ups have became an important aspect of the technology transfer process. The emergence of an entrepreneurial university brought a new scenario where many ventures are settle up by researches in order to exploit commercially the out puts of research activity. What are the main characteristics of this companies? What resources and business models are used to bring to market technologies developed in the academic environment? This paper combines resources based view and business model perspective to address these questions. The research was carried with ten case studies of technology based academic start-ups launched in the federal university of Rio the Janeiro in Brazil between 1994 and 2007.

Keywords: Academic entrepreneurship; technology based start-ups; Business model; resources based view

1) Introduction

The technology transfer process from academia to business environment is very complex and has a systemic profile with the participation of multiple actors (Bozeman, 2000). There is an emergence of a new profile of university, the academic entrepreneurship is a new trend in universities in different parts of the globe (Clark, 1998; Etzkowitz, 2002; Tornatzy *et al*, 2002).

The creation of enterprises in the academic environment, technology based academic start-ups (TBASU), is only one mode immersed in a complex system of interactions. Despite being just one aspect of this process, the creation of academic start-ups has became an important aspect of the technology transfer process (DiGregorio & Shane, 2003; Wirght et al 2008).

1.1) The formation of technology based academic start-ups from the resource-based view

An approach widely used in studies about the creation and development of technology based start-ups is the Resource Based View (Barney et al. 2001; Brush et al. 2001). The works based on this approach focuses its analysis on resources identified in the creation and development of technology based start-ups that gives them a competitive advantage. In these studies, the authors emphasize the differences in available resources in the process of creation and development of the new venture (Shane & Stuart, 2002). Other authors focus their work specifically on the analysis of financial resources (Hellman & Puri, 2000), organizational and technological resources (Bower, 2003; Heirman & Clarysse, 2004; Landry, 2006) and even wider views considering the social, technological, financial and human resources (Druilhe & Garnsey, 2004).The authors that pursue this conceptual approach define resources broadly, encompassing all tangible and intangible assets and competences linked to the firms in a "semi-permanent" way. As a result of this approach there

are a number of different classifications of resources that can emerge from the analysis of different realities.

Lichtenstein & Brush (2001) analyzed the gap of adequate resources to the growth of emerging ventures. In the context of the growth of small business these authors defined the following resources: financial, systems and organizational structures, managerial competence, qualification of human resources, technology, physical resources, leadership, organizational culture and informal systems. Landry et al (2006), in a paper on the propensity of Canadian researchers to create new ventures also used the resource-based view as a backdrop and set out a conceptual model of categorization with six resources in the company creation process: financial, intellectual property, knowledge, organizational, social and personal trajectory. In another study Brush et al (2001) categorized the resources present in the start-up process in six types: technological, human, social, financial, physical and organizational.

In the context of this work will be using a framework that combines the approach built by Mustar et al (2006) and the approach of Landry et al (2006). Figure 1 below illustrates the proposed model.

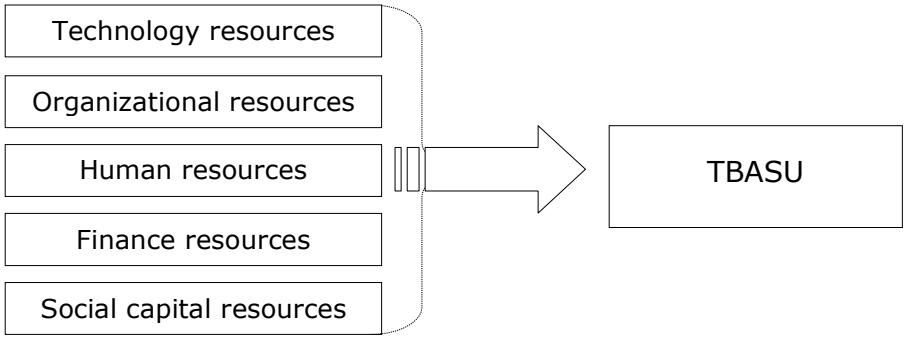

Figure 1 - Resources present in the process of technology based start-ups

Source: Authors' adaptation based on Landry et al (2006) and Mustar et al (2006)

The category technological resources refers to basic skills and technologies specific to each company. The technology based start-ups have variance in the degree of innovation and technological scope and the profile and intensity of activities of R&D and positioning in the cycle of product development. The category of organizational resources refers to possession or access to facilities and distribution networks, support, customer base, strategic suppliers, management system, among others. Human resources are analyzed based on the attributes of founder team and his collaborators, both in terms of technical and managerial. Usually these resources are measured in terms of the size of the founding team, the trajectory of entrepreneurs and technical and managerial experience.

The social capital resources are defined by Brush et al. (2001) as the inter-relations between the entrepreneurs, the new venture and the environment where they are inserted. Financial resources are related to the amount and profile of funding required for the creation and development of the new venture. These resources may come from public sources, private or own.

1.2) Different business models adopted by Technology Based Academic Start-ups (TBASU)

From these resources, technological, human, organizational, financial and social capital, researchers create new companies in order to commercially exploit the results of their research activities. One of the biggest challenges facing in this process is the definition of a feasible business model, enabling the company's expansion and enhancement of its profitability. Chesbourgh & Rosenbloom (2002) define business model as the articulation of value proposition, market segmentation, positioning in the value chain, cost of infrastructure to produce and offer products and services. The business model is formed from the allocation of different resources available,

technological, human, organizational, financial and social capital in order to generate and capture value in specific market segments.

Bower (2003) was one of the first authors to refer explicitly to the business model of technology based start-ups, highlighting the intellectual property assets as an important source of competitive advantage in the emerging phase of new technologies such as biotechnology. According Mustar et al (2006) studies focusing on the perspective of business model can be divided into three groups: (i) those that categorize start-ups from the activities performed, (ii) from the type of conversion technology and knowledge into economic value, (iii) from the direction for growth.

The authors that categorize the start-ups from the activities performed use the following taxonomy: service oriented firms, product oriented firms and intellectual asset oriented firms. The service oriented firms offer consulting and R & D services, the product oriented firms search for scalability with a product with a clear value proposition. The intellectual asset oriented firms try to reach the market trough different channels, normally boarding their technology in product and services from other companies.

A second group of studies look at how technology and knowledge are converted into commercial value. Mustar et al (2006) identifies four different modes for this process: business infrastructure or technology platform, product companies, companies in transition (from product to technology platform); prospectors. Businesses infrastructure or technology platform (Heirman & Clarysse, 2004; Druilhe & Garnsey, 2004) present a strategy of seeking venture capitalists in the early stages. Heirman & Clarysse (2004) show that business infrastructure have negative cash flows in the early stages, where resources are spent on developing the technology platform final at the expense of marketing and sales. Aggarwal & Bayus (2000) estimated an average of 14 years for the commercialization of new technology platforms, time horizon long enough compared to the one of most venture capital firms.

Heirman & Clarysse (2004) identified a third group, start-ups that in its early stages are focused on one specific product or service and over time identify new market demands and are able to diversify its portfolio. These companies are considered ventures in transition, are born to explore one specific product or service and increasing its market penetration migrate to the business model of infrastructure / technology platform. Prospector companies were identified in the work of Druilhe & Garnsney (2004). These are companies over their early years seek to merge prior knowledge of entrepreneurs to the knowledge acquired in the market for exploring new business models. These authors adopt a dynamic view, seeking to explain how the business model evolves as the entrepreneurs enhance their knowledge about resources and opportunities available. These authors identified a significant number of start-ups that are born without a clear idea of how they create value from the resources available, so spend most of their activities in search of applications compliant market demands.

The third group categorizes technology-based companies from the orientation of growth. In contrast with the success stories described by Saxenian (1996), Autio & Lumme (1998) concluded that in Finnish technology based companies did not show significant growth. Other studies, such as Wtterwulghe (1998) show that French and Belgian technology based companies are mostly formed by a single entrepreneur, without a clear business strategy.

In the context of this work will be adopted a classification of business models based on the activities performed by these companies, using the classification proposed by Mustar et al (2006): service oriented firms, product oriented firms and technology asset oriented firms. These three business models were identified in the companies studied in COPPE/UFRJ.

1.3) Methodology and data collection

The research involved in-depth case studies with ten technology based start-ups created in COPPE/UFRJ, supported by the business incubator between the years 1994 and 2006. These companies were created by students in master's and doctorate, teachers and researchers from COPPE and other laboratories located in its surroundings. The research questions addressed in the

analyses was: What are the profiles of the technology based academic start-ups? What kinds of resources are mobilized in this process? What are the business models adopted by this companies?

Interviews were conducted in person and by phone through a structure questionnaire between July and October of 2009. It was possible to observe the characteristics of these companies in terms of trajectory of the partners, projects carried out in an academic setting before creating the company's products and services, intellectual property, customers, sales, team, R&D and established relationship with the academic unit of origin. In addition, we analyzed the resources present and the business models adopted in the start-up process.

The analysis points to correlations between the resources present at the creation of the company and the business models adopted. The identification of start-ups began with an exploratory research in the website of the COPPE/UFRJ business incubator, which was followed by further lifting information from the websites of the incubated firms. We then carried out an interview with the manager of the business incubator of COPPE when it was possible to obtain an overview of the history of each company supported and identify those that were created by university staff. From this initial survey it was possible to select the ten cases studied.

The paper is organized as follows: in section two it is presented a characterization of COPPE / UFRJ in the context of the Brazilian higher education and innovation systems. In this section the ten case studies are presented. In section three the profiles of the start-ups in terms of resources and business model are analyzed.

2) Characterization of COPPE/UFRJ: from human resources formation to academic entrepreneurship

The Coordination of the Graduate Programs in Engineering (COPPE) is one of the academic units of the Federal University of Rio de Janeiro (UFRJ). The UFRJ is the largest federal university in the country with 28 teaching units, offering 145 courses to 33,300 undergraduate students. It has about 3,800 teachers of whom approximately 2,200 have a doctorate degree. The scientific activities are part of the routine of the university with 85 graduate programs that offer 85 masters and 74 doctoral courses. All these research activities degree 1,500 masters and 720 doctorates per year (UFRJ, 2009).

COPPE is one of the largest academic units of UFRJ with 13 graduate programs in engineering: Civil, Chemical, Electrical, Computer, Polymers, Metallurgy / Materials, Nuclear, Chemical and Biochemical Processes, Mechanical, Biomedical, Transportation, Production and Oceanic.

Six of these courses are evaluated with the highest grade awarded by the Ministry of Education, grade 7, four are evaluated with a grade 6, four with grade 5 and one with a score of 4 (CAPES, 2009). This is the biggest infrastructure for teaching and research in engineering in Latin America, with about 3,000 graduation students, 300 teachers and over 100 laboratories. Each year about 150 doctoral theses and 300 master dissertations are defended at COPPE. In addition, the campus housing research centers such as CENPES/Petrobras, the state-owned oil and gas company, CEPEL/Eletrobrás, the national company of electric power, and CETEM, in mineral research.

This academic unit (COPPE), has a foundation called COPPETEC that currently manages approximately 600 projects totaling in the year 2008 revenues of about $ 250 million (Coppetec, 2009). Mechanisms such as the business incubator, the technology transfer office and the technology park were formed gradually over the years 90s and 2000s. These institutional and organizational changes that occurred mainly in the last 15 years approached COPPE/UFRJ to the concept of entrepreneurial university developed by European and North American authors (Clark, 1998; Ropke, 1998; Etzkowitz, 2002; Tornatzky et al, 2002).

The Business Incubator of COPPE was founded in 1994, since then supported the creation of 46 companies with innovative products and services of high technological content. The incubator now has 1900 m2 of built area, with availability of 24 modules of incubation with 30 m2 each. There are 15 companies incubated and some research laboratories of Petrobras holding the remaining

modules. The operational model used in the incubation process involves the provision of physical infrastructure and consulting services in the areas of marketing, financial, accounting, law and design. The technology transfer office of UFRJ was created after the incubator. In 2001 it was created the Division of Intellectual Property and Technology Transfer - DPITT in UFRJ, which in 2007 was replaced by the Innovation Agency of UFRJ. Currently the agency has a portfolio of around 140 patents of which four are licensed (UFRJ, 2009).

From 2003 begins the deployment of a technology park at the university, the park came into operation in 2008, after an investment of approximately U$ 50 million. There are about 350.000 m2 and 50% of this area is already urbanized. The Park of Rio is home to twenty companies which together employ about 200 technicians and researchers (Guedes, 2009).

Since the 1970s COPPE had a relationship with state enterprises, mainly in the oil, electrical, mining, telecommunications and nuclear sectors that have research centers located on the university campus. Moreover, in the last 15 years, with the creation of business incubator, followed by the creation of the technology transfer office, deployment of the technology park and the foundation of the Innovation Agency in UFRJ, COPPE has been undergoing a process of transformation towards the market promotion of the technologies generated from its research activities.

2.2 - Contextualizing COPPE in the Brazilian innovation system

In fact, only in the 90's is that the creation of academic start-ups emerges as an additional possibility to promote technology transfer between the academic and business institutional sphere in Brazil. Until then the emphasis was focused on training of highly qualified human resources to work in existing companies. As domestic firms have a low rate of innovation and fewer are those that do R&D, creating a new generation of technology-based firms, born in the academic environment, emerges as a possibility for public policy.

The change in the Brazilian innovation institutional environment has been very intense over the decades of 1990 and 2000. In the early 90's the country had about ten incubators in operation at the end of this decade there were over one hundred business incubators established throughout the country, mostly in universities and research institutes (Renault, 2006). The volume of finance resources available for activities in science and technology also increased significantly in Brazil between 1999 and 2009. Just at the end of the 90s comes into operation a new policy on funding for innovation activities, the "sectoral funds". These are funds focused on specific sectors such as petroleum, electricity, telecommunications, and mineral resources, among others.

The resources that feed these funds come from taxes paid by companies in these sectors. In 1999 the total volume of finance resources available in the national fund for science &technology was about U$ 100 million, in 2008 were already U$ 1 billion, ten times more. Despite the significant increase in the budget of these funds only around one third of the resources are effectively invested annually, once the operational structure of the funding agencies did not have a proportional growth.

Added to this significant increase in finance resources, in 2004 the Brazilian Innovation law was approved. This law regulates the public private interface issues related to activities in science, technology and innovation. There are three central pillars covered by law: (i) all federal universities, which is concentrated the bulk of research activities carried out in the country, must establish centers of technological innovation that are responsible for managing intellectual property in the academic context; (ii) the law allow the sharing of infrastructure, physical and human resources between universities and enterprises, allowing the temporary removal of teachers to work in companies and installation those within the university campus; (iii) the law allows the realization of public investments, grants, in private companies that are engage in R&D activities.

All these changes in the national institutional context directly affected the process of creating technology based start-ups in COPPE. It is observed that over time the resources available have been gradually intensifying, which directly impacted on the business model adopted by companies (Renault, 2010).

2.3 - Technology based academic start-ups at COPPE / UFRJ

Since its establishment, in 1994, until 2007, the business incubator of COPPE supported 46 start-ups. In the interviews conducted with the business incubator manager, it was possible to identified 18 companies that were created by students in master's and doctorate and professors from COPPE and others departments of UFRJ that was the target of the research.

Ten cases, out of 18, were selected for this study, a sample distributed over the period of operation of the Business Incubator of COPPE. Table 1 below provides a brief description of the cases studied.

Grom Acústica e Automação	The company was founded in 1992 by four graduate students of the Robotics Laboratory from the mechanical engineering program. Develops systems for automated data collection in acoustics and vibration.
Terrae Engenharia Geotécnica	The company was founded in 1994 by three graduate students from the civil engineering program that were researching geotechnics. The company provides consulting services to contain slopes and sells a special block, developed by the company.
Solucionar Informática e Sistemas	Solucionar develops software for workflow and project management. The company was founded in 1998 by a group of researchers who were consulting for COPPETEC in the development of software tools for managing projects and it's workflow.
Polinova Consultoria em Polímeros	Polinova was created in 2003 by two doctoral students of the Institute of Macromolecules (IMA). The company provides consulting services in the polymer segment and offers products for the segments of construction, shipbuilding and oil & gas.
Eneltec Energia Elétrica e Tecnologia	Eneltec was founded in 2004 by three PhD students of the Laboratory of Power Electronics from the electrical engineering program. Provides consulting and R&D services in the sectors of electricity transmission, renewable energy, power quality and operation of power systems.
Gerar Tecnologia Gestão de Energia Renovável e Aproveitamento de Resíduos	Gerar was created in 2004 from a multidisciplinary project in the field of renewable energy. The company had the involvement of doctoral students and teachers. Provides studies and consulting projects in the field of renewable energy and holds the patent of an equipment that produce bio diesel.
PAM Membranas Seletivas	Pam Membranas was founded in 2005 by three professors and two doctoral students of the Laboratory of Membrane Separation of the chemical engineering program. The company develops filtration systems using polymer membrane that allows reuse of water.
Controllato Monitoração e Controle de Vibrações em Estruturas	Controllato was founded in 2005 by a researcher and a professor of the Laboratory of Vibration Control of the Civil Engineering. The company develops electromechanical devices for monitoring and control of vibrations in large structures.
Kognitus Automação e Processamento de Imagens	Kognitus is a software company that provides technology based on pattern recognition of images and sounds, specially in access control. The company was created in 2005 by a teacher and a Master student from the Electronic Computer Center of UFRJ.
BrStreams Tecnologia de Informação e Comunicação	BrStreams was founded in 2006 by a teacher and four students, researchers from the Laboratory of Parallel Computing (LCP) of the Department of Computer Engineering in association with a business partner, Logistec. The company developed a system for video stream based on parallel computing that allows better quality with the same hardware infrastructure.

Table 1 - Academic start-ups selected for the case studies

Source: The authors

From 1992, when the first academic start-up was created in COPPE, until 2006, there is an evolution of the companies profile and trajectory. In the first three cases the companies were created from projects performed exclusively in the academic sphere. The university was the first customer of the three companies, two of which were born of projects that have been demanded by the university. In these three companies there is no involvement of teachers, the team was formed

by master and doctorate students who decide to commercially exploit a basic skills acquired in their academic activities.

Since the year 2000 there is a change in the profile of the academic start-ups, which start to be originated in sectoral projects embedded in specific industry chains, or from consulting services performed on a recurring basis by the academic laboratory to companies outside the university. Arguably this change is linked with the launch of a new fund system, the sectorial funds, that provide grants for R&D projects in specific industrial chains like oil and gas, electricity power, TICs, Mining, Biotechnology, and others. With this new fund system the amount of money available for R&D projects increase ten times in the decade of 2000.

From 2005 there is a tendency to involve teachers in the academic start-up formation process. All start-ups studied created from this year had teachers on their corporate boards. Probably this trend is related to innovation act, passed in 2004, that allows the formal involvement of teachers in these companies.

3) Business models adopted by TBASU at COPPE / UFRJ: an analysis from the resource-based view perspective

The conceptual framework proposed for the analysis of the TBASU created in COPPE merges the resource-based view with the analysis of different business models adopted by start-up companies. The resources considered in the analysis were human, technological, financial, organizational and social capital. The business models identified were: (i) service oriented firms that provide consulting and R&D customized services; (ii) intellectual property oriented firms that make their technology marketable trough partnerships with other companies; (iii) product oriented firms that provide products with a clear value proposition and scalable business.

The business model focused on consulting and R&D services is the one that most resembles the routines of research laboratories in the academic environment. This is may be a clue to understand why all TBASU created in COPPE from the 90s to now adopt this business model as a starting point. The business model based in intellectual property assets seems to be a natural outgrowth of the initial phase of TBASU doing R&D services. Once they perform these kind of activity it is natural the arising of new technologies with market potential, so they seek for partnerships to embark their technologies into products or services of third parties, reaching the market indirectly. This is a business model very convenient for them since it's possible to scale up without a big investment in marketing, distribution, production, among other organizational resources. Companies that adopt the business model based on intellectual property assets receive royalties for licensing its technologies. To some extent this process is also similar to the routine of the academic environment, where the technology transfer offices search for technology liaison to business sector. Moreover, the product oriented business model is the most distant from the academic environment. Companies focused on product require higher investments, take longer to start sells and revenue.

3.1 - Business models and resources

The resources needed to make a successful product business model are very different from those observed in the academy. For service oriented business model the main resource is human capital, high qualified work force that can customize services from a given technology and competence basis. The academic environment is a plentiful supply of qualified human resources, which makes it a huge basin of multidisciplinary expertise. In the business model based in intellectual property assets, technology is the main resource, which is also widely available in the academic environment. In the other hand, in the product oriented business models the organizational resources are the central ones. These resources are not available in the academic environment, what makes very difficult for TBASU to adopt this business model.

The organizational resources generally are related with companies' assets, tangible and intangible. This includes production facilities, distribution network, sales channel, and technical support, among

others. The academic environment does not have these resources, which are usually more common in the business sector. Of the ten companies studied, none has adopted a business model focused on products in the first years of operation. The following Table 2 presents an analysis of the resources needed for articulation of each of the three business models in the ten cases that were studied.

Resources	Service oriented firms	Intellectual property asset oriented firms	Product oriented firms
Technology resources	Technical skills combined with technologies that are used in the provision of customized consulting and R&D services. Low concern with intellectual property	Technologies developed in R&D projects, transfer without direct intervention in production or marketing of final products or services. High concern with intellectual property	Mature technology, tested in the market. Technology for product development, production and management. High concern with intellectual property.
Human resources	Technical Profile. High proportion of masters and PhDs among company's employees. Specific skills in project management	Technical Profile. High proportion of masters and PhDs among company's employees. Need for managerial and law skills.	Technical, managerial and commercial profile. Low proportion of masters and PhDs among company's employees.
Organizational resources	Software or methodologies for project management.	Patent or registration of intellectual property. Structure for license agreement and monitoring of sales.	Distribution network, technical support, investment in brand, certification, production structure, among others.
Financial resources	Low investment, organic growth, slow and gradual.	Public and private investment in R&D. Exogenous growth	Public and private investment, growth potential scalability
Social capital resources	Academic	Academic and business	Predominantly business

Table 2 -Business models adopted by TBASU and the resources needed for its creation and development Source: The authors

In the analysis performed in the ten academic start-ups from COPPE it was possible to observe that the biggest lack of resources to adopt a successful product business model was the organizational resources that are not available in the academic environment. This asymmetry of resources may partly explain the concentration of companies that adopt business model focused on services.

3.2 - Business model adopted by academic spin-offs in COPPE

Despite of the concentration of TBASU on business models with services focus, among the ten companies studied, five had developed its initial business plan focused on marketing products. Two other companies are in the software industry and mixed business models focused on product license (software) and services (customization, deployment, training and support). Two companies have focused their business plans to provide services and only one company started directly with a business model based on intellectual property assets. However, with the start of operations, all companies have moved to the model of customize service delivery.

The Brazilian system of funding for innovation activities seems to influence this process. Financing instruments allows investments in hiring high qualified human resources (MSc and PhD) and the purchase of inputs for R&D activities. There aren't grants for managerial, marketing and production activities, so the investments available do not fill the gap of organizational resources between academic and business institutional spheres. Two factors are influencing the adoption of service oriented business model by the TBASU in COPPE, in one side they seem to replicate the routines lived in their academic laboratories of origin and in the other the financing system is reinforcing the organizational resources gap between both institutional spheres.

One of the academic entrepreneurs interviewed commented on this dilemma, "the grant announcements have two distinct sides, are grants for R&D activities, what is good, but ends up leading the company to just stay in that." This company was one that began a strategy to migrate from a business model focused on services with a focus on products, on the transition he said "we had to seek venture capital, the available public grants do not fund what we need to grow." Interestingly, often more than one business model is adopted in the same company, with an evolution over time. Figure 2 below represents the business model adopted by the ten companies studied and the three vectors of evolution observed over time.

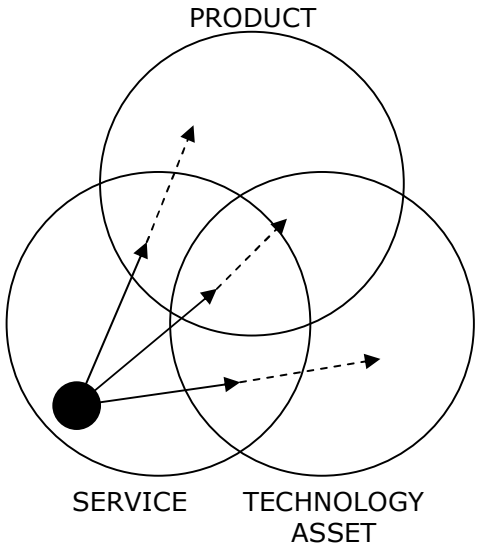

Figure 2 - business models adopted by TBASU of COPPE / UFRJ

Source: The authors

After start-up period all companies seek for scalability of its operations to increase their revenue, so they try to adopt simultaneously more than one business model, departing from customize services to an intellectual property asset oriented and a product oriented business model. This creates hybrid business models that mix different resources in different value propositions for specific market segments.

Conclusions

The analysis of the creation of technology based academic start-ups (TBASU) from an approach focusing on the business model adopted by these companies is an issue that needs to be deepened; there are few papers on the subject (Mustar et al 2006). The conceptual approach from the resource-based view, added to the analysis of different business models adopted by TBASU offer a framework that introduces new dimensions in the analysis of this process.

In the ten cases studied it was possible to observe a strong correlation between the routines and resources present in the academic environment and those which were available for TBASU in their early stages. Human and technological resources are widely available in academic environment and are the central ones for service and intellectual property oriented business models. In other hand, organizational resources are the central ones in product oriented business model and are scarce in the academic environment. This lack of organizational resources, added to the correlation of routines and the abundance of human and technology resources explain partially the concentration of TBASU that adopt service and intellectual property oriented business model in the case of COPPE.

What was possible to see in the analysis of TBASU at COPPE is that all the companies adopt a service oriented business model in the early stages of the venture. In a second moment these companies start to adopt a hybrid business model that merges services with technology assets and products. The adoption of a hybrid business model involving the three placements, services, intellectual property asset and product seems to be a trend among TBASU in COPPE.

In this study two issues remain for further exploration. First, a qualitative characterization of these ten companies gives us some clues about the potential variance of innovation indicators commonly used uniformly in all enterprises. For example, in companies focusing on customize service oriented business models the proportion of MSc and PhD in the total number of employees seems to be much higher when compared to product companies. Customize services companies seem to invest a higher percentage of their revenues in R&D, but seem to patent less then product oriented firms.

The second issue that should be deepened is the business model adopted by start-ups in different economic sectors and fields of knowledge. In our sample all companies studied are from the engineering and software knowledge fields, acting in energy (oil, bio-diesel and electricity power) and construction sectors. Probably in electronics or biotech sectors new patterns of business model will emerge.

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