TITLE: BUSINESS DEVELOPMENT IN A NREN AS AN INNOVATION STRATEGY – PROCESSES AND CASES

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Abstract
The paper describes a model for using the results of R&D in the form of licensing and transfer of these technologies to the marketplace. The model has been applied in RNP – Brazilian NREN - sustainably in that new businesses are generated. The whole process contributes to the Brazilian System of Innovation generating innovative products to society and producing financial resources for the implementation of new R&D projects and new undertakings. The model ensures the full innovation cycle from the technological results of their projects of R&D, adequately treats the intellectual property in the form of patents, trademarks and registers of computer programs and promotes the transfer and licensing of these technologies to startups and established businesses. Cases will be described to illustrate this model.

Keywords

1. Organization RNP

The Rede Nacional de Ensino e Pesquisa - RNP (Brazilian NREN), which was created as a project on September 1989 by the Ministry of Science, Technology and Innovation (MCTI), which became a nonprofit company in 1999, operates the network for Research and Education. Leading provider of connectivity for research and education in the country, it serves more than 300 organizations, including more than 130 public universities and 30 centres of public and private research, totaling about 800 distinct sites, supporting more than 3.5 million users with the use of the network infrastructure benefits.

Its goal is to ensure the excellence of the network infrastructure at the national, metropolitan and local levels (networks of campuses); achieve with innovative applications and services the demands of specific communities (telemedicine, biodiversity, astronomy etc.), and promote the training of human resources in information and communication technologies.

RNP offers free Internet access to federal higher education linked to the Ministry of Education (MEC), to units of federal research institutions linked to MCTI and other educational institutions and public or private research. Besides the integration of the Brazilian territory, RNP network offers international connections to the United States.

2. Innovation in RNP

2.1 The Mission of the RNP and its R&D

With a mission to promote the innovative use of advanced networks, RNP carries out R&D mainly in cooperation with universities, research institutions and undertaking. Moreover it is engaged in promoting R&D activities in general in the market, on matters related to the development of networks, middleware and applications. It also encourages, among users of all areas of knowledge, to make effective use of new products - basically services available to them through it, through its Service Portfolio.
Another highlight is the work of political articulation of RNP along the national and international RD&I communities in networks and distributed systems, which results in scientific and technological collaborations that set Brazil on the map of great references theme.

2.2 Innovation Process at RNP

The innovation process at RNP relies on its innovation funnel to develop new services and new processes and significant improvement of services and processes, and contribute powerfully, without departing from its primary role of an academic network, in the innovation process in enterprises within the National Innovation System.

This process is based on the Open Innovation model, originally proposed by Henry Chesbrough, which has been practiced by modern businesses and institutions in general, that want to enhance their innovation funnel. According to Chesbrough, the traditional development process of new products (goods or services) and of new businesses of a company used to occur within its funnel of innovation in its limits. However, this model, as coined by Chesbrough Closed Innovation, entailed a higher cost of R&D, beyond what it was not bringing the expected return by the companies. Get outside of its boundaries, also taking advantage of good ideas and technologies developed outside the company and transferring the partial or final technological results for the market through “spin-off” of the own company or through the licensing of these technologies to companies already established on the market is to practice the Open Innovation Model. To explore these alternatives in an open environment of ideas, technologies and resources, is concisely what makes the RNP operate its innovation funnel in the open innovation model.

RNP operates its innovation funnel, permeable to its external environment. It fertilizes its innovation process and leverages more the opportunities that exist, openly seeking other technological bases, beyond its inner technology base, and thus enhancing its innovation funnel. Operating in the open model, RNP takes more and better advantage of the intermediate outcomes of R&D, even those that do not go ahead and generate innovations for it. In RNP, it is sought to transfer the final R&D intermediate result or to companies in the market through licensing, or even by supporting the birth of a “spin-off” company, to reach new markets, in both cases, generating additional revenue for the company. Of course the reverse is also practiced, i.e. RNP search technologies for its use, contributing to fuel its innovation funnel.

An innovation, according to § 146 of the Oslo Manual, in its 3rd edition, is the implementation of a
product (good or service) new or significantly improved, or a process, or a new marketing method, or a new organizational method in business practices, the organization of the workplace or external relations. Product and process innovations, according to the Oslo Manual, in its 2nd edition, are differentiated according to their degree of novelty, being the minimum degree, when innovation is only for the company but already exists on the market / sector, intermediate grade, when innovation is for the company and for the market / industry and maximum degree, where innovation is to the world. Behind this type of degree of novelty they are inferred up different paths of innovation, correlating enterprise and market.

RNP innovates technologically, even though in different degrees of novelty, introducing new products and significantly improving its existing products, which are basically services to their user institutions and are part of their portfolios. Also innovates in processes, introducing inside, new, or improvement of its existing processes. Usually it does that in cooperation with universities and companies, in national scale, and with other academic networks of other countries in continental and international amplitudes. However, the scope of its full potential contribution to the national innovation system where it belongs to, also includes the licensing of technologies and even the induction of creating spin-off companies, which lead technological results that overflow their operation, aligning with the practice of intensive use of technological results, partial or final of the Open Innovation model, for additional revenue and decrease its cost of R&D and new businesses prospects.

2.3 Technology Prospecting
Through the prospecting of new businesses and markets, technological forecasting, trends, market needs and international cooperation with other academic networks of countries, mainly from Europe and the United States, the Department of Services and Solutions of RNP, in particular through its Deputy Director of services and Director of Engineering and Operations, along with the Board of Research and Development and the Board of Management through its Office of Businesses Development, they identify the need for new products (goods and services) or significant improvements to existing products or even new processes or significant improvement of existing processes.

This demand for products or processes, new or significantly improved if demand R&D, are channeled into topics of Work Groups Programme RNP (WG - RNP).

2.4 The Programme of Work Groups of RNP
The RNP Work Groups (WG - RNP) Programme, coordinated by the Research & Development of RNP, develops cooperative projects for RD&I with universities, research institutions and companies. Launched in 2002, it aims to develop projects with these partners, the development of pilot services and prototypes of new goods, of the interest of its members. Projects are proposed by national research groups, in response to an open call notice published annually by the RNP, which is responsible for defining the issues, object of the proclamation. The selected proposals shall be called the Working Groups (WG). Since 2005, the length of WGs began to be divided into two stages of a year, corresponding to their innovation filter funnel.

Currently, the system works as follows: in the first phase, each group develops and demonstrates a prototype of a new service. Having assessed the performance and features of all the developed prototypes, some of them are selected for the second phase. In this, the WGs should develop the prototype presented in order to implement a pilot to be tested on a small group of institutions. After this second phase, the pilot can be transformed into a new RNP service. In some cases, only the WG ends developing a prototype product, without corresponding to a new RNP service.

Each WG has a coordinator who is usually the partner researcher, university or research institution, public or private, and a team of assistants. RNP may appoint one or more employees to participate in their activities of WG. RNP user institutions (universities and research institutions) or even companies, can also participate in activities, provided that the criteria are considered by the coordination of the WG.

3. Generating new business as innovation strategy

3.1 Introduction
Since 2000, RNP promotes the use of advanced applications in computer networks. IP telephony, digital TV transmitted over the network, distance education and IP videoconferencing network are some of the applications that are being implemented in the form of new services for users.
As described above and in [Stanton 2013], in their process of innovation, RNP develops projects of R&D in a two-year cycle, of which financial resources are mainly from public sources. With themes guided by the policies of the brazilian government for scientific and technological development, the projects are coordinated by the board of RNP’s R&D and implemented by researchers from universities and research institutions.

Directly and indirectly, these technological projects produce results. Some of these results are converted into experimental service in RNP and a percentage of services deployed in the organization. However, by 2009, most of these technological results used to be interrupted, often by the lack of financial resources or just by the lack of an effective programme of technological innovation of which complete cycle could lead these technological results to the market. That year, a new created department called the RNP New Businesses Management should establish rules to select the technological results produced by RNP and create mechanisms to bring them to market in the form of goods or services. As highlighted in [Oslo 2005] RNP believes that only after the introduction of a product on the market the cycle of product innovation is completed.

Introduced in Open Innovation [Chesbrough 2003] process, the opportunities for generating new businesses must be observed, not only within the organization but also externally. Thus, the search for new businesses in the RNP does not only focus on technological results produced in the organization, but also in institutions that integrate the process of open innovation. The work described here discusses the inner processes for dealing with ideas and opportunities arising in this context and the treatment of the produced technological results.

3.2 Entrepreneurial Vision - the vision of Business

![Figure 2 – Creating Business Structure in the RNP](image)

When developing a project (technical, scientific, or business), its product (goods or service) can be a specific solution for a client, a technology without immediate application or an investigational product, etc. As said earlier, to the product became a really innovation, beyond the novelty, it must be absorbed by the market and be recognized as a successful product by it. There is too much distance between the result of a design and a fully inserted product into the market. Typically a good business plan provides all the guidelines and actions necessary to obtain a successful business from a product, just as the result of a project.
Undertake a business means to transform a technological result in a true market product, ready to be a success and make life easier for customers. Entrepreneurship is the main factor promoting economic and social development of a country. It may also be the determinant organization and business success factor. Identify opportunities, grab them, develop the skills and necessary abilities and seek resources to transform them into an economically sustainable business are essential to the entrepreneur before creating new business aspects.

The entrepreneur has like basic feature the creative spirit and researcher. He is constantly looking for new ways and new solutions, always keeping in mind the needs of people. The essence of successful businessman is the pursuit of new business opportunities, beyond the concern with the product improvement.

The concept of business vision or entrepreneurial vision in the projects development brings two immediate benefits: the first is directly linked to the innovation process. A good strategy for innovation is the introduction of the business vision to develop projects where the results (goods or services) with any degree of technological novelty are conducted to the market through an appropriate transfer vehicle.

As a second benefit, it shows up the generating of financial results projected by new business, where the results will feed back future projects - this is closely linked to the economic sustainability of the organization.

3.3 Economic Sustainability
The economic sustainability of a business is based on the wealth generation through the application of own funds obtained as a result of the business itself. RNP is a nonprofit organization, but its statute provides for the generation of economic resources as an essential part of fulfilling its mission. The mission is the main objective of the company and to reconcile the economic, environmental and social dimensions in business is an ongoing challenge.

Incorporating an entrepreneurial vision in the development of projects, the adoption of an appropriate business model, the correct treatment of the intellectual property rights (IPR), the best choice of skills and partnerships in the development and conducting business add value to ideas and opportunities, contributing to the economic sustainability of the business and the organization.

Economic sustainability must generate revenue to ensure the implementation of the business and to support at least part of the investments in prospecting and developing new businesses, maintaining the cycle of technological innovation.

3.4 Treatment of Intellectual Property
The process of generating new businesses is an ongoing process of adding value to intellectual assets (ideas, opportunities and generated technological results) that are selected. One of the most important points of adding value is the treatment of intellectual property rights.

RNP instituted in 2013 its Intellectual Property Policy which includes, besides the technological results of R&D projects, protection of trademarks and other intangible assets that it possesses. By establishing an Intellectual Property Policy for itself, for its individual projects or in cooperation with its partners, RNP has taken an important step to add more value to the technologies it develops together with partners and provides a more efficient transfer to market. The involvement and presence of RNP in the education and research sector throughout the Brazilian territory, this policy also contributes to the dissemination of culture and preservation of intellectual property rights, to the extent that all legal instruments between these institutions begin to contemplate intellectual property clauses, which align with the State policies, supported by federal Law of Innovation, having as one of its main sponsors, the Ministry of Science, Technology and Innovation (MCTI).

The qualification of RNP as Social Organization, establishing the execution of social activities directed to technological development, contributes to the alignment of intellectual property with the objectives of the RNP policy. Thus, the knowledge generated by RNP promotes the scientific, technological and educational development; the innovation of products on the market; and the impact solutions development on public policies.
4. Technology Transfer

RNP can and should play a role in integrating the universities, not only providing them with connectivity, but integrating the results of joint projects in innovative business where everyone works collaboratively and produces results with more added value.

The RNP has an Office for New Business linked to Management Board which, together with the Board of Research and Development, works in cooperation with the NITs (Centres for Technological Innovation) of R&D project partners - universities and research institutions, and with R&D departments of firms, on the protection of developed technologies and also on the licensing and transfer of these technologies to the market.

The acquirement of new technologies in an organization can occur in two ways. The first is through research and development, produced internally on the company or in partnership with other companies, universities, academic and research institutions and / or research centres.

The second comes from the commercialization of innovations, or what we call technology transfer. The technology transfer is the process by which knowledge, skills and industrial solutions are transferred (via a licensing) from a company or organization to another. This transfer can expand the innovation capacity of the licensed company, as it passes into contact with new knowledge, skills and licensed industrial solutions.

Based on RNP Intellectual Property Policy and legal frameworks for innovation, RNP acts in the spreading of the culture of intellectual property, technology transfer and offers the portfolio of intellectual assets to external agents (investors and interested), facilitating the interface between demand and supply of innovation and mainly stimulating the creation of new businesses and technology transfer, arising out of ideas and opportunities, projects in R&D, technological results and other generated innovations.

4.1 Process Steps for Technology Transfer

![Flow to treatment demands of new business opportunities and Improved Business](Image)

Figure 3 – Decision flow for creating business
4.1.1 Management of Intellectual Assets Portfolio
The Process of new business in the RNP starts with an identifying process of projects with potential for business that consists of a cataloging system of all intellectual assets produced by RNP - are all directly or indirectly from technological results from the internal projects or those developed with partnerships. This cataloging process already considers the potential of each asset to generate new business for RNP.

At this stage the ideas are recorded and institutional opportunities received within the RNP, along with a survey of the technological results through the execution of projects, identified business opportunities and services provided by RNP with or without partners. This portfolio can be fed both by internal prospecting as external demands.

4.1.2 Study of the Technical and Economic Feasibility – EVTE
From the selected technologies or technological results, a study is conducted, involving aspects of intellectual property, technical aspects, the stage of technology development, the implementation capacity, market and economic aspects. In addition, analyses are performed to confirm the technical soundness and economic feasibility of the deployment of technological solutions in the market. If required, a socioeconomic analysis is done to verify the need of other skills demanded by technological areas.

4.3 Preparation of Business Plan (BP)
The Business Plan is mainly intended to demonstrate how the company will operate in an economically sustainable manner and to perpetuate in their markets. For both it should meet the operational and financial objectives of the company for a given period of time and come up with strategies and the resources needed to achieve them, in addition to detailing the overseas markets, business models and recent results and future company prospects.

Since the development of a business is often an activity done in partnership, BP model also seeks to explore, where applicable, the commonalities partners to achieve the desired goal.

4.4 Identification of the transfer vehicle
When a technology or technological result is selected with appropriate degree of maturity for the purpose of transfer, one should choose the best vehicle to transfer or license such technology, i.e., by diffusion, technology transfer / licensing or to create a Startup.

4.5 Formalizing Negotiation and Contract
Established the technology and the related parts, the next step of the transfer is to define the legal instrument in which are set out and defined, contractual terms, the amounts of investment and infrastructure required, royalties, obligations of each party, operating conditions, etc., as well as timing and form of commitment of the parts involved in technology transfer.

4.6 Licensing / Technology Transfer
The effective transfer occurs with the development of a licensing or technology transfer agreement. Generally, at this period, are made final adjustments, both of which will be required for the technology to reach the market as the bureaucratic details of the formalization of the legal instrument.

Currently in Brazil, the investment in Science, Technology and Innovation, tax incentives and Law of Innovation and the “Lei do Bem” (Law of Good), the investments by venture capital and awareness and investment in innovation by firms in the manufacturing sector, bring a favorable scenario for the country, and RNP, within its competences, emphasizes the importance of stimulating cooperation programmes aimed at synergy between the public and private sectors.

The participation of RNP in the financial results of the licensed products commercial exploitation contributes to the development of its ability to manage the development of new business and generate new revenue to reinvest in new business projects. In line with what is suggested [GII - 2013] and [Schumpeter 1957], since the RNP focuses its expertise in managing and coordinating projects, partnerships play a key role, since they guarantee the performance of R&D and running of the future business.
5. Cases

In this session the success stories (and other non-success) are described. They motivated the RNP to develop a methodology for the development of new businesses as an innovation strategy, emphasizing the importance of protecting Intellectual Property, structuring a business plan, collaborative work, the Technology Transfer to the market and ultimately share the economic results obtained from running the business, allowing it to generate new investments in new ventures.

5.1 Case of success – HSM

HSM - High Security Module - is a product developed in partnership with the RNP, the company Kryptus and Computer Security Laboratory of the Federal University of Santa Catarina - all Brazilian organizations. The HSM is a by-product of the GT - ICPEDU which had as its main objective the creation of a software system for operation and management of cryptographic keys cycle of a PKI - Public Key Infrastructure (ICP in Portuguese) - addressed to the university environment.

The HSM is a Cryptographic Security Module with 100 % Brazilian development. It has the certificate ICP - Brazil MCT7 NSH3 and NSF2 and it is compatible with the FIPS -140 Level 4. It allows the creation and storage of cryptographic keys in a secure environment, protecting them against physical and logical attacks. The SE version (Secure Execution) also allows the storage and the safe execution of user applications inside the equipment.

Apart from all the development of management software, all hardware, manufacturing test processes - the hardware has numerous physical and logical protections against attacks – it was also careful with product approvals and protection of all intellectual property involved. With the product in the final stages of construction, RNP promoted throughout the process of technology transfer involving the three partners and negotiating the ownership of the product and shareholders in these economic results as receiving royalties.

The HSM was the first cryptographic security module to be certified by ITI - Brazilian Institute of Information Technology - for use in ICP - Brazil, and it is currently the only one to have accreditation with maximum confidence level of approval (NHS3) and maximum physical security (NSF2 equivalent of FIPS 140-2 level 4), which makes this equipment ideal for use in CAs of ICP – Brazil.

This is a typical example of a business enterprise of seizing an opportunity, but counting with a very competent team, focused, where every action was planned and executed.

5.2 Case of failure - main difficulties

The creation of a business does not happen from one day to another. In the case of the RNP, it is built each step of a creating process of new businesses as described above. Therefore, the process is constantly evaluated to determine its continuation as a business. Thus a business project can be aborted during these successive analyses and does not become a business. We can highlight next the main factors of unsuccessful businesses failed to materialize.

5.2.1 Lack of vision of entrepreneur

Throughout this paper we highlight the huge importance of entrepreneurial vision to create a successful business. Most of RNP R&D projects occur within the WGs and are run at universities. There are some cases in RNP in which members of the development team are awakened to have an interest in Startup and license the technology, because the assumption is that they are the most knowledgeable of the developed technology. It’s true! However this is very little to undertake business based on that technology. Sometimes they have lack of the entrepreneur vision to conduct business, gather the necessary skills to seek sources of financial resources, benefit from tax incentives and to have a good knowledge of the current market and especially to estimate the future and so on.
5.2.2 Lack of IP culture
Another factor contributing to the failure of a business, which has already been noted by RNP is the lack of culture of the ones involved in the issues of the intellectual property rights, which carries the disregard, from the first moments of the partnership where we discuss first issues relating to IPR. Who will own the technology and to what extent, how and for whom the technology will be licensed, how the economic results will be divided etc. These uncertainties throughout the project can derail a solid business because the actors' expectations do not always align.

5.2.3 Lack of market insight
As the last factor highlighted, being the cause of failure of a business, it is the lack of market view of those involved in the project. The key factor and driver of RNP projects is the searching for new technologies. However, for a technological outcome, as mentioned several times in this work, to become an innovation and it needs to reach the market and so it is considered a success by it. However, a lack of vision, or even align with the exact needs of the customers, the generated product is loaded with new features and technology, but in some respects does not meet the expectations of customers, even those not declared.

6. Conclusions

Since the financial resources of NRENs are not always sufficient to spread all the knowledge generated internally, it is necessary to organize an efficient strategy that allows share that knowledge with society. RNP adopted the strategy of undertaking new business with this knowledge, turning it into technological innovations, either as a product or process.

Undertake a business means to transform a technological result in a true market product, ready to be a success and make life easier for customers. Entrepreneurship is the main factor promoting economic and social development of a country. It may also be the determinant organization and business success factor. Identify opportunities, grab them, develop the skills and necessary abilities and seek resources to transform them into an economically sustainable business are essential to the entrepreneur before creating new business aspects.

It is not only do projects of new technologies, but new business projects as well. It is essential to seek more efficient ways to make innovation: through partnerships with the productive sector and global collaboration. Add value to intellectual assets ensuring intellectual property is an essential step to an efficient process of technology transfer to the marketplace.

Finally, it is important to NRENs to concentrate efforts on the efficient and self-sustaining generation of innovative new products, developing new technologies and new processes, and stimulating the emergence of new companies, entrepreneurs and new business.

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