Spin-off or Spin-in: a model for technology transfer and commercialization

WEISZ, Joel[1]
HECKSHER, Suzana Dantas[2]
FERRAZ, Fernando Toledo[3]
MELLO, José Manoel Carvalho[4]

Abstract:

An obstacle in managing new technologies has been insuring that they end up as successful business rather than just adding to academic knowledge. Public policies have often resorted to promoting the creation of startups, either with seed money and grants or by promoting their association with venture capital funds. However, startups are frequently too small to meet demands from big clients. Due to resource constraints, they may neither have the capacity to supply the quantities of products (goods or services) ordered, nor can they often provide the full range of products required by a customer who would prefer not to break down his order into many specialized suppliers. This paper discusses the hypothesis that one manner of overcoming such limitations would be finding ways that enable Research-based Spin-off firms to share their complementarities.

Various types of organizations have been conceived to enhance the effective transfer to market of technology generated in the academic environment. Among those models, different forms of networking have been studied over the last two decades, and, in some instances have actually been implemented. The Brazilian funding agency FINEP promoted the implementation of cooperative technological innovation networks with the idea of joining the efforts of business with the academic activity. The results of this initiative were rather limited, as the academic participation outweighed the industrial involvement. Nevertheless, it had the merit of setting a pattern for ensuing initiatives in Brazil. The model envisaged in this study is to create a new corporate shell that will in some way absorb various startup companies providing services that complement each other for a given industry. Thus, the new corporation would be able to fulfill the needs of a big client in an industry that demands technology-intensive products (goods and services). Among the difficulties expected in such an endeavor are financial constraints of RBSO firms, and the need to join groups with different interests,

[1] Cognética, Consultoria de Empreendimentos Ltda.; Rua Lopes Quintas 390 / 602; 22460-903 Rio de Janeiro, RJ; Brazil, and Universidade Federal Fluminense, Doctoral Program In Industrial Engineering (UFF/TPP); Niterói, Brazil; jweisz@globo.com .

[2] Ph. D. Professor at the Universidade Federal Fluminense in the Industrial Engineering Program (UFF/TPP); Rua Passo da Pátria 156, bl. E, s/ 443; 24210-240 Niterói, Brazil; suzana_hecksher@yahoo.com.br.

[3] Ph.D. Professor at the Universidade Federal Fluminense in the Industrial Engineering Program (UFF/TPP); Rua Passo da Pátria 156, bl. E, s/ 443; 24210-240 Niterói, Brazil; fernandoferrazuff@yahoo.com

[4] Ph.D. Visiting Professor at the Universidade Federal Fluminense in the Industrial Engineering Program (UFF/TPP); Rua Marquês de São Vicente 230, C-01; 22451-040 Rio de Janeiro RJ; Brazil; josemanoel.carvalhodemello@gmail.com

varying degrees of maturity, and diverse expectations into one corporate shell that is expected to become one bigger supplier for that industry. Also defining the optimal legal and managerial framework for this new organization will possibly present its share of hurdles. This paper studies the effort and results of such an initiative.

One reason for the choice of this model was the idea that vertical and horizontal cooperation with customers, suppliers and other firms "plays a more distinct role in innovation performance of SMEs" than cooperation with government agencies. Some initial findings indicate that public science, technology, and innovation policies could also focus on organizational innovation by fostering new types of linkages between supply and demand for technology.

This text is meant as a contribution in the issue of Technology Transfer, marketing and Commercialization, as it deals with one model for absorbing technological knowledge into productive activities. Furthermore, as part of its focus on organizational innovation, this study examines the concept of *intermediaries* linking startups to a big client, as one possible category into which the model could fit. Primarily, the authors have elaborated on a financial system that reinforces the demand side of technology, rather than technology push. Such a system elicits the idea of using demand-side policy mechanisms rather than promoting the generation of technology. The model conceived would represent an innovation friendly financial system that provides a financial support for startups based on expected demand, therefore not having to depend on political decisions for its funding.

Key words:
Technology transfer; intermediaries; cooperation with client; speed-to-market; Research-Based Spin-off firm (RBSO); cluster.

Introduction:

The authors have participated in the preliminary discussions for the conception and creation of an organization destined to enhance the technology transfer and commercialization (TTC) from research-based spin-off firms (RBSO) (Conceição, Fontes, and Calapez, 2012) that germinated in the academic environment (Mello et al. 2013). This paper proposes to study this organization as an organization model and as a pointer indicating technological innovation policies in the light of previous experiences and of literature on organizations and their performance in Technology Transfer and Commercialization (TTC). The interest on a model for effective TTC stems from the need to identify factors for overcoming obstacles on the way to successful experiences. RBSO firms are typically financially fragile, and government funding for them, especially in Brazil, has been inappropriate. Startup firms usually have no capacity to leverage funding for industrial investment, which is usually a multiple amount as compared to R&D investment.

This explains the fact that RBSOs are "resource constrained (especially financially) and have limited time before they must succeed in the marketplace." (Clausen and Korneliussen, 2012). Startups are often too small to meet market demand, especially when they have to meet demand from big clients, who require quantities, as well as quality and reproducibility, and are not prone to spread out their procurement into many small purchases. Furthermore, speed-to-market (Chen et al. 2010, p. 18) is a key issue for Research-Based Spin-off firms (RBSO). Those limitations constrain their capacity to meet market needs.

This paper discusses the hypothesis that one manner of overcoming such limitations would be finding ways that enable RBSOs "to share knowledge and profit from complementary competences" (Zeng, S. X., Xie, X. M., and Tam, C. M., 2010).

Background:

Various types of organizations have been conceived to enhance the effective transfer to market of technology generated in the academic environment (TTC). Among those models, different forms of networking have been studied over the last two decades, and, in some instances have actually been implemented in Brazil. The Brazilian funding agency FINEP used an Interamerican Development Bank (IDB) loan to the Brazilian Government for promoting the implementation of cooperative technological innovation networks that were conceived upon a study made in the US National Science Foundation (Weisz, J. and Roco, M., 1996). The results of this initiative, as presented in the Third Triple Helix International Conference (Weisz, J. and Longo, W. P. 2000) were rather limited, as the academic participation outweighed the industrial involvement.

Internationally, various schemes for funding RBSO firms have been conceived, such as the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) of the US Government that offer successive grants to academic startups. Several Brazilian initiatives, some originating in the central government and some other in state or local governments, emulated SBIR. Furthermore, zero-interest loans were designed for RBSOs, as well as grants making it possible for emerging firms to develop their technology up to the stage in which it is ripe to become a business plan. More recently, FINEP replaced that mechanism with a new program called Tecnova, which also entrusts the operation of the funding to state government authorities. There are at least two seed-money funds created by central government agencies: Seed-money fund "*Inovar Semente*" created by FINEP and "*Criatec*" launched by BNDES. Different funding schemes have been devised for small firms such as Angel Investors, Venture-capital funds, patent-based investment funds (Gredel, D., et al, 2012), as innovation intermediaries.

Most Brazilian R&D project financing mechanisms are designed in such a way that only medium size or big corporations have access to them due to the high value of minimal loans, due to demands that are difficult for RBSO firms to meet, such as providing real guarantees, and submitting to credit risk analysis (Inova Brasil, FINEP)

(Linha BNDES Inovação). Funding for small firms, especially in Brazil, is usually limited to Research and Development investment (R&D). The funds are often granted under judgment that resembles academic criteria, and frequently handed out to an academic researcher instead of financing the startup firm (Weisz, J., 2006). Most of the R&D funding for RBSOs is handed out, in Brazil, by state government agencies that distribute money that either comes from central government agencies or from their state government treasuries. At times there are also local private institutions, such as business associations that contribute with their funds and advices. Yet, as mentioned above, in addition to being distributed according to academic criteria, those funds are destined solely for R&D. However, the startup firms need other investment before they can actually survive and, most important, before the developed technologies become innovation. Real return on investment will actually be obtained after concrete industrial investment, which is expected to come in sequence to R&D.

Startup firms usually have little capacity to leverage funding for industrial investment, which is usually a multiple amount of R&D investment. Therefore, startups are often too small to meet market demands, especially when they have to meet demand from big clients who require quantities, as well as quality and reproducibility. The obstacles on the way for successful innovation, would suggest that RBSO are the wrong choice as vehicles for innovation. This limitation holds true internationally "From a resource perspective, financing and access to co-specialized assets are two major obstacles for SMEs and academic spin-offs with regard to technology commercialization. In many countries, risk capital for SMEs is scarce" (Gredel, D. et al, 2012). In addition to funding, different types of obstacles are faced by RBSO firms, which can be related to market, management, finance, physical, or government regulation and bureaucracy (Geenhuizen and Soetano, 2009).

Yet, in certain circumstances, small firms are in favorable conditions for technological innovation. " (…) regimes characterized by high technological opportunity, low cumulative knowledge, strong external technological links and well-developed industrial property rights favor small firms vis à vis larger organizations" (Revilla, A. J., and Fernández, Z. 2012) due to their flexibility and adaptability to highly dynamic environments and technological discontinuities. Those authors contend that the difference in performance between small and large firms stems to some extent from external contingencies, which ought to be better studied. Their conclusion is that smaller firms, such as RBSOs are favored by the proximity to the science system, whereas "innovation performance of larger firms is comparatively better in regimes with limited use of intellectual property rights and where the relationships with clients and suppliers are important sources of opportunities for innovation."

The model proposed in this study offers a mechanism that is expected to overcome both the size limitations of the small firm and the lack of flexibility or of adaptability to rapidly changing technological outlook that affects larger firms.

Organizational model and speed-to-market:

An important variable for the viability of RBSO firms is speed-to-market. As some studies point out (Clausen and Korneliussen, 2012), there is a "knowledge gap in the literature on innovation" regarding the influence of organization on the speed to market of new technology. However, "most studies of New Product Development (NPD) speed are at the project level […] research on the organizational level should be an important consideration … " (Chen et al., 2010, p. 28). Nevertheless, Clausen and Korneliussen dwell mostly on the influence of entrepreneurial orientation on graduation time for incubator firms, rather than on organizational arrangements. Furthermore, studies suggest that organizational " … emphasis on speed and functional diversity have the expected significant positive impact on NPD speed … " (Chen et al., 2010, p. 28).

Speed-to-market is considered in relation to the type of organizations involved in implementing technological innovation. This article is meant as a contribution to the understanding of new types of organizations that play a role in the increasing complexity of national systems of innovation, with "innovation becoming more open or distributed over time … Within this more complex realm, has emerged a set of actors who may be broadly termed as 'intermediaries'" (Howells, 2006). One particular type of organizational arrangement, the cluster of RBSOs in the model being described in this study is analyzed as a potentially successful solution.

As shown above, the Brazilian public policy has been one of fostering supply of technology rather than acting on the demand side of technology and, more specifically, on approximating industry to university spin-offs. Relying on government action and on funding agencies does not guarantee proper technology transfer. Promoting the approximation and cooperation between RBSOs and their clients seems to be more efficient in promoting speed-to-market for emerging technologies. This study focuses on the design of an organizational arrangement that favors vertical and horizontal cooperation with customers, suppliers and other organizations. Acting on the organizational model "plays a more distinct role in innovation performance of SMEs" than cooperation with government agencies (Zeng, S. X., Xie, X. M., and Tam, C. M., 2010).

In this respect, this type of organization can correspond to the concept of *intermediaries* (Howells, J., 2006), as one possible category into which the model could fit. Its objective is to link a set of startups to a big client for the purpose of establishing an outlet for their technology. Thus, the model operates by bringing the demand for technical solutions close to the technology generating source and, in this way directing the R&D effort toward meeting actual demand. This model represents a user-led initiative boosting innovation out of technology generated in the academic environment. Therefore, this model is closer to the idea of market pull rather than technology push.

Such a system elicits the idea of using demand-side policy mechanisms (OECD, 2011) rather than promoting the generation of technology. "(…) policy makers seeking to boost innovation are increasingly looking beyond traditional supply-side policies such as R&D support to demand side in order to accelerate innovation." (OECD, 2011).

Brazilian policy makers have, in some instances intended to act on the demand side (OECD, 2011), especially since the late 1990s, upon a more critical view of the linear model as a basis for public science and technology policy. Science and technology policies gave way to more emphasis on innovation policy, and some initiatives were taken in that direction, such as promoting cooperative research networks (Weisz, J., and Longo, W. P., 2000), tax incentives for investment in R&D (Law 11.196/2005 and subsequent), that stimulate investment by firms investing in R&D, and a proposed use of government purchasing power (Law 12.349/2010 and other) as a mechanism for promoting technological innovation. Although those mechanisms are supposed to intensify investment on technological innovation, their effect has been rather insignificant in the Brazilian economy. The use of tax incentives in Brazil was limited to 460 companies in 2008 (MCTI, 2013). If compared to the universe of 106862 Brazilian industrial companies, of which 33 thousand declared having engaged in some kind of innovation in 2008, and of which, in turn, 4754 companies declared having invested in R&D in that same year (IBGE / PINTEC 2006 – 2008), one may conclude that the effectiveness of that mechanism is rather low. The same comment applies to the use of government purchasing power as a mechanism for promoting technological innovation, as this practice has not spread over various government agencies. Therefore, one conclusion we arrive is that government policy has not been one of acting on the demand side.

Hsie, Lee, and Ho (2012) design an analytical framework for policy makers and business planners to examine how value is created and captured in service clusters. The authors "argue that a firm's decision to enter or exit a service cluster depends on the net effect of agglomeration economies (i.e., cluster effects) and the economies of network (i.e., network effects)."

The model conceived in this study, a cluster of RBSO firms, compensates for the ineffectiveness of government mechanisms. It is the type of organizational arrangement that promotes the proximity between technology supply and demand by its end user. From a technology supply side perspective, the new organization functions as an innovation accelerator. It provides the participating RBSO firms with access to financial resources, entrepreneurial start-up support, and access to networks (Carayannis and Zedtwitz, 2005, p. 105). Access to financial resources in the case of this model is provided either as a result from orders placed by the client corporation, which fulfills the actual purpose of the new organization, or from government initiatives designed to foster organizational innovation. Eventually, investors may acquire shares of the new organization. Entrepreneurial start-up support is a consequence of the networking within the new Organization and with the outside business environment, as well as from the opportunity to face the need to meet the demand from big clients.

The need to provide the full range of products required by a customer who would prefer not to shop from various small suppliers indicates a need to find ways that enable RBSOs "to share knowledge, and profit from complementary competences". There are significant synergies arising from the cooperation among RBSOs, resulting in enhanced innovative performance. On the other hand, "(…) linkage and cooperation

with government agencies do not demonstrate any significant impact on the innovation performance of SMEs." (Zeng, S. X., Xie, X. M., and Tam, C. M., 2010).

Towards the model:

As shown above, most initiatives for promoting technology transfer in Brazil have acted on the supply side of technology. They are meant to enhance the growth and maturity of startups and to create conditions for further advancing the maturity of the technology to be exploited. Yet market criteria are important when choosing in which technology to invest (De Coster and Butler, 2005). In other words, demand is a relevant condition for the success or technological innovation. Those authors indicate an order of criteria for assessing new technology ventures, in which they stress technological and commercial risk and market criteria. Therefore, promoting the presence or the proximity to demand is a way to foster successful technological innovation.

RBSO firms are often limited to producing and selling their intellectual property (IP) rights. In fact, "the case of firms that specialize in the production and sale of intellectual property and thus operate in the ''market for technologies'' (Gans and Stern, 2003) is becoming more frequent," (Conceição, O. et al, 2012). Usually, the technology is acquired by bigger firms that do not necessarily implement business for which the technology was meant. This may hold especially true, if the IP is acquired by a company that sees the innovation as a potential competitor. The proposed model pushes the R&D staff responsible for the technology development into contributing to implement the innovation. The model conceived in the present case, in which the authors participated in the phase of conceptual discussions, is peculiar in the sense that it acts on the demand side of technology transfer. In other words, the cluster of RBSOs promotes the commercial use of technology designed in the academic environment. The initiative, in the case described in this text clearly arose from a prospective client for the technology developed by RBSO firms. One determining factor for product quality and NPD speed is responsiveness to demand (Chen et al., 2010). Chances for technological innovation as well as speed to market improve when there is a need for it.

Smaller RBSO firms tend to be favored by their "proximity to the science system", whereas larger firms show better innovation results "where the relationship with clients and suppliers are important sources of opportunity for innovation" (Revilla and Fernández, 2012). The model that is the object of this study seeks to profit from the advantages of both the proximity to the science system of the small RBSO firms and the rapport to big clients made possible by the size of the new corporate shell created by the entrepreneurs of the small startup firms.

Gathering a group of complementary RBSO firms into one cluster was conceived as a means to profit from the advantages of both the innovativeness and flexibility arising from the small size of individual participants and the comprehensiveness of the encompassing corporate shell. This solution is in line with a new pattern of competition, as pointed out by Porter. "Competition will be among

clusters of related business units rather than among individual business units" (Porter, 1985, p. 364).

Additionally, the new model is expected to lead to improved innovative performance by participating RBSO firms, given that there are significant positive relationships resulting from "inter-firm cooperation, cooperation with intermediary institutions, (and) cooperation with research organizations". Furthermore, authors expect the intense involvement of the client in the implementation of the new model to substantiate vertical cooperation with an important customer and eventually with suppliers, which again plays an important role in innovation performance for SMEs (Zeng, S. X., Xie, X. M., and Tam, C. M., 2010).

Another feature considered important for the success of the new model being proposed is the fact that a cluster of RBSO firms with related and mutually complementing technological innovations will profit from synergies. The motivation for gathering or acquiring related technology is strategic in its nature. "A bundling of competencies can be important in order to stay competitive" and to strengthen firms technological competence (Hussinger, 2010). In addition to strengthening the new corporate shell due to the alliance of several players, the new organization is also expected to provide an increased scope of the services rendered in one particular field, thus preventing the client from having to shop in many SMEs.

The spin-in model:

The objective for the model conceived in this study was twofold: from the technology supply side, the aim is organizing a cluster of RBSO firms in the form of a new corporate shell for providing complementary services for a given industry, thus bundling competences (Hussinger, 2010), and placing emphasis on functional diversity (Chen et al. 2010). A newly created corporate shell should be able to supply the full range of services required by a big client. From the technology demand side, the aim is one of exposing the RBSO firms to the client's technological needs and having them work in collaboration with the client in finding the necessary technological solutions.

The startup firms, in this model, become part of a new and bigger corporate shell, of which they will become shareholders. Hence the idea of "spin-in" as opposed to the more widely used concept of spin-off firms: instead of small firms parting from larger organizations, in the model being proposed, small firms would join to form one stronger outfit. In addition to strengthening the technology supply side, from the perspective of technology demand, this new corporate shell would be able to fulfill a wider span of needs of its big client, who would therefore not have to shop from many small scale partial suppliers in a given range of products. Eventually, the client may be willing to support the inception of that new corporation and strengthening it, in other words, to foster its supplier.

The legal format of that cluster could be the object of further discussions. The model might comprise an informal network of RBSO firms or an ad-hoc consortium for meeting specific demands. The legal setting could reflect the participants' interests,

differing degrees of technological and entrepreneurial maturity or different financial robustness. In this model, the authors propose the format to be one of a private corporation, in which the RBSO firms would participate as shareholders, and consequently, with a decision making power proportional to its participation as members of the board of directors. Each participating firm would be rewarded for its participation on services rendered and technology supplied to clients, and executive positions in administering the new corporation would be considered an activity to be compensated.

Concluding remarks:

The proposed model is expected to convert a set of RBSO firms into one stronger organization capable of meeting the demand of big clients. The main gains obtained with this model are:

Regarding entrepreneurial issues:

i) Cooperation among different startups thus improving their innovation performance;
ii) Creating one stronger organization that would improve the bargaining power
    a vis-à-vis government agencies, banks, and other institutions regarding financial or regulatory requirements
    b in negotiating with big clients;
iii) Enabling RBSO firms to supply the quantities, the quality, the repeatability, and reliability required in susceptible technologies;
iv) Offering the full range of equipment, and services needed by clients, and therefore being able to provide better customer service.

Regarding public innovation policy:

i) Overcoming limitations to funding of RBSOs
ii) Putting in place a fostering system that acts on the demand side
iii) An indication that public science, technology and innovation policy could also focus on organizational innovation by fostering new types of linkages between supply and demand for technology

The main difficulties that may be encountered in choosing and implementing the model:

i) The novelty of the initiative and the resulting uncertainty regarding the outcome to expect;
ii) The uncertainty as to how far the client will go in becoming a partner in the new model
iii) The difficulties in overcoming the different views, interests and business situations of the various participating firms.

Most studies on research-based spin-offs (RBSO) firms and, particularly, most experiences in fostering RBSO have concerned the technology push side of innovation

policies and management. In this article, the authors propose acting on the demand side of innovation, which the authors believe to be more effective.

Nevertheless, further studies may be undertaken in the future to expand on how the participation of RBSO firms in this model is affected by the nature of the knowledge being exploited, conditions to take control of intellectual property, location and degree of control upon complementary assets and institutional setting in which the RBSO originated.

REFERENCES

- Carayannis, E. G., and Zedtwitz, M. v., Architecting gloCal (global – local) real – virtual incubator networks (G-RVINs) as catalysts and accelerators of entrepreneurship in transitioning and developing economies: lessons learned and best practices from current development and business incubation practices. Technovation 25 (2005) 95 – 110.
- CGEE, Capacitação Empresarial em Consultorias de Engenharia e Inovação, Relatório Final, Centro de Gestão e Estudos Estratégicos, 167 p. + attachments, Brasília 2010, unpublished.
- Chen, J., Damanpour, F., and Reilly R.R., 2010. Understanding antecedents of new product development speed: a meta-analysis. Journal of Operations Management 28 (1) 17 – 23.
- Clausen, T. and Korneliussen, T. The relationship between entrepreneurial orientation and speed to the market: The case of incubator firms in Norway. Technovation 32 (2012) 560 – 567.
- Conceição, O., Fontes, M, and Calapez, T., The commercialisation decisions of research-based spin-off: Targeting the market for technologies. Technovation 32 (2012) 43 – 56.
- De Coster, R., and Butler, C. Assessment of proposals for new technology ventures in the UK: characteristics of university spin-off companies. Technovation 25 (2005) 535 – 543.
- FINEP, Inova Brasil, http://www.finep.gov.br/pagina.asp?pag=programas_inovabrasil access on May 29, 2013.
- Geenhuizen, M. v., and Soetano, D. P., Academic spin-offs at different ages: A case study in search of key obstacles to growth. Technovation 29 (2009) 671 – 681.
- Gredel, D., Kramer, M., Bend, B., Patent-based investment funds as innovation intermediaries for SMEs: In-depth analysis of reciprocal interactions, motives, and fallacies. Technovation 32 (2012) 536 – 549.
- Howells, J. Intermediation and the role of intermediaries in innovation. Research Policy 35 (2006) 715 – 728.
- Hsie, Pi-Feng, Lee, Chung-Shing, and Ho, Jonathan C. Strategy and process of value creation and appropriation in service clusters. Technovation 32 (2012) 430 – 439.
- Hussinger, K., On the importance of technological relatedness: SMEs versus large acquisition targets. Technovation 30 (2010) 57 – 64.
- IBGE – Instituto Brasileiro de Geografia e Estatística, PINTEC – Pesquisa Industrial de Inovação Tecnológica 2006 – 2008. Published in 2010 (the most recent issue). http://www.ibge.gov.br/home/estatistica/economia/industria/pintec/2008/defaultzip_cnae2_2008.shtm access on May 29,2013.
- Law 11.196/2005 and subsequent legal documents: Decree 5798/2006; Law 11.484/2007; Law 11.487/2007; Complementary Law 123/2006; Law 11.774/2008; Decree 6909/2009; Law 12.350/2010.
- Law 12.349/2010, and Decree 4467/2012.
- Linha BNDES Inovação, http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Areas_de_Atuacao/Inovacao/ access on May 29, 2013.

- MCTI (Brazilian Ministry of Science, Technology and Innovation). http://www.mct.gov.br/index.php/content/view/8563.html access on May 29, 2013.
- MELLO, J. M. C. de, HECKSHER, S. D., FERRAZ, F. T., and WEISZ, J. Spin-off or Spin-in: Having Technology Generate Value. IAMOT2013 – 22nd. International Conference on Management of Technology – Proceedings, Porto Alegre, Brazil, 2013.
- OECD (2011), Demand-side Innovation Policies, OECD Publishing, http://dx.doi.org/10.1787/9789264098886-en, access on March 05, 2013. ISBN 978-92-64-09887-6.
- Porter, M. E., Competitive Advantage: creating and sustaining superior performance. The Free Press, 1985.
- Revilla, A. J., and Fernández, Z. The relation between firm size and R&D productivity in different technological regimes. Technovation 32 (2012) 609 – 623.
- WEISZ, J.; ROCO, M C. ENGINEERING RESEARCH AND EDUCATION NETWORKING IN THE AMERICAS. In: IV INTERAMERICAN CONFERENCE ON ENGINEERING AND TECHNOLOGY EDUCATION - INTER-TECH 96, 1996, Valencia / Venezuela. IV Congreso Interamericano de Educación en Ingeniería y Tecnología. 1996. v. CD-ROM.
- WEISZ, J.; LONGO, W P. Technological Innovation Networking in Brazil: An assessment of the RECOPE sub-program. In: THIRD TRIPLE HELIX INTERNATIONAL CONFERENCE, 2000, Rio de Janeiro. Third Triple Helix International Conference. The Endless Transition (Procedings). Rio de Janeiro: 2000. v. CD-ROM
- Weisz, J. *Mecanismos de Apoio à Inovação Tecnológica* – 3rd. ed. (2006), Brasília – SENAI/DN
- Zeng, S. X., Xie, X. M., and Tam, C. M. Relationship between cooperation networks and innovation performance of SMEs. Technovation 30 (2010) 181 – 194.