

025-1226

Difficulties and problems with the innovation process in academia

Authors:

Paula Salomão Martins – Universidade Federal de Juiz de Fora, MG – Brasil

paula.salomao@engenharia.ufjf.br Phone: 55-32-32321950 Address: Rua Dr

Dirceu de Andrade, 107/apt 402. Juiz de Fora, MG, Brasil. Zip Code: 36025-330

Thais Cristina Pereira Ferraz – Universidade Federal de Itajubá, MG – Brasil

thaiscristinap@yahoo.com.br Phone: 55-32-91972607 Address: Campus Prof.

José Rodrigues Seabra, Instituto de Engenharia de Produção e Gestão. Itajubá, MG,

Brasil. Zip Code: 37500-903

Luiz Henrique Dias Alves – Universidade Federal de Juiz de Fora, MG – Brasil

luiz.alves@ufjf.edu.br Phone: 55-32-32138133 Address: Rua José Honório

Loures, 235. Juiz de Fora, MG, Brasil. Zip Code: 36036-680

POMS 23rd Annual Conference

Chicago, Illinois, U.S.A.

April 20 to April 23, 2011

1 INTRODUCTION

Brazil is set in a context of limited success in its innovation development when compared to developed countries and the other BRICs countries - like China - especially in academia, where discoveries are often manifested in dissertations and theses, but rarely end up generating benefits to society and to the researcher through their application and dissemination in the market (Martins, 2011).

In Brazil, entrepreneurial initiatives in the academic sphere are still in an early phase. But the government is already showing support for this type of venture. Freitas, Gonçalves, and Cheng (2010, p.2) comment that in the Brazilian context, although the results are still pretty modest, some specific government actions can already be seen, such as support for a number of spin-offs or technology-based start-ups .

The creation of the Law and the Executive Order of Innovation (Decree no. 5563, 2005; Law no. 10.973, 2004)¹ testifies to the growing importance being placed on the need to assist in the generation and consolidation of technology-based companies on a national level (FREITAS; GONÇALVES; CHENG, 2010 and SILVA; MOTTA, 2008).

However, Brazilian academic entrepreneurs need technical-managerial support, as well as government support, for their ventures to take any real effect and generate socio-economic value (CHENG et al., 2007).

Thus, it is clear that there are still many difficulties to be overcome by Brazilian researchers for their innovations to generate all their potential benefit.

¹ Decree No. 5563 of October 11, 2005. Regulation to Law No. 10973 of December 2, 2004, which provides for incentives for innovation and scientific and technological research in the production sector, and for other measures.

2 THE CONCEPT OF INNOVATION

The minimum requirement determining an innovation is that the product, the process, the marketing or organizational method be new (or significantly improved) for a given organization or society.

According to Taylor (1994), the process of technological innovation, described by traditional models, begins with the identification of a need or opportunity for improvement and incorporates knowledge and constraints of the technological, economic, and social environments until resulting, eventually, in an invention. When incorporated into a product and introduced to the market, this invention becomes an innovation, and the diffusion stage begins, with the product's market launch.

According to Zawislak (TIDD; BESSANT; PAVITT, 2008), what is considered invention, and not innovation, is a new technology or product that cannot generate sufficient returns to offset the investment made in knowledge, necessary information, and creativity expended, much less generate an extraordinary profit to those who so ventured. To generate this return, it is important that there is an integration among technology, market, and company, forming a "strategic vision of innovation" (TIDD; BESSANT; PAVITT, 2008).

3 THE PROBLEMS OF INNOVATION

According to Tidd, Bessant, and Pavitt (2008), the real challenge of innovation is not invention, but how to make it work technically and commercially. Innovation is more than just conception of an idea, it is the process of developing its practical use.

Van de Ven et al. (1989) in their studies, call attention to the complexity of the ways in which innovation develops over time, and propose some interesting additions to the basic model of innovation: Shocks promote innovations; Ideas abound; Setbacks occur frequently, plans are overly optimistic, commitments increase, mistakes

accumulate, and vicious cycles may develop; The restructuring of the innovation team usually occurs as a result of external intervention, change in staff, or other unexpected events; Top management plays an important role; Success criteria change over time, differ between groups, and turn innovation into a political process; and Innovation requires learning, but many of its results are due to other events that occur as innovation develops.

Thus, to generate value, innovation must be set in a broad perspective. It is not enough to focus on a single dimension of innovation: organizational, market, and technological changes interact. Better management of research and development can improve the efficiency or productivity of technological innovation, but will contribute little to the product's effectiveness, and therefore can not guarantee commercial and financial success (BESSANT, 2003).

Accordingly, Tidd, Bessant, and Pavitt (2008) suggest that innovation should not be seen in a limited way. This concept should include:

- Viewing innovation as a process of linear "technology push" or one in which it is trusted that the market will drive innovation;
- Seeing innovation simply in terms of major "breakthroughs" and ignoring the significant potential of incremental innovation;
- Viewing innovation as a simple isolated change, rather than part of a broader system;
- Seeing innovation only as a product or process, without recognizing the interrelationship between them.

In addition, one must consider that there is a high degree of uncertainty in innovation (Rosenberg, 1994), generated by technical, market, social, and political factors, among others. As one moves from incremental to radical innovation, the degree

of uncertainty increases, to the point that what is being developed is unknown. This makes the chances for success of an innovation not very large, unless this is monitored by a well structured management process (TIDD; BESSANT; PAVITT, 2008).

Thus, two factors related to innovation are agreed upon: innovation is a process, not an isolated event, and must be managed as such; and the influences on this process can be manipulated to affect the outcome, that is, innovation can be managed (TIDD; BESSANT; PAVITT, 2008, p.107).

4 INNOVATION AT UNIVERSITIES AND RESEARCH CENTERS

In the Middle Ages, the university looked only to teaching activity, transmitting the knowledge already generated. They were created almost exclusively for the purpose of generating scientific and technological knowledge, and training skilled labor (REIS, 2004). In the late nineteenth century, most academic institutions began to emphasize the link between teaching and research, resulting in the so-called "First Academic Revolution" (GARNICA; TORKOMIAN, 2009).

As generators of knowledge, universities became an object of interest of approach for the production sector, while the majority of public research funds allocated to universities in the United States became scarce. This led to a search on the part of academics to supplement the resources for research through interaction with private capital (ETZKOWITZ, 2004 apud GARNICA; TORKOMIAN, 2009). Added to this concern was the fact that new scientific-technical know-how for industrial application began, via a process of spill-over from research activities, to result in new technology-based companies.

Thus, actually, it is observed that universities were expanding their sphere of activities through greater interaction with other segments of society, and thereby increasing their return to society (REIS, 2004).

In this context, the establishment of technology management policies in academia became essential to ensure the interests of both parties (universities and companies) and allow a maximization of the use of technologies generated, while seeking to minimize conflicts. The two main aspects that comprise a university's technology management policy relate to the intellectual protection of technology, for its appropriation by the university, and its transfer to industries that can implement it (GARNICA; TORKOMIAN, 2009).

Thus, as part of the institutional context, organizational structures were created within universities, or even associated with them, to manage intellectual property and technology transfer. This is due to the high degree of specificity and complexity required in the collaborative process between universities and companies, in which are seen barriers to cooperation, such as extending of project times, higher degree of uncertainty, the existence of basic research at the university, the different administrative philosophies of the organizations, and excessive bureaucracy in the academic structures (SEGATTO-MENDES; SBRAGIA, 2002 apud GARNICA; TORKOMIAN, 2009).

5 METHODOLOGY

The Survey research method was used to carry out this work. Research questionnaires were developed and applied, and answered by university researchers known for developing innovative activities. The article is part of a research project conducted by Martins (2011).

6 RESEARCH RESULTS

6.1 Universities and Research Centers

Table 1 lists the participating educational and research institutions.

Table 1 - Participating educational and research institutions.

DEPARTMENT	UNIVERSITY OR RESEARCH CENTER
Department of Mechanical Engineering	University of São Paulo –USP
Department of Science and Technology	Southeast Federal Institute of Technology -MG
Department of Production and Mechanical Engineering	Federal University of Juiz de Fora - UFJF
Electric power department	Federal University of Juiz de Fora - UFJF
Department of Electric Circuits	Federal University of Juiz de Fora - UFJF
CODAGEO	Ouro Preto Federal Institute of Technology
Department of Physical Education	Federal University of São Carlos - UFSCar
I Vision Laboratory	Federal University of Bahia- UFBA
Department of Chemicals	Federal University of Juiz de Fora - UFJF
Bioinformatics and Animal Genomic Laboratory	Embrapa Gado de Leite
Building site department	Federal University of Juiz de Fora - UFJF
Department of pharmaceuticals	Federal University of Juiz de Fora - UFJF
Department of Biotechnology	Universidade Católica de Brasília
Department of Geology	Federal University of Minas Gerais - UFMG
Department of Entomology	National Institute of Research - Amazonia
Pró-reitoria de Graduação	State University of Feira de Santana- Bahia
Department of Spectroscopy and Materials	Federal University of Juiz de Fora - UFJF

Part 1 - General Approach to Innovation

Tables 2 and 3 present the results obtained on the opening questions from the questionnaire given to researchers from universities and research centers (CP). Such questions are important in elucidating general themes of innovation in laboratories and departments.

Table 2 - Innovation types developed in the institutions or laboratories

TYPES OF INNOVATIONS	NUM.	PORCENT.
Products and Services	5	25%
Process	6	30%
Technological	13	65%
Social and Sustainable	6	30%
Other: Development of Methodologies and Modellings	1	5%

Table 3 - Innovation focus in the institutions or laboratories

INNOVATION FOCUS	NUM.	PORCENT.
Radical Innovation	2	10%
Incremental Innovation	10	50%
The two previous answers	8	40%

Through the analysis of Tables 2 and 3, one can see that the main type of innovation developed by researchers participating in the study is technological innovation, and that there is a balance between incremental and radical focus.

Part 2 - Tools for Innovation Management (IM)

Tables 4, 5, and 6 show the results obtained on the questions relating to the researchers' use of innovation management (IM) tools or systems. Such questions are important in verifying whether the widespread practices in the literature are known and used in the conduct of the innovations in academia, and identifying the main difficulties for the conduct of the processes of innovation (PI). Also, the main reasons for not using IM tools are presented.

Table 4 – Use of Innovation Management (IM) tools

Yes	3	15%
Not	17	85%

Table 5 - Difficulties and / or disadvantages in the use of IM tools

DIFFICULTY OR DISADVANTAGE	NUM.	PERCENT
Lack of knowledge of the tools	1	33%
Lack of staff training for use of tools	3	100%
Complexity of the tool	1	33%
Adapting the tool to the academic environment and culture	3	100%
Bureaucratization generated by the use of the tool	0	0%
Increased innovation process costs generated by deployment of the tool	0	0%
Other: Length of time for information generation by the tools	1	33%

Table 6 - Reason for not using IM tools

REASONS FOR NON-USE OF TOOLS	NUM.	PERCENT
Lack of knowledge of the tools	13	76%
Unfamiliarity with the benefits generated by the use of tools	6	35%
Lack of staff training for use of tools	6	35%
Complexity of the tool	0	0%
Adapting the tool to the academic environment and culture	2	12%
Bureaucratization generated by the use of the tool	0	0%
Increased innovation process costs generated by the deployment of the tool	0	0%
The need for deployment of tools is not perceived in the laboratory or department	4	24%
The tools are not applicable to the academic environment	0	0%
The tools are not suited to academia	1	6%
Other: There was no structured process for innovation management	2	12%

Based on the results presented in Tables 4, 5, and 6 it can be stated that, for all researchers participating in the study who use management practices, the main difficulties are related to lack of staff training for use of the tools, and lack of adaptation of these practices to the academic environment. And the majority, who do not use management tools, responded that this was due to their unfamiliarity (76%), and no

researcher said it was due to the complexity of the tool, the bureaucratization generated by it, the increased costs generated by its implementation, or non-applicability of these practices to the academic context.

Part 3 - Complementary Aspects of Innovation

Tables 7 and 8 show the results obtained on questions relating to the implementation of partnerships, this being an important means of developing innovation in the Brazilian academic environment.

Table 7 - Establishment of partnerships

Yes	16	80%
Not	4	20%

Table 8 - Difficulties in the establishment of partnerships

DIFFICULTIES	NUM.	PORCENT.
Differences in strategies and goals	6	38%
Problems with the partner	3	19%
Weak -Strong relationship	3	19%
Cultural incompatibility	2	13%
Insufficient trust	3	19%
To expose the knowledge	3	19%
Putting on operational/geographical	2	13%
Personal disagreements	1	6%
Lacks or communication difficulty	3	19%
Lack of commitment	3	19%
Inefficiency and lack of freedom	2	13%
Time. Unreal expectations	2	13%
Asymmetric incentives (when the benefits for the parts are not balanced)	1	6%
Turns the development of costlier and complicated product	1	6%
Difficulty of accomplishment of shared research	2	13%
Other: Bureaucracy and non investment for the companies in the shared research	2	13%

With respect to this subject matter, the main difficulties experienced by academic researchers are related to differences in strategies and goals (38%) between the university or research center and its partner (companies or other universities).

Part 4 - General Aspects of the Innovation Process

On the question related to problems encountered in the innovation process, various issues were raised by the researchers, such as:

- Lack of time and skilled labor for research, since the professors have classroom and advisory commitments;
- Researcher unfamiliarity with the concepts and implications of innovation;
- Difficulty of "taking the idea from paper" and putting it into practice;
- Lack of financial and human resources for research;
- Difficulties in establishing partnerships with companies, with little commitment from the various connections and partners in the resolution of difficulties arising during implementation of the innovation project;
- Existence of bureaucratic and legal obstacles, especially in public service;
- Ideological resistance to innovation;
- Lack of internal governance and controls of the institutions and research centers; and
- Lack of culture or difficulty in obtaining intellectual property.

7 CONCLUSIONS

From the results presented in the study it can be concluded that:

- In Brazil, there are still difficulties related to the culture for innovation, especially within universities and research centers, as these environments do not offer the best framework for the development of innovation.
- Despite the known benefits and positive impacts that innovation can bring to society, its development process is not yet formally managed, with a large widespread unfamiliarity on the part of researchers about the existence of innovation management practices or the benefits arising from their use.

- In the establishment of partnerships - one of the most widely used forms of strengthening the relationship between universities and industry -, differences in objectives and strategies among partners still exist, which can compromise not only the outcome of the research involved, but also reduce the benefits that could be generated for both parties.
- Despite government initiatives to stimulate innovation, there are still cultural issues that must be surmounted so that innovation can be fully developed.
- To improve the innovation process and its viability, innovation management tools should be better disseminated in the scientific community and their use should be encouraged. However, there should be a policy of researcher assistance and guidance toward adopting these practices, since some tools can be complex and require training to implement them in the academic routine.

8 REFERENCES

- BESSANT, J. *High Involvement Innovation*. Chichester: John Wiley & Sons, Ltd., 2003.
- CHENG, L. C. *et al.* **Plano Tecnológico**: um processo auxiliar ao desenvolvimento de produtos de empresas de base tecnológica de origem acadêmica. *Locus Científico*, 1, p. 32-40. 2007.
- FREITAS, J. S.; GONÇALVES, Carlos A.; CHENG, L. C. **O Fenômeno dos Spin-Offs Acadêmicos**: Estruturando um Novo Campo de Pesquisa no Brasil. In: ENCONTRO DA ASSOCIAÇÃO NACIONAL DE PÓS-GRADUAÇÃO E PESQUISA EM ADMINISTRAÇÃO, 34, 2010, Rio de Janeiro. Anais... Rio de Janeiro: ANPAD, 2010.
- GARNICA, L. A.; TORKOMIAN, A. L. V. **Gestão de Tecnologia em Universidades**: Uma Análise do Patenteamento e dos Fatores de Dificuldade e de Apoio à Transferência de Tecnologia no Estado de São Paulo. *Gestão & Produção*, v. 16, p. 624-638, 2009.
- MARTINS, P. S. **Estudo da relevância de práticas de inovação**: um comparativo universidade-empresa. Juiz de Fora: UFJF, 2011. 160 f. Trabalho de Conclusão de Curso (Graduação em Engenharia de Produção) – Universidade Federal de Juiz de Fora, Juiz de Fora, 2011.

OSLO MANUAL. **Diretrizes para a coleta e interpretação de dados sobre inovação.** 3. ed. OECD: Organização para a Cooperação e Desenvolvimento Econômico. FINEP, 1997.

REIS, D. R. **Gestão da inovação tecnológica.** Barueri: Manole, 2004.

ROSENBERG, N. *Exploring the Black Box: Technology, Economics, and History.* Cambridge: Cambridge University Press, 1994.

SILVA, S. M. A; MOTTA, A. L. T. S. **Ciência e Tecnologia no Brasil: A Lei da Inovação.** In: CONGRESSO NACIONAL DE EXCELÊNCIA EM GESTÃO, 4, 2008, Niterói. Anais... Niterói: IV Congresso Nacional de Excelência em Gestão, 2008.

TIDD, J.; BESANT, J.; PAVITT, K. **Gestão da inovação.** 3. ed. Porto Alegre: Bookman. 2008.

TOLEDO, J. C. **Gestão da mudança da qualidade de produto.** *Gestão & Produção*, v. 1, n. 2, p. 104-124, ago. 1994.

VAN DE VEN, Andrew H.; Angle, Harold L.; POOLE, Marshall Scott. *Research on the Management of Innovation.* New York: Harper & Roe, 1989.