



INITIATIVE PRIORITIZATION FOR INNOVATION IN THE BRAZILIAN PHARMACEUTICAL INDUSTRY: A PROPOSAL USING MULTICRITERIA

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ABSTRACT

The structure of the pharmaceutical industry requires special attention on the part of developing countries, whose populations remain dependent both on the distribution of drugs and on a policy of significant reduction in established prices. It is essential that governments, businesses and universities work together in order to plan future strategies for this sector. This is the aim of the Competitiveness Forum for the Pharmaceutical Production Chain, a Brazilian government program with an established plan of initiatives and investments. This article reflects on the Forum's technological innovation initiatives, financed with more than R\$200 million in resources from Sectoral Funds. Given this industry's dependence on innovation, the present work presents a decision-making methodology for determining investment priorities to be applied by the working group of the above-mentioned Forum. It also aims to offer support mechanisms for a better distribution of financial resources by creating a hierarchy of the already functioning programs of the government agencies.

Keywords: Technological management. Competitiveness forum. Investment in innovation.

RESUMO

A conformidade de indústria farmacêutica demanda especial atenção por parte dos países em desenvolvimento cujas populações permanecem dependentes tanto da distribuição de medicamentos como de uma política de redução significativa dos preços praticados. Dessa forma, autoridades governamentais, empresários e membros da academia devem se unir no sentido de planejar as estratégias futuras para o setor, e essa é a proposta do 2 Fórum de Competitividade da Cadeia Produtiva da Indústria Farmacêutica, programa do governo brasileiro que explicita diretrizes de ações e investimentos. Neste artigo serão consideradas as ações de inovação tecnológica Fórum que já geraram mais de R\$200 milhões em ações continuadas desenvolvidas com recursos dos Fundos Setoriais. Dada a dependência de inovação que essa indústria demanda, o trabalho apresenta uma metodologia de decisão de priorização de investimento a ser aplicada a esse grupo de trabalho do Fórum. Pretende-se assim oferecer subsídios para maximizar a distribuição de recursos através da hierarquização dos programas das agências oficiais de fomento.

Palavras-Chave: Gestão tecnológica. Fórum de competitividade. Investimento em inovação.

BRIEF HISTORY OF THE BRAZILIAN PHARMACEUTICAL INDUSTRY

The Brazilian pharmaceutical industry was created with the domestic capital of small family businesses. It evolved following the founding of state research and manufacturing enterprises such as the Instituto Oswaldo Cruz and Butantã, and finally, in the 40s and 50s expanded decisively through the actions of international groups. (KATZ et al, 1997).

In 1983, Brazil began a pharmaceutical production project which involved the federal government, through its Central de Medicamentos (CEME) agency, domestic companies and public research institutions, as well as the Companhia de Desenvolvimento Tecnológico (CODETEC). The goal of this project was to increase domestic capacity in this sector by copying products and processes patented outside Brazil without paying royalties. The beginning of the 90s saw the government launch a program of eliminating tariff barriers, which in the last decade has generated a deepening of external dependence for the supply of ready-made pharmaceuticals and drugs, which for the most part, are not innovative products.

In 2001, the Brazilian government decreed a price freeze on domestically-produced drugs. The pharmaceutical industry suffered a reduction of 3.8% in its labor force, a figure equal to the loss of 1,500 jobs.

In the present decade, the government has returned to a focus on the strategic planning of the various policies for the sector, amongst which are the Competitiveness Forums and a “new industrial policy”, within which the pharmaceutical industry is given some prominence. (BRASIL, 2003).

INCENTIVES FOR THE PHARMACEUTICAL INDUSTRY

In 2003 the government defined its priorities in terms of a “new industrial policy” in the areas of capital goods, software, semiconductors, medications and 21st century technologies such as biotechnology, nanotechnology and biomass (BRASIL, 2003). An indication of the government’s understanding of the importance of the strategic importance of the pharmaceutical sector was the creation of the Competitiveness Forum for the Pharmaceutical Production Chain. Launched by the Ministry for the Development of Industry and Commerce in May 2003, this participatory planning initiative aims to examine industrial policy for the pharmaceutical sector, which produces raw materials for the pharmaceutical industry as whole. To implement this process, the Ministry created five working groups, whose responsibilities were defined as follows: 1 - access, government purchasing and social inclusion; 2 - investments; 3 - foreign trade; 4 - technology; 5 - regulation and quality.

The working groups have made recommendations presented by the Ministry of Development, Industry and Foreign Trade – (MDIC in Portuguese) (MINISTÉRIO DO DESENVOLVIMENTO, INDÚSTRIA E COMÉRCIO EXTERIOR, 2006). With regard in particular to group 4 (technology), the proposal is to focus initiatives of the Sectoral Funds – financing instruments – on projects aimed at innovation in products and industries; to divide between the state and the industry the risk associated with innovation using non-recoverable financial resources; to improve human resources; to define priorities for science and technology; to allow for the participation of development agencies and banks in pioneering projects; to create a catalog of available services and equipment; to revise the Industrial Development Plan (PDTI in Portuguese) and the Agricultural Technology Development Plan (PDTA in Portuguese) and to develop activities which promote innovation.

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DECISION-MAKING METHODOLOGIES

With regard to decision making, most researcher agree on two important points: that all available tools serve only to help in making decisions, that is, they minimize, but do not eliminate, the element of risk, and that is preferable to have multilateral rather than unilateral decisions, with negotiation and individual will being essential elements. This being the case, it is important to examine tools which are of use in group decision making, like the study begun by the Frenchman Jean-Charles Borda in 1870 (CRUZ, 2005). He proposed that persons faced with deciding amongst competing alternative projects, rather than merely making a choice, should create a ranking of preferences. In this process, the alternatives are assigned discrete values in accordance with the number of decision makers. Table 1, for example, simulates a situation involving ten people and a single choice:

Table 1: Decision making using Borda’s method

Decision maker / Participant / Stakeholder	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Best project (alternative)	A	A	B	A	D	D	A	A	B	D
Second best project (alternative)	C	C	C	C	B	B	C	C	C	C
Third best project (alternative)	D	B	D	B	C	C	D	D	D	B
Fourth best project (alternative)	B	D	A	D	A	A	B	B	A	A

Source: Developed by the authors

In this case, the projects are assigned points from 1 to 4 in the following way:

Table 2: Tabulation using Borda’s method

Projects	Points										Total	Simple arithmetic average
	4	4	1	4	1	1	4	4	1	1		
A	4	4	1	4	1	1	4	4	1	1	25	2.5
B	1	2	4	2	3	3	1	1	4	2	23	2.3
C	3	3	3	3	2	2	3	3	3	3	28	2.8
D	2	1	2	1	4	4	2	2	2	4	24	2.4

Source: Developed by the authors

In this possible situation, project C would be preferred, having a higher level of acceptance than the others. It should be noted that the result will be the same using either the total or the average. In spite of the benefits offered by this method, the objection may be raised that the person making the evaluation (participant in the process or stakeholder) must ensure that the projects are always equidistant, that is to say, the possibility does not exist that one option be much better than another, as, for example, A being worth 8 points, while B, C and D are awarded 4, 3 and 1 points, respectively.

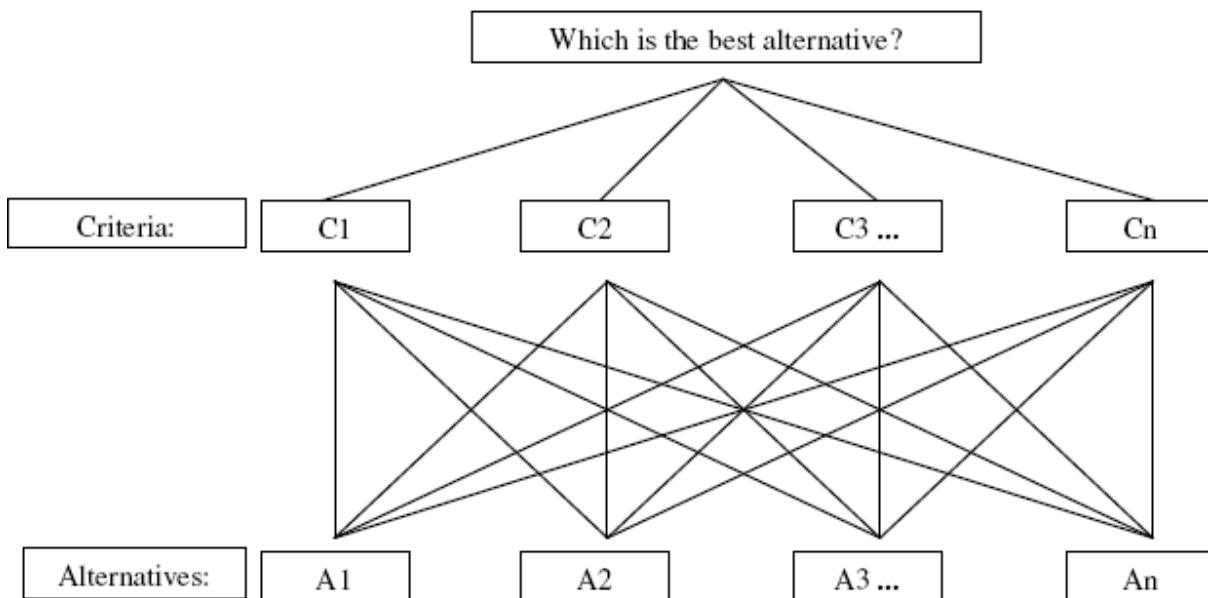
Given this limitation, it is suggested that the decision maker(s) use an established mathematical methodology for the prioritization of alternatives, such as, for example, the Analytic Hierarchical Process Method developed by Saaty in the 70s. This methodology consists in separating the alternatives into combinations of pairs in order to evaluate the extent to which one alternative is better than the other, based on a comparison scale which lists relative verbal appreciations and numerical values (defined by the decision maker) of each pair.

- When alternative A is equal to alternative B (verbal scale): 1 (numerical scale)

- When alternative A is a little better than B: 3;
- When alternative A is moderately better than B: 5;
- When alternative A is much better than B: 7;
- When alternative A is extremely better than B: 7;

At the end of this process the decision maker(s) evaluates which criterion is more important than the other (also separated into pairs), based on the central question to be answered, such as, for example, how to prioritize investments in given areas. The figure below illustrates the process:

Figure 1: Analytic Hierarchical Process Method



Source: Adapted from Costa, 2002

It is to be hoped that the use of this process will produce a ranking which indicates the preferences of the decision maker in regard to different alternatives. This ranking is presented in the form of a percentual scale, indicating which the best alternative is for this particular decision maker, i.e. the alternative with the highest percentage. As for the mathematical efficiency of this method, it should be noted that this has been discussed and proven in innumerable MA and PhD theses and scientific articles. It does not fall within the scope of the present work to discuss the resolution algorithm. Suffice to say that the process produces a scale of priorities from 0% to 100%, which can be used as points in the Borda method, and which allows the decision maker/stakeholder to avoid being partisan, as he is not creating the scale directly with numerical points, but indirectly, mediated by individual judgments.

APPLICATION TO THE PHARMACEUTICAL INDUSTRY:

Schumpeter (1943) was the first author to develop a theory of economic growth focused on investment in technological innovation. Through a process of “creative destruction” innovation will replace existing technologies, generating “waves” of economic growth. Thus, developed countries aim to foster research and the development of products

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and services as a strategy for economic development. Antunes and Mercado (2000) emphasize the importance for developing countries of formulating a technological and industrial policy, increasingly linking universities and companies, keeping in mind the great need for investment in research. A test of the proposed process was undertaken in the Competitiveness Forum for the Pharmaceutical Industry, with an emphasis on those areas where the focus is on debate about developing technological innovation. During a period ending in 2005, the activities proposed by the Forum were divided into seven categories, with each of these further subdivided into specific initiatives. These categories are presented below, with the associated objectives and investment amounts allocated.

Category: Support and Research

1 Initiative: Program for Human Resources Training in Strategic Activities– RHAÉ Inovação; amount allocated: R\$7,100,000;

2 Initiative: Modernization of research institutes in order to obtain funding for laboratory infrastructure; amount allocated: R\$17,100,000;

3 Initiative: Collection (improvement in conditions for the preservation and distribution of microorganisms and authenticated cells, certified biological reagents and related information); amount allocated: R\$5,000,000;

4 Initiative: Animal rooms (modernization and maintenance); amount allocated: R\$1,000,000.

Category: Basic Research

1 Initiative: Expansion of the tender of the National Council for Scientific and Technological Development – CNPq (support for research activities); amount allocated: R\$42,000,000.

Category: Creation of Partnerships

1 Initiative: Structuring projects for state-level science, technology and innovation systems in order to provide long-term financing of basic and applied research projects; amount allocated: R\$30,500,000;

2 Initiative: Cooperative projects (financial support for research, technological development and/or innovation projects); amount allocated: R\$55,000,000;

3 Initiative: Bioproducts (support for the development of bioproducts with potential for therapeutic use, based on substances obtained or extracted from the flora and fauna of Brazil); amount allocated: R\$12,000,000.

Category: Production of Biopharmaceutical and Immunobiological Products

1 Initiative: Center for production of antibodies for use in the medical and agricultural veterinary sectors; amount allocated: R\$407,000;

2 Initiative: Production center for mono- and polyclonal antibodies to meet the needs of research laboratories; amount allocated: R\$467,000;

3 Initiative: Production center for mono- and polyclonal antibodies to meet the needs of research on pathogens in citrus and potato cultivation; amount allocated: R\$354,000;

4 Initiative: Production of blood products – factors VIII and IX (for patenting and technology

transfer); amount allocated: R\$850,000;

5 Initiative: Support for domestic laboratories which produce vaccines (BCG, tuberculosis, rotavirus and influenza, amongst others); amount allocated: R\$1,300,000;

6 Initiative: Neoplasias (support for research activities with diagnostic kits and biological markers); amount allocated: R\$3,000,000.

Category: Quality Improvement

1 Initiative: Metrology for the manufacturing sector; amount allocated: R\$350,000;

2 Initiative: Clinical research in university hospitals (development of protocols); amount allocated: R\$29,200,000.

Category: Development of New Technological Routes

1 Initiative: Transgenic goats and sheep with bioreactors for the production of pharmaceuticals; amount allocated: R\$12,700,000;

2 Initiative: Technological innovation (strengthening of the Program for Research in Companies); amount allocated: R\$20,000,000;

3 Initiative: Self-sufficiency in radionuclides; amount allocated: R\$3,000,000;

4 Initiative: Functional genome network; amount allocated: R\$4,000,000;

5 Initiative: National proteome network (prospecting for bioactive proteic molecules and peptides, with the aim of developing new classes of drugs and substances); amount allocated: R\$5,600,000;

6 Initiative: Basic pre-clinical and clinical research in cellular therapy using embryonic and adult (bone marrow) stem cells, derived from umbilical cords and other tissues; amount allocated: R\$11,500,000;

7 Initiative: Instituto Milênio (promotion of research networks all over Brazil); amount allocated: R\$45,000,000.

Category: Prospecting

1 Initiative: Collections (overview of current state); amount allocated: R\$250,000;

2 Initiative: Animal rooms (overview of current state); amount allocated: R\$250,000.
Competitiveness Forum for the Pharmaceutical Chain of Production

APPLICATION IN THE COMPETITIVENESS FORUM FOR THE CHAIN OF PRODUCTION OF THE BRAZILIAN PHARMACEUTICAL INDUSTRY

As the initiatives presented were already underway, and are ongoing, the fundamental question for the members of the Forum was: "GIVEN THE ONGOING NATURE OF THE INITIATIVES, WHICH OF THEM SHOULD BE PRIORITIES FOR THE NEXT FIVE YEARS (2006 to 2010)? The members of the Forum were contacted, initially by e-mail, later by telephone, and in some cases, they were personally interviewed. The aim was to have them, on the basis of the discussions being promoted in Forum meetings, individually create a hierarchy of

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initiatives, using the Analytic Hierarchical Process Method.

During the months of April and June, 2006, contact was established with the forty members of the Forum. The questionnaire submitted to them asked for comparisons of the initiatives, following Saaty's table (1991). Thus, each interviewee began his or her evaluation with the seven categories, with the task of identifying priorities in global terms. The results obtained from the interviews with the members of this working group, after being processed by Analytic Hierarchical Process Method, showed the following individual priorities:

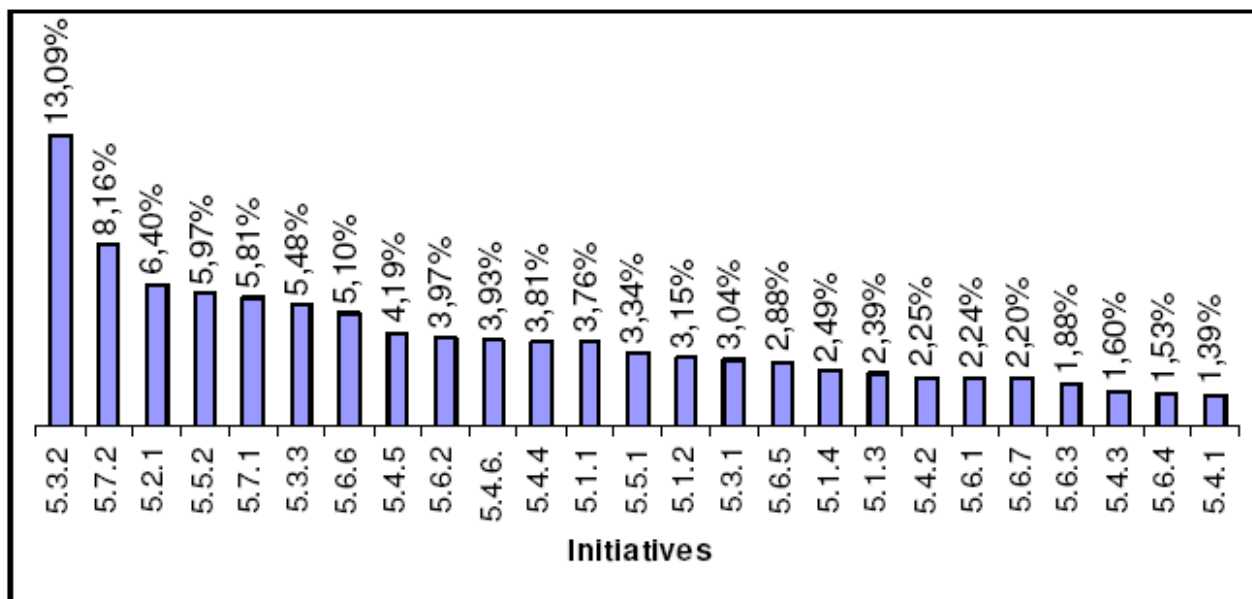
Table 3: Percentages of the Specialists

Average Percentage by Category	Initiatives	Average Percentage by Initiative
Support and Research: 11.80%	5.1.1 RHAIE innovation	31,85%
	5.1.2 Modernization of research institutes	26.67%
	5.1.3 Collections	20.26%
	5.1.4 Animal rooms	21.07%
Basic Research: 6.40%	5.2.1 Tenders	100%
Creation of Partnerships: 21.60%	5.3.1 Structuring projects	14.09%
	5.3.2 Cooperative projects	60.58%
	5.3.3 Bioproducts	25.36%
Production of Biopharmaceutical and Immunobiological Products: 17.20%	5.4.1 Production of antibodies for medical and veterinary areas	8.09%
	5.4.2 Production of antibodies for laboratories	13.11%
	5.4.3 Production of antibodies for research	9.33%
	5.4.4 Blood products	22.17%
	5.4.5 Support for laboratories	24.41%
	5.4.6 Neoplasias	22.90%
Quality Improvement: 9.30%	5.5.1 Metrology	35.91%
	5.5.2 Clinical research	64.09%
Development of New Technological Routes: 19.80%	5.6.1 Goats and sheep	11.34%
	5.6.2 Innovation	20.04%
	5.6.3 Radionuclides	9.51%
	5.6.4 Genome network	7.73%
	5.6.5 Proteome network	14.53%
	5.6.6 Pre-clinical research	25.74%
	5.6.7 Instituto Milênio	11.11%
Prospecting: 13.90%	5.7.1 Collections	41.59%
	5.7.2 Animal rooms	58.41%

Source: Developed by the authors, based on the given answers and processed by the Analytic Hierarchical Method

The next step was to arrive at an average weighted between the value of each category and the percentage for each initiative. Graphic 1 below shows the results in the form of priorities for the years 2006 to 2010:

Graphic 1: Final Average Percentage



Source: Developed by the authors, based on the given answers and processed by the Analytic Hierarchical Method

CONCLUSION

The Brazilian pharmaceutical industry deserves special attention from government and business, principally when it comes to making strategic decisions. More particularly, the issue of a concerted effort to develop a policy of promoting innovation and decreasing the external dependency which the country faces demands the creation of alternatives in order to minimize the risks associated with faulty decisions made by too few actors. The Competitiveness Forums offer an excellent opportunity to streamline government initiatives, which often appear in a scattered way in the form of isolated tenders issued by ministries, without the requisite communication to be expected of the State.

What the Forums lack, especially the most important ones such as that of the pharmaceutical industry, are decision-making mechanisms which reflect the magnitude of the issue, that is, which are validated in the universities and in both the public and private sectors. This lack is met by the Analytic Hierarchical Method. The union of this method with that of Borda allows for decisions based on multiple decision makers. Another interesting fact which bears mentioning before reaching any conclusion has to do with the particularity of consumption in the pharmaceutical sector. It is not only the subjective concept of “product utility” which determines purchase, that is, the consumer’s perception of the importance of a given product.

Another way in which product utility is expressed becomes evident when two consumers are prepared to pay different prices for the same product. In the pharmaceutical market there exists the objective fact of the illness, whose cure is sought by means of a specific treatment, which involves the use of one or more active principles or medications prescribed by a doctor. The proposed methodology, independent of the results obtained, could come to orient these investments like a Pareto Curve ABC analysis (used by stock managers to identify which products are most important). In the proposed case, the seven priorities correspond to exactly 50% of the preferences of the specialists. This fact could point the way to its increased utility in the distribution of resources and/or the application of effort in certain areas. In

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conclusion, it is important to emphasize the need for the methodology to be applied again in the coming years in order to correct possible errors. Some initiatives certainly will not have produced the desired results, and it is for this reason that Competitiveness Forum should not relinquish its questioning role.

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