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From: Willy H. de Sousa
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Prezados Senhores,

Estou encaminhando nos arquivos atachados, para registro e controle, dois trabalhos apresentados por mim em dois congressos internacionais:

- 10388
1. STRATEGY FORMATION IN THE MIDDLE MANAGEMENT PERSPECTIVE: A CASE STUDY IN THREE BRAZILIAN RESEARCH AND TECHNOLOGICAL INSTITUTES, apresentado no "14th International Conference on Management Technology", Viena, Austria, entre os dias 22 e 26 de maio de 2005;
 - 10389 2. DEVELOPMENT OF A CULTURE BASED ON STRATEGIC AND KNOWLEDGE MANAGEMENT OF A BRAZILIAN PUBLIC RESEARCH INSTITUTE: THE CASE OF THE NUCLEAR AND ENERGETIC RESEARCH INSTITUTE – IPEN apresentado no 5th Triple Helix, Turin, Itália, entre os dias 18 e 21 de maio de 2005.

Atenciosamente,
Willy Hoppe de Sousa

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STRATEGY FORMATION IN THE MIDDLE MANAGEMENT PERSPECTIVE: A CASE STUDY IN THREE BRAZILIAN RESEARCH AND TECHNOLOGICAL INSTITUTES¹

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ABSTRACT

A case study was conducted to improve the knowledge about strategy formation process in three different public Brazilian Research and Technology Institutes. The present article presents part of a study which focused the "core" of the strategy formation process. The case study was developed based on the following strategy formation schools organized by Mintzberg et al. (2000): *design, planning, learning, cultural, power and environment*. Data were collected for two situations: present and desired situation. The analysis of these data also allowed the identification of what has to be changed in the strategy formation process of these RTIs. The findings of the study has shown that presently RTIs have some common aspects (formality, political strength and one, five and ten years strategy approach) and have some different aspects (responsibility, information process, pro-change culture and environmental approach) in their strategy formation process. Interestingly, the study showed that the three RTIs may have a similar pattern for a desired strategy formation process. The study also showed that the

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difference between the present situation and the desired situation can be used as opportunities to improve the strategy formation process for each of the three RTIs.

INTRODUCTION

Brazilian Federal and State Government have been in the last years increasingly concerned with the quality of the management of their public organizations. The need to improve the quality of their services aligned with the need to manage scant resources has stimulated many public Brazilian managers to engage their organization into quality management programs. Thus one topic that must be considered within this quality management approach is strategic management and, specially, how strategies are formulated within public organizations.

Traditionally governmental organizations are considered bureaucratic and slow. There are exceptions. There is a group of organizations who were created to help and develop technologies and thus helping to increase the technology dynamics of their environment. These organizations are the Research and Technologies Institutes (RTIs). In principle, these organizations are complex to be managed. They need to have well defined strategies in order to satisfy the demands of their clients and the expectations of their main stakeholders.

Comprehending how the strategy formulation happens in these organizations is the main objective of this study. It's expected that such a study will bring new academics insights as well as will help to improve the quality of the management of such organizations. In order to accomplish such objective, three successful Brazilian public research institutes located in São Paulo were studied: Instituto de Pesquisas Tecnológicas (Technologies Research Institute), Instituto de Pesquisas Energéticas e Nucleares (Nuclear and Energetic Research Institute) and the Centro de Caracterização e Desenvolvimento de Materiais (Materials Characterization and Development Center).

This article is organized with the following structure: after this introduction, the conceptual framework is presented; on the second block the conceptual framework is presented; on the third block previous studies about the RTIs strategies schools are presented; the following block presents the research methodology; on the fifth block the results are presented and on the last block the main conclusions are discussed. The bibliography reference is listed at the end of the article.

CONCEPTUAL FRAMEWORK

Strategy is a large and controversial theme. According to Amaru (2000, p.393), “under the focus of enterprises management, strategy has several meanings. Long term environment, planning and competition are some key words associated to the main meanings that were in small amounts added to the modern vocabulary of strategic management.”

For Stoner & Freeman (1985, p 143), strategy may be either “the large program for defining and reaching the objectives of an organization and carrying out their missions” or “the standard of the organizations answers to its environment through the time.”

Alfred Chandler (according Stoner & Freeman, 1985, p.143) studying the growth and development of four American enterprises defined strategy as “the setting of long term basic objectives and targets of an organization, and the adoption of ways of action and allocation of the necessary resources in order to reach these objectives.” This definition is known as initial strategic approach.

According Mintzberg (2000, p. 16-19), strategy may understood as...

- ◆ a plan, a sense or action towards the future,
- ◆ a standard, e.g., a consistency of conduct through the time,
- ◆ a position, e.g., the location of certain products in specific markets,
- ◆ a perspective, e.g., the fundamental way of an organization to carry out the things,
- ◆ a trick, e.g., a specific action in order to deceive the opponent or competitor.

By this way, the term strategy may refer to different approaches and involve different premises. Thus, the strategy has an important function for the organizations by defining the big issues and releasing the people to take care of the details. For instance, if the strategy of a company may define that it will assume a costs positioning, the operational and tactical will follow such strategy by a trustworthy offer of less cost compared to the competitors.

In the book *Safari of strategy* Mintzberg (2000) contributes for divulgating some approaches on strategy. He organized the approaches and the premises of many authors and named them as “schools”. In the sequence, a summary of the approaches and the premises that characterized the schools treated by Mintzberg is presented.

Prescriptive Schools

Design School: the strategy formation as a conception process. The Design School proposes a strategy formulation model where adequate balance between the internal capacities and the external possibilities are searched. This model - based at the analyses of forces and weaknesses, opportunities and threatens - considers the management responsibility and values as a base to form the strategy. Afterwards the strategy is evaluated, selected and implemented. The strategy should create and/or maintain a competitive advantage in the chosen activity area. The design school is important because it causes reflections and discussions about strategies and looks for a balance between external aspects and internal capacity.

The premises of this school were based on Selznick (1957), Chandler (1962) and Learned, Christensen, Andrews and Guth (1965). The main premises that support this school are briefly described as follows:

- ◆ The formation of strategy occurs in accordance to a conscious thinking process and to an acquired aptitude, e.g., it is formally learned. The action must flow from reason: efficient strategy derives from a rigidly controlled human thought process;
- ◆ The responsibility for the control and perception must be of the main executive: the strategist;
- ◆ The strategies must be unique, and the best of all result from an individual design process;
- ◆ The process will be finished when the great strategy appears, ready to be implemented;
- ◆ The strategies must be obvious;
- ◆ The action starts after prescription (separation between formulation and execution).

The main critics about this strategy process are the following:

- ◆ The strategist must carry out a plan that foresees the changes that may occur during the planning period, something that normally doesn't happen;
- ◆ It's hard for an organization knowing with precision its strong and weak points in relation to its competitors and to the situation of the market. This is difficult to accomplish due to the complexity of obtaining trustworthy and exact information about the competitors and volatile and complex markets;
- ◆ The more clear and formal the strategies are, the narrower peripheral sight will be;
- ◆ The separation between strategy formulation and action reduces the engagement of the people, generates difficulties to be handled with instable environment as well as it's difficult of being foreseen.

Planning school: the strategy formation as a formal process. The base of planning school structure is the design school and started to shape with the book *Corporate Strategy*, published

by Igor Ansoff in 1965. The basic script is similar to that of Design School. The strategy formation planning happens according to the formal process of the organizational strategic plan. The process begins with the social economic target of the organization (mission) (depending upon the method that was employed) and ends with the definition of programs and projects. This school is important as it proceeds analyzes and reflections about the organization supporting and encourages the strategic behavior.

The premises of the school are the following:

- ◆ The strategies must result from a controlled and conscious process of formal planning outlined by checklists and supported technically;
- ◆ The responsibility of the whole process is of the main executive and the responsibility of the process execution belongs to the planning people staff;
- ◆ The strategy appears ready from the process, must be specified so that they must be carried out, and this occurs in consequence of programs, projects, budgets, etc.

The main critics about this formation strategy process are the following:

- ◆ The prevision required for preparing the plan and the execution of strategies;
- ◆ The low connectivity between strategy formulation and strategy implementation.

Positioning school: the formation of strategy as an analytical process. This school begins taking form by the publication (1980) of the book *Competitive Strategy*, by Michael Porter. It focuses the importance of the strategy instead the process by which is formulated. This school also develops the foundations around the key-strategy, named generic strategy. The formation of strategy succeeds according to the analytical process that looks for the defense of the organization business against present and future competitors, against suppliers and clients with large bargaining power and against aggressive substitutes that can impose quality standards and price controls. The main idea is that the industry structure should guide the strategic position which by itself explicit the organizational structure and the organization functioning. This school enlarged the organizational strategic vision by adding new aspects to the existing set of technical and strategic models. Its main premises are:

- ◆ Strategies are generic positions that enable achieve superior performance;
- ◆ The market is economic and competitive;
- ◆ The strategy formation process is a selection process of generic positions based in market conditions (considering more emphatically the industry).

The main critics about this strategy formation process are the following:

- ◆ The focus is narrow and oriented only by the economical and the quantifiable aspects;

- ◆ May be more efficient in large organizations, which have more power market, less efficient competitors and more manipulation political power potential;
- ◆ The strategy tends to be seen as a generic position.

Descriptive schools

Entrepreneur school: a strategic formation as a visionary process. It focus the strategic formation process at the leader and emphasizes the most innate state and process, e.g., intuition, judgment, situational perception, wisdom, experience and criterion that give the direction sense. The strategy exists in the strategist-entrepreneur mind as a business vision. The strategy generation is controlled by the pro-active search of new opportunities. The power is concentrated in the main executive and the growth is the main target of organization. The entrepreneur school has focused the sensible personalized idiosyncratic aspects of leadership not considered by the former schools.

The main premises are:

- ◆ Strategy exists at the leader's mind as a perspective and as vision of the organization future;
- ◆ At the best hypothesis, the strategy formation process is a half conscious process;
- ◆ The leader promotes the vision decidedly and keeps the personal control of the execution;
- ◆ Strategy tends to be deliberated in a global vision and emergent as long as unfolds;
- ◆ The organization is moldable and has simple structure.

Cognitive school: strategy formation as a mind process. In order to understand how strategies are formed, there is a need to understand the mind of the strategist and its limitations. This school considers that the strategy formation is a process where there is a reality simplification at the strategist mind. The strategist mind builds the world by his perception and interpretation of complex environments and full of ambiguous information. Strategies emerge as perspectives that give form to the manner by which people deal with environments. In order to have the strategy designed, environment is considered a product of formation, experiences, beliefs and cognitive process of the strategists.

The school intends to comprehend how strategies are formed in the strategist mind. Some cognitive characteristics/mechanisms used in the strategy formation process are presented in summary:

- ◆ Cognition as a mess in the way people process information in order to make a decision due to world complexity versus human capacity for processing information, inclinations and

distortions at the decisions processes and different cognitive styles of strategists;

- ◆ Cognition as information processing: particular process of the strategic decision occurs by the particular way of feeling, codifying, storage, choosing and evaluating results;
- ◆ Cognition as a map: a precondition for the strategic cognition is the existence of certain mental structures that organize the knowing (cognitive charts);
- ◆ Cognition as a fulfillment of a concept: the way how cognitive maps are created is important for understanding the formation strategy; the generation of strategies is the fulfillment of concepts;
- ◆ Cognition as construction: the mind imposes a particular interpretation about environment – the mind build its own world. In some way, the mind has its own mind – the mind has its own cognitive dynamics.

The premises of this school are:

- ◆ The cognitive strategy is a cognitive process that occurs at the strategist's mind;
- ◆ Strategies emerge as perspectives in the form of concepts, schemes and mental structures that give form to the way by which people work with information that come from the environment;
- ◆ Information may flow through adulterated filters before being decoded by the cognitive maps or may be simple interpretations of a world in the form it is perceived: the perceived and codified world may be modeled, framed and built;
- ◆ As a concept, strategies are difficult to be fulfilled and when fulfilled the tendency is to be below of the expected and they are hard of being changed when not more feasible.

Learning school: the strategy formation as an emergent process. The attention to how the organizations are learning entities has grown mainly after the publication of Peter Senge's book, *The Fifth Discipline* (1990). The importance of the learning school grows in organizations that operate in complex, dynamical and volatile environments. For the learning school, the question to be answered is how strategies are formed in the organizations and not how they are formulated. The authors of the school agree that the formation of the strategies is a function of the learning process, which is a function of the time, and it depends of the capacities of the firm. Strategies may emerge when people act individually but in the most cases by acting collectively. Successful experiences create initiatives that may become emergent strategies. The emerging of ideas for the strategic changes seems to depend upon of the initiative and skills of people that act in the organizations as intrapreneurship. There is a clear difference between the deliberated strategies that focus on the control and the emergent strategies that focus on learning.

The premises of this school are:

- ◆ The complex and unforeseen nature of organization environment makes difficult the execution and control of the planned strategies;
- ◆ The strategy formation must assume the form of a learning process along the time, where formulation and implementation are undistinguishable;
- ◆ In general it is the collective system that learns: there are many potential strategists;
- ◆ The learning happens by the behavior that stimulates the retrospective thought and understanding about the action;
- ◆ Successful initiatives may converge and become standards;
- ◆ The leadership function is to manage the strategic learning process: this includes the subtle relation between thought and action, control and learning, stability and changing;
- ◆ Strategy appears firstly as past standards, then as future plans and finally as perspectives to guide the organization behavior.

This process of strategy formation may cause the inexistence of strategy due to an unarticulated incremental growth where a change may occur fragmentally. An excessively emphasis at the learning process may affect the development of a coherent strategy.

The power school: strategy formation as negotiation process. The strategy formation is a consequence of influence processes, negotiations and allowances among individuals and groups. Strategy may reflect the interests of individuals, powerful groups or may be the result of coalitions. It is an opened process of influence where power and politics are used to negotiate the strategy in favor of certain interests and competitive targets. The power must be made within the organization (micro power) mainly through the political game that occurs inside the

several levels of power as well as externally (macro power) when the organization applies its power for influencing and negotiating with agents of external environment in order to adequate to the organization interests. The easiest way of controlling the power of external agents is to control their behavior.

Nevertheless it cannot be stated that the strategy results only due to the interests struggle or the conflicting objectives. On the other hand there is no sense understanding the strategy formation as a no-power process and absence of political game. The main premises of this school are the following:

- ◆ The strategy formation is molded by power and politics;
- ◆ The micro power sees the formation as a synergy through persuasion, bargaining and sometimes as a straight confront in form of political games;
- ◆ The macro power sees the organization promoting its own welfare by means of control or cooperation with other organizations.

Cultural school: a strategy formation as a collective process. The strategies formation is a consequence of social synergy rooted by the force of the organizational culture. This force may change or perpetuate the strategies. The culture has influence in the way of thinking and the formation strategies process. The main premises of this school are the following:

- ◆ The strategy formation is a synergetic process based on beliefs and common interpretations of the organization members;
- ◆ The beliefs of an individual are acquired through a cultural process or socialization that in part are tacit (not verbal) and by this reason the origins and beliefs (of this culture) may remain obscure;
- ◆ The strategy assumes the form of a perspective with root mainly in the collective intentions and is reflected in the standards by which resources and capacities of organization are protected and used for its competitive advantage;
- ◆ The culture and specially the ideology may not encourage strategic changes and thus perpetuate the present strategy.

Environmental school: a strategy formation as a reactive process. This school has its origins in the contingent theory. The authors of this school see the environment as an actor unlike the other schools that consider it as a factor. The strategy formation is a consequence of environmental analysis because the environment represents a set of forces to which the organization must adequate itself reactively. The environment is the main agent in the strategy formation process. The organization reacts according to the environmental demands and

reduces the strategy formation to a kind of a mirroring process. Thus the organizations are considered passive entities reacting to an environment that establishes the guidelines. In the process of strategy formation the environmental dimensions are sometimes abstract, vague, complex, dynamical and hard to be perceived. The main premises of this school are the following considerations:

- ◆ The environment - a set of general forces - is the main agent in the process strategy formation;
- ◆ The organization must answer to these forces or will be eliminated;
- ◆ The leadership will be passive in order to read the environment and guarantee an adequate adaptation of the organization;
- ◆ The organizations form groups, compete at niches, and remain at these position until their resources become scarce and the conditions too hard and then later they bankrupt.

Configuration school: strategy formation as transformation process. The strategy formation is a function of transformation processes that happens in the organization. The configurations are states of the organization. This configuration is a function of the context that surrounds the organization at a certain moment. The stability is interrupted by transformations that guide the organization from one state to another. This process starts new configurations between states of the organization and the environment context and consequentially new strategies set.

Critics of these school state that is wrong to affirm that organizations are static or are changing quickly. Most of the organizations in the most part of the time change incrementally (Donaldson, 1996).

The summary of the main premises of the configuration school is presented below:

- ◆ In the most part of the time, the organization may be described as some type of stable configuration of its characteristics;
- ◆ At a certain moment, stability is interrupted by some transformation process that guides the organization to another configuration;
- ◆ Successive configuration states and transformation periods may arise a standard sequence and thus describing the organization life cycles;
- ◆ The strategic management should sustain the stability, make adaptable changes and do periodically changes as well as be able of managing these processes without destroying the organization;
- ◆ The conscience that a different and not excluding process of strategy formation exists is an important contribution to the strategic process.

Once presented a synthesis of the conceptual framework which this study is based, the next block will focus on some information about the technologies research institutes and the strategies formation schools identified for this type of organizations in previous studies.

RESEARCH AND TECHNOLOGY INSTITUTE STRATEGIES SCHOOLS: PREVIOUS STUDIES

RTIs: some basic explanations. The following quotation, despite quite old, seems to explain well the function of Research and Technologies Institutes:

“Economic growth depends to large extend on industrial development, which in turn is greatly influenced by the national research effort and the rate at which results of the research are applied industrially. (...) It is through the generation of new ideas and techniques and finding means of exploring new materials and processes that progressive industrial advancement can be achieved. Industrial research institutes are the accepted instrument for this purpose, whether established within the frame of existing national development or as independent entities. These institutes are organized to undertake research in the fields of interest to industry, render various technical services, and carry out investigations of industrial projects either at the initiative of the institute itself or at the request of enterprises, the business community, industry or Government” (UNIDO, 1971, p.1)

Research and Technology Institutes (RTIs) are complex organizations. They may be technologically focused or they may be technologically multidisciplinary. They may have a national perspective or a local perspective. They may have large or small (or both) companies as client which can be public or private entities (or both). As Rush et al. states:

“There is no unique or correct model for an RTI. The right ‘model’ for a given RTI at a given time depends on the needs of its users, the state of development of the national innovation system in which it plays a part and the uniqueness of its contribution to the functioning of that system.” (Rush et al., 1996, p.174)

RTIs and the strategies schools: some findings in the literature review. Part of the literature review was dedicated to identify traces of any of the schools previously mentioned. The results are shown in table 1. Far from being exhaustive, this review was enough to show that different schools may be present in the strategy formation of the RTIs.

Review of selected comments from previous studies and its respective strategy formation school			
Comment	Nature	School	Authors
As part of the strategic planning of the activities of any RTI, a review and assessment of the institute's strengths, weaknesses and needs is a useful starting point.	prescription	planning	Rush et. al, 1996, p. 184
Brazilian RTIs do not have formal organized actions for midterm and long term plan	description	planning	Sousa, 2000
RTIs should have a long term plan.	prescription	planning	Marcovitch, 1978; Araoz, 1995; Sousa, 2000
Without decisive leadership it is unlikely that any RTI could carry out its mission effectively.	prescription	entrepreneurship	Rush et. al, 1996, p. 180
A contemporary concept of RTIs should base itself on the principle of entities which learn and evolve, not only scientifically or technologically, but from an organizational point of view as well – in their internal and external relationships.	description	learning	Salles-Filho et al., 2000, p.7
Most of the RTIs used lobbying, networking, marketing and image-building techniques to influence industry, government, universities and other important stakeholders in the S&T system.	description	power	Rush et. al, 1996, p. 180
Brazilian RTIs lack willingness to improve their governance: they do not accept stronger influence of the industry	description	power	Sousa, 2000
The problems that justified many RTIs today no longer exist, and present problems won't be tomorrow's crises. There is a need of internal innovation, not always accepted by all members of the RTI.	description	culture	Marcovitch, 1978, p. 44
Most RTIs conducted strategic planning exercises but accepted the main structural characteristics of the institute and consider most government policies as given...	description	environmental	Araoz, 1995, p. 27
The balance between acting as technology leaders or as service providers in technological change depends on the state's willingness to pay for part of the RTIs activities	description	environmental	Rush et. al, 1996, p. 184

RTIs may have more or less autonomy, according to legal system they are inserted and according to the legal regime they have.	description	environmental	Marcovitch, 1978, p. 46
At the national level, the search for new technology opportunities is a key function of RTIs. It enables the larger ones to fulfill their role as agents of industrial modernization and to avoid reinventing wheels.	prescription	environmental	Rush et. al, 1996, p. 181
RTIs have an organizational structure that varies according to the kind of services offered: the more the organization develops innovative activities, more flexible this structure must be.	description	configuration	Marcovitch, 1978, p. 46
A revitalization exercise should go much further. It should explicitly aim at introducing desirable changes in all aspects of the RTIs structure and its legal status, and should make explicit proposals to the authorities regarding new policies...	prescription	configuration	Araoz, 1995, p. 27

Table 1: Review of selected comments from previous studies and their respective strategy formation school.

Source: elaborated by the authors.

As can be seen in the table 1, we defined the quotations of the different studies as *prescriptions* (suggestion or recommendation from the author) or *descriptions* (explanations from what was observed by the author) in order to qualify the nature of the original comment.

This review was executed to identify among previous studies the possibility of diversity in the formation strategy schools within RTIs. Seven strategy formation schools were found. This result suggests that RTIs strategy may be influenced by different schools. On the other hand, the review also helped to confirm that none of the previously studies were specifically addressed to identify which strategy formation schools may be influencing RTIs strategies. These findings were the main stimulus to the development of a study dedicated to analyze the strategy formation within RTIs. The methodology of the present study is explained in the next block.

RESEARCH METHODOLOGY

Research problem

In order to improve the knowledge concerning strategy formation process, a study was carried out with the aim to answer the following question:

“What are the main characteristics of the strategies formation process in Research and Technology Institutes?”

In order to find out the answer for this general question, the research was organized to investigate the following aspects:

1. The meaning of success;
2. The importance level of having defined objectives for 1, 5 and 10 years;
3. The main factors that can jeopardize these objectives;
4. The importance level of having their clients and a portfolio of services clearly defined;
5. The importance of having pre-defined strategies and stable strategies for 1, 5 and 10 years;
6. The present characteristics of the strategy formation;
7. The desired characteristics of the strategy formation and, thus
8. The changes needed in the present characteristics of the RTIs strategy formation.

The present article is organized to present the findings of the last three objectives.

Methodology

The case the study was selected because “is a contemporary phenomena within its context in the real life (...) and take the advantage of pervious theoretical developments to conduct the data collection and analysis” (Yin, p.32-33).

In order to achieve the objectives of this study three RTIs were selected: Instituto de Pesquisas Tecnológicas (Technologies and Research Institute - IPT), Instituto de Pesquisas Energéticas e Nucleares (Nuclear and Energetic Research Institute – IPEN) and the Centro de Caracterização e Desenvolvimento de Materiais (Materials Characterization and Development Center -

CCDM). These RTIs were chosen due to the following aspects: firstly, all of them are somehow developing management quality improvements; secondly, the authors of this study have no difficulties to contact the direction of these RTIs in order to execute the research and third, they have significant differences among their profile as can be shown in the table 2.

	IPT	CCDM	IPEN
Main stakeholder	Secretary of Science, Technology Development and Tourism of São Paulo State	São Carlos Federal University	Nuclear National Energy Comission – Ministry of Science and Technology – Federal Government
Foundation year	1899	1996 (official inauguration)	1956
Annual income/budget, including fomentation agencies	US\$ 17,13 million (2002)	US\$ 560.000,00 (2000)	US\$ 12, 45 million (2002)
Relation between income/budget without salaries / income/budget with salaries	55% (2002)	112% (2000)	33% (2002)
Size of the total working force	1474 (2002)	60 (2003)	1493 (2003)
Permanent working force	924 (2002)	35 (2003)	1084 (2003)
Strategic units researched	Chemistry and Geology	Metallic Material and Polymeric Materials	Chemistry and Environment Radiation Center and Technology Center

Table 2: RTIs profile

Conceptual model of the research

The present article will focus on the findings related the “essence” of the strategy formation process. It is assumed that the Mintzberg’s et al. strategic formation schools can be used to help to understand the strategy formation process of an RTI. Two situations were investigated: one representing the present situation faced by the RTIs, and another one representing a desired situation which, each RTI should struggle to reach. The difference between the present situation and the desired situation was used to identify the opportunities to improve the strategy formation process within the RTIs.

The conceptual model of the research is presented in the figure 1. Each block represents one specific objective mentioned earlier. The blocks that are represented in dashed lines were only

presented for didactic purposes (the effectiveness of content of the strategies as well as what strategy should change was out of the scope of the study). The lines connecting the blocks are also merely illustrative since it wasn't an objective of the present study to evaluate such association. There is an assumption that such association should exist. Also, the content of which strategies or which clients or services are offered as well as which objectives are targeted by the RTIs was also out of the scope of this study.

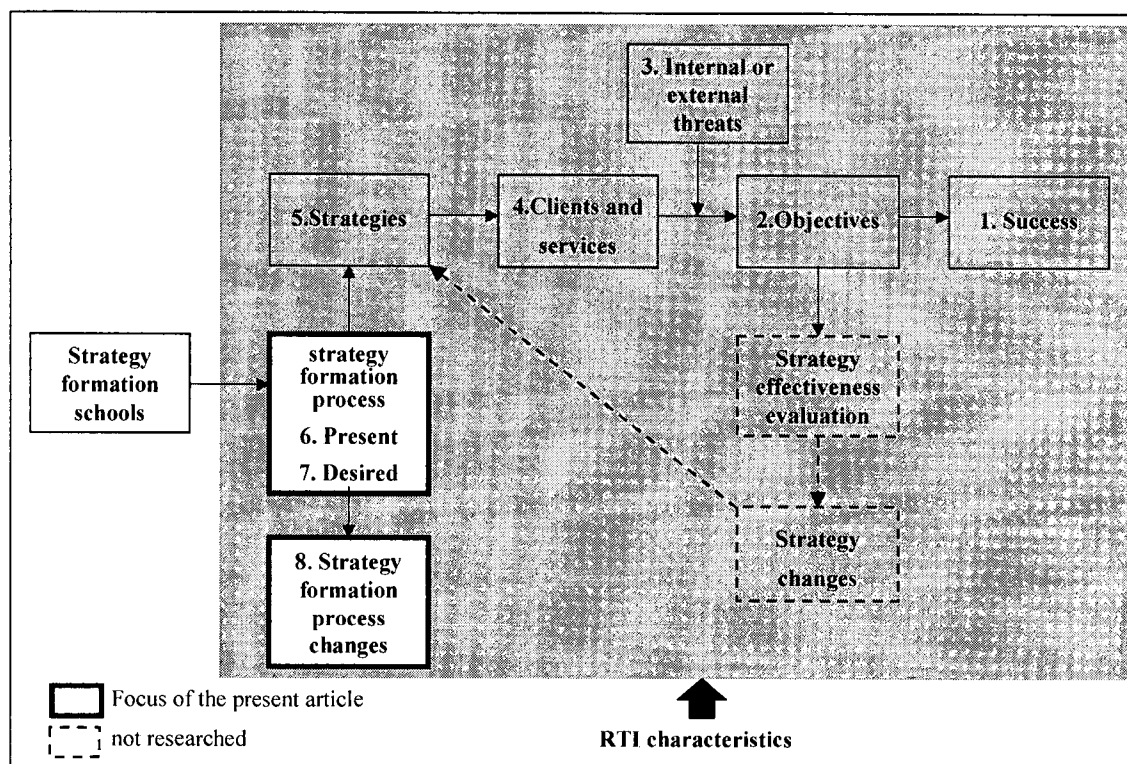


Figure 1: conceptual model of research

The analysis of the strategy formation school involves some complexities, thus some simplification was done in order to make this study viable. Only six of ten strategy formation schools were considered in the study: *design*, *planning*, *learning*, *cultural*, *power* and *environment*. The evaluation of the *positioning school* wasn't included in the research because it would involve some "content analysis" of the strategies of the RTIs - something that would involve a more structured analysis process (for instance, which type of clients are targeted and which types of services are offered) - thus was considered out of the scope of this study. The *cognition school* and the *entrepreneur school* also would request some deeper insight of the "manager's mind" or its personalized and idiosyncratic aspects - which also would request a more complex research procedure.

In order to perform the empirical part of the research, seven variables were considered to identify the central aspects that were underlying the strategy formation schools in the RTIs: *formality of the planning process, main strategies definition responsibilities, information basis used to define the main strategies, political strength², cultural influence over main strategies change, behavior induced due to external environmental influence and definition/implementation of the main strategies.*

In the next block further explanations will be given about these variables and its operationalization.

Variable operationalization

In order to measure each of the variables, a differential semantic scale was used. The polar classification of this differential semantic is presented in the table 3.

Variable	Simplified Notation	Differential semantic			
		Polar situation 1	Simplified Notation	Polar situation 2	Simplified Notation
formality of the planning process	Formality	Formal	Formal	Informal	Informal
main strategies definition responsibilities	Responsibility	Hierarchical superiors of the manager interviewed	Superiors	Group which the manager interviewed was responsible	Group
Information basis used to define the main strategies	Information process	Facts and confirmed tendencies	Facts	Intuition	Intuition
political strength	Political strength	Hierarchical superiors of the manager interviewed	Superiors	Group which the manager interviewed was responsible	Group
cultural influence over	Pro-active culture	Favorable	Favorable	Unfavorable	Unfavorable

² *Political strength* was defined and explained to each interviewed as the professional and political connections with different organizations in interest of the unit/RTI success. It may include connections with financial organizations, clients, governmental institutions, political entities, Universities, other RTIs and so on.

main strategies change					
environmental approach	Environmental approach	Reactive strategies	Reactive	Pro-active strategies	Pro-active
Definition / implementation of the main strategies	Strategy approach	Strategy is defined before its implementation	Defines first, implements after	Strategy is defined simultaneously with strategy implementation	Defines and implements simultaneously

Table 3: semantic differential applied to each variable of the study

Each of these variables was measured in a five point semantic differential scale (a “no opinion” answer was also available). For instance, concerning the first variable, the interviewed manager was requested to answer the following question:

“Concerning the formality of the planning process, nowadays the planning process in the unit under your responsibility is...

- a) totally formal;
- b) there is a predominance of the formal aspects above the informal aspects;
- c) there is an equilibrium between formal and informal aspects;
- d) there is a predominance of the informal aspects above the formal aspects;
- e) totally informal;
- f) I have no opinion.”

The other six variables were evaluated using a similar procedure.

The last variable, *definition/implementation of the main strategies*, was evaluated using the mentioned structure three times, each one considering three different time horizon reference: 1 year, 5 years and 10 years.

Source of data and data collection

The primary data sources were interviews with middle managers made by the authors. The reason to interview middle management came from Wooldridge and Floyd findings:

“Middle managers felt that they were in a better position to propose, initiate, and evaluate alternative courses of action. (...) when they voiced dissatisfaction with

their organization's strategy it was not in terms of objectives but rather in how the objectives were to be accomplished" (Wooldridge and Floyd, 1990, p.238).

Thus none integrant of the top management team (board of directors, including CEO at IPEN and IPT or CEO at CCDM) was interviewed. The main sources of information were interviews with strategic business units, coordinators of subunits or project coordinators. Besides that, a coordinator should have at least a budget under his responsibility and at least one person under his responsibility. 17 interviewers fitted these requirements. The table 4, presented below, demonstrates the profile of these managers.

Institute		Budget/income (US\$) ³	Size of group under responsibility	Experience at the RTI	Experience at the present duty
CCDM	average	232.000,00	10	6	3
	minimum	47.000,00	5	2	1
	maximum	500.000,00	22	7	4
IPEN	average	375.000,00	60	23	4
	minimum	53.000,00	3	15	2
	maximum	753.000,00	180	29	7
IPT	average	6.225.000,00	83	20	5
	minimum	133.000,00	13	8	1
	maximum	26.650.000,00	210	26	7
Total	average	2.287.000,00	52	16	3
	minimum	53.000,00	3	2	1
	maximum	26.650.000,00	210	29	7

Table 4: characteristics of managers interviewed and group they are responsible.

The questions were read by the interviewer and, when requested, additional explanations were presented. In each interview, it was requested to the manager to answer the questions under his point of view as a manager of a group or as a project manager. The interviews were executed in June, 2003.

Data analysis

The variables measurements can be presented as intervalar data (Cooper & Schindler, p.202,

³ Data refers to year 2002. US\$ 1,00 = R\$ 3,00.

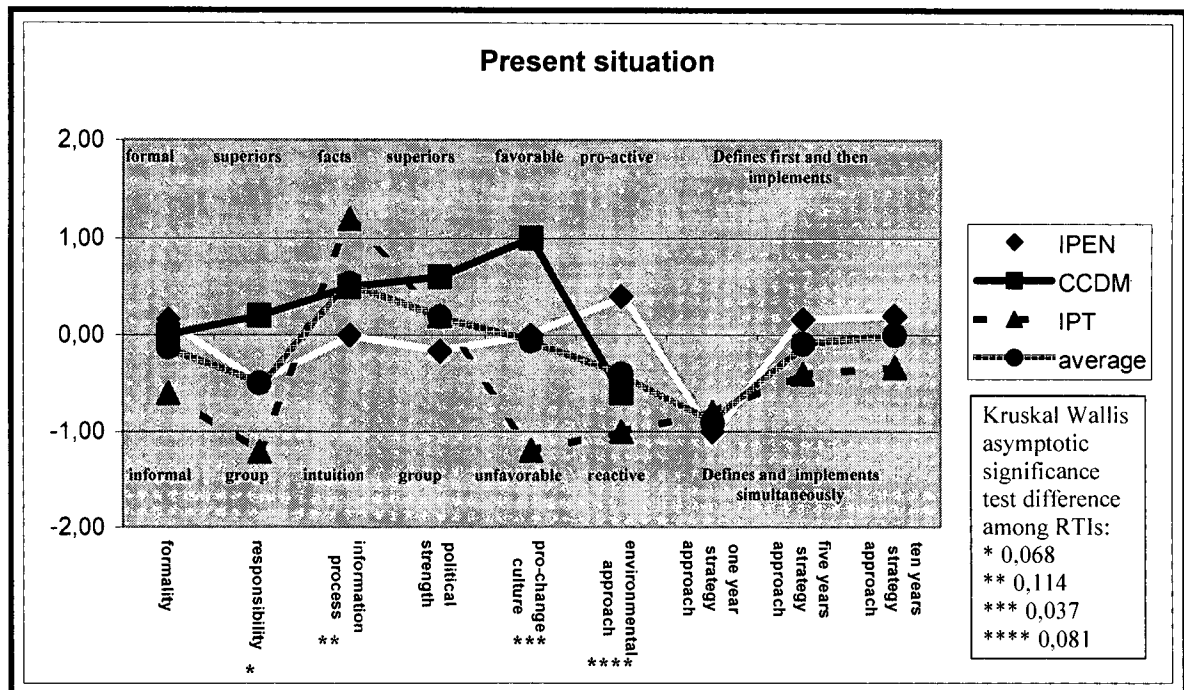
2003). Thus the average value of each variable will be used to present the results considering all RTIs together or individually.

Non-parametric tests were used to evaluate the significance. In order to measure the significance of the differences of the strategy formation process in the present situation and in the desired situation among the three RTIs, the Kruskal-Wallis test was executed. In order to measure the significance of what variable of the strategy formation process should change in each RTI from the present situation to the desired situation, Wilcoxon-test was performed. The SPSS student version software, release 7.5, was used to perform the significance tests.

RESULTS

Strategy formation process: present situation

The results of the research are presented in the graphic 1.



Graphic 1: present situation of the strategy formation process

In general terms, the average results of the three RTIs demonstrated that six of the nine variables are near an equilibrium situation. The test analysis pointed that, with significance lower than 12%, the three RTIs differ in four variables: *responsibility*, *information process*,

pro-change culture and *environmental approach*. The other variables presented significance higher than 12%. Three variables – *information process*, *environmental approach* and *one year strategy approach*- diverge from the equilibrium situation.

Concerning the *formality*, it was found that, at the average, there is an equilibrium situation between the formal and informal procedures involving the planning process at the three RTIs.

The variable *responsibilities* evidenced statistically differences among the three RTIs: At IPT there is a slightly tendency to the superiors define the main strategies; at IPEN there is a slight tendency to the group define the main strategies and at CCDM this tendency is stronger.

The variable *information process* also presented statistically difference among the three RTIs: IPT and CCDM tend to use more facts (and confirmed tendencies) than intuition to plan their activities; IPEN stays at the middle range between using facts (and confirmed tendencies) and intuition to plan.

The analysis of *political strength* variable pointed out no statistical difference among the RTIs. Thus one can consider that there is almost equilibrium of the *political strength* of the superiors and the group at the three RTIs. At the average, there is a slight tendency of *political strength* to the superiors.

Concerning the results of *pro-change culture variable*, at the average, the RTIs are neutrals; but when the results are analyzed per each RTI, there are statistically differences among the RTIs: the *pro-change culture variable* can be considered somehow unfavorable at IPT, neutral at IPEN and somehow favorable at CCDM.

The variable *environmental approach* evidenced, at average, that the RTIs are, concerning their strategy formation process, slightly reactive. But statistically differences among the RTIs were identified: at IPEN, the strategy formation is somehow pro-active; at CCDM and at IPT the strategy formation is more reactive.

The variable *strategy approach* was analyzed with three different time perspectives⁴ (one year, five years and ten years). The difference between IPT and IPEN cannot be considered with significance. The average result of both RTIs shows that for periods within *one year strategy approach*, the strategies are defined and implemented simultaneously. For longer periods (five

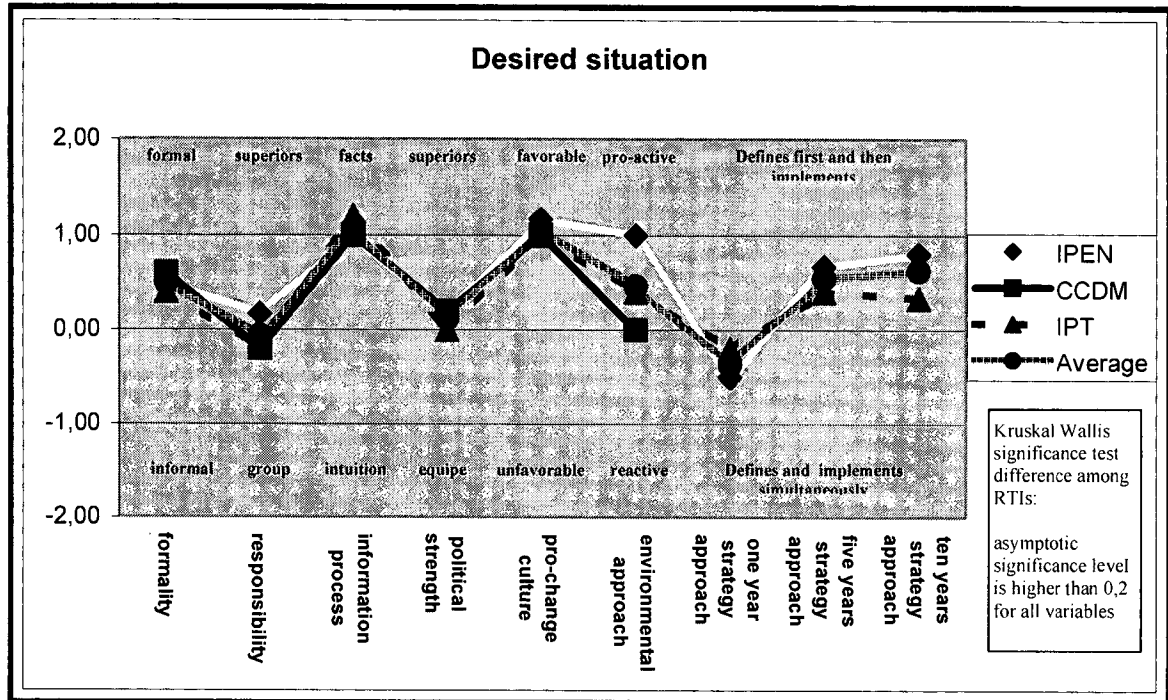
⁴ Due to methodological change during the data collection, CCDM results were not considered.

or ten periods) there is an equilibrium situation between defining first and then implementing the strategy and defining and implementing it simultaneously.

Strategy formation process: desired situation

The findings of the research of the desired strategy formation process are plotted in the graphic 2.

All variables presented a significance level higher than 20%. This means that the results may be due to chance. Despite this limitation, it may be possible that the three RTIs have a similar perspective of their strategy formation process for a desired situation in the following perspective: the *formality* should be slightly towards the superiors; the *responsibility* and the *political strength* should be distributed equally between the superiors and the group; strategies formation *information process* should be based more on facts than intuition, *pro-change culture* must be intensified and *environmental approach* must be slightly towards pro-active. Concerning the *strategy approach for one year*, the strategies formulation should be slightly based on *simultaneous effort of defining and implementation* while for five and ten years strategies should be slightly emphasized in *defining first and implementing after*.



Graphic 2: desired strategy formation process

Strategy formation process: what need to be changed

In order to find out, what should be improved in each RTI, Wilcoxon test was applied to evaluate the difference between desired situation and present situation. The tables 5, 6 and 7, display the test result for each RTI.

Test Statistics: IPEN ^b									
	present formality - desired formality	present responsibility - desired responsibility	present information process - desired information process	present political strength - desired political strength	present pro-change culture - desired pro-change culture	present environmental approach - desired environmental approach	present one year strategy approach - desired one year strategy approach	present five years strategy approach - desired five years strategy approach	present ten years strategy approach - desired ten years strategy approach
Z	-1,414 ^a	-1,633 ^a	-1,414 ^a	-1,000 ^a	-1,633 ^a	-1,089 ^a	-1,342 ^a	-1,342 ^a	-,816 ^a
Asymp. Sig. (2-tailed)	,157	,102	,157	,317	,102	,276	,180	,180	,414

a. Based on positive ranks.
b. Wilcoxon Signed Ranks Test

Table 5: Variable change analysis at IPEN

Test Statistics: CCDM ^d						
	present formality - desired formality	present responsibility - desired responsibility	present information process - desired information process	present political strength - desired political strength	present pro-change culture - desired pro-change culture	present environmental approach - desired environmental approach
Z	-1,732 ^a	-1,000 ^b	-1,000 ^a	-1,414 ^b	,000 ^c	-1,732 ^a
Asymp. Sig. (2-tailed)	,083	,317	,317	,157	1,000	,083

a. Based on positive ranks.
b. Based on negative ranks.
c. The sum of negative ranks equals the sum of positive ranks.
d. Wilcoxon Signed Ranks Test

Table 6: Variable change analysis at CCDM

Test Statistics: IPT ^d									
	present formality - desired formality	present responsibility - desired responsibility	present information process - desired information process	present political strength - desired political strength	present pro-change culture - desired pro-change culture	present environmental approach - desired environmental approach	present one year strategy approach - desired one year strategy approach	present five years strategy approach - desired five years strategy approach	present ten years strategy approach - desired ten years strategy approach
Z	-1,890 ^a	-1,890 ^a	,000 ^b	-,577 ^c	-2,121 ^a	-2,070 ^a	-1,342 ^a	-2,000 ^a	-1,414 ^a
Asymp. Sig. (2-tailed)	,059	,059	1,000	,564	,034	,038	,180	,046	,157

a. Based on positive ranks.
b. The sum of negative ranks equals the sum of positive ranks.
c. Based on negative ranks.
d. Wilcoxon Signed Ranks Test

Table 7: Variable change analysis at IPT

The following analysis, in each RTI, focus the results were the significance level is lower than 12%.

- IPEN: two variables need to be improved: *responsibility of strategy definition* and *culture change*. Concerning *responsibility of strategy definition*, IPEN should improve it into the direction were the superiors should have more involvement in the strategy definition process; concerning the *culture change*, IPEN should somehow change into the direction were should develop a culture more oriented to changes.
- CCDM: two variables need to be improved: *formality* and *environmental approach*. Concerning formality, CCDM should increase the *formality* of planning process and concerning

the *environmental approach*, and should look for an equilibrium situation between reactive and pro-active behavior.

- IPT: five variables need to be changed: *formality, responsibility, pro-change, environmental approach* and *five years strategy approach*. IPT's planning process has to be more *formal*; concerning *the responsibility*, there is a need to reach an equilibrium situation between the involvement of the superiors and the groups; the *organizational culture* need to be more favorable to change. IPT's *environmental approach* should become pro-active and its *five years strategy approach* should concentrate more effort on defining strategies before their implementation.

Synthesis of the main findings

Perspective	Strategy formation process variables
Present situation	<ul style="list-style-type: none"> • Characteristics with no statistical difference among the three RTI: <ul style="list-style-type: none"> ○ <i>Formality</i>: equilibrium between formal and informal; ○ <i>Political strength</i>: slightly influenced by superiors; ○ <i>One year strategy approach</i>: predominance of definition and implementation simultaneously; ○ <i>Five years strategy approach and ten years strategy approach</i>: equilibrated situation between defining and implementing strategies simultaneously and defining them first and implementing them after. • Characteristics with statistical difference among the three RTI: <ul style="list-style-type: none"> ○ <i>Responsibility</i>: <ul style="list-style-type: none"> ▪ IPEN: slightly predominance of the groups; ▪ CCDM: slightly predominance of the superiors; ▪ IPT: predominance of the groups; ○ <i>Information process</i>: <ul style="list-style-type: none"> ▪ IPEN: equilibrium between facts and intuition; ▪ CCDM: slightly predominance of facts; ▪ IPT: predominance of facts; ○ <i>Pro-change culture</i>: <ul style="list-style-type: none"> ▪ IPEN: neutral situation: not favorable, not unfavorable; ▪ CCDM: predominance of a favorable pro-change culture; ▪ IPT: predominance of an unfavorable pro-change culture; ○ <i>Environmental approach</i>: <ul style="list-style-type: none"> ▪ IPEN: slightly pro-active; ▪ CCDM: slightly reactive; ▪ IPT: reactive predominance.
What has to change	<ul style="list-style-type: none"> • IPEN: <ul style="list-style-type: none"> ○ <i>Responsibility</i>: increases the involvement of the superiors in order to reach an equilibrated situation. ○ <i>Pro-change culture</i>: increase the favorability to change when changes are needed. • CCDM: <ul style="list-style-type: none"> ○ <i>Formality</i>: increases the formality of the planning process; ○ <i>Environmental approach</i>: search for an equilibrium between being pro-active and reactive. • IPT: <ul style="list-style-type: none"> ○ <i>Formality</i>: increases the level of formality: the planning process should be more formal than informal; ○ <i>Responsibility</i>: higher superiors involvement: an equilibrium between superiors and groups has to be reached; ○ <i>Pro-change culture</i>: organizational culture should be more favorable when

	<p>changes are needed;</p> <ul style="list-style-type: none"> ○ <i>Environmental approach</i>: strategies should be more be pro-active; ○ <i>Five years strategy approach</i>: intensify the effort to define the strategy before its implementation.
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Table 8: synthesis of the main findings

CONCLUSIONS AND FINAL COMMENTS

A case study was conducted to improve the knowledge about strategy formation process and related topics in three Brazilian public Research and Technology Institutes. The present article presents the part of the study which focused the core of the strategy formation process. Six strategy formation process schools from Mintzberg et al. (2000) perspective were selected to develop the study: *design, planning, learning, cultural, power* and *environment*. Measurements of some representative variables of these schools were performed to evaluate the present situation and a desired situation. The difference between these two situations pointed out the characteristics that may need to be changed in the RTIs strategy formation process.

The research methodology has been proved viable for the purposes of this initial study. In order to overcome some low significance level measured in part of the results, research with a bigger sample size need to be carried out in order to confirm or refute some of the interesting results founded here. The main results of the study were synthesized in the table 8.

In short terms, it was found that the three RTIs have, presently, some common aspects and some differences in their strategy formation process. It was also found that these RTIs – with differences in size, main stakeholders or application areas - may have similar aspects in the strategy formation process for a desired situation. Opportunities for improvement in the strategy formation process were identified for each RTIs revealing that studies like this one may help organizations to identify and correct problems or difficulties with their present strategies formation processes.

A final suggestion as an opportunity to improve the comprehension of the strategy formation process in the RTIs (and also other types of organizations) would be the development of studies similar to this one, including the remaining four strategies formations schools not considered in this study.

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