

Brazilian aerospace sector under the prism of the resources based strategy

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Abstract - The main guiding document of government actions in the aerospace sector in Brazil is the National Program of Space Activities (PNAE). We analyze the Brazilian aerospace industry from an angle that was not regarded with much emphasis by PNAE, the resource-based strategy. The resource-based strategy, as is already known, searches within the classical microeconomics and economics of transaction costs its main theoretical postulates. In this case, the Brazilian aerospace industry, we understand that the scope of analysis must still overcome the microeconomic aspects, since the conditions are very restrictive in terms of budget. So, the paper extends the scope of the analytical strategy based on resources, with the generic strategies of Porter [1] and diamond theory [2] – analyzing the Brazilian aerospace industry from the perspective of competitiveness. The intention, as a hypothesis of this case study is to examine whether the challenges of resource-based strategy, besides the concept of a guaranteed allocation of specific assets, it would not be able to elucidate better than PNAE already do – taking as a background the porter’s concept of competitiveness – the interests of different stakeholders on the issue.

Keywords: Brazilian aerospace sector, Resources based strategy, Contracts incompleteness

I. INTRODUCTION

Brazil’s policies and actions guiding aerospace sector are ruled in the National Space Activities (PNAE) [3], document of the Ministry of Science, Technology and Innovation, and its agency, the Brazilian Space Agency (AEB).

Beyond the political directives and the decision power, this program (PNAE) started to evoke a lot of intentions. In the past, before engaging the AEB in this process, this order matters were the sole purview of the Air Force Command, and nowadays the scope of the program was strongly extended, with great amplitude of areas at the same frame. These are (i) earth observation (ii) scientific and technological missions, (iii) access to space, (iv) weather, (v) telecommunications, and yet, (vi) research and development.

Basically the program should be to mobilize research and product development – and the investment required – to produce satellites and to launch vehicles.

The country still has a huge number of people in extreme poverty, so, very often the government alters the budget and excludes money from the sectors like this, with a very specialized knowledge and praxis, far from the necessity of its people.

So, that private industry participation in this program is a real necessity. Therefore with a framework of limited resources, and the urgency of an agreement between public and private interests.

This is a problem that involves the development of strategies based on resources [4], while taking into account nuances of public administration, often closer to the

macroeconomic constraints, than the demands of competitiveness industries.

Thus, an analysis that take into account only the microeconomic variables, to encompass the private interests, or only the macroeconomic variables, to encompass the public interests, would be doomed to failure, simply because it is incomplete. We have to consider what Porter [1] termed broadly as generic strategies for competitiveness, and to expand the same concept to the competitiveness of nations [2].

Moreover, we must also consider the types of contracts that would be more appropriate in situations like this [4]-[5], i.e. guarantees to the very specific asset allocation and consequent incompleteness of contracts [6].

According to PNAE Brazilian industries – especially small and medium enterprises –have collaborated in a ratio ranging between 10 and 20% of the program's efforts. And even according to the PNAE, the Brazilian government, exclusive client of these companies has not ensured continuous and uninterrupted flow of orders, undermining the financial health of private companies that participate in the program.

The program PNAE (p.67) recognizes "the need to adopt strategies to strengthen the space industry." Another problem identified by the PNAE is poor integration between industries and universities.

And, paradoxically, the PNAE complains of low capacity utilization and human resources, knowledge circulation and low fledgling exchanges between industries, research institutes and universities.

This work begins with the theoretical concepts of these previously exposed difficulties, to, examining some relevant variables from other countries, revisit and evaluate the success or rejection of their initial hypothesis. First will be elucidate the problem, the purpose and hypothesis itself.

II. PROBLEM, OBJECTIVES AND HYPOTHESIS

The problem addressed in this paper is the relative delay presented by Brazil in its aerospace program in the face of immense challenges – management and control – that are imposed on a nation with this size and complexity of infrastructure, and possible ways to achieve this massive investments that must be made to reverse this situation.

The objective is to present an expansion of the scope of analysis already provided by the PNAE, adding the resource-based strategy and discuss the inexorable incompleteness of contracts that ensure the asset allocation very specific. All through the prism of competitiveness.

The hypothesis is that such a theoretical framework may facilitate future negotiations on the relationship between those involved and coordination that is necessary for good understanding among all parties involved with the problem.

III. THEORETICAL FRAMEWORK

The theoretical framework of this article begins with the concept of resource-based strategy [4], followed by the concepts of generic strategies of Porter [1], as well as his theory of the diamond to the competitiveness of nations [2]. So, from this background, illuminating the concepts of guarantees in the allocation of specific assets (relationship of specific assets) and incompleteness of contracts [4] - [5] - [6], we present the argument and support the research hypothesis.

Resource-based strategy

Several strategic planning' authors [4] - [7] - [8] - [9] have considered the views of companies through resources such as the new knowledge into strategy.

Some focusing on Adam Smith's theorem that the division of labor and their expertise is limited by the size of the markets, and classical microeconomic theory, and its precepts as law of demand, experience curves, economies and diseconomies of scale or scope, and elasticity price, to argue that the strategy of an organization should respect these dictates.

Others giving more emphasis on cost functions, dynamics between fixed costs, variable costs and marginal productivity, to develop the most appropriate strategies.

Still others support his research on rarity and imitability of resources as basis for strategy formulation.

But there seems to be some unanimity among theorists of strategic planning that as important as the eyes on the market is what is addressed to the problem of allocation of resources, resource-based strategy, as a basis of value creation.

The resource-based strategy would thus be based on what an organization is valuable to your customers, this property can be represented by scarce resources or specialized, tangible or intangible, whose careful management should lie mainly in the types of care contracts specific allocation of resources, especially when offered customers a few buyers. These ideas will be taken forward.

Porter generic strategies

Porter [1] suggested that an organization chooses one of two generic strategies for competitiveness and value creation: the strategy of differentiation and cost leadership strategy. Both can be managed to a large number of customers buyers (large target), or to a limited number of customers buyers (focus or specialization).

In differentiation strategy seeks to greater profitability through increased remuneration margin of resource costs, where prices were plus due to its rarity, specialization or brand appeal.

In the strategy of cost leadership organization would – even when opting for narrow target customer buyers – to ensure economies of scale and productivity based on volumes, not prices plus.

Porter's diamond theory

After the notable contributions made to the competitiveness of organizations, Porter [2] started to formulate the same question for the case of nations: what exactly determines the competitiveness of a nation?

The analogy of this theory with the diamond is due to the fact that Porter [2] says that exists six determinants of competitiveness of a nation, say six vertices of the diamond explaining the competitiveness of nations. All of them linking to all others in multiple directions. That is, with a clear causal relationship between all conditions.

The first of the six vertices of the diamond relates to the strategy, structure and rivalry among the major companies within that nation. The more solid is the strategy and structure of these companies, and the more fierce is the rivalry that these companies need to face, especially with external competitors, better for the competitiveness of the nation.

The second vertex are companies and related support firms that those national leaders who are responsible for the country's competitiveness. Are other companies that make up the supply chain sector that dominates the national productivity? These companies also need to be "protected" by the nation-state, to ensure support to leading companies, forming so-called business clusters [10].

The third vertex is represented by demand conditions. If a country has poor, destitute, non-educated, hardly a demand for the products of the leading companies are defendants in volumes required for corporate profitability.

The fourth point is what Porter [2] calls the factor conditions. Factors of production, human resources and adequate infrastructure for productive activities, the scope of the theory of the firm, or financial resources, material and human. Part of what was said, and is valid for the third vertex, also applies to this.

The fifth vertex is the government itself. Porter [2] argues that the government's role more important than that of ensuring macroeconomic conditions, is the guarantor of the operating conditions of the leading companies in the nation.

The sixth vertex concerns random and unexpected. That is, even a nation that guarantees all the above conditions can be hit by disasters difficult to predict, or conjugations of unfortunate political decisions that can become brittle every other vertex of the diamond.

Guarantees in the allocation of specific assets

The idea that the allocation of specific assets should be examined with some care stems from the finance literature that discusses particularly the notion of risk involved in the investments. This is because, from the seminal studies of Herbert Simon and his theory of rationality frontier, the world of corporate finance began to revise their vision of classical symmetry of information among agents.

After the famous studies of Jensen & Meckling [11], which focused on the problems of agency conflict, corporate finance literature has provided important contributions of Garud & Shapira [6], who analyze the lack of symmetry that exists in large corporations when one takes into account the decision-making process, from risk analysis.

The alignment of risk proposed by Garud & Shapira [6] seeks to contribute to a broader discussion about the processes of decision making in corporate finance, specifically in investment decisions and long-term financing.

The bottom line is: who has the authority in decision-making in business? While the answer is direct and immediate, the question began to involve much greater breadth of problems since we started to consider the companies, and their results, not only from the actions – and

results – of managers, but also the reflections these same acts imputed to the entire set of business activity involved. In a word, the transition from stockholders phase to stakeholders phase. This passage has not been easy, since the act of deciding involves uncertainty, and thus, the same way you can expect good results, bad results may also occur.

The authority to decide in modern enterprises was delegated by shareholders to management, and control of their results has been done mainly in the light of the theory of finance, which naturally tends to reward – with greater autonomy of control, and often with subsidies and wage gains – administrators who achieve positive returns on capital. Thus, the theory of finance tends to be a "risky one" only when involved with negative results, or losses. And the positive results are always targeted, representing return, not risk.

Of course nobody should be against positive financial results, the least in principle, since your search at any cost can motivate managers to incur excessive boldness, putting everyone at high risk exposure. These seem to have been the reasons for failure of Bank Berings and Enron, among others.

And so comes the first major complication: in the case of poor results, who will, in addition to liability, be the burden?

If the company does not produce the intended results, there will be layoffs, suspension of contracts and suspension of payments of bonds, as finance. Taxes will no longer be paid, and a series of negative consequences will follow, with impacts even in the larger society.

Some even believe that the biggest losers are those who lose their jobs, or just those who do not participate in decision making. And this has led to the inability of alignment between risk, return, control and responsibility.

Others still argue that the form of contract to be required to be covered all the possibilities arising from interests, rights and obligations of different stakeholders.

Because of this, following the line of reasoning Garud & Shapira [6], let us focus on the issues pertaining to the formation of contracts, or what degree of completeness would require these contracts involving risk in long-term investment.

Incompleteness of contracts

It seems elementary to admit that those who put their investments, jobs or other interests in situations of uncertainty or risk should be the same to exercise control over their possible outcomes.

In the period considered of entrepreneurial capitalism, the founders used to be the major decision makers, not delegating this task to anyone. Thus, besides the burden of their decisions, they were also the ones responsible for power and control.

From the moment that the founders began to delegate the decision-making process to professional administrators, beginning the period of managerial capitalism, it also starts up the practice of the board of directors overseeing the actions of their agents.

Companies now are run by professional managers to professional managers, since they tended to put their interests above any other. It became a time when it is common for boards complain greater boldness and optimism on the part of managers, who, anxious to preserve their jobs, often were seen by counselors as conservatives, for example, in their predictions.

However, the period of managerial capitalism, with proper separation of ownership and control, together with the growth experienced by large companies, made it difficult – if not impossible – to board members to demand and obtain sufficient information about the financial operations of the companies. Moreover, with the increasing complexity of financial markets and the high degree of overlap of financial operations, it became also difficult to demand the exactly questions and answers about the professionalism and correct management. And often the actions of the company itself began to be offered as a bonus to directors in cases of good results.

This use of company stock options as bonuses to executives starts to require new notion of risk, since the managers, eager for bonuses and short-term gains, have to make decisions that – besides the already mentioned excessive risk exposure – tended not to add value to all stakeholders, not in the long run.

A first change in this new approach should be made in the quantification of risk, which is a measure of overall variability (variance) that includes in its calculations both positive returns as the negatives. Why this kind of calculus, if the risk managers tend to consider only the negative returns, obsessively is pursuing only positive returns?

Regardless of exposure to the uncertainty that their actions can lead to the others involved, something would be made to revise the risk calculations. In finance, risk and return are – on average – strongly and directly correlated. If the goal is to obtain high returns, there will be necessarily the exposition to high risks. But if the directors consider only risk what is not positive feedback, how to get the calculations, so that a final statement – profit and loss also – be done in light of the benefits that everyone can get, not only the administrators bonuses? Let it be remembered that we are talking about the aerospace sector that blends public and private interests.

This all suggests that contracts are always incomplete, requiring more than contracts, but mutual perception of gains and losses for everyone involved within this kind of business. Garud & Shapira [6, p. 248] argue that any alignment of risk between stakeholders of a company can only take place through the cognitive dimension of the concept of risk:

Under conditions of uncertainty and ambiguity, outcomes can be defined only up to a probability distribution. So, the discussion deals with the basics of trust and culture, because the issue of shared perceptions, understanding and convergent expectations are the building blocks That may lead to alignment of risk, returns and responsibility in the modern corporation.

Still, these authors admit that there is a difficulty in obtaining permanent alignments, even through mutual perception, since there is strong asymmetry between those involved. Asymmetry that arises mainly from different forms of: (i) power and access to information, (ii) ability to interpret the information, and (iii) existing levels of aspiration.

Looking more closely at these sources of asymmetry, it appears that because of the asymmetry of power and access to information, managers tend to shape and lapidary the information that other agents will receive. This kind of "information treatment" would be done so that everyone feels secure. Also when would be better not to be.

In asymmetric perspectives the company's employees usually tend to underestimate the likelihood of negative events, or about which they have not sufficient information.

In the asymmetric aspirations willingness to take risks is a matter that depends on the context. Moreover, people who are below their levels of aspirations tend to exhibit lower risk aversion [12].

We conclude from all of this is that the decision-making processes in big programs like the PNAE, should search for mutual perception of all stakeholders: shareholders, directors, employees, suppliers, government, among others.

This perception could be yielded through the application of techniques reported in the literature of planning and forecast such as: subjective probability [13] - [14], scenarios and expert panels [15], as well as hybrid methods [16].

IV. DISCUSSION

As seen in the theoretical framework presented earlier, one of the approaches to resource-based strategy requires to ensure – through the eyes of the investor – minimum volumes of supply, so as to achieve economies of scale and labor productivity, even in very specialized activities.

If we approach the problem from another theoretical perspective, still in the very resource-based strategy, these one that is called of cost functions, it is inescapable to admit that the aerospace industry is, by its own specialization, an industry shrouded in fairly high costs of research, development and application (implementation) technologies.

Benefits that could accrue from investment in the specialized sector, as rarity or low imitability, are minimized since the Brazilian government is the only buyer.

When we direct our attention to the Porter's assumptions, and noting again that the Brazilian government is the only customer, it also seems inescapable the need to admit that the only viable strategy for the competitiveness of the supplier companies that are willing to share with the government the investments in the sector, is the differentiation strategy with targeted narrow focus.

So, private companies will require greater profitability, also to get the highest return investments.

Now let's look at the issue of competitiveness on the diamond prism, i.e., the competitiveness of the Brazilian nation in aerospace.

With regard to the first vertex of the diamond (strategy and structure of the leading companies in the industry) we can enumerate Embraer Defense and Security, as well as several companies that orbit it productively, making its supply chain, as a point in favor of competitiveness.

Moreover Embraer, besides being the world's third largest aerospace company, is a company that still faces fierce competition with foreign companies. Something that Porter' [2] approach considers very positive. And also as positive is mandatory that an emphasis be made even for the privileged, and the strategic role played by the Alcantara Launch Center.

Another highlight favorable to competitiveness should be given to research institutes in Brazil, the Aeronautics Technological Institute (ITA), the National Institute for Space Research (INPE), and Aerospace Technical Center ' Institute of Aeronautics and Space (IAE / DCTA). Both as regards the training and specialized human resources, as in regard to remote sensing software that INPE develops, as well as its Integration and Tests Laboratory (LIT).

With regard to the second vertex of the Porter'[2] diamond (companies and related support), it seems that the Brazilian situation is not so favorable. Brazil has given

unmistakable signs of difficulty articulating sectors that elects its competitiveness, failing to realize the formation of clusters, not even in the airline industry [16].

The third vertex (demand conditions) is not of direct interest to this case study, since it does not make sense – at first – to speak in demand for satellites for the purpose that is being discussed here.

With respect to the fourth vertex (factor conditions) its important to consider that Brazil have very prominent factors, and also has specialized human resources and infrastructure well suited for positioning in a competitive manner. Beyond all of that we must also highlight the geographical position of the Alcantara Launch Center, in Maranhão, as well as the Barreira do Inferno in Rio Grande do Norte. A disadvantage of this fourth vertex is the low number of civilian universities involved with the aerospace issue. However, we must discern, and put a critical eye into the analysis on which extent does research institutions in the aerospace sector are effectively in their search for private partners. Attention should be given to the risk that the institutes represent an entry barrier to private entrepreneurs, especially small business entrepreneurs, perhaps not quite prepared to go through some corridors notary, bureaucratic, existing in Brazil.

In the fifth vertex (role of government) may reside, paradoxically, one of the main threats to PNAE. This is because Porter [2] suggests that governments act only as facilitators of business processes, and this is not what is observed in the position of the Brazilian government, almost always more concerned about macroeconomic conditions, and, rarely, facilitating the microeconomics of companies who elects to be your partners in strengthening the economy. International comparative studies on the quality of the business environment continue pointing Brazil as one of the leading among the countries that has obstacles to free enterprise.

The sixth vertex (role of chance and contingency) appears to be where the smallest number of threats to PNAE exists. This is because once that it was a project of long-term investments which includes the active participation of the Brazilian government and robust private interest organizations; this will certainly have the ability to mitigate the pitfalls that arise along the way.

V. CONCLUSIONS

The Brazilian Air Force, preparing for the implementation of CNS / ATM (Communication, Navigation, Surveillance and Air Traffic Management), air traffic control, relies on satellites for communication, navigation and positioning, to air traffic control. So that also depends on the success of PNAE.

The success of the PNAE, according to this work' evidences may be jeopardized, because of that the sector seems unattractive to private entrepreneurs and maybe also to universities and research institutions.

Brazil has not been having much capacity for coordination between strategic actions necessary to strategic sectors, such as aerospace, and others, important, for example in its exports. It is inevitable to think in sectors such as aerospace and automotive, as examples that best illustrates this desired coordination of efforts.

In the aviation sector there is a company leader (Embraer) that surely facilitate such coordination. The same perhaps

cannot be stated with respect to the auto sector, represented in Brazil, in its entirety, for multinational companies.

Another problem is the low level of investment that Brazil has been doing in its industrial park, as shown by the data in

the table below, with selected countries due to the proximity to the sectors under discussion.

TABLE 1: STATISTICS OF SELECTED COUNTRIES

	GDP per capita (US\$)	Industrial sector (% GDP)	Labor force in industry (%)*	Gross Investments (% GDP)	Growth of industrial production (%)	Military investments (% GDP)
EUA	\$48.100,00	22,1%	20,3%	12,4%	2,5%	4,06%
Brazil	\$11.600,00	26,9%	14,0%	19,0%	4,0%	1,70%
China	\$8.400,00	47,1%	27,8%	48,4%	13,0%	4,30%
North Korea	\$1.800,00	48,2%	65,0%	n/d	n/d	n/d
Ukraine	\$7.200,00	34,7%	18,5%	19,0%	6,5%	1,40%

* North Korea services included

Source: CIA World Facts Book

Brazil has become so dependent on exports of natural resources that it is difficult to glimpse – in the short term – any immunity that the country can achieve within the "currency war" that follows the strategy of export commodities.

Not to mention that – alongside the artificial lift enhancement of the currencies and its exports – a flood of cheap imported products does not contribute to the

strengthening of productive chains of strategic interest, such as the aerospace, automotive and aerospace.

VI. REFERENCES

[1] Porter, M. E. *Competitive strategy: techniques for analyzing industries and competitors*. New York: The Free Press, 1980.

[2] Porter, M. E. *A Vantagem Competitiva das Nações*. Rio de Janeiro: Campus, 1998-5^aed.

[3] Programa Nacional de Atividades Espaciais (PNAE), 2009. *Ministério da Ciência, Tecnologia e Inovação e Agência Espacial Brasileira*, Brasil.

[4] Besanko, D., Dranove, D., Shanley, M. *Economics of strategy*, John Wiley & Sons, New York, 2000.

[5] Landes, D.S. *The wealth and poverty of nations*. New York: W.W.Norton, 1998.

[6] Garud, R., Shapira, Z. "Aligning the residuals: risk, return, responsibility and authority" *Organizational decision making*. Cambridge: Cambridge University Press, 1997.

[7] Hambrick, D.C., Fredrickson, J. W. "Are you sure you have a strategy?" *Academy of Management Executive*, vol.19, No.4, 2005.

We argue about the importance that the Brazilians strategic sectors receive more consistent treatment to manage their clusters in the line of research proposed by Porter [2] and Di Sérgio [10].

The objective of the paper was achieved by presenting an expansion of the scope of analysis already provided by the PNAE, adding the resource-based strategy and discussing the inexorable incompleteness of contracts from the perspective of the entrepreneurs - and its aiming for profits - that would participate on these efforts to consolidate the Brazilian aerospace sector. All through the prism of competitiveness.

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[8] Barney, J. B., Hesterly, W. S. *Administração estratégica e vantagem competitiva*. Pearson Prentice Hall, São Paulo, 2008.

[9] Rumelt, R. P. *Estratégia boa, estratégia ruim: descubra suas diferenças e importância*. Rio de Janeiro: Elsevier, 2011.

[10] Di Sérgio, L. C. *Clusters Empresariais no Brasil: casos selecionados*. Saraiva, São Paulo, 2009.

[11] Jensen, M.C., Meckling, W.H. "Theory of the firm: managerial behavior, agency costs, and ownership structure." *The modern theory of corporate finance*. New York: McGraw Hill, 1976.

[12] Khaneman, D.; & Tversky, A. 1979 "Prospect theory: an analysis of decision under risk". *Econometrica*, 47, 1979.

[13] Vianna, N. W. H. "Probabilidade subjetiva e o júri de especialistas", 84 p. Dissertação (Mestrado em Administração). Escola de Administração de Empresas de São Paulo da Fundação Getúlio Vargas. FGV, 1982

[14] Vianna, N. W. H. "A subjetividade no processo de previsão", Tese (Doutorado em Administração), FEA/USP, 1989.

[15] Schlaifer, R. *Probability and statistics for business decision*. New York: McGraw-Hill, 1959.

[16] Silva, L. M. A. “Instrumentalização do planejamento estratégico: aplicação no setor aeroviário comercial brasileiro”. 182 p. Tese (Doutorado em Administração), FEA/USP, 2000.