MANAGEMENT OF SPACE PROJECTS UNDER THE PERSPECTIVE OF CONTINGENCY THEORY

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THIS ARTICLE AIMS TO ANALYZE AND RELATE THE MANAGEMENT OF ENGINEERING PROJECTS AND SPACE TECHNOLOGIES ACCORDING THE PERSPECTIVE OF CONTINGENCY THEORY, USING AS BASIS FOR THE STUDY TWO SATELLITES PROJECTS OF THE NATIONAL INSTITUTE OF SPACE RESEARCH (INPE): THE CBERS, SINO-BRAZILIAN SATELLITE OF EARTH RESOURCES, DEVELOPED IN COOPERATION WITH CHINA AND THE AMAZôNIA-1 REMOTE SENSING SATELLITE. THE STUDY USED A METHODOLOGY OF DESCRIPTIVE NATURE WITH INVESTIGATIONS BASED ON A CASE STUDY IN THE LITERATURE. IN THIS WORK, SOME ASPECTS OF CONTINGENCY THEORY SUCH AS ENVIRONMENT, STRATEGY, TECHNOLOGY, MANAGEMENT, PROJECT HISTORY AND THE ORGANIZATIONAL CONTEXT WERE THE MOST INTERESTING POINTS TO SHOW THAT THERE IS NO SINGLE FORMULA TO MANAGE A COMPANY AND ITS PROJECTS.

Keywords: CONTINGENCY THEORY, PROJECT MANAGEMENT, SATELLITES.

GESTãO DE PROJETOS ESPACIAIS SOB A PERSPECTIVA DA TEORIA DA CONTINGêNCIA

Área Temática: 5. GESTÃO DA PRODUÇÃO

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ESTE ARTIGO TEM COMO OBJETIVO ANALISAR E RELACIONAR A GESTãO DE PROJETOS DE ENGENHARIA E TECNOLOGIAS ESPACIAIS SOB A PERSPECTIVA DA TEORIA CONTINGENCIAL, UTILIZANDO COMO BASE PARA O ESTUDO, DOIS PROJETOS DE SATéLITES DO INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS –INPE. O CBERS, SATéLITE SINO-BRASILEIRO DE RECURSOS TERRESTRES, DESENVOLVIDO EM COOPERAçãO COM A CHINA E O SATéLITE DE SENSORIAMENTO REMOTO AMAZONIA-1. O ESTUDO UTILIZOU UMA METODOLOGIA DE NATUREZA DESCRITIVA COM INVESTIGAçõES BASEADA EM ESTUDO DE CASO EXISTENTES NA LITERATURA. NA REALIZAçãO DO ESTUDO ASPECTOS DA TEORIA CONTINGENCIAL COMO AMBIENTE, ESTRATéGIA, TECNOLOGIA, GESTãO, HISTóRICO DE PROJETOS E O CONTEXTO ORGANIZACIONAL FORAM OS PONTOS DE MAIOR INTERESSE PARA MOSTRAR QUE NãO Há UMA FóRMULA úNICA PARA ADMINISTRAR UMA EMPRESA E SEUS PROJETOS.

Palavras-chave: TEORIA DE CONTINGêNCIA, GESTãO DE PROJETOS, SATéLITES.

1. Introduction

1.1 Initial considerations

The Contingency Theory has its origins in Lawrence and Lorsch's research on organization vs. environment confrontation, where the organization's view as an open system has led managers to consider the influences that the environment may have on the company. In their research Lawrence and Lorsch, they were concerned about the characteristics that companies must have to deal efficiently with different external and technological conditions (Chiavenato, 2014).

The implications derived from this research suggest that there is no structural pattern to be followed by all organizations, since this pattern is modified due to the influence of the environment in which the organization is inserted, ie, there is no better style or better way to manage an organization and manage projects, but several ways that depend on factors such as environment where it offers contingencies that can be seen as opportunities, constraints or threats that influence the organizational structure and the internal processes of the same causing the transformations in its interior (Chiavenato, 2014). This contradicts much of the theory and practice of project management, which is based on the premise that projects are solitary - that is, they are unique commitments, largely independent of their organizational environment and history (Engwall, 2003).

The study present analyzes and relates the management of engineering projects and space technologies from the perspective of contingency theory. Therefore two INPE satellites projects were used: CBERS and Amazônia-1.

Looking at the use of contingency theory to analyze the relationship of these projects to environmental factors by focusing on observable organizational behavior and the external environment, since organizational behavior is a function of its contingent consequences, which influence organizational performance consequently in their projects (Engwall, 2003).

It was also sought to analyze the influence exerted by market factors and technology. These are contingent environmental factors in projected organizations that, when deeply analyzed, show that the environment shapes organizations.

1.2 Methods

In this work we chose to use the qualitative research of descriptive nature, with investigations based on an exploratory case study, bibliographical and documentary material to support the literature review.

The choice of the qualitative methodology is due to the fact that it is a comprehensive, semi-structured and open investigation, which uses beliefs, values, representations, habits, attitudes and opinions (Minayo & Sanches, 1993).

In conjunction with the case study which is an empirical investigation, a method that covers everything - planning, data collection techniques and analyzing them, (Yin, 2001) allowing us to understand why certain things or questions arise during the study .

The study addresses general institutional aspects regarding the management of two INPE space projects: the family of CBERS Satellites and the Amazônia-1 Satellite, both of Remote Sensing and present the main environmental factors that impact on its development.

2. Contextualization

2.1 Contingency theory

In the middle of the 20th century, studies related to the focus on the organizational structure began what today would be the contingency theory. These studies, led by researchers such as (Woodward, 1958), (Burns & Stalker, 1961) and (Lawrence & Lorsch, 1967), argue that there is no model structure for all organizations, diverging from classical management studies, which emphasized that a single organizational structure was effective for any type of enterprise (Donaldson, 1999).

In their research on Contingency Theory, (Lawrence & Lorsch, 1967), were concerned about the characteristics that companies must have in order to efficiently cope with different external and technological conditions (Chiavenato, 2014). The implications derived from this research suggest that there is no structural pattern to be followed by all organizations because this pattern is modified due to the influence of the environment in which the organization is inserted.

The contingency highlights three assumptions that contribute to the assertion that there is no structural pattern to be followed: *(1) there is no better way to organize and manage organizations; (2) a way of organizing or managing is not always equally effective; (3) different ways of organizing or managing generate different results.*

These assumptions tell us that there is no better style or better management. What exists are many ways that depend on factors such as the environment where it offers contingencies, which can be seen as opportunities or constraints and threats, which influence the organizational structure and

internal processes of the same, causing the transformations inside (Epstein, 2002).

Frame 1: Comparison between the CBERS Satellite and the PMM-Amazônia-1 Satellite.

	CBERS satellite	PMM-Amazônia-1
Mission	Control of deforestation and burning in the Legal Amazon, monitoring of water resources, agricultural areas, urban growth, land occupation, education and many other applications.	To provide data for environmental monitoring, to continue and to improve the real-time detection system (DETER) of deforestation in Brazil.
Scope	50% Brazilian project	100% Brazilian project
Investment	US$ 50 Million each satellite	R$ 233 Million
Resourses	Multiannual plan	Treasure
Beginning	1988 (CBERS-1 released 1999)	2001

Source: Author, (2018).

2.2 INPE space mission

The INPE is one of the executors of the National Space Activities Program (PNAE), responsible for the development of Earth observation, optical and radar satellites, as well as scientific and meteorological satellites. The missions related to these satellites are provided for in the PNAE and respond to the governmental needs for the implementation of various public policies and the solution of national problems.

Among the missions of INPE, the Sino-Brazilian Satellite of Terrestrial Resources (CBERS) and the Amazônia-1 Satellite stand out.

The design and authority of the projects are the responsibility of INPE, while the equipment and subsystems of the satellites are contracted and manufactured in the Brazilian industry. The activities of assembly, integration and testing of the satellites are carried out at the Integration and Testing Laboratory (LIT) of INPE. The Frame 1 shows a comparison between the two satellites.

3 Case Study and the Approach used

3.3Project amazonia-1

The Amazonia-1 is the first Earth Observation satellite to be completely designed, integrated, tested and operated by Brazil. It began to be developed in 2008, its proposal and conception were carried out on the initiative of the Brazilian Space Agency (AEB), which also led to contracting the

development of the system with national companies, and INPE acted as technical agent with these companies.

The Amazonia-1 satellite is part of the Multimission PMM Platform Program. The objective of the PMM is to create a platform that will group all the equipment that perform functions necessary to the survival of a satellite, regardless of the type of orbit. (INPE - Instituto Nacional de Pesquisas Espaciais, 2018a). The satellites designed for the PMM are medium-sized, with mass less than 2204 Lbs. The Amazônia-1 satellite will provide remote sensing data to observe and monitor deforestation, especially in the Amazon region, as well as diversified agriculture throughout the country, with a five-day revisit rate, seeking to work in synergy with the programs existing environmental (INPE - Instituto Nacional de Pesquisas Espaciais, 2018b).

Classified as a low polar orbiting satellite, the Amazonia-1 will orbit the planet passing through the two poles, coming from the North towards the South, flying over Brazil during the day (INPE - Instituto Nacional de Pesquisas Espaciais, 2018a).

The nationalization of the various components that make up the Amazonia-1 satellite is a relevant feature of the project, for example, the WFI (Wide Field Imager) camera that has been designed and built by a consortium formed by the companies Equatorial Systems, from São José dos Campos, and Opto Electronica, from São Carlos, city of the interior of São Paulo. This same camera, with few differences, is installed in CBERS-4. The Frame 2 presents the list of the national companies responsible for manufacturing the PMM subsystems and the Payload Module:

Frame 2: National companies supplying the PMM subsystems - Amazônia-1

EQUIPMENT SUBSYSTEMS	HIRED COMPANY
Service Module (PMM)	
Service module structure	CENIC Engineering Industry and Trade Ltda.
Solar generator	ORBITAL Engineering.
Propulsion	Fibraforte Engineering Industry Trade.
Payload Module	
Payload module structure	CENIC Engineering Industry and Trade Ltda.
WFI camera	Equatorial / Opto Electronics.
AWDT X-Band Antenna	Omnisys Engineering Ltda.
Digital data recorder	Equatorial Systems.
RTU	Omnisys Engineering Ltda.
DC/DC	AEL Systems.

Source: INPE, (2017).

With investments around R $ 200 million, the development of Amazônia-1 seeks to encourage national industry with the supervision of INPE (Silva, 2016).

Initially the Amazônia-1 satellite was scheduled to launch in 2010, but due to delays related to budget factors, hiring of the launcher, which must be done two years in advance, among other factors, was postponed, the current forecast for launching the Amazônia-1 is in 2018. (INPE - Instituto Nacional de Pesquisas Espaciais, 2008). The Frame 3 describes some of the problems related to delays in the launching of the Amazônia-1 satellite.

Frame 3: Schedule of the Amazônia-1

AMAZÔNIA-1 SCHEDULE INCLUDING PMM
SADA. Controls the placement of the Solar Panel. It may need to be refurbished. Forecast: delivery of the company report by the end of June 2016.
ACDH. Acquired from Argentina two complete flight models. Contract ended in July 2016. **Launcher**. It has to be hired two years in advance.
Cabling. Completion of space cabling manufacturing. Forecast: April 2017. DC / DC.
TT&C. First models were received in April 2017. Test of the electric model. Depends on the cabling. Prediction: until August 2017.
CDR. Critical Project Review. Forecast: October 2017. Environmental Testing. Simulations of vibration at launch and spatial conditions. Forecast: June 2018.
WFI. It was intended to produce a more advanced version of the WFI camera, but it was decided to use the same model of the CBERS. A WFI interface with the satellite, which is called the RTU, will need to be acquired. January 2018.
Batteries. They should be replaced, but will be acquired next year. The AIT is expected to begin in November 2017 and should last from 8 to 9 months. FRR.
Final review. Prediction: August 2018. **Release**. Forecast: December 2018

Source: INPE, (2017)

3.3.1 Project analysis

The Amazônia-1 satellite project encountered numerous difficulties throughout its development. Some legal problems between INPE and contracted companies (suppliers), including the exchange of suppliers and the acquisition of electronic components.

The INPE's purchasing management is one of the greatest obstacles that the institute faces in fulfilling its mission. Due to the restrictions of Law 8,666, 1993 (Law on Bids) and also the interpretation and oversight procedures of agency of control, procurement processes are slow and bureaucratic. The Institute currently has a small number of staff in the purchasing area. In addition, it has not an internal legal area that gives supports the bidding processes and is submitted to an external legal body, the Legal Counsel of the Union (CJU).

All of this puts at risk the very relevance of the institution when a scenario of internationalization and globalization of research is glimpse.

Another problem is the lack of specialized technical personnel that can act in the two space projects. Recently the INPE was able to approve some projects with the CNPQ, and hired engineers and technicians, who receive training and perform specific activities, under the supervision of INPE specialists. Due to management, financial and political problems, the Amazônia-1 project already has a delay of 7 years in its launch schedule.

3.2 CBERS project

The INPE sought international cooperation for reasons of geopolitical strategy and aimed at access to sensitive technologies necessary for the development of remote sensing satellites autonomously. Together with the Ministries of Science and Technology and Foreign Affairs, it began discussing and negotiating with China in 1984 a cooperation protocol for the development, manufacture, testing and launch of two large remote sensing satellites. The cooperation also included the operation, reception, processing and dissemination of the images by Brazilian and Chinese stations.

The signing of the cooperation protocol between Brazil and China in 1988 resulted in the launch of the first satellite of the CBERS series in 1999 and the CBERS-2 in 2003. Since the success of this program, the launch of CBERS-2B in 2007, and the expansion of the joint mission with two more satellites, CBERS-3 and CBERS-4.

In 2013, with the failure to launch the CBERS-3, the Brazilian and Chinese teams agreed to make a major effort to produce, integrate, test and launch the CBERS-4 satellite, within one year. The satellite was successfully launched in December 2014, bringing new perspective to the extension of the program between the two countries. The CBERS 4A satellite will be launched in 2019 and will be assembled, integrated and tested at LIT - INPE.

Just like the CBERS-3 and 4 satellites, the CBERS 04A will be a medium-resolution remote sensing satellite with optical payloads operating in the visible spectrum with resolutions ranging from 2 to 60 meters.

The Frame 4 shows the characteristics of the first-generation satellites of the CBERS Program (CBERS-1, 2 and 2B) and the second-generation satellites (CBERS-3, 4 and 04A):

Frame 4: Characteristics of the satellites of the CBERS Program

Characteristics	CBERS 1, 2 e 2B	CBERS 3 e 4	CBERS 04A
Total mass [Lbs]	3196	4585	4365
Power generated [W]	1100	2300	2100
Data rate [Mbps/s]	100	300	900
Projected life [years]	2	2	5
Brazilian participation [%]	30	50	50

Source: CBERS-INPE, (2017)

As a strategy to bring society closer to the space program and to facilitate access to data, the CBERS images are provided free of charge not only in Brazil but also to countries in South America that are in the range of INPE reception antennas in Cuiabá, Mato Grosso. The Brazil is today the largest distributor of satellite images in the world, thanks to the image distribution policy adopted in June 2004. In 2008, Brazil and China decided to offer CBERS images for the entire African continent for free. The distribution of the images contributes to governments and organizations in Africa monitoring natural disasters, deforestation, threats to agricultural production and risks to public health.

3.2.1 Project analysis

Despite delays in their launch timelines, component acquisitions and political blockades, CBERS satellites have complied and complish their goals. The anticipation of the CBERS-4 launch had a major impact on INPE-related activities. The technical problems observed in CBERS-3 had to be corrected in CBERS-4 in a shorter time than anticipated in the schedule. In addition, the processes for the purchase of equipment and components had to be quickly defined. With the accomplishment of assembly, integration and testing (AIT) activities in China, INPE was forced to send, together with the experienced servers, technical outsourced personnel, so that its part in the mission could be fulfilled, within the agreed time frame the Chinese.

3.3 The organizational environment of space projects

As contingency theory asserts, organizations operate in an environment that surrounds them. The environment can be seen as anything that externally involves an organization that is beyond its borders or limits, with peculiarities with intense competition, economic difficulties, technological changes, uncertainties about governmental policies and other factors (Dess & Beard, 1984). The

environment can be characterized as: general environment (macro environment) and task environment (micro environment).

The macro environment is where all organizations operate, being broader involving the whole society. This environment has some components, such as: cultural environment, economy, technology, demography, social and natural environment.

The micro environment concerns the nearbly and immediate environment of each organization. Each organization has its own micro environment, from which it obtains its inputs and which places its outputs or results. This micro environment is related to resources, stakeholders, suppliers, regulators, customers or consumers and their competitors, disputing with them both their inputs and their outputs.

In relation to dynamics, the micro environment can be termed as stable or unstable. The micro stable environment is one with few changes or slight and predictable changes allowing standardized reactions, with a more bureaucratic and more mechanized model. Since the unstable task environment has fast and unforeseen changes with constant mutability (Dess & Beard, 1984). Products derived from organizations operating in this task environment become obsolete quickly; are constantly changing suppliers, their management is edhocratic for the contingencies that the organization can not predict.

Another feature of the micro environment is in relation to its complexity that can be described as: homogeneous task environment and heterogeneous task environment. The homogeneous environment is one where environmental elements have the same characteristics and actions as their needs, management is simpler with few departments. It has customers, suppliers and competitors that are little different from each other and can be treated with a certain uniformity. In the heterogeneous, the organization has a larger number of departments, each responsible for one aspect or segment of this environmental variety (Dess & Beard, 1984). Your customers, competitors, markets and suppliers are heterogeneous with each other. Multiple products or services are part of their complex features.

3.3.1 Classification of the INPE space projects environment

When analyzing the environment to which INPE projects are inserted, we can classify its environment among: Heterogeneous and stable X heterogeneous and unstable or complex and predictable X complicated and challenging, as shown in Figure 1.

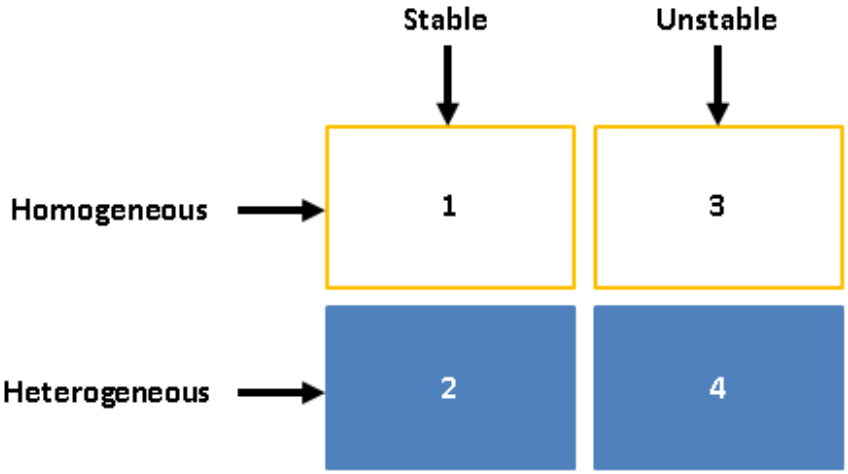

FIGURE 1: Classification of INPE project environments - AUTHOR, (2018)

Managing an organization in quadrant 2 and 4 involves major challenges, complexity and high level of innovation. When classifying this type of environment for INPE projects, its organizational structure is defined as consisting of several departments and laboratories, each of which faces a specific environmental element, made up of customers, suppliers, competitors. In the face of environmental heterogeneity. In addition, there is still the bureaucratic model to treat environmental agents routinely, repetitively and conservatively, little subject to change.

Not leaving beside its characteristics of heterogeneous environment, unstable and challenging, with flexible, adaptable and malleable organizational model, to deal with the various environmental agents in a changeable, creative and innovative way.

Frame 5: Factors and variables that most influence the CBERS program

Factors	CBERS Project
Technological	Accumulated knowledge about how to do things (techniques, applications, patents, development, etc.). There is no exchange of technology between Brazil and China
Political	Law 8666 - Law on Bids Embargoes for obtaining electronic components and high-tech equipment, due to China's cooperation.
Economic	Acquisition of equipment and supplies; Search by quality
Financial	Dependence of financial resources of the Federal Government - MCTI Technological projects of national and international programs
Legal	Law 8666 - Law on Bids Audits of Controlling Bodies (TCU, AGU)

Source: Author, (2018)

Analyzing the influence of the environment on the development projects of the CBERS and Amazônia-1 satellites, we have in the Frames 5, 6, 7 and 8 the factors and variables of the general and task environmental, which have more influence on the organization and consequently on the projects.

Frame 6: Factors and variables that most influence the realization of the CBERS project

Factors	CBERS - Project
Consumers	Government Agencies, such as IBGE, INCRA, Embrapa, IBAMA, ANA, and geoprocessing companies, as well as NGOs. Countries of Africa and Latin America
Suppliers and Raw Materials (components)	Embargoes and technological blockades imposed by supplier countries. High-tech companies in Brazil.
Competitors	There is no competitor in the manufacture of remote sensing satellites in Brazil.
Regulatory Groups	MCTIC, Sindae, AEB

Source: Authors, (2018)

Frame 7: Factors and variables that in the Amazônia-1 project

Factors	Amazônia-1 Project
Technological	Government Agencies, such as Petrobras, IBGE, INCRA, EMBRAPA, IBAMA, ANA and NGOs. Technical team composed of outsourcers and fellows.
Political	Law 8666 - Law on Bids
Economic	Acquisition of equipment and supplies; Search by quality
Financial	Financial Resources of the Federal Government - MCTIC Foundations of Development
Legal	Law 8666 - Law on Bids Audits of Controlling Bodies (TCU, AGU)

Source: Author, (2018)

Frame 8: Factors and variables that most influence the realization of the Amazônia-1 project

Factors	Amazônia-1 Project
Consumers	Government Agencies, such as IBGE, INCRA, EMBRAPA, IBAMA, ANA, and geoprocessing companies, as well as ONG's.
Suppliers and Raw Materials (components)	International market National companies of the space area.
Competitors	There is no competitor in the manufacture of remote sensing satellites in Brazil.
Regulatory Groups	MCTI, Sindae, AEB

Source: Author, (2018)

3.3.2 Analysis of the influence of the organizational environment on space projects

Based on the investigation of the factors and their respective variables that most influence the overall organizational environment of the projects, it can be observed that in relation to the two projects presented, the resources available to the CBERS are larger due to the cooperation agreement between Brazil and China. Since each country must comply with the agreement to pay 50% of the satellite, the Brazilian government is obliged to comply with its commitment and provide the financial resources to design the satellite.

Therefore the national space companies divide to dominate the technology involved and win the bidding for the supply of equipment and systems under the responsibility of Brazil (INPE - Instituto Nacional de Pesquisas Espaciais, 2011).

Based on these data, it is observed that the political factor exerts a great influence on the organization and on the fulfillment of deadlines to be fulfilled in the space programs. The bureaucracy and difficulty in acquiring components and electronic equipment, exclusive of suppliers from other countries and the time for the development and manufacture of the equipment contribute to the delay in the schedule and higher cost of the project.

Another factor that exerts great influence in the general environment is the financial one. While resources for the CBERS project are practically guaranteed annually by MCTIC, the resources of the PMM - Amazônia-1 project are contingent upon the Brazilian Space Agency (AEB).

In the task environment, the main consumers of the CBERS and Amazônia-1 projects are the Federal Government agencies, which use the data produced by the satellites in various applications, such as data on Amazon deforestation and other areas, changes in currents oceanic, tidal, atmospheric chemistry, agricultural planning, geoprocessing, monitoring of watersheds, with fluviometric and pluviometric data, data to control fires to environmental control agencies, among others.

In relation to the task environment, there is a barrier imposed by developed countries, which holds the technology but imposes restrictions on the acquisition of components and electronic equipment and aggregate materials, mainly due to cooperation with China, as is the case with the CBERS project.

The CBERS and Amazônia-1 projects are subject to a series of processes that may hinder their

execution, such as the need to obtain complex technologies, unexpected changes in legislation, financial market fluctuations, and organizational changes related to governmental and economic policies, contingencies of financial resources or even their cooperation partnerships. In Frame 9, we present some barriers in the management of space projects studied in this research and the contributions of the contingency approach.

Frame 9: Main barriers in project management - CBERS and Amazônia-1

Projects	Area	GP Issues	Contributions of the contingency approach
CBERS	Assembly, Integration and Testing	1 - Hiring of specialized labor. 2 - Acquisition of equipment and supplies.	1 - Hold public tender or make temporary contracts viable. 2 - Debureaucratize the acquisition of equipment and supplies of high technologies.
	Financial	1 - Insufficient government financial resources.	1 - Enable partnerships with private companies. 2- Increased financial resources.
	Quality Assurance / Product Guarantee	1 - Hiring of skilled labor	1 – Hold public tender or make temporary contracts viable.
	Engineering and Space Technology Coordination	1 - Senior servers in the retirement phase. There is no replenishment.	1 - Hold public tender or make temporary contracts viable.
PMM Amazônia-1	Integration and Testing	1 - Hiring of specialized labor. 2 - Acquisition of equipment and supplies.	1 - Hold public tender or make temporary contracts viable. 2 - Debureaucratize the acquisition of equipment and supplies of high technologies.
	Financial	1 - Insufficient government financial resources.	1 - Enable partnerships with private companies. 2 - Increased financial resources.
	Quality/Product guarantee	1 - Hiring of specialized labor.	1 - Hold public tender or make temporary contracts viable.
	Engineering and Space Technology Coordination	1 - Senior staff retiring. No hiring or preparing other people.	1 - Hold public tender or make temporary contracts viable.

Source: Author, (2018)

4. Discussion of Results

In the analyzed projects, it was possible to observe that the general environment and the task environment exert great influence in the CBERS and Amazônia-1 satellite projects; and many of these factors can impact their cycle.

The task environment plays an important role in projects of this nature, imposing difficulties related to the acquisition of components and electronic equipment and high-tech materials. Government constraints in supplying countries directly affect the design of satellites, as well as cost and time to completion of projects. These technological blockades, imposed by rulers who hold this technology, slow the design of Brazilian strategic projects.

Still in the task environment, projects of this nature face difficulties related to long-term manufacturing, causing delays in the fulfillment of several manufacturing phases. Added to these factors are the long and bureaucratic bidding processes imposed on public agencies for their acquisition, and it will be possible to justify one of the reasons for the delay in space projects, especially in the case of the Amazônia-1 satellite.

In the general environment, the financial factor affects the development of the projects, since the main source of funds is the federal government. Projects are always subject to budget cuts, depending on political decisions and the socio-political and economic momentum that the country is going through.

It can be observed that the contingency approach offers greater freedom for administrative decisions and processes that depend on the organization's environment. In space projects, contingency outflows are perceived by unclasp constraints such as embargos and blockades from a supplier country, adapting to changes in regulatory groups or agencies, or even changes in legislation.

Analyzing these two space projects of INPE, we can observe that the management models applied to the two projects have different approaches. The cooperation project with China has already integrated, tested and launched five CBERS family satellites since 1999 (18 years), where only one of them was unsuccessful due to a launcher failure. The PMM project, created in 2002, has already consumed about 183 million of reais, and the Amazônia-1 engineering model is in the process of being set up, with a forecast to launch the flight model by the end of 2018. Many factors influence the management of the Amazônia-1 satellite project; among them we can cite the scarcity of resources of the federal government, decrease of the technical team dedicated to this project, difficulty in the acquisition of components and electronic equipment. Observed the practices of

project management of the Amazônia-1 project, the same approach of the premise of solitary project vision. In spite of this, INPE seeks to overcome these obstacles, not limited to a single management model, as shown by the contingency theory, trying to adapt to environmental conditions.

5. Final Considerations

Contingency theory shows that project management is mostly relative, there being a relationship between external environmental factors and the management of the organization that is inserted to achieve the goals set by the company. These inherent characteristics of projects are present in engineering processes and space technologies. These in turn are of high complexity and technology, with characteristics of innovation and consequently present high risk level, with difficulties in defining the requirements, attributes and scope (Epstein, 2002).

The role of contingency theory in the management of this category of INPE project shows that, for organizations with complex products and systems, such as satellites, there is a functional relationship between environmental conditions, technological complexity and appropriate administrative techniques to achieve the objectives defined in the project effectively. This corroborates with contingency assumptions that there is no single model or form of management to follow, in other words it all depends on internal and external factors that surround organizations.

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