SYSTEMIC CONSTRUCTION OF A SPACE LAUNCHING BASE IN MEXICO

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Summary

The Mexican State, educational institutions and research centers have made efforts to found organisms, programs and projects, in order to promote spatial technological development, which appear and disappear without reaching the objective for which they were founded.

In order to achieve technological development, it is necessary to integrate government-academia-industry, and it is the Mexican Space Agency, an agency of the Mexican State which is responsible for carrying out this activity; Nevertheless the Agency establishes what must be done to reach the technological development but does not mentioned how to achieve it. For this reason, designing a systemic model was proposed which allows the integration of scientific research in companies based on market goals, objectives and strategies.

The systemic model has three stages within which are five phases and within them are eight subphases: The three stages are: input (I); Box (B); Output (O); O = IB, that is, I and B can be adjusted to achieve O. Holding fixed I and O. B will have infinite solutions. Ideally B = O / I = 1 in practice will be less than 1. Therefore the systemic model for the development of the Mexican special system has infinite solutions.

It is proposed that spatial technological development begins with the construction of a spatial launch base as ground conditions exist for space launches and would attract different companies such as satellite constructors, space launchers, fuel producers, tourism services, etc.

Keywords: technological development, model, research, base, releases.

1. Introduction

Mexico is better located in latitude with respect to the Ecuador than USA, Russia and China, which is why they have more advantages for the space industry. The State of Quintana Roo is the most suitable for the construction of a Mexican Space Launch Base (MSLB) since it is only at latitude 18 °.

It is estimated that the cost for a space launch base is 300 million dollars, and if about $ 150 million were paid for the launch of the Bicentennial satellite, obviously two launches would recover the investment.

With the installation of the MSLB satellite construction companies, launchers, fuel producers, tourist services, etc. wouldl be founded in the vicinity, in order to avoid costs of

transportation, that is to say, they would generate countless companies that contribute to the technological development (TD) of the country.

Othón Pompeyo Blanco, one of the ten municipalities of Chetumal, south of Quintana Roo, has a strategic location for this project, due to its proximity to the Ecuador. Thus, we can save fuel, and the trajectory of space devices put into orbit would turn to the east, not cross any population áreas and avoid accidents (Bulletin UNAM, 2011). Therefore, the MELB is proposed to begin the technological development of the Mexican space system (TDMSS).

2. Systemic model

The use of models has shown to be effective in this planning task; A model is a series of steps or it may be an elaborate mathematical structure that represents the problem abstractly. A model is considered a conceptualization of the problem by which a solution will be advanced; in this sense, the models are a methodology to search for solutions (Van Gigch, 2008). It is considered that a model reaches an end result from the analysis of context and basis of the investigation. The first order cybernetic model of Wiener (1948), consists of three stages: input, Black box and output.

Ackoff (1986), Steiner (1969), Ozbeckhan (1974) and Sainz (2012) conclude that any planning model can be designed in five phases: 1.Information; 2. Detection of the problem; 3. Planning to solve the problem and project the system; 4. Evaluation and 5. Results.

In Fig. 1, the systemic model (SM) for the TDMSS is presented based on the three stages of the Weiner and Shannon model and with the five determined phases, which are divided into eight sub phases.

The five corresponding phases with their respective sub phases are described below, and all within the three stages mentioned.

The first phase of the MS system model for MESTD consists of two sub-phases: 1. Analysis of the development of the international space system (DISS), and 2. Analysis of MESTD. The second phase is constituted by sub-phase 3. Diagnosis. The third phase is made up of sub-phase 4. Proposal. The fourth phase representing the planning to solve the problems and to project the organization, is constituted by three sub phases: 5. Mission, Vision, Values and Strategic Objectives of the proposal; The sub-phase 6. Strategies and the 7. Strategic plan. The fifth phase, Results and Evaluation, make up sub-phase 8, corresponding to obtaining MESTD.

The design of the MS for the MESTD should be placed within the overall planning process, and outline the phases for its elaboration. The MS must have validity in the long term, and can never be realized from short-term plans. Moreover, the systemic plan must continue to transform the system indefinitely (Sainz, 2012).

According to Ackoff (1986), a set of two or more interdependent problems constitute a system. This set is known as problematic and its solution must focus on the system and not on each of its parts; The author states that interactive planning considers the present, past and

future as inseparable parts of the problem, and if the three temporal aspects are not taken into account, the plan will be obstructed. The phases of interactive planning do not need a specific order since they are interdependent of the MS; Each feeds and is fed by the others. The results of any phase can be adjusted in others. Therefore, as there is no order of beginning and ending, more can be left incomplete and another started. Based on the foregoing, the design of the sub phases of the MS for the MESTD is described.

Sub-phase 1: Analysis of the development of the international space system

The success of the international space TD is primarily due to the state intervention of the countries that have achieved TD, and have done so through space agencies such as the United States National and Space Administration (NASA) (USA); The Federal Space Agency of Russia (ROSCOSMOS); The National Space Administration of China (CNA) and the European Space Agency (ESA).

Based on work done, among others, by Voss, (2011) Meacham, (2013) Ellis, (2010). Lucena, (2011). Space agencies are considered as a strategy of the state policy of each country. They strengthen basic and applied research, educational institutions and research centers, in particular space research, link and integrate the space industry. National security, defense and marine agencies have their own development, based on basic and applied scientific research as any technological advantage is the main strategy of the armed forces, also they participate and collaborate with space agencies, resulting in a great impact on the TD.

Space agencies in each developed country or community are closely related to each other and therefore participate in joint space projects. The analysis of the status of the development of the international space system (DISS) should allow the definition of the key success factors for the space TD, taking into account internal and external factors that are not controled.

Sub-phase 2. Analysis of the Development of the Mexican Space System

A state policy is needed (Poveda, 2009), in order to avoid the failures that have occurred so far in Mexican space policy, such as the cancellation of the National Outer Space Commission (NOSS) from 1962 to 1977; This body developed space research that resulted in the launching of rockets and space balloons; The Mexican Institute of Communications (MIC) from 1987 to 1997, was the interlocutor and promoter of research efforts in educational institutions (Méndez, 2009). Currently, the Mexican Space Agency (MSA), which began operating in 1911, has the same objectives as the two previous ones, which are to feature space scientific research in order to promote the TD, that is to say, the purpose of which is to arrive but it does not explain how.

The programs and projects that have been generated in higher education institutions and research centers are emerging and disappearing, such as that of the Autonomous University of San Luis Potosí (AUSLP), which launched its first rocket before the US launched their first satellite, Explorer 1, and two months after the Union of Soviet Socialist Republics (USSR) launched its first satellite, Sputnik 1; The University Program for Spatial Development Research (UPSDR), was canceled after designing to construct and put into orbit

its satellite in 1995, UNAMSAT 2; The SATEX project (Poveda, 2009), began 22 years ago has no results to date.

Sub Phase 3: Diagnostics of TDMSS

In order to make a diagnosis, it was necessary to first analyze the international and national contexts related to TDMSS. In the DISS analysis, situations were determined that should be taken into account, since they affect positively or negatively the TDMSS. In the TDMSS analysis, the following factors were determined:

The regulatory framework for communications in Mexico has been influenced on many occasions by the national and international powers that work for their individual and group interests. The organisms founded by the Mexican State, appear and disappear due to the lack of a State policy that favors the TD.

National institutions, mainly educational have not had continuity in their programs of space research since they have made isolated efforts to generate scientific research.

The External Factor Evaluation Matrix (EFEM) and the Internal Factor Evaluation Matrix (IFEM) (Sainz, 2012) make the diagnosis based on the international and national analysis of space systems.

Matrix EFEM

Table 1.EFEM of TDMSS

Out Facts.	Variable	Ponderación	Classification	P Results.
1 Internacional Services.	Oportunity	0.15	3	0.30
2 Internacional Participation	Oportunity	0.15	3	0.30
3 Internacional Support.	Oportunity	0.15	4	0.30
4 Orbits Allocation	Oportunity	0.01	3	0.03
5 Orbits Cancelation.	Threats	0.25	1	0.25
6 Satelital Trash.	Threats	0.14	2	0.28
7 Tecnológic Dependence,	Threats	0.25	1	0.25
Total		1		1.71

The weighted total result of 1.71, corresponding to the EFEM matrix, shows that TDMSS is uncompetitive with international space systems, that is, that the opportunities are very few and the threats are very strong since it is far below the average in the opportunities and threats that are in balance which equals 2.5. In order for the system to be highly competitive it is necessary to be well above 2.5, ie, the result should be 4.

IFEM Matrix

The total weighted result is 1.95; Indicates that TDMSS is well below the 2.5 average in its overall internal strategic position and indicates that it faces serious weaknesses; So it is necessary that the weighted value tends to 4.

Sub-phase 4. Proposal

Table 2. IFEM of TDMSS

Internal factor.	Variable	Weighting	Classificatio	P Results.
1.Satelitales Services	Strengths	0.10	3	0.30
2. Spacial Regulations.	Strengths	0.10	4	0.40
3. Human Resources.	Strengths	0.025	3	0.075
4. Spacial Research.	Strengths	0.025	3	0.075
5. AEM	Strengths	0.10	4	0.40
6. Few Orbits	Weaknesses	0.10	1	0.10
7. Technological	Weaknesses	0.10	1	0.10
8. Organization of Weaknesses	Weaknesses	0.10	1	0.10
9. Inequality of	Weaknesses	0.05	2	0.10
10. Industrial disengagement	Weaknesses	0.10	1	0.10
11. Brain drain	Weaknesses	0.10	1	0.10
12. Ecological	Weaknesses	0.10	1	0.10
Total		1.0		1.95

The Mexican state as a regulator of the economy and driver of national correlated with the international policy can establish the policy of integrating scientific research in companies, as well as promoting public and private investment to found self-financing companies that generate wealth, which can be public, mixed, or private initiative, systemically integrating the basic and applied scientific research that allows the space TD with the purpose of providing efficient, fast, safe and cheap service that satisfies the demand of national and international users.

Sub-phase 5. Mission, Vision, Values and Objectives of the proposal

Mission.

The core of Mexican space policy must have deep social roots. Promoting social development, well-being, integration and national development to Interconnect with the national and international communications system and provide space services with rationality.

Strengthen, through TDMSS, national security, technological infrastructure for efficient coverage of communications in all regions of the country, as well as educational, ecological, cultural and social programs.

View

Generate profitable companies that provide individuals, professionals and researchers and graduates of the educational infrastructure, from all areas of knowledge with the opportunity to participate in TDMSS and reduce technological dependence and impact on the political, economic and social development of Mexico. Thus, achieving results through the rationalization of resources.

Values

Integrity. Act and communicate with responsibility, honesty and transparency inside and outside the companies.

Aspiration. Act with passion and sense of urgency, impose challenges and achieve goals and objectives. Make decisions wisely, without fear of error or failure.

Human Resources. These are the backbone of organizations and for this reason their welfare should be sought within the company. Natural resources. No company is justified fo nott caring and improving the ecology and environment.

Strategic Objectives

Integrate research and technological management for development in space companies.

Sub-step 6. Strategies

In order to formulate the strategies, the combinations of the Opportunities Strengths (OS) are used, which allow to know the strengths of the TDMSS to take advantage of the opportunities presented by the international community in the area of communications; As well as taking into account the strengths against external threats with the combination (ET). In the same way the strategies corresponding to the combinations are obtained: weaknesses opportunities (WO) and weaknesses threats (TW) (David, 2008).

Sub-phase 7: Strategic plan

This sub-phase proposes the design of the strategic plan, which should be based on consistency, with all that has been shown in previous phases. The strategic plan for TDMSS indicates how technology management should be carried out, that is, it allows the Mexican State to implement decisions on policies, plans, programs, projects, etc. which is related to the creation, diffusion, transfer and use of technology.

Sub-phase 8: Technological development

With this sub-phase we close our MS for the TDMSS, that is, we make the corresponding feedback by joining the phase of the TD (output) with sub phases 1 and 2 corresponding to the analysis of the developments of the international and national space systems; When

closing the cycle we can modify each one of the five phases that simultaneously contain the eight sub phases.

Validation of SM for TDMSS

Based on the SM for the TDMSS, proposed in Fig. 1, we began to validate it, based on the concepts of Wiener's model (1948), Shannon's Mathematical Theory of Information (1948) and Bertalanffy's General Theory of Systems (1968).

If the input (I) and the output (O) of a system are known, then we can design what is in the box represented by B, fig.1. The meaning of the box is that we do not know what exists within it.Then the model designers have the freedom to propose infinite solutions provided that the output is the expected response, which in the case that concerns us, is the TD beginning with the construction of a spatial launch base in Mexico since the model can be applied to any particular system.

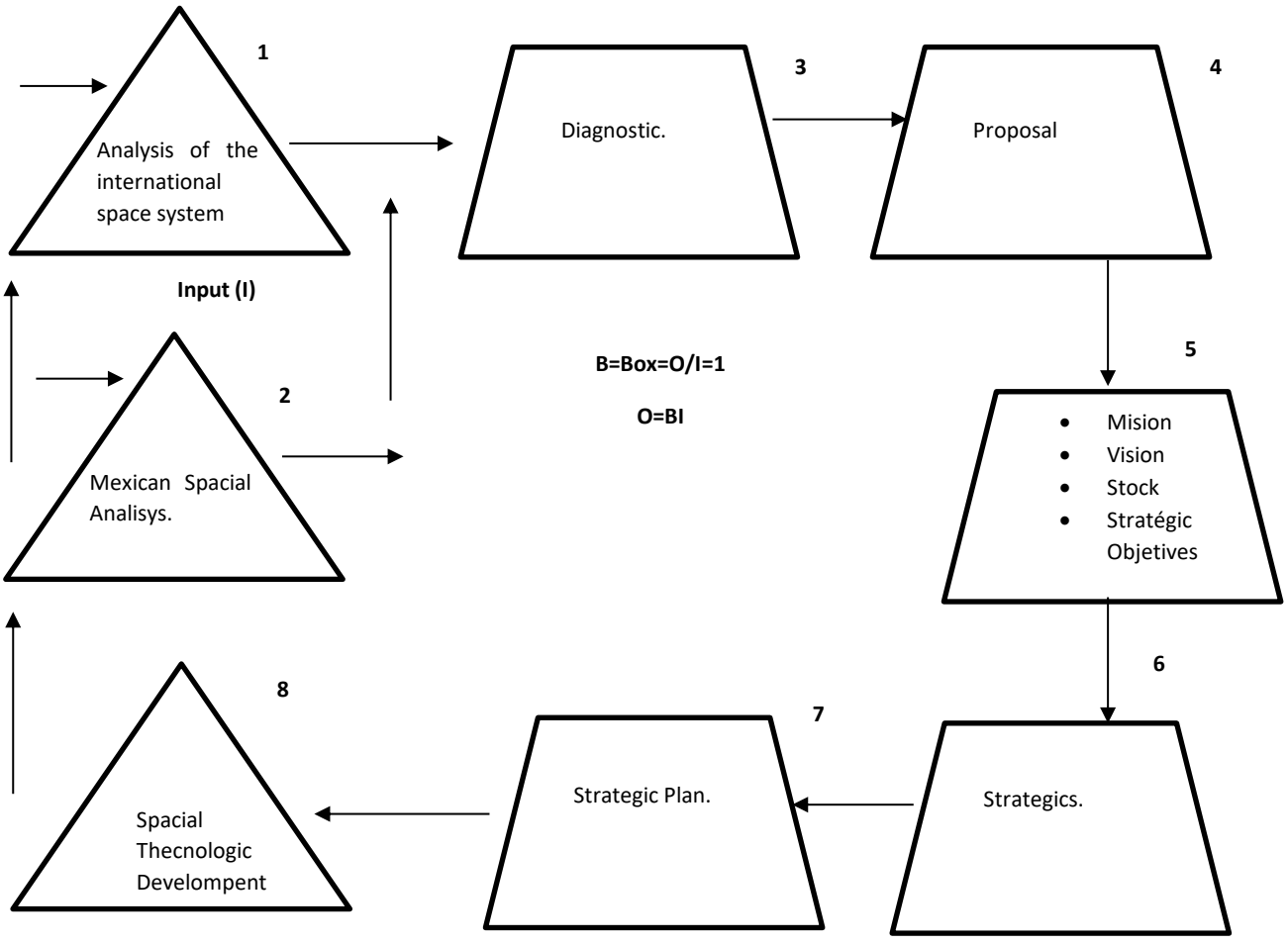

Fig. 1. Systemic Model for the Technological Development of the Mexican Space System

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