SYSTEMIC INTEGRATION OF SPACE INTEGRATIONS IN MEXICO

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ABSTRACT

The construction of a space launch base in Mexico, has as its objective the spatial technological development through a systemic method which consists of three stages within which there are five phases and within them there are eight sub phases; This method allowed determining the following results: Detection of the problem; make the diagnosis; the solution proposal, and the planning to achieve the objective.

The limitation of this work is that it cannot be guaranteed that there will be technological spatial development since it is the responsibility of the Mexican State to implement the corresponding policies to thus achieve it. The originality of this article is that it is treated with a deductive approach, and we find that there is no technological development in the country and it is essential to have it for integral growth.

Key words: technological development, systemic method, launch base, Mexico.

INTRODUCTION

Technological Management (TM) is a strategy that permits decisions about policies, plans and programs related to the creation, use, diffusion and transfer of technology (Cordua, 1994). The main objective of the TM is to achieve technological development (TD) (Nuñez, 2011).

The Technological Management for the Construction of a Space Launch Base in Mexico, considers among other factors the following:

The cost of the Russian space launch base in Korou French Guiana was approximately $ 361 million (Space Daily, 2004). On the other hand, the Mexican government paid about 1,600 million dollars to foreign companies that are outside the country for the Mexsat project which consisted of designing, building and launching three Mexican satellites as well as reconditioning the control centers of Iztapalapa (García, 2012), located in Mexico City, and Hermosillo, Sonora; Given this situation, there are obviously resources to create the infrastructure that the TD allows.

The municipality Othón Pompeyo Blanco, one of the ten municipalities of Chetumal, south of Quintana Roo, Mexico which has a location of 18 ° latitude with respect to Ecuador is better located than some of the major space launch bases such as those in the US, Russia and China, which would save fuel, and the trajectory of spacecraft placed in orbit, which would turn eastward and would not cross any population, thus avoiding accidents (Gómez, 2011). Therefore, the SLB proposes to begin with the technological development of the National Space System (TDNSS).

With the installation of the SLB, transportation costs will be avoided; satellite builders, launchers, fuel producers, tourist services, etc. would be founded in the vicinity, and this will start the country's spatial TD.

SYSTEMIC MODEL

A model is a series of steps or can be an elaborate mathematical structure that represents the problem abstractlyand allows a conceptualization of the problem by which a solution will be advanced. In this sense, the models present a methodology to look for solutions (Van Gigch, 2008).

Based on the planning models, among others, those of Ackoff (1986), Steiner (1969), Ozbeckhan (1974) and Sainz (2012) it is concluded that any systemic model (SM) can be designed in five phases, as shown in Table 1.

Table 1. Phases and Subphases of the Systemic Model for TDNSS

Phases of the systemic model	Sub phases of the SM for the TDNSS
I. Analysis of information	1. Analysis of the international space system 2. Analysis of the Mexican space system
II. Detection of the problema	3. Diagnosis of NSS
III. Proposed solution	4. Proposed solution for the TDNSS
IV. Planning to solve the problem and project the system towards the corresponding objective	5. Mission, Vision, Values for the TDNSS 6. Strategies for TDNSS 7. Action plan for TDNSS
V. Evaluation and Results	8. Evaluation and Results of TDNSS

These phases and sub phases can be encompassed in three stages: Entrance, Black Box and Exit. In Fig. 1, the SM for the TDNSS is presented based on the three stages of the model of Weiner (1948) and Shannon (1949) and with the five determined phases, which at the same time are divided into more or less eight sub phases.

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

The success of the international spatial TD is due mainly to the intervention of the State of the countries that have achieved it through the space agencies such as the National and Space Administration (NASA) of the United States of America (USA); the Russian Federal Space Agency (ROSCOSMOS); the National Space Administration of China (NSA), and the European Space Agency (ESA).

Based on work done, among others, by Voss, (2011) Meacham, (2013) Ellis, (2010). Lucena, (2011). The space agencies are considered as a strategy of the State policy of each country to strengthen basic and applied research, educational institutions and research centers, particularly space research, and link and integrate the industrial space sector.

The national security, defense and marine agencies have their own development, based on basic and applied scientific research since any technological advantage is the main strategy of the armed forces. However, they participate and collaborate with the space agencies, resulting in a great impact on the TD.

The space agencies of each developed country or community have a close relationship with each other and therefore participate in joint space projects. The analysis of the development situation of the international space system

(DISS) should allow the definition of the key success factors for the spatial TD, taking into account internal and external factors that are inside or out of control.

Sub phase 2. Analysis of the Development of the National Space System

The Mexican State founded and canceled organizations such as the National Commission on Outer Space (NCOS), 1962-1977; This agency developed space research that resulted in the launching of rockets and space balloons. The Mexican Institute of Communications (MIC), 1987-1997, 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 previous two, which consist of promoting scientific space research in order to promote the TD; that is to say, the purpose to which one wants to arrive is stated, but not how to do it.

The programs and projects that have been generated in the higher education institutions and research centers appear and disappear, such as the Autonomous University of San Luis Potosí (UASP), which launched its first rocket before the USA launched its first satellite. , Explorer 1, and two months after the Union of Soviet Socialist Republics (USSR) launched their first satellite, Sputnik 1; the University Program for Space Development Research (UPSDR), was canceled after designing to build and put into orbit its satellite in 1995, UNAMSAT 2; the SATEX project (Poveda, 2009), which started 22 years ago and has no results to date.

Sub phase 3: Diagnosis of NSS

Here are some research questions to determine the diagnosis of SS

1. Did Mexico initiate its space research after the countries that have had technological space development?

Answer: Mexico started these activities at the same time as the USSR and the USA (Poveda, 2009).

2. Do they have the financial resources to start TDNSS?

Answer: Yes, 1600 million dollars were paid for designing the last three Mexican satellites of the Mexsat project to build and launch in other countries (García, 2012). On the other hand, Russia built a space launch base in French Guiana at a cost of 361 million dollars (Space Daily, 2004). Therefore, they had the financial resources to build the NSLB.

3. Are there national researchers?

Answer: Yes, based on the SCImago Journal & Country Rank report for the year 2013, Mexico ranks 28 internationally and second in Latin America, after Brazil.

4. In Mexico is basic and applied scientific research integrated systemically in the productive sector?

Answer: No, scientific research is stored mainly in educational institutions; unlike the developed countries that have systemically integrated the productive sector (Nelcy, 2009) based on their goals, objectives and market strategies.

Based on the questions, it is determined that there is no TDNSS in Mexico as for example, the Mexican satellites that cover the orbits assigned by the International Communications Union (ICU), are designed, built and launched in other countries; because the basic and applied scientific research has no connection with the productive sector of the country.

Sub phase 4. Proposal for the TDNSS

It is necessary that a State policy systematically integrates basic and applied scientific research in the productive sector in Mexico, in order to avoid the failures that have occurred to date in the Mexican space policy.

The Mexican state as the regulator of the economy and the leader of national policy, correlated with the international one, can establish the policy of integrating scientific research into 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 and systematically integrates the basic and applied scientific research that allows TDNSS with the purpose of providing an 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; promote social development, welfare, integration and national development. Interconnect with the national and international communications system to rationally provide space services.

It must also strengthen through TDNSS, 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

IIt must generate profitable companies that provide workers, professionals, researchers and graduates of the educational infrastructure of all areas of knowledge, the opportunity to participate in TDNSS to reduce technological dependence and impact on the political, economic and social development of Mexico, achieving results through the rationalization of resources.

Values

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

Aspiration. Act with passion and a sense of urgency, impose challenges and achieve goals and objectives in order to reduce political and social economic conflicts.

Human Resources. They are the backbone of organizations, for this reason within the company it should safeguard their welfare: Natural resources. No company is justified that does not take care of and improve the ecology and environment.

Sub phase 6: Strategies for TDNSS

In a systemic approach, strategies are a means to achieve long-term objectives, from three to five years, and generally cause the transformation of the system. On the other hand, if the approach is for a continuous improvement of the system, the strategies can be short-term, that is, less than two years (Van Gigch, 2008).

The strategies contemplate the strategic goals and objectives (Fred, 2008) for the development of the SE, through its external and internal development. In order to propose the strategies, the combinations of strengths opportunities (SO) are used, which allows knowing the strengths of the SE to take advantage of the opportunities presented by the international community in the area of space communications; as well as take into account the strengths against external threats with the combination (TS). In the same way, the strategies corresponding to the combinations are obtained: opportunities weaknesses (WO) and threats weaknesses (TW) (David, 2008).

Sub phase 7: Strategic plan

In this sub phase, the design of the strategic plan is proposed, which must be based on coherence, with all that has been explained in previous phases. The strategic plan for TDNSS, indicates how technological management should be carried out, that is, allows the Mexican State to implement decisions on policies, plans, programs, projects, etc. related to the creation, diffusion, transfer and use of technology.

Sub phase 8: Technological development

With this sub phase we close our SM for the TDNSS, that is, we perform the corresponding feedback by joining the TD phase (output) with the sub phases 1 and 2 corresponding to the analysis of the developments of the international and national space systems; at the end of the cycle we can modify each of the five phases that at the same time contain the eight sub-phases.

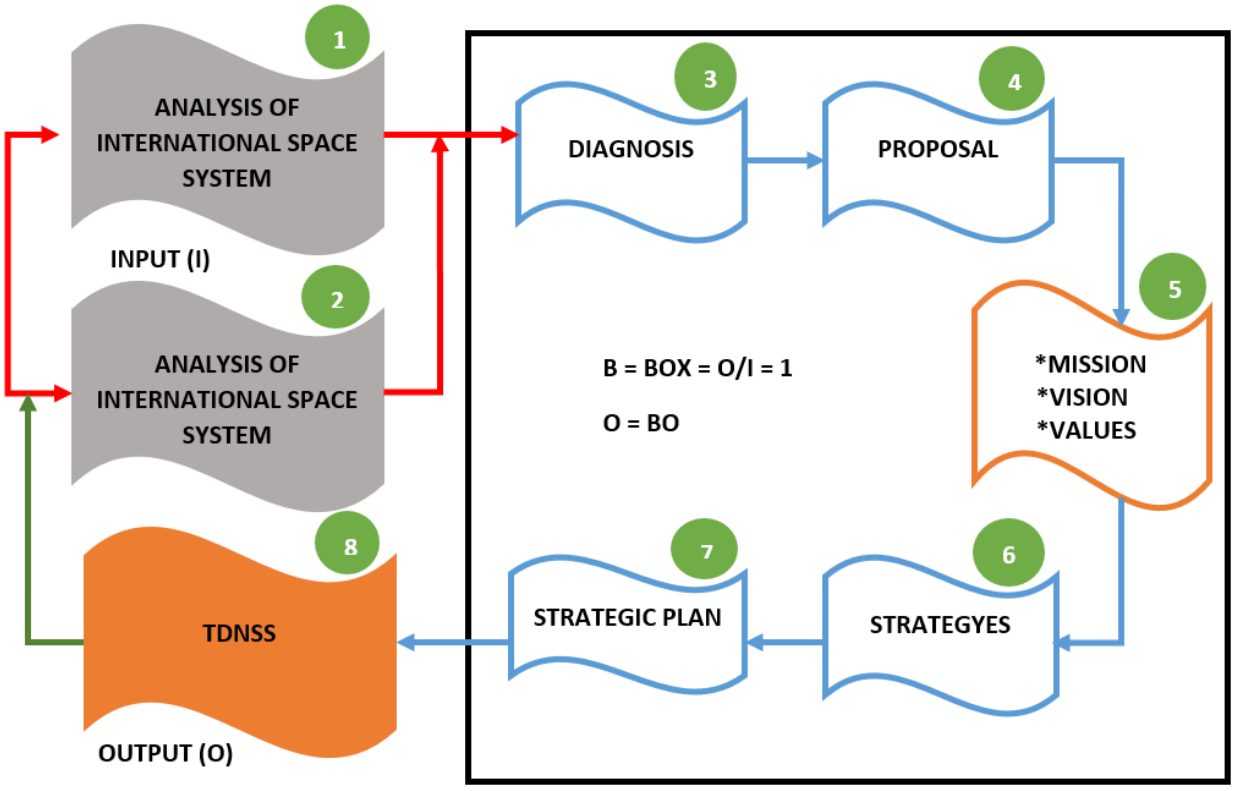

Figure 1: Systemic Model for the Technological Development of the National Space System

VALIDATION OF THE SM FOR THE TDNSS

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

If we know the input (I) and the output (O) of a system, then we can design what is in the box represented by C, Fig.1. The meaning of the box is that we do not know what exists within it, so model designers are free to propose infinite solutions as long as the output is the expected response, which in the case at hand, is the TD starting with the construction of a space launch base in Mexico since the model can be applied to any particular system.

CONCLUSIONS

Based on what has been described, this document concludes that achieving technological development in Mexico is essential to reduce the political, economic and social conflicts that are taking place in the country. It is feasible to have TD since there are all the resources such as higher education institutions, research centers, researchers. In order to achieve this, the Mexican State must carry out an effective and efficient reform that allows the integration of basic and applied scientific research in companies. In the case of space communications systems in Mexico, Mexican satellites that have provided communications services since 1985 to date were designed, built and launched in other countries because scientific research is not integrated into the productive sector.

The technological management for the proposed Mexican space system is based on the construction of a SLB that allows international competition, due to a better location, with respect to the USA, Russia, China, Japan, etc., due to closeness to Ecuador; This situation has as a consequence, among other factors, satellite fuel savings, longer duration and useful payload as well as lower launch cost.

The SLB will bring as a consequence the foundation of satellite construction companies, mainly in the southeast area due to the convenience of avoiding the transport of satellites from faraway places, which would avoid greater cost and deterioration, as well as companies that produce fuels and components for the TD of the Mexican space system SE

The satellite TD generates considerable income; The Association of the Satellite Industry (ASI), published its 17th report on the behavior of the sector in 2013. The study conducted by Tauri Group mentions that the growth of the satellite industry grew by 3% significantly both globally and in US with revenues of 195.3 billion dollars in 2013. The industry grew by 3%, higher than the US economic growth of 2.8% and the global average of 2.4%. The satellites contribute 60% of the income of the space industry, 320,000 million dollars, and 4% percent of the income of the telecommunications industry that was five billion dollars.

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