SCIENTIFIC RESEARCH FOR THE MEXICAN SATELLITE SYSTEM

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ABSTRACT

A technology Management Model for the Mexican Satellite System, based on concepts from different writers is proposed such as: management and technology management. This latter concept involves creation, dissemination, use and transfer of technology. At the next step a Systemic Planning Model for the Mexican Satellite System, is proposed, in order to contribute to technological development.

The Stages of Systemic Planning Model for the Mexican Satellite System are: 1 International analysis, 2 Satellite system .analysis, 3. Diagnosis of, national satellite system using the SWOT, 4.. Formulation and answer research questions 5. Proposed solution 6.Mission, vision, values and strategic objectives of the proposal, 7.Strategies, using SWOT: SO, ST, WO and WT combinations, 8. Action plan 9. Technological feasibility, 10.Technological development. From the analysis and diagnosis, it was found that one of the great strengths in our country is scientific research, including space developed since the 1940s, but it is isolated. It is proposed to found humanist satellite companies, to promote and preserve ecology consisting of self-financing, public, mixed or private initiative, that systemically integrates basic and applied scientific research, among other companies which are engaged in the design, construction and launch of satellites with the purpose of contributing to the technological development to provide an efficient, fast, safe and cheap service to meet the demands of domestic and international users.

The problem is that, in Mexico as in most developing nations, scientific research is not a systemically integrated industry. For this reason, it is impossible for space technology to develop.

KEYWORDS: Model of Systemic Planning, Mexican Satellite System, technological development.

1. INTRODUCTION

The logical question posed was: Is there basic space and applied research in Mexico. The answer was yes, but this is academic and is not connected to the technological development a state policy aims to integrate. Systemically this research helps potential companies to achieve technological development

If scientific research is not integrated in business like developed countries did over 20 years ago, there will be no technological, economical or social development. Poverty will continue to rise and technological dependence will increase leaving us at the mercy of international forces.

Technology Management in the International Space area is carried out mainly through space agencies in some countries, or a community of nations such as the National Aeronautics and Space Administration (NASA) of the United States of America (U.S.), the European Space Agency (ESA) and others. The main features they have in common is that they all arise from a state policy that aims to integrate scientific and business research to technological development, in particular both short and long term spatial plans (López & Dorremochea, 2007).

The space industry in the United States of America (USA), has been developed in competitions. This is achieved by the integration of government, industry, business, research and society. The union of these sectors allows satellite launches, telecommunications, satellite command and control, satellite imagery, global positioning, navigation and timing, space surveillance, weather information, environmental monitoring, industrial, and technology support (Sharma et al, 2011). NASA is the government agency responsible for the management of advanced technologies in the United States (Casler, 2013).

The functions of the Russian Federal Space Agency (ROSCOMOS) include among other political and legal regulation, the provision of state services, management of space assets to the state, the management of international cooperation projects. Joint space programs related entities with the space industry and military space technologies and strategic missiles. The Federal Space Program (FSP) is a basic document for the establishment of state orders, including the design and use of space equipment for the integration of science and industry (Makarov & Payson, 2009).

China has formulated policies to build an innovative technological space, with the integration of industry, academia, the research community, science, technology and research institutions as the main participants. China believes that future generations will inhabit space and part of their investigation is aimed at that goal. Its development strategy is what they call “leapfrogging”, that is, as far as possible not to make continuous progress with technologies that already exist but move forward and take the lead with innovations (CNSA -2011).

Europe had no space presence before the 1970s and from this date has made extraordinary progress, currently being at the forefront of space research in climate change and the environment areas and possesses a family of premier launchers. This giant leap was made through the European Space Agency (ESA) and the nations that comprise it, including Spain (López & Dorremochea, 2007).

Spain is among the six major countries, and has at Villafranca, Madrid an ESA establishment dedicated to space science, It began its space activities with a greater delay than most European countries, but today it ranks high in the ESA, thanks to continued support from the Spanish government, and with the creation of the Ministry of Science and Innovation, which aims to integrate Science-Technology-Enterprise (López & Dorremochea, 2007).

In Mexico the space policy of the Mexican state is characterized by a series of failures such as the cancellations of the National Commission of Outer Space (SENCO), the Mexican

Institute Communications (IMC), the University Research Program Development Space (PUIDE) and Satmex Project (Méndez, 2009; Poveda, 2009).

The Mexican Government considered the Mexican Satellite System (SSM) as a strategic area from 1985 to 1996. From that year the Constitution was amended in Article 28, which allowed the passage of a strategic area a priority area, and being a state enterprise was concessioned to private enterprise Satmex, which struggled to replace Solidaridad 2 satellites and Satmex 5, which was intended to be launched in 2011. The first launched in 1994 was designed for a service life of 14 years (Tun, 2006) and currently has 19 and is partially working. The second has presented failures. It was not until March 2013 when the Satmex 8 was launched and placed in the same orbit as the Satmex 5, to reinforce (Satmex 8, 2013).

Faced with the possible loss of satellite orbits assigned by the World Radiocommunication Conference (WRC) of the International Telecommunication Union (ITU), the delay of replacing the Satmex, the Mexican government in late 2011 announced the start of a Mexsat system which depends on the Ministry of Communications and Transportation (SCT), agency of the Federal government, and in December 2012, launched the first of three scheduled satellites called Bicentennial in the same orbit occupied by Solidaridad 2. The other two satellites of this program will be put into orbit in 2013 and 2014 (Telecomm, 2011).

The aim of this paper is to make a proposal to avoid situations that threaten the cancellation of satellite orbits, and as well as other strategies, promote public and private investment, providing an efficient, fast, safe and economical way to meet the demand of users, in line with innovative technologies and to reduce technological dependence .

In principle an effective and efficient policy is needed to promote technological development in this country. (Poveda, 2009) states it is necessary to systemically integrate scientific research in enterprises in accordance with the goals, objectives and strategies of the same market (Nelcy, 2007). Not doing scientific research will continue to imply a poor technological development.

To achieve the objectives a Model of Technology Management (MTM) for the Mexican Satellite System (SSM) is seen as a stage Model of Systemic Planning (MPS) for the proposed SSM. The last stage corresponds to the technological development with which the cycle is closed.

2. TECHNOLOGY MANAGEMENT MODEL FOR THE MEXICAN SATELLITE SYSTEM

2.1 MANAGMENT

Management is the process undertaken by one or more people to coordinate the work activities of others in order to achieve higher quality results that a person working alone could not reach (Ivancevich et al., 1995).

2.2 TECHNOLOGIC MANAGEMENT

Technology Management (GT, for its acronym in Spanish) is the process of adoption and implementation of policy decisions, strategies, plans and actions related to the creation, dissemination and use of technology (Cordua, 1994). It is a process that addresses the interfaces between science, engineering, economics and management institutions (Zoltan, 1995). The GT promotes the organization and execution of tasks in close relationship with the agents (researchers, engineers, scientists, technologists).

In the glossary of terms of the Inter - Development Executive Secretariat of the Andrés Bello Scepter Inter - Development Bank (IDB - SECAB - CINDA), confirmation is found this management concept: The GT is the discipline in which knowledge of engineering, science and management are mixed in order to make the planning, development and implementation of technological solutions that contribute to achieve the strategic and technical objectives of an organization (Bid, 1990).

Academic and industrial complexity grows with the cost and increased technological innovation. Emerging technologies, such as nanotechnology, biotechnology and information technology and communication (ICT) offer significant opportunities to allow gain and socio-economic growth of a country. The TMP is a difficult topic, in terms of theory and practice. Several disciplines are relevant from an academic point of view, such as science, engineering, economics, sociology and psychology. For there to be good management practices, technology tools to support decision -making and actions is necessary (Phaal et al., 2006).

NASA is the government agency responsible for the management of advanced technologies in the United States (Casler, 2013).

The pharmaceutical company Nucitec SA de C.V. developed its own technology management model based on 4 basic functions: analysis, strategy, execution and results, but technology transfer is essential to achieve the expected results. The technology transfer process has three easy steps: identify, validate and select the new technology. One strategy that has helped the company to transfer technology are partnerships with different universities such as: the Universidad Autónoma de Querétaro (UAQ). Universidad del Valle de Mexico (UVM), Universidad Nacional Autonoma de México (UNAM) and partnerships with research centers such as the Center for Innovation and Technological Development in Computation (CIDETEC), Western Human Nutrition Research Center (USDA, Davis California), University of Queensland Australia (Cortés & Penaloza, 2008).

The TMP is concurrent systematically managing functions of planning, organizing, directing and controlling by adequate technological capacity for the needs of the company. It is a tool that considers financial, technological and market aspects, framed within the general processes of innovation that companies are subject to increase their competitive advantage. In a broader context, the management of technology is an essential activity in the overall business strategy, a determinant of leadership, progress and competitiveness (Salazar et al., 2010).

Technology management is the integration of knowledge engineering, the sciences and disciplines in the area of management oriented plans and implementation of technological capabilities in the design and achievement of the strategic and operational objectives of an organization (Khalil & Ezzat, 2005).

Technology management meets the resources needed in an organization, such as: knowledge, human talent, research and technology, while promoting their ongoing interaction (Zartha & Herrera, 2007).

Technology management is formed by three main factors: leadership, employee motivation and proper management of technology. The objective is to create a technology management agreement between all the factors such as: research, development, planning, engineering, equipment, software, production, and communication to work together in the most efficient way to produce goods or services. This improves the competitive position of public or private institutions in the long term (Kropsu et al., 2009).

Technology management is associated with innovation processes and technology sourcing (González et al., 2012).

Patents can support the management of technology (Ernst, 2003).

Technology management researchers are interested in the generation of new technologies and improvements in existing technology. They define innovation as a continuous process (Gopalakrishnan & Damanpour, 1997).

Based on the concepts of technology management, innovation and technological development, mentioned above, a Model of Technology Management (MTM) for the Mexican Satellite System (SSM) is proposed (Fig.1)

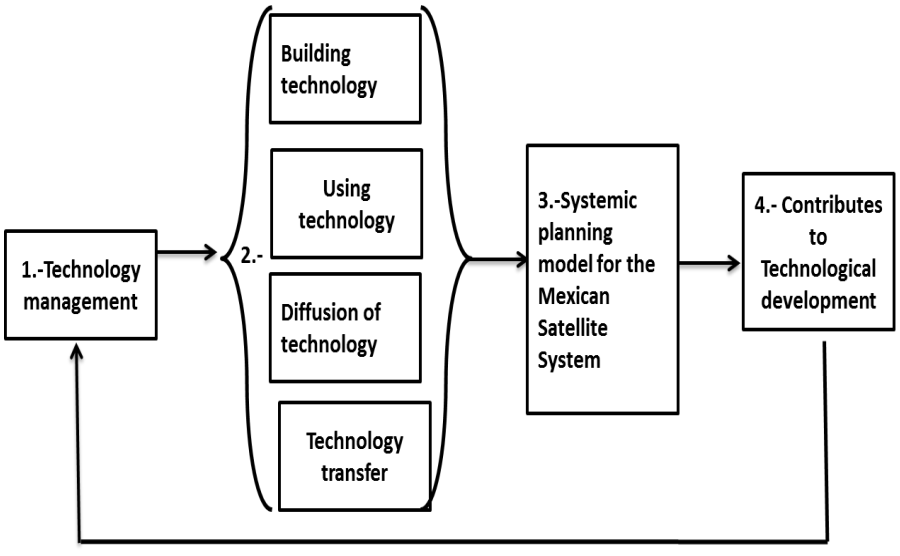

Fig. 1 MTM SSM proposed in which the MPS is contemplated for SSM.

3. SYSTEMIC MODEL FOR PLANNING THE MEXICAN SATELLITE SYSTEM

In Figure 2 the stages of the MPS to the SSM are proposed, which are described below.

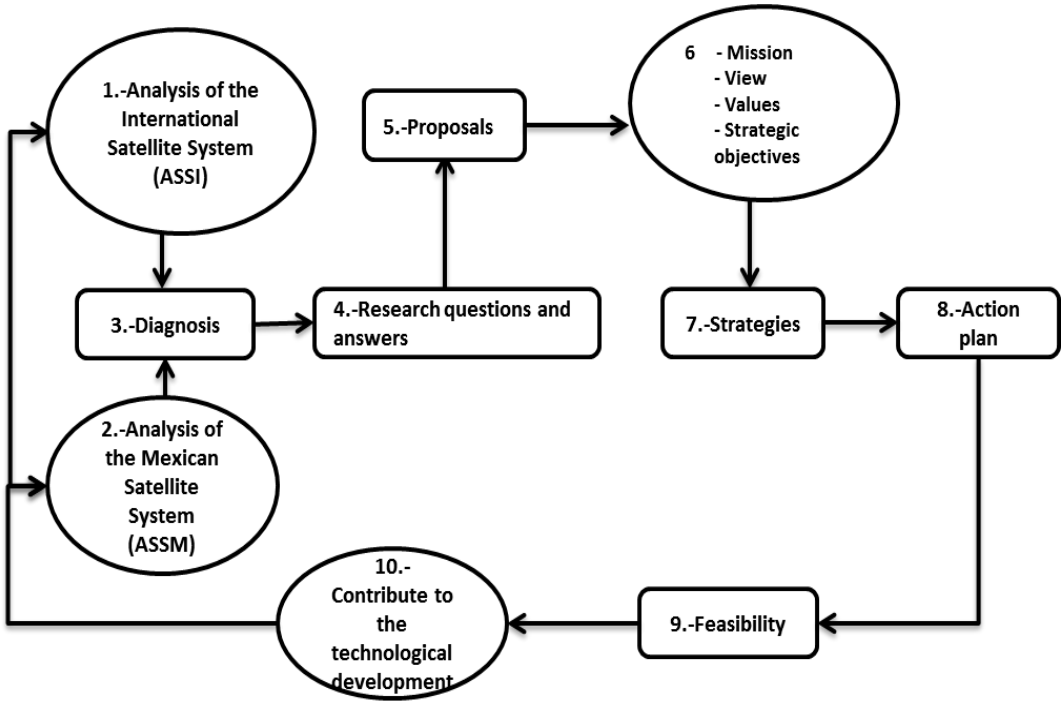

Fig. 2 MPS proposed for SSM.

3.1 ANALYSIS OF INTERNATIONAL SATELLITE SYSTEM

The main relationship between the SSM and the International Satellite System (SSI) is considered briefly such as:

Inequity in satellite orbits assigned among the countries of the world (Satellite, 2013).

Satellite trash is polluting our planet and space, besides being a danger to the population and for spacecraft (Piña, 2008).

The Development Sector of the International Telecommunication Union (ITU-D) has a policy of support for the poor and emerging economies of developing countries in communications, so that our country can apply for this opportunity for their development (ITU-D, 2013).

3.2 ANALYSIS OF A NATIONAL SATELLITE SYSTEM

There are four geostationary orbits, three of which belong to Satmex and / or Eutelsat Communications, and the other belongs to the "MedCom and SES SA" company.

With the creation of the Mexsat program, the possibility of losing the orbital positions allocated by the ITU is avoided. Mexsat share orbital positions with Eutelsat Communications (Telecomm, 2011).

3.2.1 TECHNOLOGY TRANSFER

Satellites used in the orbits assigned to Mexico, have been designed, built and launched by foreign companies. This technology transfer is very expensive according to studies that have been made and equals about 40% more than its actual value (Charles, 1982).

3.2.2 REGULATORY FRAMEWORK

The Mexican State had an Electrical Communications Act (ECA) 1926, until the reforms to the Federal Communications Act (LFC) and the Federal Radio and Television (TRF TV) 2010. Being the framework for development communications development. However, as almost always, groups of political and economic powers have benefited, more than the population (Álvarez, 2007).

The reforms of the LFC TV and TRF, benefit "Televisa" and "TV Azteca", so that the interventionism of the Supreme Court of the Nation (Villamil, 2012) was required.

3.2.3 SCIENTIFIC RESEARCH

Developed countries have integrated basic and applied scientific research in the companies for over twenty years, but our country and most of the poor or developing countries are in the previous stage, which is the management knowledge, ie, the development of scientific research (Nelcy, 2007).

Space science research took shape in late 1957 when the Autonomous University of San Luis Potosí (UASLP) launched its first space rocket, two months after the Union of Socialist Soviet Republics (USSR) launched the Sputnik1. Two months before that U.S. launched Explorer 1 (Saucedo, 2011).

In the decade of the 1960s, the Secretariat of Communications and Transportation (SCT), sentaround a dozen rockets and balloons into space (Méndez, 2009).

The Autonomous University of Mexico (UNAM) through the University Program for Space Research and Development (PUIDE), designed and built a satellite for meteorological scientific research, which was sent into space in 1995 by the USSR (Poveda, 2009).

With the purpose of investigating the country, using photography and Ku band frequencies, several Mexican institutions have participated since 1993 in the Satmex project to design, build and launch a satellite (Poveda, 2009).

The March 31, 2011 network was created in the IPN, the Network of Experts on Telecommunications (Polytechnic Gazette, 2011) and, on November 24, 2011, the UNAM began with the Network Space Science and Technology (RedCyTE) (Arreola, 2011). Both institutions had the purpose of developing and promoting scientific research and technological development.

3.2.4 MEXICAN STATE AGENCIES FOR DEVELOPMENT OF COMMUNICATIONS

To coordinate efforts, concerns, aspirations generated in projects and research programs in institutions, mainly the higher education and research centers, the Federal Government through the Ministry of Communications and Transport (SCT) cover three agencies: the first is the National Commission of Outer Space (1962-1977) (Méndez, 2009). Ten years after its dissolution, the second was created: The Mexican Institute

of Communications (1987-1997), which also was dissolved (Poveda, 2009). Fourteen years after this dissolution the activities of the third began: The Mexican Space Agency (EMEA) in November 2011.

The AEM is a public agency dependent SCT, whose function is to coordinate the Space Policy of Mexico, with the purpose of developing human resources, research, technology and infrastructure necessary for the country's technological development (Mendez, 2009).

3.3 DIAGNOSTIC

To carry out diagnostic, a tool to determine the Strengths, Weaknesses, Opportunities and Threats (FODA) for the SSM was applied.

The main strength of the country is the development of scientific research, particularly space research.

The main opportunity for Mexico is soliciting support of ITU-D for the development of communications.

The main weakness is that scientific research is isolated. It is not connected to technological development.

The main threat is that if scientific research to the productive sector is not integrated, the country becomes dependent on foreign technology.

3.4 RESEARCH QUESTIONS AND ANSWERS

Question. Why we have failed at least three times in the space issue? What was in common with the three previous failures? (Poveda, 2009).

Response. All these frustrations are because, these projects are individual projects and not the result of a state policy (Poveda, 2009).

The disappearance of the CONEE, BMI and PUIDE demonstrate that the policy of the Mexican government is not continuous and has isolated initiatives, mainly from public institutions. Consequently there is no course in higher education institutions and research centers, as rightly mentioned Poveda with the cancellation of the University Program Research and Development Space (PUIDE) and as mentioned, they did not know how to build a satellite.

After over 70 years of space research there is no technological development in this field. This is because there is no connection between scientific research and technological development.

3.5 PROPOSAL FOR SATELLITE TECHNOLOGY DEVELOPMENT

The Mexican government as regulator of the economy and impulse for national correlated with international policy, can promote public and private investment to fund self-financing satellite companies that generate wealth, which can be public, mixed or private initiative, systemically integrating basic and applied scientific research in other companies, engaged in the design, construction and launch of satellites with the purpose of providing an efficient, fast, safe and cheap service that meets the demand of national and international users.

In Mexico, through public and private institutions, human resources are obtained, that generates scientific research in all fields of knowledge. Therefore, it is necessary to integrate companies through a state policy.

3.6 MISSION, VISION, VALUES AND STRATEGIC OBJECTIVES OF THE PROPOSAL

MISSION

To be interconnected with the national and international system of communications and provide innovative satellite services. Disseminate and use satellite technology. Strengthen through Mexican satellite system, the national security; technological infra-structure for efficient communications coverage in all regions of the country, create educational, ecological, cultural and social programs.

VISION

Companies. Generate companies that integrate profitable scientific research to give people, professionals, researchers, graduates of the educational infrastructure in all areas of knowledge, the opportunity to participate in the technological development of the Mexican satellite system to reduce technological dependence that impacts on the political, economic and social development of our country.

VALUES

Rationality. Achieving results with the right resources.

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

Human Resources. The reason for the organizations should be the welfare, pleasure, nutrition of the company for human resources working efficiently and effectively, considering the contributions of each member with a systemic approach for the common goal

Natural resources. No company is justified without caring and improving the ecology and environment.

GENERAL STRATEGIC GOAL

To contribute to the technological development in the country.

SPECIFIC STRATEGIC OBJECTIVES

Integrating research and technological development management in satellite companies.

Providing innovative, efficient, effective, quality and low-cost national and international public and private institutions as well as individual users.

3.7. STRATEGIC DEVELOPMENT OF MEXICAN SATELLITE SYSTEM

For the strategies the following combinations SWOT: SO, ST, WO, WT. Are used The main strategies are presented:

SO. The Mexican satellite system can continue to provide international services.

ST. If human resources of the country are not focused towards technological development, they will seek opportunities in other countries and will continue to have growing problems in the political, economic and social fields.

WO. Currently many efforts are being made to conserve the geostationary satellite orbits due to technology import costs increasing by 40 %.

WT. Satellite development will ensure the country it's four satellite geostationary orbits assigned by the International Telecommunication Union (ITU) and is in a position to get others.

In Figure 3 the model for system diagnosis and strategies to guide is presented, using the SWOT.

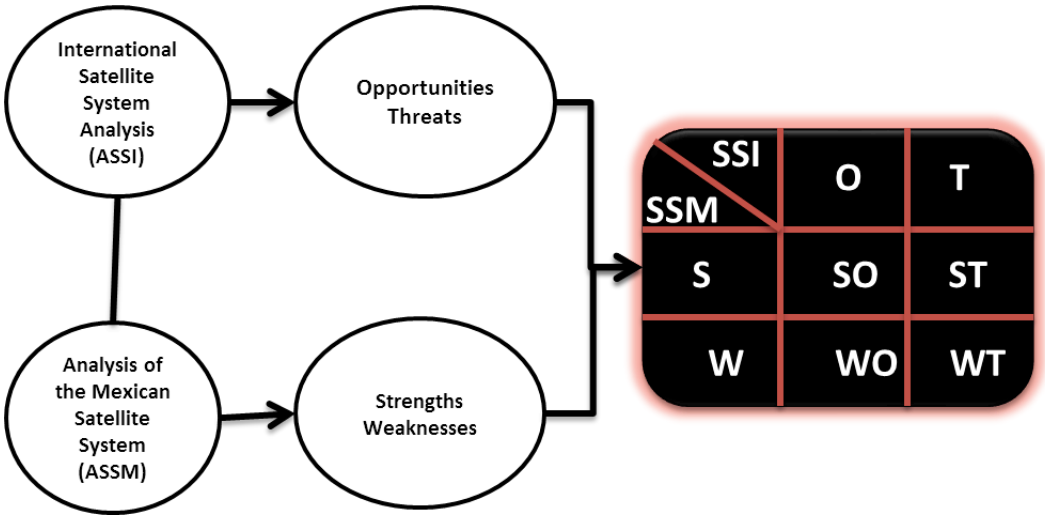

Figure 3 Model for system diagnosis and strategies to guide using the SWOT.

3.8 STRATEGIC ACTION PLAN FOR THE DEVELOPMENT OF MEXICAN SATELLITE SYSTEM.

3.8.1 INTERNATIONAL

Make international agreements with nations and different public and private institutions, primarily with space agencies to develop a system of interaction and cooperation, in order to establish mutual benefit generating policies related to basic and applied scientific research in the area of communications particularly the satellite. To fostering an innovation and ongoing review of international regulatory framework that contributes to political, economic and social technological development as well as to solve the problems generated by the international satellite system, including the hazards of satellite debris and ecological degradation (Makarov & Payson, 2009).

3.8.2 NATIONAL

Establish agreements with public, private and Government of the Republic States to attract companies that integrate scientific research, for the creation, dissemination, transfer and use of technology in the area of satellite communications in order to help technological, political, economic and social development of our nation.

3.9. FEASIBILITY OF STRATEGIES

3.9.1 INTERNATIONAL

Mexico may request the support of the Telecommunication Development Sector (ITU-D). This area was created to help spread equitable, sustainable and affordable access to telecommunications, thereby promoting greater economic and social development in nations and companies especially the poorest countries (ITU-D, 2013).

Membership offers the opportunity to establish relationships with the best talent in the industry represented by more than 700 private sector entities in addition to 193 governments that make up the United Nations (UN) and its regulators. Participation in the process of ITU standardization allows directly influencing the technological forces that decide the future of the industry of Information Technology and Communication (ICT) (ITU-D, 2013).

3.9.2 NATIONAL

The legal framework for telecommunications in which the SSM is implicit began with the Electrical Communications Act of 1926 to reform the LFT and LFR and TV in April 2011, and has reflected the changes of the Mexican State to a State Auditor and promoter.

To promote technological development in communications, the Mexican State must generate regulatory policies to benefit the national interests, not the powers that be.

3.10 TECHNOLOGY DEVELOPMENT

Technological development can be defined as the springs caused by technical progress, innovation, invention, design, adaptation among others (Schumpeter, 1975) for the benefit of the national and international community.

China has shown that it is possible to move forward as a nation systematically and successfully with their rise and technological development in the space industry (Satmex, 2010).

CONCLUSIONS

The satellite orbits are mainly concentrated in three countries which is a disadvantage for our country and having four or more is not the same as having 500 in U.S.A. Mexico has resources that will allow technological development creating their own policies and technological strategies, mainly for what the international community has not done, allowing it to be major player in the area of communications in particular satellites.

Based on the potential of human resources, the country has proposed that the Mexican government can promote satellite companies in which this systemically integrated scientific research, development and technology management can find niche opportunities that meet the needs of the system to become national and international satellites. These companies can be mixed, public or private initiatives that generate wealth that is not to be subsidized by the Mexican government. This scientific research will be a “Rio Bravo” and not a huge dam with stagnant water creating frustrations for researchers and society. No longer will there be countless questions such as why do we want more professionals and researchers?

Human resources are most valuable in a company, and the Mexican government can lead them to provide care, feeding, training, services, incentives, participation, etc. for the workers. The company is a system and if the human resources which are the most valuable of the same system are not working properly it is difficult to obtain technological development.

If scientific research is not integrated into business there cannot be technological development in the satellite system, and of course in any other area. Therefore, economic, political and social development and also wealth will continue to accrue for a few people and poverty will increase for most of the population.

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