TECHNOLOGY MANAGEMENT THROUGH SPACE AGENCIES

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ABSTRACT

Technology management is the process of directing all activities geared to a public or private institution to make the most efficient use of technology.
Technology is created through joint expertise, scientifically arranged, to design and create goods and/or services that facilitate daily life. These skills are acquired in educational institutions and finally applied in technological development industry by acquisition or through research. Within space technology, this can be done through space agencies.
In this paper the major space agencies are: National Aeronautics and Space Administration (NASA), Russian Federal Space Agency (ROSCOSMOS), China National Space Administration (CNSA) and European Space Agency (ESA), which systemically work with industry and academia integrating basic and applied scientific research in each country.
The Mexican Space Agency (AEM) is the youngest space agency. Unlike its predecessors, it has failed to integrate basic and applied scientific research to the productive sector as demonstrated throughout this document.
Keywords: Technological Development, Space Agencies, NASA, ROSCOSMOS, Mexican Space Agency.

INTRODUCTION

Technology Management in the space area is carried out mainly through the space agencies in developed countries, such as NASA, ROSCOSMOS, CNSA, ESA, among the most important. The main features they have in common is that they all arise from a state policy that allows the integration of academia, basic and applied science in industry since the 50s (Nelcy, 2007), based on research goals, objectives and marketing strategies of companies, for technological development, in particular in space, through short and long term plans.
In developing countries, scientific research is not integrated into the productive sector (Nelcy, 2007) for this reason the programs of space agencies of these countries are specified to be only isolated initiative interlocutors of different sectors in the space area.
In Mexico there are bodies established by the Mexican government to impulse scientific research in order to promote technological development such as the National Commission of Outer Space (CNEE, 1962-1977), the Mexican Institute of Communications (IMC, 1987-1997) Also, AEM which began its activities at the end of 2011 shows that there is no continuity in the space policy of the Mexican state.
These discontinuities are considered failures of the space policy of the Mexican state, mainly due to scientific research that is isolated from the production sector, i.e. the need to solve specific industrial problems is generated, and if there is no need any initiative will tend to fail.
From the above it is proposed that Mexico promotes systematic scientific research in business as they have for decades in developed countries (Nelcy, 2007).

THEORETICAL

Management

Management is the word that has several synonyms such as administration, processing, etc. It is a process that consists of a series of activities and operations such as: planning, organizing, deciding and evaluating. This implies structure and use of resources to achieve a goal; this system is a set of policies, concepts and practices consistent with each other in order to achieve the objectives (Hitt, 2006).

Technology

Technology is a set of scientifically arranged knowledge, allowing the design and creation of goods and/or services that facilitate adaptation to the environment and satisfy the essential needs such as personal desires (Castañeda, 2012).

Space technology is technology related to space, the use and maintenance of different systems on location in space or space flight and the return of the people and things from space. Space technology has great applications for security and defence, helping governments to control their borders, radar systems, positioning systems, etc. (Roman, 2012).

Technology Management

Technology management is defined as the process of managing all activities geared to a public or private institution to make the most efficient use of technology internally generated and purchased from third parties, and to incorporate new products and ways to be produced and delivered to the market (Hidalgo, 1999).

Innovation

Innovation centres in universities and research institutes and their links with industry regulations and laws on patents and technology transfer is issued to facilitate links between universities, research institutes and industry (Xiwei, 2007).

In Figure 1 a simple schematic innovation is shown.

Fig. 1 Simple model of the innovation process (MICIT, 2002).

Technological Development

Technological development is good for humanity, and a way to encourage technological development in public and private companies in research (Villarroel, 2004). Technological development in industry is by acquisition or through research (Morales, 2012).

ANALYSIS OF SPACE AGENCIES

National Aeronautics and Space Administration (NASA)

NASA is the U.S. space agency responsible for the civil space program, in addition to aerospace research, and has been researching and working with the AMES Research Laboratory of Intelligent Systems (SSRL) for space development (Papasin, 2003).

In 2006 Lockheed Martin (A company designing satellites) and the University of Hawaii College of Engineering renewed the cooperation agreement through the Industrial Affiliates Program (UH). The partnership agreement provides for the engineering faculty to receive support from Lockheed Martin including guest lecturers for classes, clubs, meetings, seminars, presentations and review of student projects and provide other interactive programs. Members of the industry such as Lockheed Martin are invaluable to students and teachers as they work closely with industry leaders and thereby improve the curriculum of the Faculty of Engineering, learn about technologies, applications and methods (University of Hawaii, 2010).

The National Science Foundation (NSF), the Office of Naval Research (ONR), the U.S. Administration for Research and Development on Energy (ERDA) and the Department of

Energy (DOE) are organisms along with the National Institute of Health (NIH), the various agencies including NASA and the Air Force Office of Scientific Research (AFOSR) the Army Research Office (ARO) and Projects Agency Defence Advanced Research (DARPA) are the main actors in the United States for science, research and engineering development. Most NASA centres, the National Centre for Atmospheric Research (NCAR) and the Lincoln Laboratory Massachusetts Institute of Technology (MIT), generate research and development, as well as a group of scientists and engineers, in addition to generating new fundamental knowledge and technologies through basic and applied research. Private industry also made significant investments in research and development, for example, the Bell Telephone Laboratories, Hewlett- Packard, General Electric, Westinghouse, IBM, Texas Instruments, and Xerox (Lane, 2008).

The Federal government of the United States is interested in public-private partnership, and has been given the task of supporting the private sector industry, research and education (Lee, 2010). Strengthen and maintain space-related science, technology and industry, are critical to the U.S. space development (Voss, 2011).

Russian Federal Space Agency (ROSCOSMOS)

ROSCOSMOS presides over all space activities in Russia, both civilian and military, and is directly controlled by the Head of Government of the Federation, which approves and funds its programs. It has a high level of management and operates with a high degree of autonomy, consisting essentially of the military, starting with the main sectors within the agency which are the Ministries of Defence, Science and Technology, Industry and Energy (Petroni, 2009).

The Lavochkin Association works with ROSCOSMOS. Lavochkin is a company working on the development of automated spacecraft for fundamental planet scientific research of the moon and stars from other systems and galaxies. Scientific research and development of the school, was founded by Semyon A. Lavochkin, corresponding member of the Russian Academy of Sciences (PAH) (Shatskaya, 2012). The project of the World Space Observatory Ultraviolet (WSOUV) is an initiative aimed by ROSCOSMOS for high performance observations in the ultraviolet range. To develop this project Russia had industrial support from the Kayser-Threde company (Reutlinger, 2011). ROSCOSMOS currently has under its jurisdiction 149 aerospace organizations, including companies, production organizations, public and private organizations and foreign joint ventures (Roscosmos, 2013).

China National Space Administration (CNSA)

The CNSA, the China space agency responsible for space activities and policies for the Chinese development in space is an area of strategic importance for economic and technological development. China carries out a wide range of satellite, space flight and commercial launches that China has launched without fail since 1996.

By 2002 China had launched 15 non-national commercial satellite, NigComSat-1 as Nigeria, Venezuela Venesat-1, among others. The People's Liberation Army (PLA) plays an important role in the China space activities, space launches and space activities executed by the state- owned China Aerospace & Technologies Corp., with a number of companies for scientific development and technology of China. One example is the company Great Wall Industry Corporation (GWIC) which is part of this network business, and is the only organization authorized by the Chinese government to provide commercial launch services and aerospace technology. The China Academy of Space Technology (CAST) and the China Academy of Launch Vehicle Technology (CALT) regularly participate in interactions between China and Latin America and other clients (Ellis, 2010).

China has formulated policies for the development of the space industry, to build an innovative technological space, with the integration of industry, academia the research community, science and technology enterprises and research institutions (China Space Activities, 2011).

The National Science Foundation of China (NSFC) supports research related to space.

The Commission on Science, Technology and Industry for National Defence made a statement on the launch of a satellite. In addition, the Ministry of Agriculture and the Aerospace Science & Industry Corporation have also supported programs. There are many universities and research institutions involved in space projects of China. They are: Agricultural University of China, Nanjing Agricultural University, Agricultural University of Southern China, Huazhong Agricultural University, Guangxi University, Northeast Forestry University, Sichuan Agricultural University, the University of Science and Technology of China, Lanzhou University, Wuhan University, Zhejiang University and Harbin Institute of Technology (Chengzhi, 2011).

The Aerospace Corporation, Science and Technology of China (CASC) also known as the China Academy of Launch Technology (CALT) is the largest Chinese company involved in the development and manufacture of space launch vehicles (Mark AS, 2012).

European Space Agency (ESA)

ESA is an intergovernmental organization in charge of space development for the European continent. ESA began its activities in 1975 (Spagnulo, 2013). The ESA coordinates the policies, regulations and laws relating to satellite communications in the European Union (Scholastic, 2013).

The ESA through the Centre for Industrial Technological Development (CDTI) businesses and educational institution scientists have made satellite launches which were led by companies and researchers (Lopez, 2009).

Mexican Space Agency (AEM)

The AEM was created in July 2010, its mission being to transform Mexico into a country with science and space technology development activities of international class and articulate industrialization programs and services in frontier technologies, and high impact social development levels (AEM , 2013).

Before the creation of the AEM, the National Commission of Outer Space (CNEE, 1962-1967) had already been created and also the Mexican Institute of Communications (IMC, 1987-1997) to foster basic and applied research to achieve space technology development. Experience to date shows that the success of these programs depend on the continuity to be given to them (García, 2010). Due to this lack of continuity these bodies established by the State have disappeared. Since 2008 interest has been raised among a group of specialists, scholars, scientific and civil society to create a AEM, with powers to conduct studies, analyses and proposals necessary for space activities (Neri, 2009).

The aerospace industry in Mexico consists of three sub-sectors: aeronautics with 190 companies, aviation and aerospace. The latter becomes relevant to the creation of the AEM (Castillo, 2010).

The first strategic objective of the space policy of Mexico is creating an enabling institutional framework for spatial development in Mexico to strengthen the technological, educational and industrial areas, to improve the conditions and opportunities of life for the scientific population. Among other strategic objectives in the Mexican space policy is to encourage production chains linking the industrial sector and academic services to increase Mexico's competitiveness sectors, according to installed capacity in different regions of the country (AEM, 2013).

The AEM creates and executes the General lines of the Space Policy Mexico and in July of 2011 these lines were published, and reviewed at a Government meeting, calling upon experts in space such as the Secretariat of Public Education (SEP), the Ministry of Finance and Public Credit (SHCP), the Secretariat of Communications and Transportation (SCT), Ministry of the Interior (SEGOB), the Ministry of Foreign Affairs (SRE), the Ministry of Defence (SEDENA), the Navy (SEMARNAT), the National Association of Universities and Institutions of Higher Education (ANUIES), the National Academy of Medicine of Mexico (ANMM), the National Institute of Statistics, Geography and Informatics (INEGI), the Academy of Engineering of Mexico, the Academy Mexicana for Sciences (AMC), the (IPN) National Polytechnic Institute, the

National Autonomous University of Mexico (UNAM) and the National Council for Science and Technology (CONACyT) to formulate the outlines of the Mexican Space Policy (Viñals, 2013).

Outline:

1. Rectory State in the matter

To take the guidance of the State in space, through the formulation and implementation of space policy and the National Space Development Program of Mexico, aimed at preserving national sovereignty and national interests in the exploration and exploitation of space.

To develop work plans involving both channelling support of various kinds to entities active in the field, such as the creation of new bodies and institutions involved in research, development and innovation in space and in the training of human resources in science and space technology.

To maintain a state policy in space, to set short, medium and long term goals that may suit the circumstances and maintain continuity in time.

2. Autonomy of the country in space material

To define and lead the various programs of action in space, with the imperative to achieve the development of scientific, technological, educational, and industrial and services in this and other related sectors of national activity capabilities.

To integrate and coordinate the performance of all institutional actors engaged in space activities, to consolidate a national basis able to alternate with foreign and international organizations in the field.

3. Protection of sovereignty and national security

To give priority to projects that contribute to the solution of national problems.

Collaborate with the agencies responsible for national security in the design of strategies, actions and tools that strengthen space technologies for security and national sovereignty.

Establish permanent inter-agency mechanisms for monitoring and surveillance, with the participation of the agencies that make up the National Security Council, so that the space industry of Mexico has a development in accordance with the provisions of the National Security Law.

4. Protection of Population

Harness space science and technology to improve the protection of the Mexican population to natural hazards, risks to national security, and other biological threats that challenge the integrity of the territory and its inhabitants.

5. Greening

Promote the development of space science and technology in coordination with the Government Agencies responsible for this, for a rational use of natural resources and ensure environmental sustainability in the long term.

6. Research, scientific, technological development and innovation

Promote scientific research, technological development and innovation in the space area in coordination with the institutions of education, research, technological development and innovation, both in public and in private. This includes the development and, where appropriate, the establishment of research institutes, vocational training, technological development and innovation in the aerospace field.

7. Development of the productive sector

Promote the development of the productive sector through its relationship with the government and academic institutions, articulating value chains to increase their competitiveness and stimulate job creation, using vocations and capacities of different regions.

Promote national projects integrating technology and encourage participation of highly qualified professionals in the design, construction and operation of facilities equipment

and aerospace human resources.
Encourage the creation of new spin-offs from space technology developments.
Transfer the experience of aerospace developments to the rest of the economy.
8. Developing Human Resources
Design and implement a strategy for human resource development with the participation of national and international institutions, in order to promote the development of scientific and technological capabilities.
Create educational programs from the basic level, with a focus on problem-based learning and aerospace projects, in collaboration with relevant parties.
9. Coordination, regulation and certification
Coordinate the efforts of the various players in aerospace.
Sort through networking and linking the various sectors involved in the aerospace field.
Promote the creation of a regulation according to the dynamics of the sector to facilitate its development.
Coordinate the development of standardization, accreditation and certification in the field in collaboration with national and relevant foreign agencies and international organizations.
10. International cooperation
Participate in regional and international activities in space, in collaboration with relevant Federal agencies.
Establish mechanisms for international cooperation and technology transfer for the benefit of public and private entities that make supply chains in the space sector, in collaboration with relevant Federal agencies.
Promote the signing of international agreements on technical and scientific cooperation, in coordination with the competent authorities, preserving the national sovereignty of the Mexican state.
11. Dissemination of aerospace activities
To sensitize the society about the importance of the development, ownership and use of scientific and technological knowledge associated with the aerospace activity.
Foster a culture of space knowledge so that new generations are involved early on in this area.
12. Financing
Create and promote in the public and private sectors, instruments to ensure budgetary support of the Mexican Space Agency, in order to continue the National Space Development Program as part of a long-term state policy.
13. Organization and management
Create and promote linkage mechanisms and participation of representatives of government, non - governmental, private space industries and experts in a personal capacity and specialized techniques, issue recommendations to the Governing Board and the Director General of the Mexican Space Agency NGOs in order to enrich the development of space activity of Mexico (AEM, 2013).
Within these general terms there is a line called: Research, scientific, technological and innovation development, but unfortunately, there is no mention of how to achieve the technological development.
Another line is: Development of the productive sector, in which it is mentioned that it is necessary to promote the development of the productive sector through its relationship with the government and academic institutions, articulating value chains to increase their competitiveness and stimulate job creation, using vocations and capacities of different regions. But it does not mentioned how to achieve this development.
Scientific and technological research is a strategic activity, particularly since the results of these investigations directly or indirectly affect the needs of society in the development and growth of the domestic industry and the generation of innovations to increase our competitiveness as a nation as our country has human capacity for scientific

and technological research in the aerospace sector, these include: astronomy, astrophysics and planetary research, space medical sciences, telehealth, space communications, planning and observing spacecraft (PNAE, 2011) .
Mexico aerospace is a component supplier to the U.S. Thanks to Mexican companies that began with assembly functions, many of these companies already have significant progress in integration and even aspects of design, research and development, using numerous professionals with expertise and doctorate studies. Opportunities for collaboration between business and educational institutions are developing in an intense form favoured by CONACyT funds. This has supported small, medium and large businesses, and generated the interaction between the Government-Industry-Academy as in this way only the challenges of aerospace (PNAE, 2011) will be addressed.

CRITICAL ANALYSIS

Aerospace activities are considered as strategies for transformation in developed countries by linking the industrial, public and academic sector. Linking is carried out by space agencies for space policy in each country. The aerospace industry is considered by many developed countries as a strategic sector of the economy, therefore it has been subject to government control.
Space agencies in developed countries began to draw on the knowledge gained in the academy and get them started in industry; also industrial workers have returned to academia to provide their experience in the industry as is done in the University of Hawaii, where research groups are not isolated to the productive sector.
Petroni, G., Venturini , K., Verbano, C. , & Cantarello , S. (2009) mention that the Military plays an important role in these agencies as in the case of Russia. In Mexico only the Ministry of Defense and SEMARNAT were convened to develop the outlines of the Space Policy of Mexico. Another example is China. "The People's Liberation Army (PLA) plays an important role in China's space activities" (Ellis, 2010).
To minimize these problems it is necessary to propose a long-term strategy that allows on the one hand, contributing to the development of proprietary technology to provide solutions to national problems, and secondly, the creation of sustainable value chains and knowledge that are robust and this stiffens variations of the global economy.

CONCLUSION

In Mexico we have the ability to do research in space, but unfortunately, we do not have a state policy where scientific research is integrated and applied to companies. Since this research is isolated from the productive sector, this paper proposes creating a policy that allows the integration of basic and applied scientific research that is generated primarily in the education sector with industry as they have in developed countries since the 1950. (Nelcy 2007). This country will form development and innovation, and major problems such as the brain drain, unemployment and, poverty will be solved, among other socio-economic and political problems.
The space industry is increasingly important; it enables new generations to work and live in space. This will not be an obstacle, but a challenge.

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