SATELLITE SYSTEM PROBLEMS IN MEXICO

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ABSTRACT

The Mexican government announced the creation of the Satellite System (Mexsat) for national security and telecommunications services in Mexico thus aims to put into orbit the satellite Mexsat 2 (Boeing 702HP) in July 2012, through the Russian spacecraft Proton-M in the position 116.8W, which will have with 40 transponders for Ku band, and 24 for C band, this satellite will replace Satmex 5. Mexsat 3 will be put in orbit by the Ariane Space Company onboard the spacecraft Ariane 5 from Kourou Space Centre in French Guiana in the position of 114.9W, It will have 12 transponders for the KU band and 12 for the C band, with a weight about 30550 kilos and a life time about 15 years, Mexsat will replace Soliadridad 2. By 2014 Mexsat 1 will replace Satmex 6 in the orbit 113W. Three satellites will be built by Boeing Space Enterprise and Intelligence Systems, two of them for mobile services and other for fixed services; two earth stations; operation network systems and geostationary user terminals per 1000 million dollars. The current fixed and mobile communications systems services which are based on a variety of satellite systems offer the transmission and reception of voice, audio, video, broadband data etc., thus means that the satellite systems need continue providing an efficient service, and developing technologies.
There are several model of planning i.e. those of George Steiner, Rusell Ackoff and Hazan Ozbeckhan, The latter was chosen because in the first stage allow to detect problems, however the other ones spouse that already exist and have to solve them. The detection of the causes which origin these problems and the possible solution strategies for Technological Management of Mexican Satellite System was made through the use of this model, based on the standards, conventions and national and international regulations.
Keywords: Satellite, Mexsat, technological management, Mexican satellite system.

INTRODUCTION

The currently telecommunications are changing continuously, satellite systems are not exception, this is the reason why satellite systems to evolve and offer new features in terms of technology require proper management in all the services they offer, for this is necessary to make the necessary arrangements for technological development and place them according to the needs of the country and offer new services.

Currently Mexican Satellite System is administrated by Satmex, in which Mexican Government havea 20% of the financial shares nonvoting, however, this enterprise have problems related with the replace of Solidaridad 2 launched to orbit on October 7th 1994, which was constructed for a period or 14 years, on march 2008 it was put on an inclined orbit in order to make it work partially per 3 years more. In 11996 Satmex 5 was put in orbit, on January 27, 2010 Satmex reported a failure in the primary propulsion system (XISP), which kept him in orbit but continued operations because the system became operational support chemical propulsion, which has a duration of 2.5 years so that they must take immediate replacement. This company offers various communications services but the continuous evolution create the need to improve schemes for systems of transmission, reception, administration and rules that govern them with a benefit for users so “la Secretaria de Comnicaciones y Transportes (SCT), la Comisión Federal de Telecomunicaciones” among others are responsible of technological development of the Mexican satellite system based on the policies of the International Telecommunication Union (ITU) which is located in Geneva Switzerland; the goal of this research is to raise the technological management based on the current problems of Satmex and Mexsat in order to facilitate a higer development and offer new services to compete with the satellite systems from other countries that are serving our country, however implementation will be in charge of the Federal Government under the relevant bodies.

CONCEPTS

Management

In a general way the meaning of administration, arrangement, and management are synonymous In spite of the efforts and discussions in order to explain the difference, the main point of this concepts is that all of the make reference to a process of organizing, leading, evaluating and controlling how H. Fayol mentioned in the early century or Koontz (Koontz H. y Weihrich H., 1998). With a current or managerial connotation management is taken as a global and inclusive institutional role of all the parts of an organization (Mora J. Transformación y Gestión Curricular, 1999). In that way, the management makes emphasis in the direction and leadership exercise.

Technology

It refers to the objects or ways used to produce, sell or use a product or service; many authors are coming to standardize the following definition (Bid-Secab-Cinda, 1990): “It is a body of scientific and empirical knowledge for use in the production, marketing and use of goods and services”.

Technological Management

The following definition is very typical of the publications of the Inter-University Centre for Development (CINDA): Process of adoption and implementation of policy decisions, strategies, plans and actions related to the creation, dissemination and use of technology. It is a process that deals with the interfaces between science, engineering, economics and management of institutions. The technological management promotes the organization and execution of tasks in close collaboration with actors (researchers, engineers, scientists, technologists).

In the glossary of the “Banco Interamericano de Desarrollo-Secretaría Ejecutiva del Convenio Andrés Bello-Cetro Interuniversitario de Desarrollo (BID–SECAB–CINDA)” we find a confirmatior of that meaning. Technology management is the discipline which combines knowledge of engineering, science and administration in order to perform the planning, development and implementation of technology solutions that contribute to strategic achieves and technical goals of an organization (Bid-Secab-Cinda, 1990).

SYSTEM IDENTIFICATION

A satellite communication system is a microwave radio system that operates using a repeater which is in heaven at 36 000 km or other distances from the earth. The repeater has one or more transponders operating in a particular band of the frequency spectrum, and whose function is (Evans B.G., 2000):
• Receive a signal of a frequency, f1
• Amplify
• Retransmit at a different frequency, f2

The geostationary satellite is located at 36 000 km away on Ecuador and has a rotation period around the Earth for 24 hours, which is said to be stationary, then turning is at the same speed as the planet, its position respect to an earth station do not change.

The C band was the first to be intended to commercial traffic by satellite; there are assigned two frequency ranges, the lowest for downlink traffic (from the satellite) and higher for uplink traffic (towards the satellite). A duplex connection for a channel is required in each direction. These bands are already overcrowded because they are also used by common carriers for terrestrial microwave links.

The next highest band available for commercial telecommunications carriers is the Ku band. This band is not congested (yet), and at these frequencies satellites can be spaced as close as 1 degree. However, there is a problem: rain. Water is an excellent absorber of these microwaves. Fortunately, severe storms rarely cover large areas, so using several widely separated ground stations rather than only one can solve the problem at the expense of spending more on antennas, cables and electronic circuits to switch rapidly between stations. It was also allocated bandwidth at Ka-band satellite for commercial traffic, but the equipment needed to use it is still expensive. In addition to these commercial bands, there are many government and military bands (Rosado Rodríguez C., 2002).

Table 1. Frequency bands of a satellite system.

Band	Frecuency	Up link (GHz)	Down link (GHz)	Problems
C	4/6	3.7-4.2	5.925-6.425	terrestrial interference
Ku	11/14	11.7-12.2	14.0-14.5	Rain
Ka	20/30	17.7-21.7	27.5-30.5	Rain; cost of equipment

A satellite can have about 40transponders, with a bandwidth between 36 and 50 MHz each one. It is possible to use a 50Mbps in order to encode a single stream of data from 50Mbps, 800 digital voice channels at 64Kbps, or several different combinations (Neri Vela R., 2002).

SATMEX

Satmex is the leading provider of satellite communications in Latin America, which operates the Mexican satellite Solidaridad 2, Satmex 5 and Satmex 6. Its satellite fleet offers regional and continental coverage in C and Ku bands, ranging from southern Canada to Argentina.

Satmex currently has three satellites in operation providing local coverage, regional and continental levels to suit different cultures and needs of America.

Permanent service.
Satellite segment.
Interconnection and cellular telephone networks.
Broadband.
Access to the Internet Backbone.

Video
Content distribution to cable head ends.
Contributing to content providers.
Content distribution network TV and radio services.
DTH.

Social Impact Services
Public and rural telephony.
Distance education.
Telemedicine.

Private VSAT networks
Additionally, Satmex offers through partnerships with various integrators and teleports, a wide range of solutions for internet access, private networks for voice and data services, video distribution, among others.

Occasional service
Coverage of special events (news, sports, entertainment, etc…).
Videoconferencing.
Distance education.
Educational TV.

MEXSAT
In November 2007 began to realize the strategic plan of satellite communications. At the request of the Office of Homeland Security Federal Government in May 2009 the project was presented in November 2009 and approved the budget by the Congress. In June

2010 Mexsat was approved by the National Security Council, in November 2010, the SCT appoints its dependence Telecomunicaciones de Mexico (TELECOMM) as operator of the system in December 2010 is contracted to Boeing Satellite System, Inc. to manufacture the three satellites. In June the company hires 2011se Ariane Space to launch the Mexsat 3, in July the company appoints 2011se AON-ISB as insurance intermediary.

METHODOLOGY

There are different models of planning, among others are those of Russell L. Ackoff, George Steiner and Hazan Ozbeckhan which we use for Technology Management Satellite System Mexico, we propose the model of Hazan Ozbeckhan because in its first phase is the problem is not known, it is therefore necessary to determine it, however in the two previous models is assumed that the problem is already known and it have to arrogate to resolve. it.

In the first phase of the model is applied a technique Kawaquita-Hiro (TKJ) which consist in a questionnaire that is sent to experts on the subject in order to asked what are the problems that exist in the Mexican satellite system, the information collected is analyzed and classified into groups with similar problems, should be careful to note that the answers are not solutions, and suggestions etc., each group of problems are designated with a name that encompasses all the problems that belong to them and undergo a process known as analytic hierarchy consisting in comparing pairs, ie, those experts comparing the importance of a problem with all other of each group and using a computer program is taken out the relative importance of each of the problems in each group whose sum is 100% of the problem to which they belong. The absolute importance of each problem is the multiplication of their relative importance by the relative importance of the global problem of which group they are part; absolute importance is ranked from highest to lowest and the resulting sum is known as the sum of Pareto, which is to consider 20% of the absolute importance of the most important problems and forget the other 80%. The technique Ishilkawua is applied to the 20% of the absolute importance of the most important problems, this technique is supported by TKJ in which experts mentioned the possible reasons that causes the problems of Mexican Satellite System.

The detection of problems, trends and the future course is what is known as baseline projection, the planning regulation includes the design of the goals, the system's mission, objectives and the ideal, the next stage is the strategic planning in which we want to know how we will solve the problems and the organizational planning consist to know what resources will solve the problem considered. Finally we close the cycle of the model with the evaluation stage in which we have to measure the scope of application of the model.

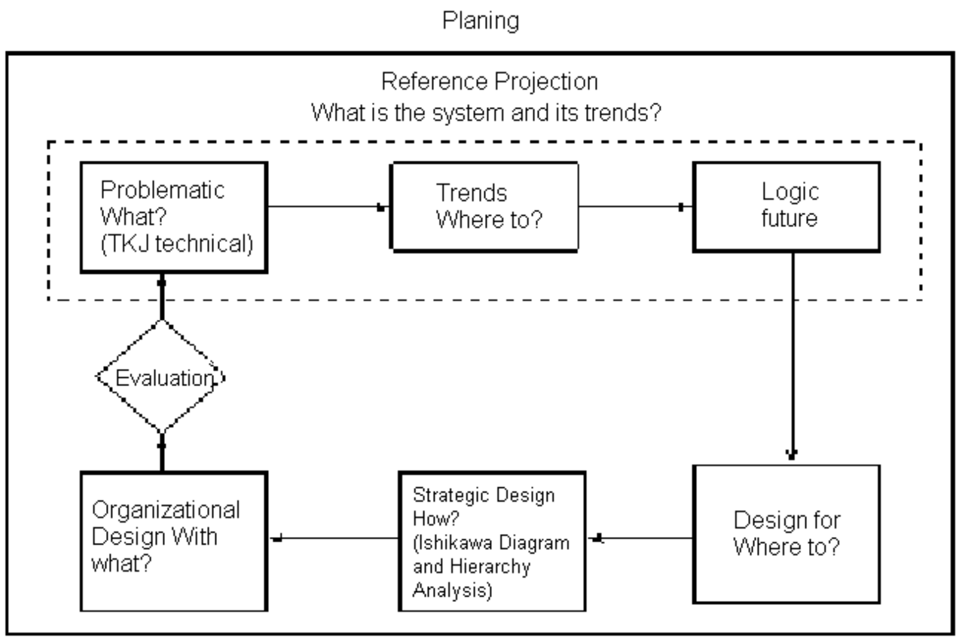

Figure 1. Hazan Ozbeckhan model

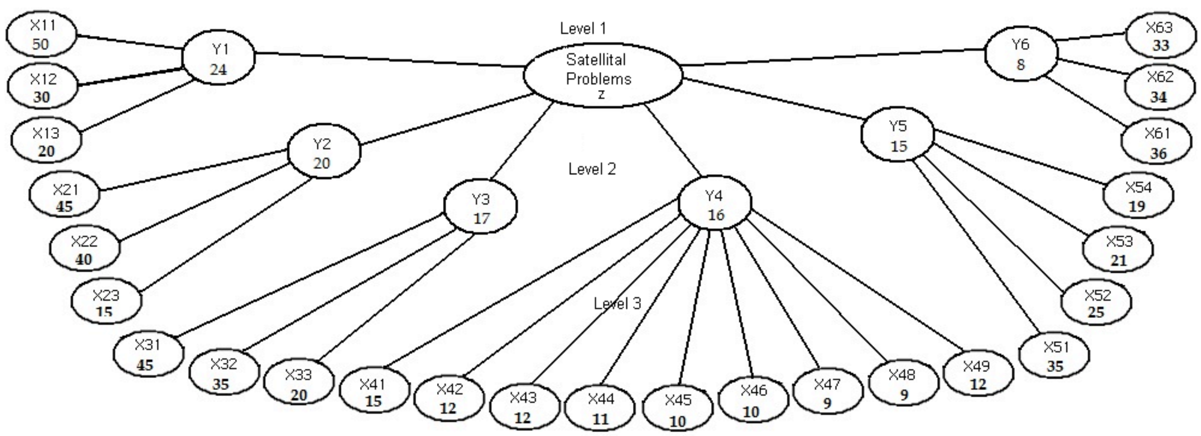

Figure 2. Hierarchical tree structure of the problem of Mexican Satellite System (Mexsat).

Table 2. Relative and absolute importance of the issue of Mexsat.

Problem	Relative Importance	Absolute Importance %
Y1 Policies satellite telecommunications	24	
X11 Policies national telecommunications	50	0.5*0.24*100= 12
X12 Policies of regional communications	30	0.30*0.24*100 =7.2

X13 Global communications policies	20	0.20*0.24*100 =4.8
Y2 Regulation of telecommunications satellite		
X21 National regulations	45	0.45*0.20*100 =9
X22 Regional regulations	40	0.40*.20*100= 8
X23 Global regulations	15	0.15*0.20*100 =3
Y3 Information Security in satellite communications	17	
X31 Virus Attacks	45	0.45*0.17*100 =7.65
X32 Participation of hackers	35	0.35*0.17*100 =5.95
X33 Efficiency in the satellite communications systems.	20	0.20*0.17*100 =3.4
Y4 Little growth in the industry of satellite telecommunications	16	
X41 Difficulty of adapting to new technologies	15	0.15*0.16*100 =2.4
X42 Integration of services	12	0.12*0.16*100 =1.92
X43 Lack of services	12	0.12*0.16*100 =1.92
X49 Product Quality	12	0.12*0.16*100 =1.92
X44 High costs	11	0.11*0.16*100 =1.76
X45 Low quality in some services	10	0.10*0.16*100 =1.6
X46 Coordination between Web producers in Mexico to offer the user a secure network	10	0.10*0.16*100 =1.6
X47 Incompatibility of services	9	0.09*0.16*100 =1.44
X48 Low impact of broadband services in the country	9	0.09*0.16*100 =1.44
Y5 Training	15	
X51 Low self-esteem in staff work	35	0.35*0.15*100 =5.25
X52 Deficiencies in staff training	25	0.25*0.15*100 =3.75

X53 Deficiency of knowledge of staff at the engineering and other areas	21	0.21*0.15*100 =3.15
X54 Companies without research departments	19	0.19*0.15*100 =2.85
Y6 Inadequate infrastructure especially in rural areas and small towns	8	
X61 Areas	36	0.36*0.08*100 =2.88
X62 Equipment	34	0.34*0.08*100 =2.72
X63 Work material	33	0.33*0.08*100 =2.64

Table 3. Sum of Pareto to consider 20% of the Mexsat problems.

X11 (1)	12	12%	12.00
X21 (2)	9	21%	21.00
X22 (3)	8	29%	29.00
X31 (4)	7.65	37%	36.65
X12 (5)	7.2	44%	43.85
X32 (6)	5.95	50%	49.80
X51 (7)	5.25	55%	55.05
X13 (8)	4.8	60%	59.85
X52 (9)	3.75	63%	63.60
X33 (10)	3.4	67%	67.00
X53 (11)	3.15	70%	70.15
X23 (12)	3	73%	73.15
X61 (13)	2.88	76%	76.03
X54 (14)	2.85	79%	78.88
X62 (15)	2.72	81%	81.60
X63 (16)	2.64	84%	84.24
X41 (17)	2.4	86%	86.64
X42 (18)	1.92	88%	88.56
X43 (19)	1.92	90%	90.48
X49 (20)	1.92	92%	92.40
X44 (21)	1.76	94%	94.16
X45 (22)	1.6	96%	95.76
X46 (23)	1.6	97%	97.36
X47 (24)	1.44	99%	98.80
X48 (25)	1.44	100%	100.24

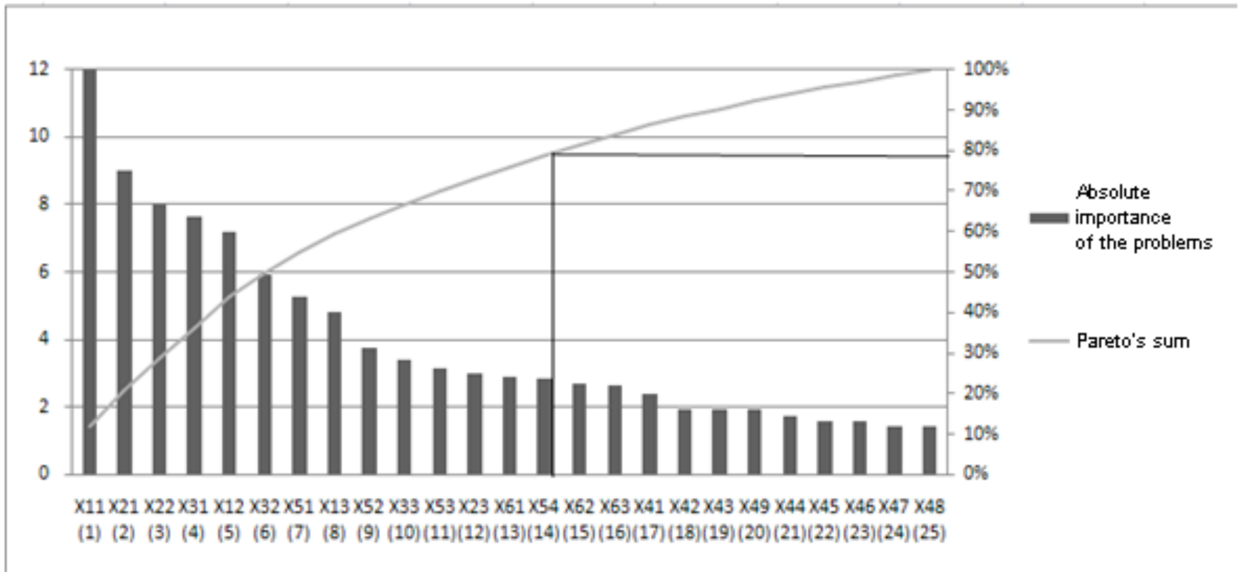

Figure 3. Problems sorted in descending whose sum of absolute importance gives us the sum of Pareto of the Mexsat issue.

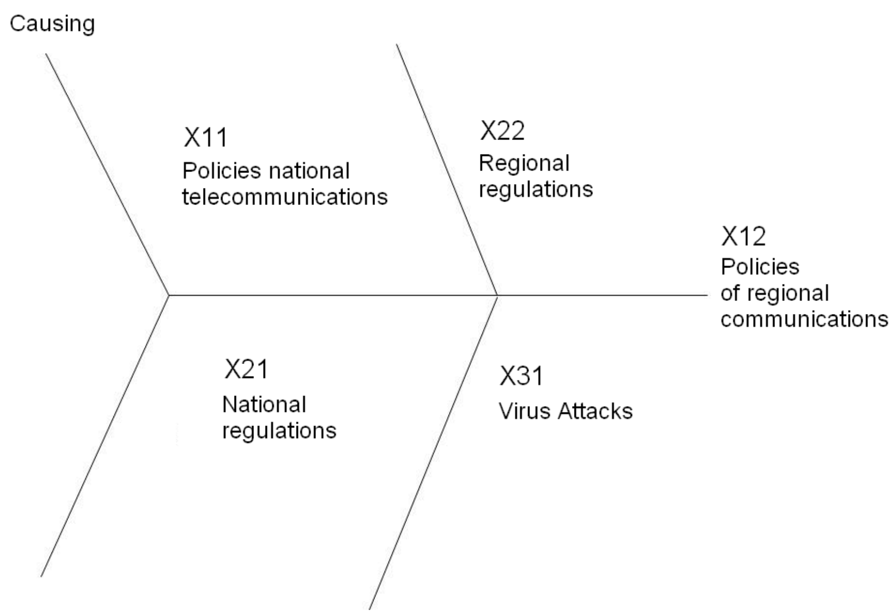

Figure 4. Skeleton of fish to determine the causes of major problems Mexsat.

RESULTS

Applying the previous technique, several problems of the Mexican Satellite System were detected, which were ranked, grouped and classified. Detecting problems is the first step the following steps are the stages of planning (normative, strategic and organizational), closing the cycle with the assessment of planning model Hazan Ozbeckhan for continuous improvement to enable the Mexican state regulate more efficiency of satellite communications in our country.

CONCLUSIONS AND IMPACT

At first it was considered that the state must have control of communications in Mexico as a result the Mexican satellite system was handled by TELECOMM later was privatized and acquired by the company Satmex, the company has been inefficient which caused him to miss the 109.2W geostationary orbit which was assigned to Canada. Satmex currently have not replaced the Solidaridad 2 satellite and Satmex 5 that should be out of orbit and if those positions are inactive is a risk of losing its, for this reason the Mexican government created the program Mexsat to try to put out the fire with pretext of continuous improvement in communications and national security in the Mexican satellite system.

Solutions and advantages of the new platform Mexsat:

1. Flexibility for adaptation and technological change:
   -Continuity of services during the lifetime of the satellite.
   -Easy technological upgrading, reduction of additional inverts
   -Support for new systems.
   -Increases the capacity of migration of equipment.

2. Broadband and Convergence of services:
   -Provides high-speed satellite connectivity.
   -Transport of multimedia information: voice, internet, video and geotagging.

3. Ubiquity:
   -All services at any time, anywhere. Allows communications by air, land and sea.
   -Homogeneous coverage of voice, data and video products across the country.

4. Autonomy of operation:
   -Control and Communications Security.

5. Technological legacy:
   -Upgraded the communications platform of national security agencies with a technologically advanced system.
   -Allows the planning and development of communications systems in the long term.

Table 4. Comparative performance between Solidaridad and the new system Mexsat.

Attribute	Solidaridad (where we are)	Mexsat (where we will be)
User Capacity	7 200 (mobile services) 300 (fixed services)	110 000 (mobile services) 10 000 (fixed services)
Equipment size	large	Discrete
Weight of the terminals	5 a 10 Kg	0.07 a 0.8 Kg
Video	No	Yes
Speed	4.8 Kbps	448 Kbps
Number of beams	1	More than 200
Frequency reuse	No	Yes

Possibility of reconfiguration	No	Yes (by Software)
Broadband Internet	No	Yes
e-mail	No	Yes
Short messages (SMS)	No	Yes
Communications standards	Closed (owner)	Open

Table 5. Effects on the economy and national development.

Attribute	Solidaridad (where we are)	Sistema Mexsat (where we will be)
Advanced services with high data transmission capacity.	Support the development of national security operations.	Voice, data, video, Geo.
ew communications backbone.	Platform of knowledge and information.	High-speed connectivity between different communication platforms.
Connect isolated areas of telecommunications.	Integrate isolated populations of the information society.	Internet, broadband, IP telephony connectivity
Provide remote services.	Improve living conditions of the population with health services, education and government services.	E-education, E-medicine, e-government transactions online.
Interoperate with other networks to deliver new mobile services.	Improving the country's competitiveness by increasing the availability of infrastructure and cutting-edge communication services.	Mobile services that leverage the use of satellite networks and cellular networks.
Services to various federal government agencies.	Generate economies exploiting a single system across multiple instances of national security and social insurance	Fixed and mobile voice, data and video for national security. Rural telephony, telecommunications services and call centers for social coverage.

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