

THE RECURSIVE FOCUS OF THE VSM TOWARDS THE JOINED ENDEAVOURS TO THE IMPLEMENTING OF THE GPS IN THE STATE OF MEXICO

Adrian E. Elizalde-Medrano, Oswaldo Morales-Matamoros, Jorge A. Rojas Ramirez

Instituto Politécnico Nacional, México

E-mails: elizalde05@yahoo.com.mx, omoralesm@ipn.mx, jrojasr@ipn.mx

ABSTRACT

It is a known fact that the mankind is working hard with all together endeavours to reach the solution to whatever kind of problems emerged from the social, political and economical dimension. So we can argue that the society needs viable patterns according to the specific features of each situation in particular. In fact the Methodology of Viable System Model VSM states that can maintain the current system in a separated way, but also maintain its identity facing the changes of the environment and considering the variety of possible states within a great diversity in order to know and measure its complex part and it's a proposal to attack its essential points. Besides the VSM shows in every recursion level the possibility to improve the productivity level of trucking because of the implementing of the GPS system. Meanwhile the viability applies its properties through the law of requisite variety of Ashby and in this way It will allow to manage the complexity of this system.

Keywords: VSM, GPS, trucking, diversity, requisite variety.

INTRODUCTION

The modeling of systems has evolved through several methodologies, techniques, metaphors and mainly by paradigms (Wittgenstein, 1975) applied to the systems science. Furthermore these paradigms revolutioned amazingly (Kuhn, 2007) through the meeting of the scientific disclosures along the time.

In this document we find that the viable stuff of all the procedures is within a group of elements dynamically related in time according to some coherent patterns. Besides it is important to say that if we talk about reclusiveness then we will express all related to the levels of organization in any enterprise. So it is prudent to mention the three main principles of the organization (Beer, 1979):

First: Managerial, operational, environmental varieties, diffusing through an institutional system, tend to equate, they should be designed to do so with minimal damage to people and cost.

Second: The four directional channels carrying information between the management unit, the operation and the environment much each have a higher capacity to transmit a given amount of information relevant to variety selection in a given time than the originating subsystem has to generate it in that time.

THE VSM IN GPS

Third: Wherever the information carried on a channel capable of distinguishing a given variety crosses a boundary, it undergoes transduction and the variety of the transductor must be at least equivalent to the variety of the channel.

Since the last three principles we can argue that the Viable System Model is recursive (Tejeida, 2010) because it allows to explain the general productivity management because of the implementing of the GPS System in the trucking of the State of Mexico.

In the following diagram we can observe that the system of trucking is integrated in a subsystem called land transport. Moreover this subsystem is integrated in a bigger system called transportation means which is regulated through SCT and TELECOMM (SATMEX) and all of them in the State of Mexico and within the coverage of the Mexican Republic.

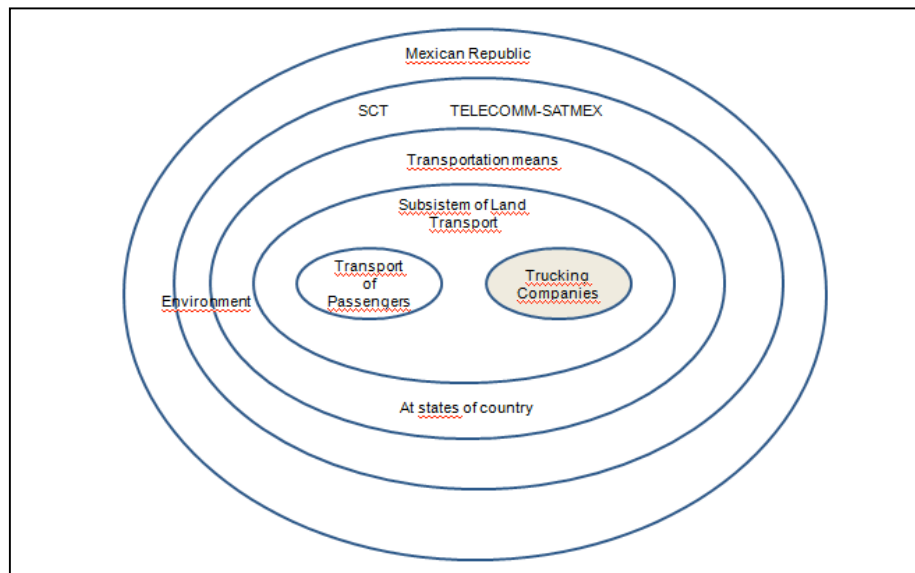


Figure 1. Location of Systems related to the trucking system

The trucking in the State of Mexico have mainly a characterization of problems very specific (Mintsis et al, 2004) which is detailed as follow:

- 1.- It has a number very high in empty trips from one origin to one destiny to all its routes.
- 2.-It has an amount very high of costs of operation such as oil, engine, wheels, and maintenance in general.
- 3.-There is not a logistical planning enough to satisfy the demand of trips in the Justing Time.
- 4.-There is not a control on the vehicle units to avoid the abandon of the assigned routes.
- 5.-There is not a network of security against robes and accidents in Mexico.
- 6.-Therer is not a way of communicating reliable between dispatch center and the vehicle unit.

THE VSM IN GPS

7.-The 90% of the roads in Mexico have many problems in their structures.

That's why the trucking companies will be monitored, positioned, communicated and controlled with the help of the system GPS which functions with satellital trilateration (Marin, 2010) as shows the following figure:

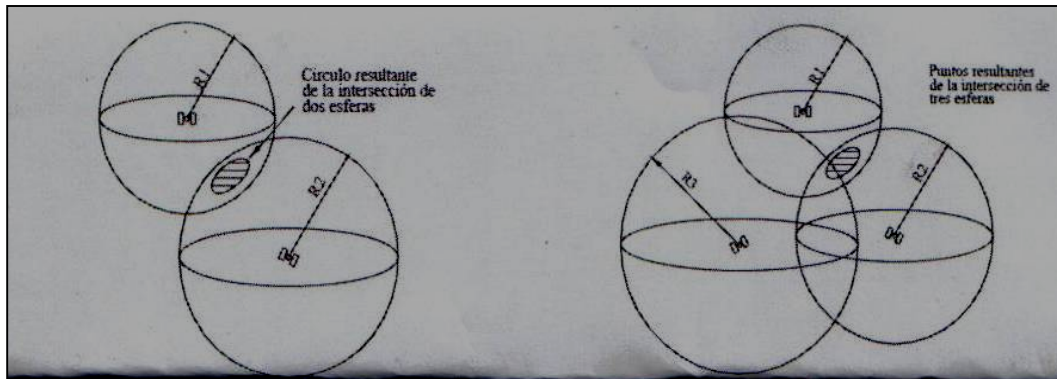


Figure 2. The Superimposition of satellites and the calculated secant

So it is important to maintain that the **GPS** is the science that **the exact position of space** along the external layer of the world. The spatial segment function by trilateration that is a basic principle of the geometry that permits to find a specific place if we know the distance from other known points. (Casanova, 2001). The geometry behind this is very simple to understand in a bidimensional space (as circles) or in a tridimensional space (as spheres).

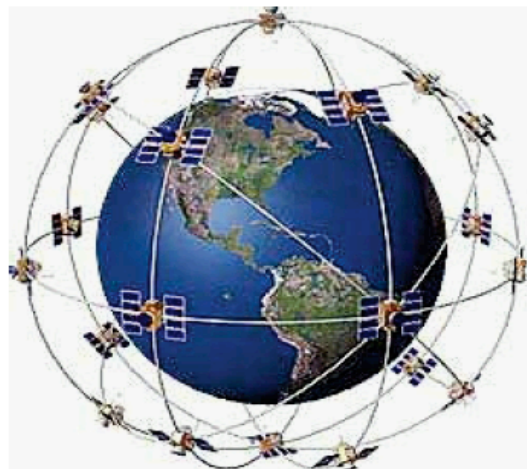


Figure 3. The Spatial Trilateration

The exact position in the earth is calculated through four satellites: The first one satellite is superimposed on another. Afterwards another is superimposed in a perpendicular way on both and thus we obtained a secant that explains that the first point of the secant is a point no

THE VSM IN GPS

detected in the infinitum but the third one point explains the exact position on the main layer of the earth with a little error of three meters in real time so it is nothing in relation to our calculation. The fourth satellite only read the position and information emerged from the trilateration function. In fact to operate under the trilateration function the segment spatial uses Navigation Satellite Timing Ranging NAVSTAR to control the twenty four satellites in six orbits with four satellites each one of them. (Casanova, 2001 et.al.) . The orbits are located approximately to 55° respect to the equator to monitor the needs of the twenty four hours of duty a day. The platform of satellites has a utility life of ten years. (Sacristán, 2007).

DESIGN OF VIABLE SYSTEM MODEL

According to the cybernetic pattern of a viable system model there are five subsystems interactively involved in some organization that is capable of maintaining its identity and transcending independently of other similar organizations within a share environment. That's why We applied part of the Viable System Model (Espejo and Harnden, 1989) because it is a recursive model (Tejeida et al, 2010) and it allows to set the next proposed Cybernetic diagram:

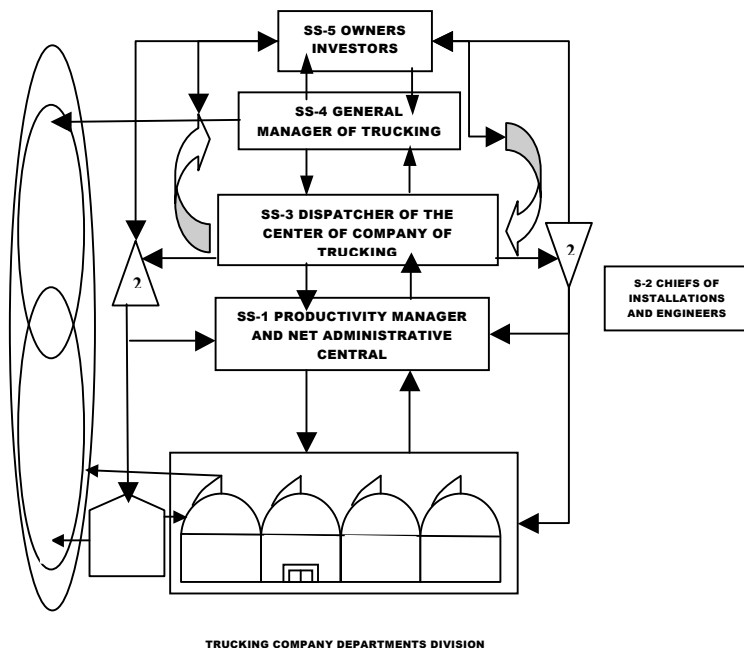


Figure 4. Cybernetic diagram of Subsystems of System GPS based in VSM

THE FIVE SUBSYSTEMS OF THE VIABLE SYSTEM MODEL

Within this Logistical Process of trucking the ability of this system to survive depends on its ability to create requisite variety known as the number of possible states that a system is capable of exhibiting through the theory of the viable systems. (Beer, 1995). Somehow the subsystems are explained as follow:

THE VSM IN GPS

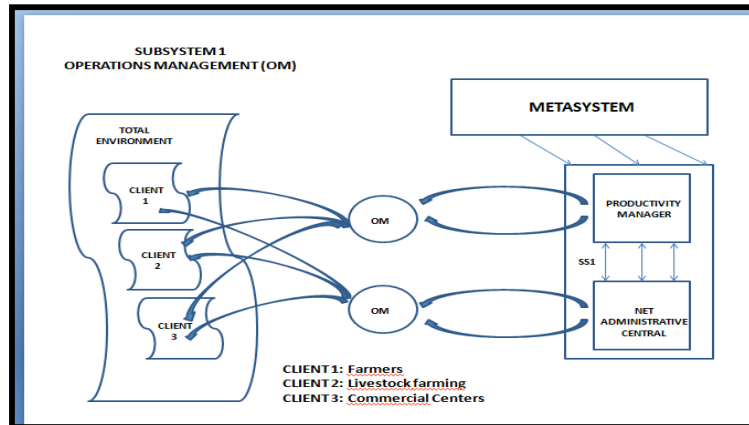


Figure5. Cybernetic diagram of Subsystem 1

SUBSYSTEM 1.-It is integrated by the productivity manager and the Net Administrative Central. it produces the system by itself and consists of various components directly concerned with carrying out all the tasks of the whole system.

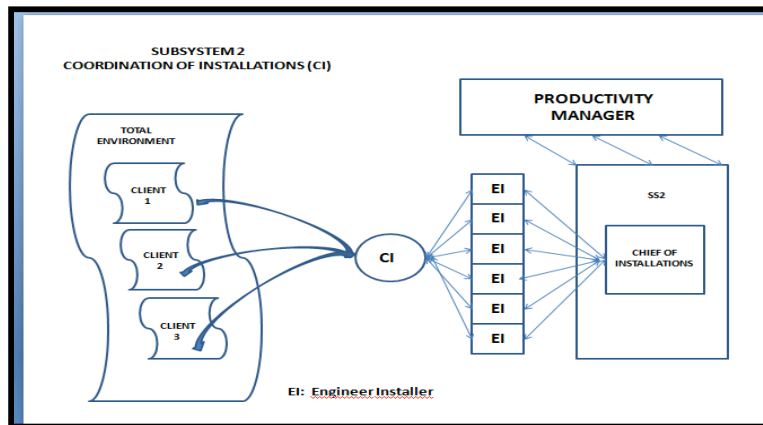


Figure 6. Cybernetic diagram of Subsystem 2

SUBSYSTEM 2.-It is integrated by the chief of installations that coordinates the activities and their engineers whom install the GPS in the trucks and give maintenance to the equipments. This subsystem has a function of coordination and its main task is to assure that the various operative departments of a trucking company act in harmony and with the maximum efficiency. it must supervise the interactions among departments and the stabilization to obtain a balance response from system 1.

THE VSM IN GPS

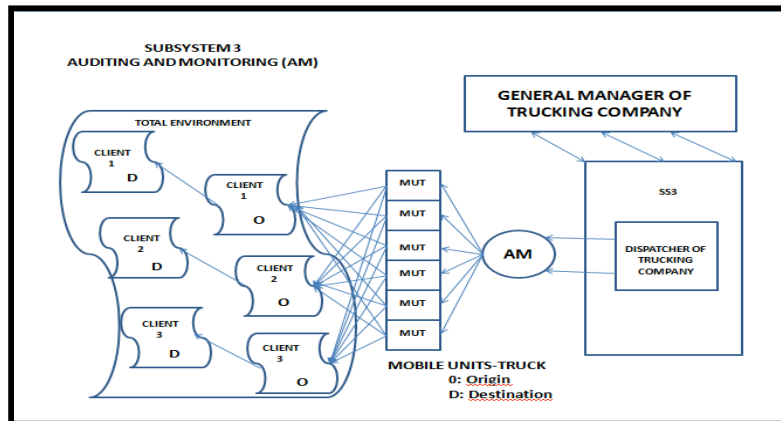


Figure 7. Cybernetic diagram of Subsystem 3

SUBSYSTEM 3.-It is integrated by the computer of the dispatch center in each company that bought the GPS which is supervising and monitoring the vehicle units on the route. This subsystem has a special command control function. It interprets the policies in an internal focus from the system 2 and monitoring and auditing reports of positionment, data and communication. The main task of this system is to give a direct access to the state of the trucks in the operations of the system 1. The capacity of chiefs in subsystem 3 of carrying out the control function needs to be in balance with the current information flowing through the data ware house DWH of the trucking company.

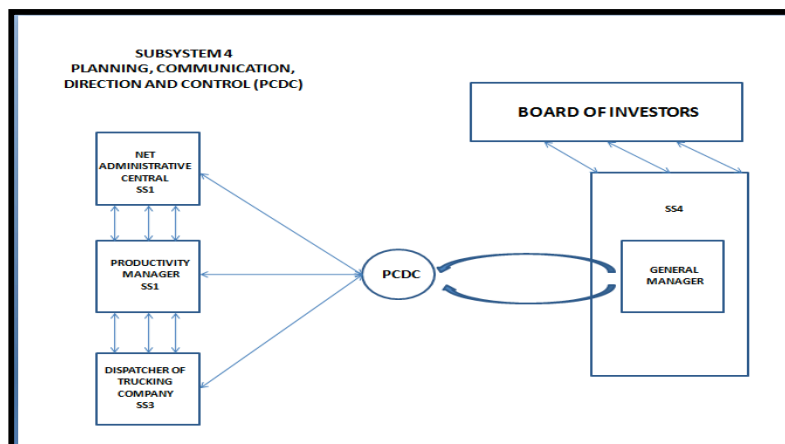


Figure 8. Cybernetic diagram of Subsystem 4

THE VSM IN GPS

SUBSYSTEM 4.-It is integrated by the general manager of the company of trucking who is the person that controls and take all the main decisions. This subsystem has to support the research and development function of the company and its main task are: To translate and report instructions between subsystem 5 board of directors and the lower level subsystems. This subsystem is the point where internal and external information can be applied together. Activities such strategic and logistic planning, research and development and public relations must be located there.

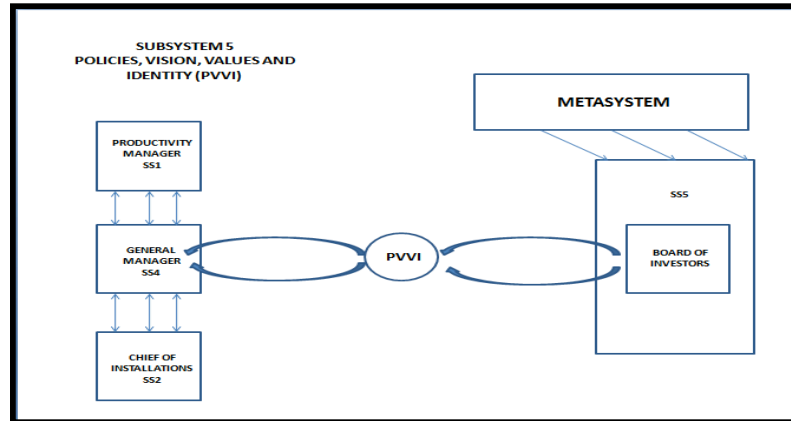


Figure 9. Cybernetic diagram of Subsystem 5

SUBSYSTEM 5.-It is integrated by the main owner or the main investors in the group. This subsystem is responsible for the direction of the whole system. it is where identity and coherence are focused by the board of directors. The subsystem five must ensure that the service system adapts to the external environment while maintaining an appropriate degree of internal stability.

THE VSM IN GPS

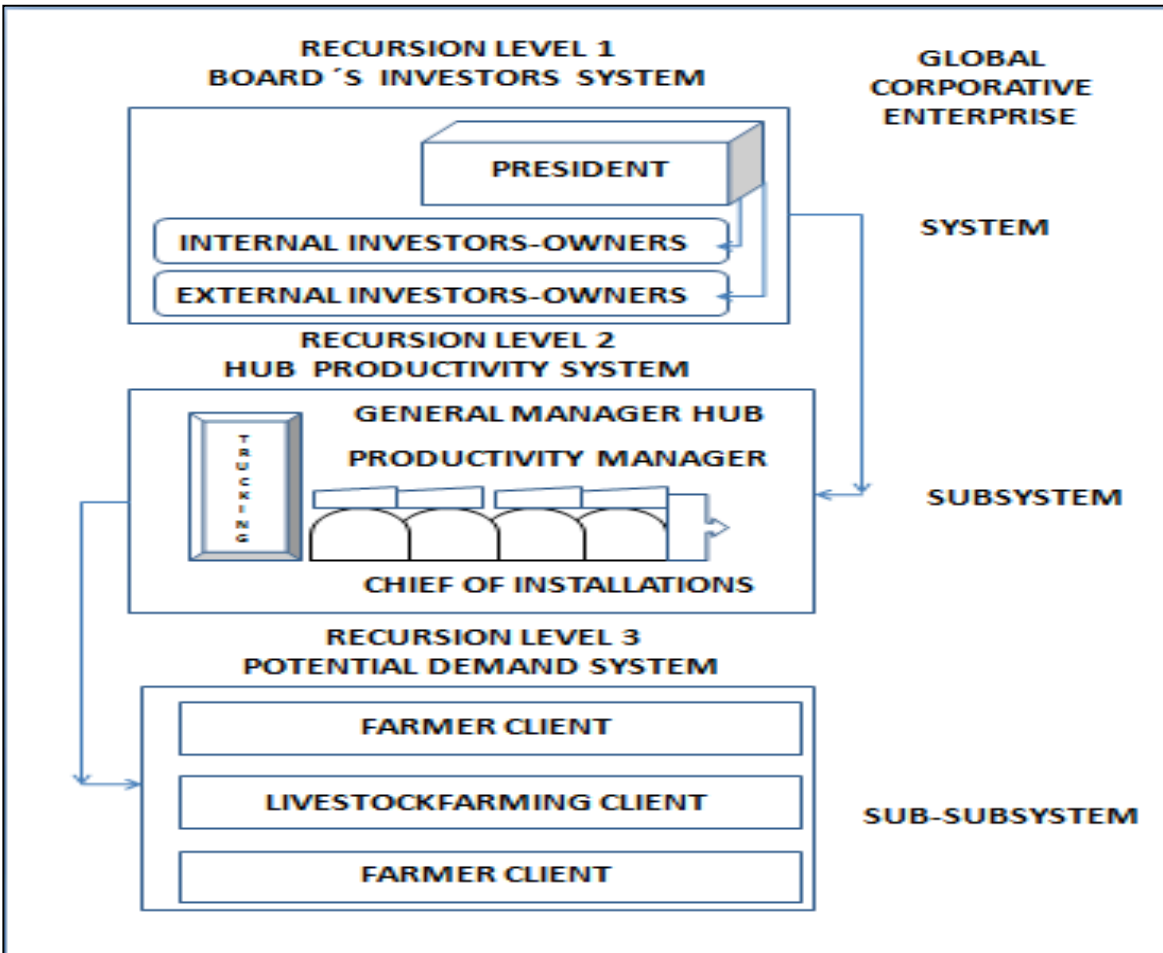


Figure 10. The General Productivity System with three recursion levels

The figure 10 shows the whole level of organization (recursiveness) and the control hierarchy (Beer, 1995 et. al) that the trucking enterprises will have if the general productivity management is stated through a holarchical set of entities whose properties characterize every one of involved levels. Certainly it shows three recursion levels for a general productivity system.

During the last Decades the level of productivity in the trucking enterprises was decreased or increased in a direct relation to the total of trucks that each company had to attend the services demand. However with the apex technology of the GPS System the trucking companies will enhance their productivity levels in a direct relation to the quality of the duty and the viability (Beer, 1979 et al) of the whole productivity system that will allow at the same time to work to all the operational elements of the system in question.

THE VSM IN GPS

PRELIMINARY CONCLUSIONS

Chart 1. Comparative stage of the System GPS in a intercontinental level.

INDICATORS	U.S.A. CASE	MEXICO CASE
Bought equipments in a National level	40,000	28,000
Time for sale	3 years (first years)	18 years (from 1992 to 2010)
Main supplier	QUALCOMM	OMNITRACKS
Applying of Productivity A.	100%	5%
Usage of financial support	100%	50%
Problems on roads	0%	80%

The Viable System Model because of it is a recursive methodology (Tejeida et al, 2010) it adapts to the solutions of the problems in the trucking generating a wide requisite variety in the implementation process of the technology GPS in the State of Mexico and although the applying follows in process, the hoped results are the followings:

Chart 2. Hoped Results with the implementation of the System GPS

INDICATORS	MÉXICO CASE
Bought equipments in a national level	84,000
Time for sale	2010 a 2020
Main Supplier	QUALCOMM
Applying of Productivity Analysis Report	100%
Usage of financial support	100%
Problems on roads	0%

We hope to implement an important number of GPS equipments in a period of ten years from 2010 to 2020 with the aid of the productivity analysis report. Besides we will support to the trucking companies to get financing to buy the required equipments. Thus we will focus the logistics of the chain of supplies towards a new paradigm to get the best success. Moreover the trucking industry will reach to improve the optimum of Pareto according to the obtained results. The incomes will have a persistent and positive tendency and the expenses will have an anti persistent and negative tendency. So the incomes will increase and the expenses will decrease and the Pareto optimum probably will improve from a 80%-20% to a 90% 10%.

THE VSM IN GPS

REFERENCES

- Beer, S. (1979) *The Hearth of the Enterprise*. Wiley: Chichester U.K.
- Beer, S. (1995) *The Brain of the Firm*. Wiley: Chichester U.K. Second Edition.
- Casanova, L.(2001) *Sistemas de Posicionamiento Global GPS* Capítulo 10. REGVEN. La Nueva Red Geodésica Venezolana equivalente al SIRGAS Sistema de Referencia Geocéntrico para las Américas. Instituto Geográfico de Venezuela Simón Bolívar,
- Espejo, R. and Harnden, R.(1989) *The Viable System Model. Interpretations and applications of Stafford Beer's VSM*. John Wiley and Sons. Aston University, Birmingham, U.K.
- Kuhn, (2007) T. *La Estructura de las Revoluciones Científicas*. Fondo de Cultura Económica. FCE. México.
- Marín, C.R.(2010) *Trilateración Satelital Topografía Plana*. Universidad Diego Portales. Magister en Ingeniería de Vías Terrestres,
- Mintsis, G. Basbas, S. Papaioannou, P. Taxiltaris, C. Tziavos, I.N. (2004) Applications of GPS Technology in the land transportation System. *European Journal of Operational Research*. 152(2004):399-409.
- Sacristán, F.(2007) Structure of the Spanish System of Satellite of Communications. *Journal of Applied Research and Technology* 5(1):58-62.
- Tejeida, R. Badillo, I. Morales O. (2010). A System Science Approach to Enterprise Resources Planning Systems. *System Research and Behavioral Sciences*. 27(1):87-95.
- Wittgenstein. (1975) *Über Gewissheit* also "On Certainty". Basil Blackwell. Oxford, U.K.