HOLISTIC COMPLEX-SYSTEMS MODEL TO SOLVE ECONOMIC-FINANCIAL ISSUES (CSMEFI)

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Abstract

The economic crisis hits the substantially prevailing financial environment globally. The financing structure of a country, a company or an individual may serve as a mechanism to amplify or reduce the impact, making it necessary and urgent to take measures aimed at reducing it.

A general financial economical system includes many factors: goods and services, input costs, profit or loss, international trade (import and export) industrial productivity, output quantities, pricing level, employment rate, capital expenditure and financial market, wealth, expectation, consumption pattern, among others. In this system, both, corporate and public sectors are linked by financial markets to make fund flow from public to business. Financial markets are complex systems which have been analyzed under a hard system thinking; from a holistic view, it can be said that there have been many critical issues unsolved in today´s world; thus, it is necessary to develop and/or apply models where the whole system is considered by including all types of relationships among all the participants. The goal is to achieve a holistic view of the main problem and develop a description of each stakeholder.

As a starting point of a new dimension of holistic thinking, to understand the dynamics of global financial market as well as its role in the economical system and to find new ways for analyzing them, it is proposed a system view to set the basis to identify and examine the dynamics of global financial and economical markets system and their relationships under a holistic, complex and soft view by introducing a new proposed model elaborated from Soft System Methodology. It is supposed this new model in order to analyze market systems and also general financial systems.

Keywords: Complex system, Economical system, Financial markets, Holistic systems.

Introduction

Complex systems are highly interrelated systems. This system includes the relations among its elements and its characteristics that bond them within the collection, in this way, the system´s properties can be described as a whole and its comprehension is possible when studying them in an holistic approach, so that, the relevant are its relations and the groups that emerge from them (Bertalanffy, 2006; Ackoff, 1999).

A Subsystem (microsystem) is a small system within the big system. It has its own purpose and contributes to the purpose of the system. It has its own parts and components which are determined by the overall purpose of the system for which it is a part. A suprasystem is a system that includes both, the system and its subsystem, such as the political system, educational system, cultural system and economical system. A macrosystem is the largest system that includes all of them. The elements of a system work as a whole in an integrated or interrelated manner. When it is analyzed a specific system, is has to be considered System Boundaries, these determine what is to be included or excluded from the system. Any kind of system is always situated in an environment; when talking about companies, this is what surrounds the organization which includes the social, political, and economical factors that impinge on the organization.

Many organizations attempt to implement solutions such as software development, statistical analysis, mathematical optimization, among others, where are used hard or closed systems methodologies where the human factor is hardly referred to as an important agent, since one of the major barriers in the solution of a problem is the aversion to change that occurs in the individual. On the other hand, it is also regular to implement solutions without previous studies and without the application of any methodology causing greater uncertainty in the effectiveness of the solution and the costs (Riemenschneider, et al., 2002). Some other approaches in the systems research area are proposed in (Alvarado, 2012). Current economical financial system has a global reaching due to the markets and intermediaries are connected through a vast international communication net, in such a form that the transfer payments and securities trading can be done in a continuously way. In this system funds flow from the agents that have a surplus or redundant of cash to the ones with a deficit, the most of the times the cash flows occur through the financial intermediaries (Samuelson, 1979; Samuelson & Nordhaus, 1980).

It is difficult to identify the best method for a given problem; this may depend on the nature of the non-linearity, system´s size, if the amount of control used or the time required for the method is important, and some other factors (Beeler, et al., 2000). The economical-financial system is a complex system that has been analyzed under a hard system approach, however, due to the global character of the economical-financial system and social, economical and political decisions that are taken on the subject, it is necessary to study it, and as much as possible, to model it by using soft

system methodologies that allow to characterize the way its interacting elements are producing its global dynamic.

Since it is critical to find all actors involved in earlier phases to know the problem and its context, before using or developing a rigid methodology that generates data and information necessary to support in the decision-making of the human factor, in this paper, it is proposed a methodology to set and analyze different economical-financial problems under a soft systemic approach that helps to take better risk decisions in a holistic integrated form (figure 1).

Although the methodology of economical – financial system was created from some stages of Checkland's Soft Systems Methodology (SSM) (Ckeckland, 2001), it is difficult to consider it as a metamethodology, because the way it is proposed the implementation of the stages differs from the way Checkland mentions them. A metamethodology must be combined ideas and procedures from a family of methodologies (González, et al., 2005).

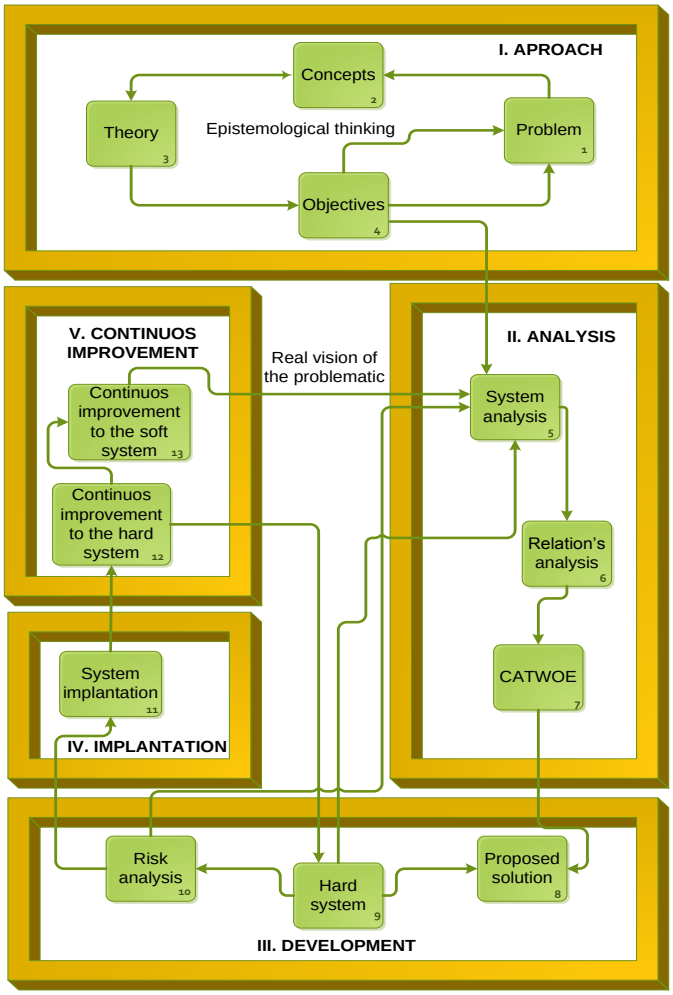

Figure 1.Systems methodology to solve economical-financial problems
Source: Compiled by Authors

Materials and Methods (Development)

Part 1 Epistemological thinking

Epistemology is the discipline that studies knowledge´s nature, its possibility, its essence and its origin. Epistemology considers three elements taking part of knowledge´s process: cognitive subject, cognitive object and the image or mental representation of the cognitive object that emerges in the human being by means of functions and intellectual operations, so that abstraction, conceptualization, developing proposals, among others, (Hessen, 2003).

Scientific thinking came up from the human necessity to explain every natural phenomenon which was attributed to magic powers, at the same time, it came up from the Aristotelian theology, that refers that the whole is greater than the sum of its parts. Since Descartes, scientific method had progressed under two related assumptions: a system could be broken down into its individual components so that each component could be analyzed as an independent entity, and the components could be added in a linear way to describe the totality of the system (Bertalanffy, 2006; Bertalanffy, et al., 1987). Von Bertalanffy proposed that both assumptions were wrong; on the contrary, a system is characterized by the interactions of its components and the nonlinearity of those interactions.

Systems theory is a transdisciplinary study of systems, it integrates natural and social sciences that covers living and nonliving systems through isomorphism principles, leaving intact the inner interactions, studying the system as a whole and covering its complexity (Van Gigch, 1991). Systems´ view was based on two fundamental ideas: first, all phenomena can be viewed as a web of interrelations among its elements. Second, all systems, whether electrical, biological, economical or social, have common patterns, behaviors, and properties that can be understood and used to develop greater insight into the behavior of complex phenomena and to move closer toward a unity of science. System philosophy, methodology and application are complementary to this science. In systems science the term methodology means the creative approximation to understand the phenomena of reality (Badillo & Peón, 2007). Methodology sets the models, strategies, methods and tools that systems theory and philosophy use in order to set the basis of studying systems.

There have been developed several systemic methodologies, the most of them from qualitative models where fundamental importance is data interpretation under a hard system approach. But when systems talk about people there is necessary to study them under soft methodologies.

STAGE 1: PROBLEM

A diverse number of methodologies have been submitted for supporting decision-making within organizations, trying to standardize and integrate data from

organizations to exploit in a simple way, detail its representation and extract relevant knowledge. Nevertheless, if the appropriated tools are applied incorrectly, the process to extract fundamental data is poor causing the entire system fails in its objective to provide a correct solution (Romero & Alberto, 2009). Consequently, it is important to identify financial problems generated in organizations, governmental institutions and private companies.

It is possible to consider that there is a financial problem when there are money loses due to different situations. This causes the necessity to develop tools to take decisions or to generate measures that contribute to solve the problem. However, frequently, the origin and the solution of the problem it is not necessarily where it is causing conflict. Due to this reason, the first stage of this methodology is to begin with a general analysis about what and why it is happening, locating the environment, the existing necessities, what is causing the problem and the difficulties belonging to the problem under study. It is important to mention that in this stage the expert's subject opinion is fundamental to understand the environment where the problematic situation is generated.

STAGE 2: CONCEPTS

Due to the proposed analysis under a systemic view, the concepts of systems theory must be used, just as the involved words in the system under study, to establish meanings and ideas in order to integrate new knowledge and experience with the previous one, it means, there are defined all the involved concepts in the problematic, including necessary ideas to understand the situation and its solution which do not have a special name in the first language. Data are required to provide information about the system´s operation, besides to forecast the environment in which the systems would operate in the future.

STAGE 3: THEORY

As the second stage, systems theory is established as requisite to analyze the problematic situation. Afterwards, there is specified the subject of knowledge or application field that problematic situation is referred to, defining the important and necessary theories to proceed to the solution in next stages, deducing and stipulating other facts by means of rules and arguments which form the basis to analyze the system and the solution.

STAGE 4: OBJECTIVES

After identifying the problem, there are set the characteristics of the environment within the system must operate and identifying the necessities to be covered to proceed with the solution.
In the most cases, the objectives of a system present several conflicts, so it is recommend making a list of necessities of involved people or situations of the problem and, based on them to set the objectives.

There are several methodologies to set objectives; they can be used in this stage. If a specific methodology is unaviable.

Based on the particular objectives it is essential to formulate a clear, real and specific general objective. The most accurate the objectives are the easiest would be to define a measure or indicator of the systems solution performance.
In this stage there is a feedback to the first one due to the most cases some considered necessities cannot be covered with the problem solution or emerge new necessities that were unconsidered.

Part 2. Real Vision of the Problematic Situation

Business Economical and Strategic Direction require research methodologies to analyze the complexity generated by the business phenomena. It is therefore essential the combination of different nature information: qualitative and quantitative, subjective and objective, both internal and external to the own studied phenomenon (Villareal & Landeta, 2010). Throughout the second part of the methodology, it is proposed a qualitative analysis of the environment in which is presenting the problem and the involved actors, and then perform an analysis and quantitative development that generate fit results to solve the raised problems.

STAGE 5: SYSTEM ANALYSIS

Due to the structure of the financial systems, the problem is related with human activity causing untidy systems, so that, it is important to set the system with all its components: agents, subsystem, environment, suprasystem and macrosystem.

Step 1. People, institutions and other factors taking part of the problem must be set as involved agents. It is recommendable to make a chart to define all the agents by icons to represent them with its corresponding description (see Figure 2).

Step 2. After defining agents, they are set within the context through holons, by identifying and enumerating the existing relations from subsystem up to macrosystem (rich vision); it is recommendable to make a chart to define all the agents with the goal to use them in the rich vision of the system as it is shown in figure 2, in order to understand much better how the system is composed and how it operates. It must be established the relations among the involved agents and observed emergent relations. Within the emergent relations it is important to take into account the negative feedback necessary to balance the system.

As it is observed in figure 2 there are one-way and two-way relations that are represented by two arrows in opposed directions among the agents, depending on the interrelations they keep.

ICON	AGENT	DESCRIPTION
System		
1.		Agent 1
2.		Agent 2
3.		Agent 3
4.		Agent 4
5.		Agent 5
Environment		
6.		Agent 6
Suprasystem		
7.		Agent 7
Macrosystem		
8.		Agent 8
9.		Agent 9

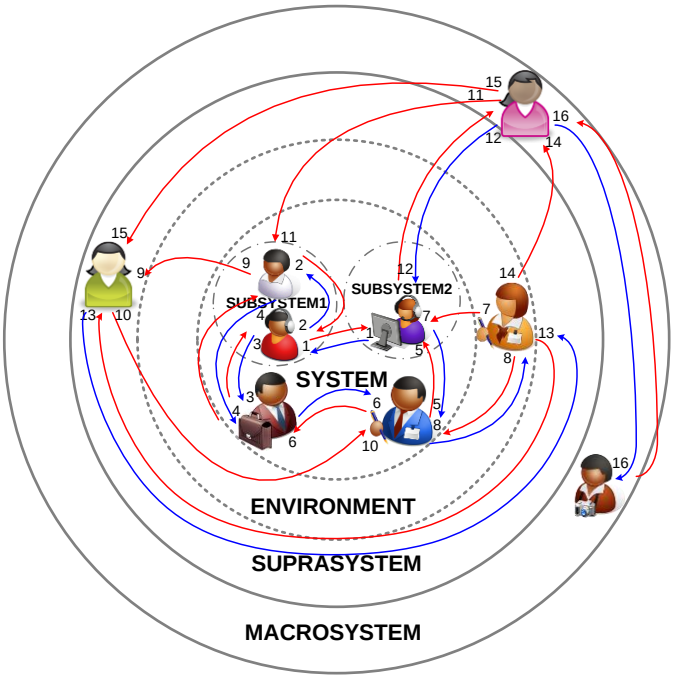

Figure 2. Rich Vision. Unstructured System
Source: Compiled by Authors

STAGE 6: RELATIONS' ANALYSIS

In this stage it must be identified the way the problem would be confronted by setting its necessities. It has to be analyzed one by one the represented relations in rich vision, with the purpose of identifying and understanding each one's operation and the conflict among the agents if exists.

From analyzing relations among different agents it could be possible to notice that its response is different according on the necessities and objectives; so that, in this stage there are eliminated relations and agents that are irrelevant or essential to solve the problem. So then, to restructure the new situation, as is shown in figure 3

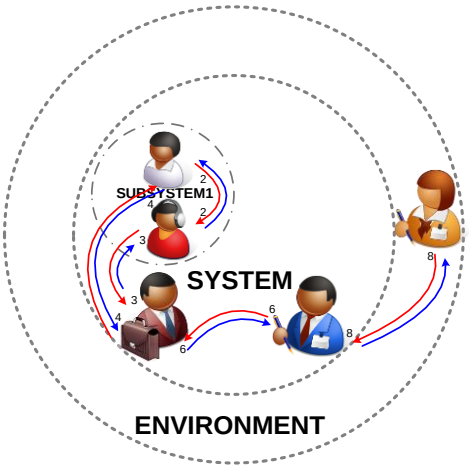

Figure 3. Rich Vision. Structured System
Source: Compiled by Authors

STAGE 7: CATWOE

This stage is based on the third stage of Checkland´s Soft System Methodology (Ckeckland, 2001; Checkland & Scholes, 1994) named root definitions of relevant systems; root definitions are done as sentences to make a transformation from different perspectives based on six elements summed up in the acronym CATWOE (table 1).

Table 1. CATWOE

INITIAL	MEANING	DEFINITION
C	Customer	Involved agents who may gain benefits or disadvantages of a system.
A	Actor	All the agents that interfere into the system´s transformation. They transform the inputs into outputs and they perform the activities defined in the system. They could be the customers and the owners.
T	Transformation process	Is the conversion that agents make to transform the inputs into outputs.
W	Weltanschauung	It refers to the point of view from the customers and owners perspective, the positive or negative vision from the different roles to make the transformation process meaningful in context.
O	Owner	Each system has an owner who has the power to star and shut down the system (power of veto).
E	Environmental constraints	External elements that must be considered. They include organizational policies as well as legal and ethical matters.

Source: Compiled by Authors Based on SSM.

To classify the involved agents in the problematic situation, and to show the world view, letter W (Weltanchauung) from CATWOE. Figure 4 shows a general CATWOE vision in the model to solve economical-financial problems; where are split the positive and negative vision from owner's versus customer's point of view and transformation it is given a solution to a soft problem (it exists human activity) by using a hard system methodology.

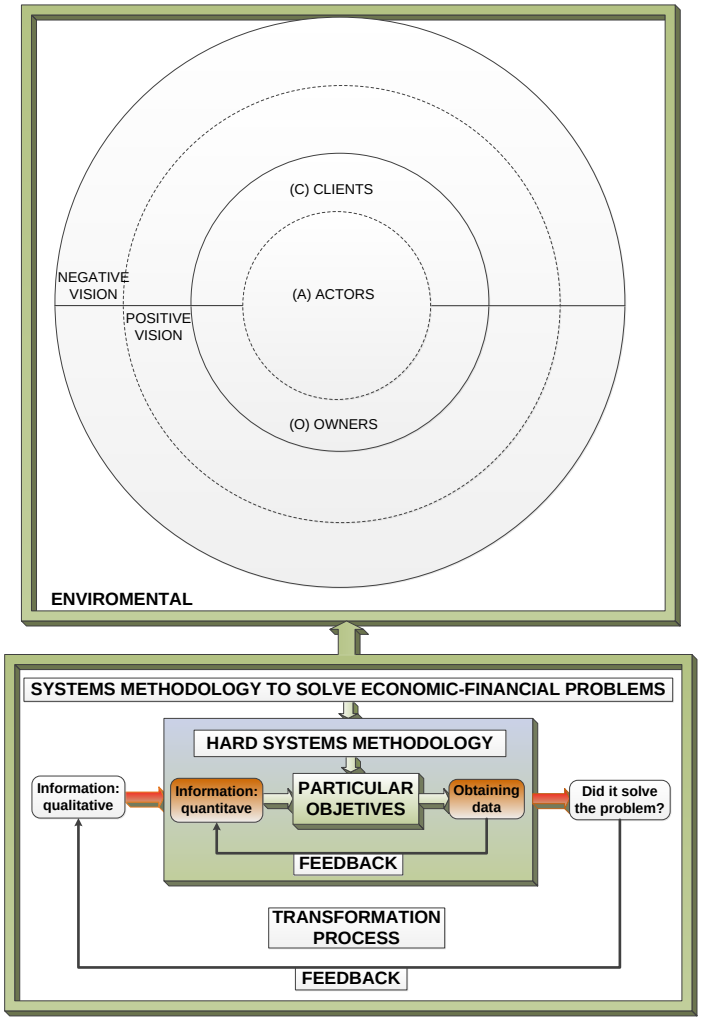

Figure 4.CATWOE schematize
Source: Compiled by Authors

STAGE 8: PROPOSED SOLUTION

After doing the qualitative analysis (stages 5, 6 and 7) it is proposed a suitable system implementation to the problematic solution (it is the solution system), taking into account the experts´ opinion, the directly involved people for accepting the project and the users of the system´s solution. In this stage there are new objectives to make the system solution, so that, it must exist a feedback to stage 3 (objectives of the system under study).

The way learners, readers, or researchers are attempting to establish whether the interventions proposed and implemented are beneficial or not, is by means of a process of scientific research, assessments or experimental studies in cases of study (Botha, et al., 2005). On the other hand, projects should have clearly defined the costs and benefits. Fact that emphasizes the importance of planning in a large number of assumptions about the project scope is needed to re-evaluate if the costs and benefits generated significant changes (Cao, et al., 2009).

STAGE 9. HARD SYSTEM METHODOLOGY

After making the qualitative analysis and based on the proposed solution of stage 8, it is necessary to develop a hard system methodology as a stage in the methodology for solving economical – financial problems. At this stage own specific branch of economic methodologies are used to treat and financier considering probabilistic and stochastic methods commonly studied or new proposals (Gao, et al., 2014, Yang, et al., 2009, Peng et al., 2009). In this stage, the hard methodologies that use an implementation in one of its steps must be simulate due to a risk analysis is proposed before implementing it in stage 11.

STAGE 10: RISK ANALYSIS

Within financial conflicts risk analysis is an essential element to be considered. There are new methods of risk management that have been designed to benefit the interests of large institutions that operate in the financial markets. It is impossible to reach a completely satisfactory solution to the posed problems for different reasons being aware the risk never disappears it is only managed seeking to develop methods intuitively plausible and effective in practice, both in historical evidence and in the current market (Nerouppos, et al., 2010).

Before implementing the solution system it must be taken into account if the financial vulnerabilities are meaningfully reduced in order to avoid some of these ones would exploit because of a threat. There exist several methodologies to apply risk analysis which can be used in this stage; in this one, it is done a comparison with the obtained results in the fifth stage and the obtained information from the simulation in the eighth stage; here it is possible to feedback stage 5 or to make the necessary modifications to the solution, or, in another case, to proceed to the implementation in stage 10. For the comparison see figure 5

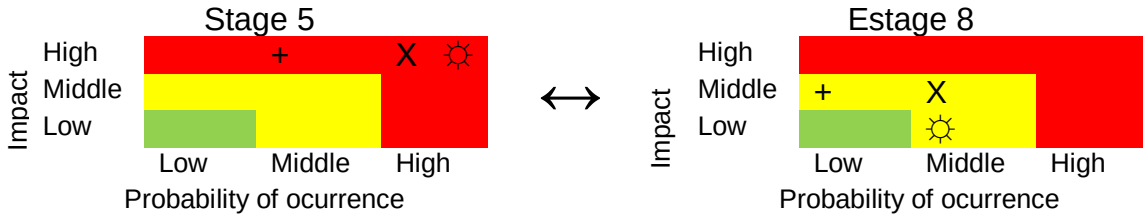

Figure 5.Risk Matrix
Source: Compiled by Authors

STAGE 11: SYSTEM´S IMPLEMENTATION

It can be observed in engineering and researching subjects that there are systems (such as the computational and artificial among others) where the major analysis is in the simulation step, and sometimes the implementation and simulation are the same step. On the other hand companies have to adapt to the new communication

technologies (Plana, et al., 2006), taking as a result of cost and time reduction in comparison with physical prototypes and experimentation (Shakeri & Brown, 2004), so that, in several economical-financial projects it is done a behavior analysis by computer simulation. For this reason, sometimes the implementation is done at the same time with applying the hard methodology system (stage 9).

It is necessary that all the proposed system would be well implemented in order to be useful. When having the final solution it must be emphasize specific proposals to take decisions. It is important to take into account that the implementation stage of the designed system is a part of the global design of the system, so that the results must be simple, direct and logic to show a precise plan to implant the system.

STAGE 12: CONTINUOUS IMPROVEMENT TO THE HARD SYSTEM

It must be detected the changes that are possible to make to the implemented hard system in order to improve it, if the feedback shows its perform is not the expected one and all the factors must be reviewed. So, in this stage there is a cycle of continuous conceptualization and changes to feedback stage 8, always to improve the hard system.

STAGE 13: CONTINUOUS IMPROVEMENT TO THE SOFT SYSTEM

As the previous stage it is necessary to detect possible changes in the general system in order to continuously improve the system´s perform; it is possible to find some important parameters to be changeable in the system design from the operation´s system. In this stage there is a feedback to fifth stage to represent the continuous conceptualization and changes to the soft system.
The questions in this stage are the same as previous ones focusing on soft systems.

Conclusion

A Holistic Complex-Systems Model To Solve Economic- Financial Issues and Its development was proposed and presented. While the application of the methodology described systems can result in extensive design process, resulting in an exploration of system requirements and system designed to adapt to these requirements.

The proposed methodology is based on some stages of MSS Checkland but specifically focused on the financial and economic area, which is why according to the implementation that comes to fill in step 3 can sometimes considered metamethodology, causing the MSPEF adaptable to any financial or economic system since some steps can be carried out jointly.

There are many benefits to using a hard systems methodology together with a methodology of soft systems in economic and financial problems, because the system is considered complex cultural and social. To build and develop a systematic methodology to troubleshoot and able to adapt to any system of that area can make

a correct and appropriate solution to issues raised with respect to risk, time, capital and processes.

Some of the cases where the proposed approach has been applied are:

1. MexDer case, a model is proposed to predict the future trend of the Mexican Derivatives Exchange (MexDer) by using Artificial Neural Networks developed in step 9 using hard methodologies. (Mota, 2012)

2. Afore case. A case of study on fund managers for Retirement (Afore), building, optimizing and covering (against market risk by volatility in the prices of various financial assets) a portfolio of investments that will reduce the loss of developed workers' savings for their future resources. (Contreras, 2012)

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