A VIABLE SYSTEM MODEL FOR MANAGEMENT OF THE ECONOMIC GROWTH

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ABSTRACT

In this paper we present a Viable System Model (VSM) approach in the field of economics with the purpose of bettering the understanding of this macroeconomic phenomenon. This paper contributes with the design of an VSM in economic science. Economic growth has been modelled to test main inputs that explain it, and to understand its behaviour. Most countries seek to increase economic growth because other economic variables improve, for example, the number of jobs increases, wages increase, or poverty decreases. The investigation first reviews the state-of-the-art, secondly it explains the methodology and the process followed, and finally it presents results. An alternative model to manage and understand economic growth is obtained. The results contribute to the economic growth theory.

Keywords: VSM, Soft System Methodology, Economic Growth

INTRODUCTION

The system of economic growth can be described by the set of forces that make it possible to increase productive capacities. These are the product of a set of elements, which associated accelerate production. We envision economic growth as a means, not an end, to achieve better levels of human well-being.

Economic phenomena are becoming increasingly complex and uncertain. Dealing with high levels of uncertainty is leading economic science to look for answers in other disciplines. Systems engineering offers an integral vision for dealing with the complexity of economic systems.

To handle this complexity in this research we propose the use of a Viable System Model (VSM). An economic system requires micro and macroeconomic information, at the national, regional and local levels, both from the government and from companies, and its rapid change produces social impact (Li, 2009).

The VSM offers high capacity systems management, is a derivation of the Theory of Organizational Cybernetics that focuses on the functions and cohesion of the system to ensure its viability (Adham *et al.*, 2012). In spite of the efficiency that VSM offers when facing problems, a significant amount of applications of this model were not carried out for the following reasons: 1) they had not identified the speed with the changes occur and 2) the problems are becoming more complex (Pfiffner, 2010)

The applications that have been developed around VSM are very varied. These range from aligning the organization's objectives to improving its internal cohesion (Awuzie and McDermott, 2016). The model has also been used to improve the quality of investigation, when the appropriate research approach is selected (Awuzie and McDermott, 2017).

For business environment, VSM has served to diagnose problems in financial companies by integrating communication, optimizing monitoring and improving management capacity and problem solving (Cezarino and Beltrán, 2009). This model has also been carried out by combining network analysis in the identification of business pathology's (Cardoso Castro and Espinosa, 2019). The VSM has also been used with models based on artificial intelligence such as artificial neural networks and Neuro-diffuse systems (Azadeh, Ziaei and Moghaddam, 2012; Álvarez-Molina *et al.*, 2015).

In the public sector, the model has helped in the coordination and administration of talent programs (Fang, Zhu and Zheng, 2015) as well as in the communication of sports information to young people by the corresponding ministry (Ben-Ali, 2011), and in the design of human communities considering sustainability criterion (Leonard, 2008). The Viable System Model promotes economic development through cooperatives to improve their management and integration with other sectors (Guarda *et al.*, 2018) and in the management of human capital and innovation in the hotel industry. (Núñez-Ríos *et al.*, 2018; Sánchez-García, Nuñez-Ríos and Badillo-Piña, 2018).

For field of economics economic growth attracts much of the organizational efforts of both companies and governments, this is especially true for underdeveloped countries. The speed of economic growth plays a preponderant role and growth is mainly given technological progress, such progress is understood as productivity-innovation which means that with the same resources of both capital, labor, inputs and energy can be produced more and with greater value (Spence, 2012).

Economic growth is one of the most relevant economic problems. There is empirical evidence that indicates as relevant several factors that influence their behavior of this phenomenon among these are:1) the positive effects of human capital (Ahsan and Haque, 2017; Altinok and Aydemir, 2017; Alvarado, Iñiguez and Ponce, 2017; Castells-Quintana, 2017); 2) investment in infrastructure (Ahsan and Haque, 2017); 3) income distribution (Rezai, Taylor and Foley, 2018); 4) the cultural diversity produced by immigration (Bove and Elia, 2017); 5) the negative effects of taxes (Chen *et al.*, 2017); 6) investment made by companies (Burger *et al.*, 2017); 7) technology and role in increasing productivity (Andergassen, Nardini and Ricottilli, 2017); or 8) environmental impact (Bretschger, 2017; Damania *et al.*, 2017).

From the context presented here it is assumed that economic growth can be managed under the framework of the VSM. The aim is to design a VSM for the management of economic growth based on Romer endogenous theory of economic growth (Romer, 1986, 1990).

METHODOLOGY WITH SYSTEMIC APPROACH

Modern sciences have been characterized by hyper specialization, to achieve this, they have developed sophisticated techniques and methods that allow to deepen the knowledge of each aspect of interest. This type of analysis integrates only a part of that reality, leaving aside elements that play an important role in the phenomenon being studied. Mobus and Kalton (2015) argue that system's science follows the branches of existing networks of relationships which makes it increasingly inclusive. Badillo-Piña (2011) points out that system's science is interdisciplinary and trans-disciplinary when studying abstract systems according to a *weltanschauung*.

Van Gigch, (2006) points out that "a system is a meeting or set of related elements" in such a way that most of the elements, be they are living organisms or not, are a system; some are subsystems of another more structured system and at the same time these can be the system of other subsystems. For Espejo and Reyes (2011) the system is the set of interrelated parts that we experience as a whole. The study of the systems is then related to the study of the whole, of the parts that make it up and the relationships between them.

Jackson (2003) argues that systemic thinkers consider monodisciplinary solutions to fail when faced with complex problems. The whole emerges from the interaction of the parts and it is this interaction that gives meaning to what emerges. Faced with this vision is the reductionist tradition that places the parts as the central element, fragmenting in order to understand the whole. This same author considers the systems are more than the sum of their parts, this does not mean that he is not interested in the parts; they interest them, but particularly those that make up the networks of relationships; the terms in which that relationship occurs and how they sustain the new entity, that is to say, the whole. The definitions presented in different systemic investigations agree that the phenomena studied under this approach are complex.

According to Mobus and Kalton (2015) they point out that complexity is linked to the hierarchical structures of systems, and they distinguish two types of complexity: realized and potential. The first of these it considers the number and type of components, as well as the number and nature of the components that are contained within its border; in the second, the potential complexity is the prelude to the realized complexity.

To the above we can add that the simple is everything that does not have many relationships nor structure; consequently, the complex would be defined as that which has an important amount of relationships, is very structured and many possible states of these relationships.

General Systems Theory is often confused with cybernetics. Von Bertalanffy (1976) argues that this is incorrect because cybernetics is based on the control of the information and feedback that systems send and receive; these systems can be more or less complex. Peón-Escalante (2015) points out that "complex organizations have an important impact on the integral transformation of the planet and all it's living beings, for better or for worse. The most complex or organized systems of social character are those that cause the strongest impact on the rhythm, orientation, and magnitude of the evolutionary changes made by man; they are determining for the future of the planet and quality of life of its inhabitants".

The economic system according to Luhmann (1996) is autopietic in the sense that it reproduces itself by means of payments; trade is the clear representation of such a fact, it implies that it can be at the same time a closed or open system if considered from a social approach.

The was developed by Beer (1972) and is inspired by Weiner research on control and communication between animals and machines. Ashby (1957) describes the mechanisms of cybernetics, as well as the elements that make it different; he proposes the concept of variety also known as Ashby's Law. The variety refers to the number of states that the system can present, it measures its complexity, that is to say, the greater the variety the greater the complexity; the internal and external variety must be the same (Adham *et al.*, 2012).

The VSM seeks to integrate the conditions necessary for any complex system to be viable, adjusting the external variety to the system with the internal variety (Leonard, 2008). This model nullifies the virtual difference between organizational structure and organizational processes (Pfiffner, 2010).

Thanks to this model the survival of the system, through the time product of the change in the environment can be guaranteed (Lewis, Feeney and O'Sullivan, 2007). Viable systems not only have the ability to survive, they also have the ability to respond to the uncertainty produced by their own environment (Awuzie and McDermott, 2017).

The VSM according to Stich and Blum (2015) rests on three principles:

1) Feasibility, which means that it is possible to react to internal and external problems in an appropriate manner.
2) Recursivity, is the self-organizing capacity of the structure.
3) Autonomy means that the system can act autonomously.

The VSM proposed by Beer (1972) aims to correct the problems of organizations. The requirements of viability are summarized in the five systems that Beer (1985) describes the systems in the following brief way:

- System 1 (S1). This system is made up of all the relevant operations that define it. It is integrated by operation units and management units that interact directly with the environment to achieve their objectives and maintain the viability of the system; this system can be recursive (Lewis, Feeney and O'Sullivan, 2007).
- System 2 (S2). It is the anti-oscillatory element, avoids S1 conflict derived from its performance and maintains the cohesion of the system.
- System 3 (S3). It is the local management. This system presents a derivation. System 3* (S3*) that performs monitoring/auditory functions. It is conceived as the auditor, obtaining information from S1. Verifies the fulfillment of the daily activities and is positioned in the here and now of the system.
- System 4 (S4). This system carries out the strategic management, it must have the capacity to adapt to the change, product of the tendency of the external environment that can compromise its viability. It coordinates the communication between S5 and S3.
- System 5 (S5). Ensures the identity and viability of the system.

Endogenous growth theory

As for the theory of growth in the present research it is adapts the endogenous theory of growth Barro and Sala-i-Martin (2004), starts from the assumption of the existence of two factors for the production of a good, which are: labor (L) and capital (K) in the production function, where Y is the national product:

$$Y = F(K, L)$$

This model also assumes a Coob-Douglas type production function:

$$Y = AK_{\alpha}L_{\beta}$$

Where A is an index of technological progress, it is constant in time (this to measure the effects of capital accumulation that is greater than 0, the coefficients α and β measure the elasticity of the national product with respect to the stocks of the factors. For this model, increasing yields are presented if and only if $\alpha + \beta > 1$ decreasing yields if $\alpha + \beta < 1$ and constant if $\alpha + \beta = 1$. However, for the neoclassical school, technology presents constant yields in K and L. If $\beta = 1 - \alpha$ and $0 < \alpha < 1$, then the production function with constant yields would be as follows:

$$Y = AK_{\alpha}L_{1-\alpha}$$

Since A is constant and flows from the outside thanks to the commercial opening; we can say that the only elements that could influence the growth of the product would be the factors K and L. This being one of the assumptions of the neoclassical model where the technology is exogenous.

VIABLE SYSTEMS MODEL FOR ECONOMIC GROWTH MANAGEMENT

One of the most important efforts in the intervention of an economic system was made by Stafford Beer in Chile during the Government of Salvador Allende in 1971-1973. Espejo and Reyes (2011) says it sought a holistic approach to directing the country's governance. What Beer was proposing, the authors argue, was not a classic centralized socialist approach, nor the Laisses-faire of the free market it was a third way. Beer was clear that an extremely complex society could neither be centrally planned nor left to the free play of market forces that assume uniform information and capabilities in society; if this happens this government would be doomed to failure. The third way proposed by Beer placed special emphasis on information and communication networks distributed on a platform where it provides decision-makers with the resources to coordinate their actions through the economy.

The main components of the VSM model for managing economic growth proposed in this paper are integrated into stage 4 of the Soft Systems Methodology (SSM) proposed by Checkland (1999). The previous stages of the development of this methodology up to the integration in the VSM are the following:

- Stage 1: Unstructured problem situation
- Stage 2: Structured problem situation
- Stage 3: Root definition of relevant systems

This author points out that the root definition is obtained from the relevant systems and has the purpose of naming the system, this is necessary in order to clearly understand what we are talking about and to have a structure to study.

For this research the root definition of two main relevant systems found on the stage 2 of SSM are as follows:

> *Sustainable economic growth management system to achieve higher growth rates through the design of relevant actions and strategies for capital investments and effective management of human resource.*

As previously stated, the importance of the economic growth system we are proposing here lies in the fact that it improves the quality of life of those who participate in this process; since it increases the profits of the companies generating jobs; increasing the income of the workers, and consequently reducing poverty levels or improving the quality of life as a whole.

System 1: instrumentation

According to the endogenous theory of growth, the system is integrated by three main factors that determine economic growth: technological progress (A), capital (K) and labor. We will not include technological progress in our system since it assumes that thanks to the commercial opening the index remains constant in a determined time. Therefore, the two factors that are integrated to the VSM will be capital and labor each one as System 1. The decision to include them as relevant systems are justified in the above mentioned theory of growth.

The systems developed below are taken from Beer (1985) VSM proposal. In Fig. 1 the two systems one are shown, in a) the S1 of capital is shown and in b) the S1 of labor is shown, also the integrations of the environment are visualized with the operative units represented in the circle and this in turn the management unit represented in the square figure.

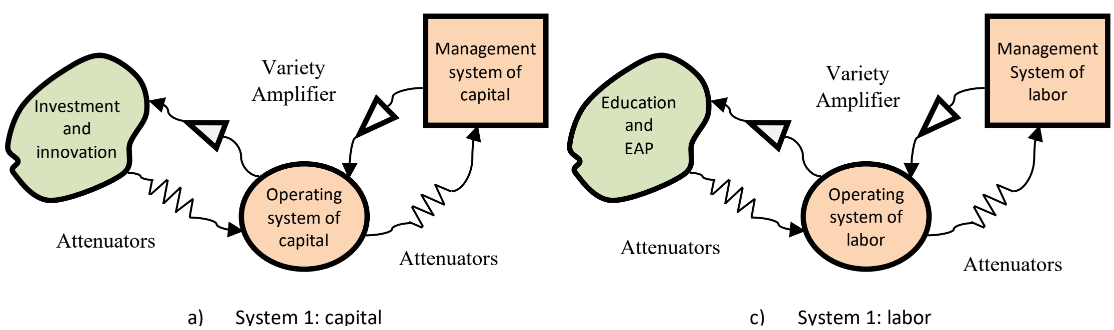

Fig. 1. Systems 1: capital and labor operating systems

The first S1 called capital operates two main elements such as investment and productive innovation. With respect to investment, it is financed from private savings (S), the government budget surplus (T-G) defined as the difference between tax revenue (T) and expenditure incurred (G) and external indebtedness (X-M) defined as the difference between exports (X) and imports (M). Innovation is a measure that translates into innovation and is also represented as technological progress.

The second S1 called labor refers to the activity carried out with the purpose of producing and/or adding value to production. In relation to the labor, the main elements that make it up are the Economically Active Population (EAP) and the human capital represented by the level of education.

The integration of S1 is carried out through communication channels called variety attenuators and variety amplifiers. The purpose is that the variety of environment is equal to or less than the operational variety each S1. In addition, the variety of the operational systems such be is equal or less than the variety management. Citing to Beer (1985) "Managerial, operational and environmental varieties, diffusing through an institutional system, tend to equate; *they should be designed to do so with minimal damage to people and to cost*"

System 2: coordination

Since its objective is the optimal functioning of the units, in the labor unit, it coordinates the efforts that promote the formation of human capital both in educational institutions and companies; in the capital unit, it coordinates the strategies that allow to increase investment through private savings, government surplus and external indebtedness in the same way as the strategies that increase innovation in order to improve productivity. S2 oversees planning, variety and culture of the system.

System 3: operational management

The part of the System three corresponding to the policy operating unit has the following functions:

- It enforces laws, rules and regulations.
- It checks out the sustainability of the S1
- It verifies that the goals are achieved in each of the process units.
- Negotiates the resources applied in each operating unit of the system and their dosage.
- Carries out audits to verify compliance in what is called the S3*.

System 4: strategic management

We will call this system the Commission for Systemic Economic Growth (COCRES). It compares the objective of the ideal system with reality. It takes into account the conditions prevailing in the external environment to adapt changes in the system of economic growth. It designs and implements the strategic plan that allows adapting the system's responses to external adversities in order to achieve the proposed goals.

System 5: policy

This is where the high-level decisions affecting the system of economic growth are taken. It is the brain of the system and as such establishes the policies, mission, vision and values of the system.

The integration of all systems makes up the VSM. This allows us to direct all efforts to make sustainable economic growth viable through the interconnection of all roles and functions of the system. This integration can be seen in Fig. 2.

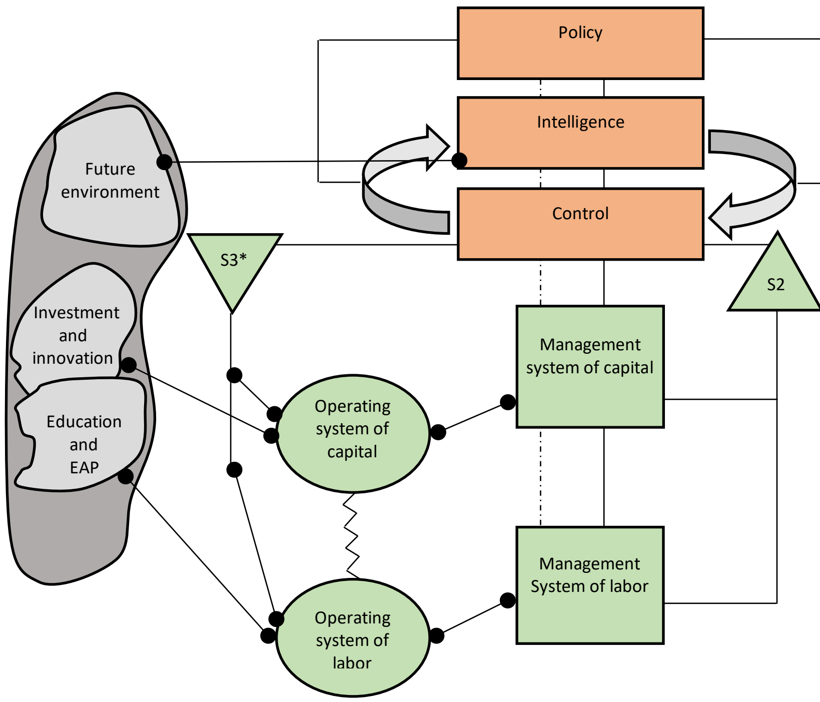

Fig. 2. VSM for management the economic growth

CONCLUSIONS

This paper proposes a systemic approach to VSM to manage economic growth based on the theory of endogenous economic growth. The economic growth system was designed to achieve the proposed objectives by integrating the VSM into the Checkland SSM. By knowing each of the roles and functions of the system and integrating them to achieve their purposes. This would improve the conditions of the economic system for the benefit of society.

The VSM can be recursive, however, in the present research only the model is developed with a single recursion. Future works would allow us to expand the number of recursions of the system to reach an optimal level of management and control of economic growth.

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