ECOSYSTEM MODELING FOR SUSTAINABLE MANAGEMENT

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Abstract

Setting new coordinates in modeling in order to ensure sustainable development in the context of the Europe 2020 strategy requirements / Horizon 2020 is a priority for protecting natural resources. The current challenges are in identifying the key aspects of IT processes, economic and ecosystem problems to ensure sustainable development. The main objectives are: a. understanding that creation and dissemination of complex system are the basic factors of economic growth; b. modeling ecosystem should take into account a strategy based on memetic engineering, bounded rationality and "Just in time" decisions. Among the conclusions: a. ecosystem modeling should take into account a strategy that sets out the way forward, focus effort, ensure consistency and flexibility; b. sustainable management has to provide a balance between socio-economic and ecological-economic systems.

Keywords: *ecosystem, memetic engineering, sustainable management, bounded rationality.*

1. Introduction

Setting new coordinates in modeling in order to ensure sustainable development in the context of the Europe 2020 strategy requirements / Horizon 2020 is a priority for protecting natural resources. The current challenges are in identifying the key aspects of IT processes, economic and ecosystem problems to ensure sustainable development. The main objectives are: a. understanding that creation and dissemination of complex system are the basic factors of economic growth; b. modeling ecosystem should take into

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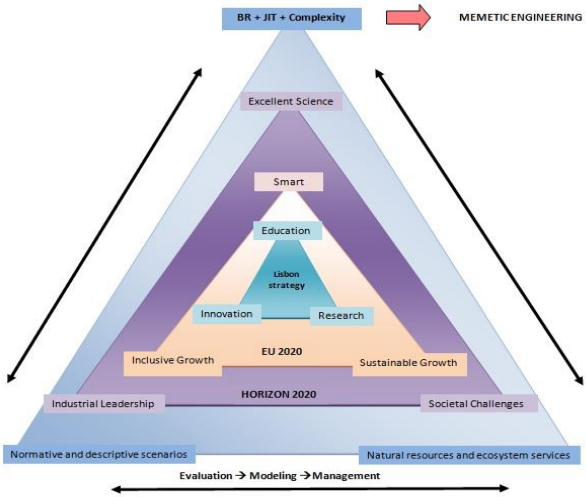
account a strategy based on memetic engineering, bounded rationality and "Just in time" decisions.

This research paper is a point of intersection in fields such as decision support systems, intelligent systems, resource management and statistics. In a knowledge-based society, the creation and dissemination of complex systems are the basic factors of economic growth. Europe 2020 strategy focuses on three priorities: intelligent growth (innovation, education and digital society), sustainable growth (competitiveness, climate, energy and mobility) and inclusive growth (jobs and skills, combating poverty) [20]. It becomes evident that a population that is aware of the importance of this strategy generates minimize costs in other public sectors.

Strategic thinking, being smart by association with the creative thinking, operates for periods of 3-5 years or even up to 10 years, as a reasoning process that can generate new solutions and build mechanisms for their implementation. By evaluating competitive advantages, risks and barriers that exist or may arise during the implementation of the strategies proposed by Horizon 2020 (Figure 1), elements of an organization's weakness can be turned into strengths and threats in the external environment - the opportunities.

Figure 1: Integrating development of socio-economic and research strategies for European Union 2020 – logical diagram



Every year, people working in decision-making must consider new parameters when dealing with the management of ongoing projects and planning new ones, being able to understand the impact and opportunities of each project. Carbon emissions, water availability and biodiversity are just some of the relatively new areas that attract increasingly more detailed control. The concept of joining these areas impact assessment is named *ecosystem services*. Ecosystem based services will become in the coming years, a standard category of performance measures [17].

Standard MEA (Millennium Ecosystem Assessment – [27]) offers four categories of ecosystem services:

• Providing services: goods and products resulting ecosystem,
• Regulating services: natural processes established ecosystem,
• Cultural services: non-material benefits obtained from ecosystems,
• Support services: functions that maintain the other services.

Ecosystem services are the benefits provided by ecosystem functioning health services and safety of people

2. Rationale

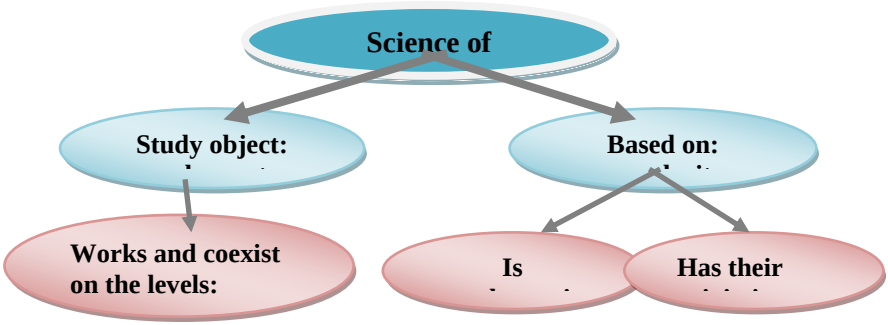
This research paper proposes an approach based on memetic engineering, bounded rationality, "Just in time" decisions and complexity to help in promoting a more efficient economy, in terms of resource use, greener and more competitive. The experimental model capable of reaching goals is to develop a management system that allows management and modeling data provided by environmental specialists, relevant to the sustainable management of natural resources and ecosystem services.

Goods and services that ecosystem provides, are vital for maintaining the welfare and future economic and social development. Their disappearance will require the adoption of costly alternative [24]. It is necessary to ensure a higher degree of awareness among decision makers and people in terms of the economic value of ecosystem goods and services. The relationship economy - environment should be optimized, and the proposed model seeks to draw attention to this decline in order not to be necessary in the future paying a huge price. The environment is the most comprehensive public good, as it provides support life on earth, sources of raw materials for the economy, landfill sites and threats to individuals and corporate social and human .

Sustainability Science (fig. 2) is based on the concepts of sustainability and sustainable development (H. Komiyama, K. Takeuchi,

2006) and general purpose includes assessment, reduce and minimize the consequences of human impact on planetary systems [25].

Figure 2: Connection between sustainability and complexity



The study of complex systems is a new approach to science that investigates how relations between the parties give rise to collective behaviour of a system and how the system interacts with its environment and form relationships [1].

The objectives of this paper, in accordance with the European framework program Horizon 2020, are finding answers to the questions "Do we take the best decisions in economic terms without take into account the depletion of natural resources? Or "Best economic decisions take into account the ability of self-regulation and support of ecological systems?". Sure, we all want to live in a clean environment in a well-balanced and safe to use non-renewable resources in a responsible manner and not to leave future generations without resources, but contribute through our actions in carrying them? Sustainable development is the ability of human society to ensure the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Report, 1978).

3. Defining main concepts

In an attempt to reduce environmental failures due to economic growth, here will be defined basic terms to understand the need of thinking, model and design ecosystems by transdisciplinary perspective.

A short definition of a meme might be "an idea, behavior or style that spreads from person to person within a culture" (Meme, Merriam-Webster Dictionary, [21]). Memes acts as a transport unit of cultural ideas, symbols or practices that can be transmitted from one person to another through writing, speech, gestures, rituals. Supporters of the concept regard memes as cultural analogues to genes that self-replicate, evolve and respond to selective pressures [8], [5].

Memetic engineering is a term developed and invented by Leveious Rolando, John Sokol and Gibran Burchett while they investigated and observed people's behavior after being exposed intentionally (knowingly and unknowingly case) to certain thematic meme. Memetic engineering is the creation and development of theories or ideologies based on an analytical study of society, culture, their way of thinking and the development of their minds, the change of human beliefs through different ways of thinking [22]. In the study of ecosystem, can be identified positive meme (e.g. specific habitat requirements) and negative meme (e.g. hydropower development, poaching, pollution, etc.).

Bounded rationality present the idea that in the decision-making process, the rationality of individuals is limited by the information they have, cognitive limitations of their minds, and finite time that they have to make a decision. This term was proposed by Herbert A. Simon as an alternative basis for mathematical modeling of decision-making process, as used in economics, political science and related disciplines; complete rationality as optimization, decisions concerning a completely rational process to find the optimal choice, given the available information [7]. Using "What-if" decisions it was tried to gather all the possibilities that bounded rationality cannot manage (we live in an open, heterogeneous, dynamic, and uncertain environment, [5]).

The term ecosystem is characterized by its components: physical, chemical, biological, economic, social, cultural, spiritual. The assessment of this system is a comparison between economic and social benefit and ecological loss. Description of ecosystem state is performed using Level III indicators (indicators of environmental or ecological, socio-economic indicators), indicators of level II (environmental groups on environmental factors / categories ecological-economic systems and indicators socio-economic, health and culture) and core indicators (indicators biophysical environment, economy, social, health and food, for culture).

Ecosystems provide human socio-economic systems, resources and services, their use should be within the carrying capacity and self-regulation of ecosystems ([3]), their overcoming generates environmental degradation [2].

4. Research method

Research methodology appeals to identify the key aspects of ecological-economic processes and information to ensure sustainable development. Model based on the evaluation of ecological-economic relations systems (experimental data) represent experimental approach to process modeling, which covers: planning and selection of model structure; parameter estimation; model validation.

The complex system aims to create a database with the appropriate structure to further processing; establishes ways of using natural resources and ecosystem services, and at the same time, to measure the economic efficiency; will be relevant to the resources for sustainable management of case studies on lotic systems; can evaluate and model the decision processes through "what if" scenarios, based on statistical and non-statistical tools.

The statistical survey based on secondary analysis will be systematized and analyzed on the basis of procedural and quantitative identification techniques, environmental impact being processed with different software tools.

5. Conclusions

The conclusions are: a. following Horizon 2020 strategy, modeling ecosystem for sustainable management involves methods based on memetic engineering, where memes are used in decision making; b. sustainable development is all forms and methods of socio-economic development, whose foundation is the first to provide a balance between the socio-economic and ecological-economic systems; c. in any organization, ecosystem modeling should take into account a strategy that sets out the way forward, focus efforts, ensure consistency, without which the organization would continually change direction, and ensure flexibility.

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