

FISCAL SUSTAINABILITY – A LOGICAL APPROACH

Ph.D. Student Diana-Maria DRIGĂ

School of Advanced Studies of the Romanian Academy (SCOSAAR), Romania
E-mail: dianadriga@yahoo.com

Abstract: *The paper proposes a logical approach to the fiscal sustainability concept. In the first part of the paper, the concept of sustainability is defined by identifying the sufficiency predicates, those logical conditions that the given system has to fulfill in order to be qualified as a sustainable system. Next, the role of autopoietic capacity in sustainable systems is highlighted. The last part of the paper considers the customization of the logical conditions of sustainability in the fiscal field. Thus, in order to define the concept of fiscal sustainability, additional sufficiency predicates will be identified, extracting from the sustainable processes those processes that are of fiscal type. Also, the paper proposes a logical formalization of the fiscal sustainability concept.*

Key-words: *sustainability, fiscal sustainability, autopoiesis, logical conditions.*

JEL Classification: *H30, O10, P10.*

1. Introduction

In the academic literature there are many approaches to the sustainability concept, in order to get a mostly comprehensive definition. The sustainability concept was first used in 1987 by the World Environment and Development Commission headed by Gro Harlem Brundtland, Prime Minister of Norway. The Brundtland Report ("Our Common Future") refers to sustainable development: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Report, 1987, p.41). So far, the concept of sustainability continues to be of interest to many specialists from all fields of activity. This paper intends to clarify the concept of fiscal sustainability, starting from defining the sustainability concept.

The paper has the following structure: in the first part, various opinions existing in the academic literature on the concept of sustainability are presented; the definition of the sustainability concept is next defined by identifying the sufficiency predicates, and the relationship between the concept of sustainability and the concept of autopoiesis is established. In the last part of the paper, the sufficiency predicates are identified, which are the basis for defining the fiscal sustainability concept from a logical perspective, and at the same time their logical analysis is made. The paper also proposes a logical formalization of the three analyzed concepts: sustainability, autopoiesis, fiscal sustainability. Finally, the conclusions of the paper are presented.

The definition of the concepts in this paper will be made from a logical perspective, by identifying the sufficiency predicates. By sufficiency predicates we understand those logical attributes which, fully verified by some entity, assign it a certain qualification. Therefore, the definition of the analyzed concept will be the result of identifying the sufficiency predicates and their logical analysis. The sufficiency predicates of the analyzed concept have to meet the following conditions:

- independence - no predicate is the logical result of another predicate;
- consistency - no predicate is contradictory to another predicate;
- completeness - concomitant verification of the sufficiency predicates.

2. The concept of sustainability

Sustainable development, as defined in the Brundtland Report, addresses concerns for the continuity of the human species by limiting the current consumption of resources, focusing on their conservation. This approach to sustainable development refers to intragenerational and intergenerational equity. Thus, present generations must

demonstrate a responsible way of consuming limited resources so that future generations can benefit from the same facilities to meet their own needs. Intergenerational equity has in view the transfer of the costs of using environmental resources by the present generations over future generations.

The concept of sustainability is also used by Pierce D., who considers that for the development of today's society no costs should be transferred to future generations, which implies a high degree of responsibility of the present generations, who must show concern for the use of renewable resources (Pearce, 1993). In 1997, John Elkington refers to the three pillars of sustainable development: economic, social and ecological - the Triple Bottom Lines model (Elkington, 1997).

The sustainable development concept became widely known after the Conference on Environment and Development known as the "Earth Summit", organized by the United Nations in Rio de Janeiro in 1992. Within this Conference, Agenda 21 was developed - the plan to support sustainable development.

Sustainable development has become a general objective of the European Union since 1997, when it was included in the Maastricht Treaty. In 2001, the Sustainable Development Strategy of the European Union was adopted at the Gothenburg Summit.

The sustainable development concept can be described as the result of integrated approaches to the political and decision-making factors, taking into account aspects related to environmental protection and long-term economic growth.

Although, in the academic literature the concept of durability is used as a synonym for the sustainability concept, some authors make a clear distinction between the two concepts. In opinion of Dinga E., the difference between the two concepts is given by the presence or absence of the cultural subjects. Thus, within the sustainable systems there are cultural subjects, which is not valid in the case of the durable systems. Cultural subjects are those subjects capable of representation, as opposed to non-cultural subjects, specific to sustainable systems, which are capable of perception (Dinga, 2009).

2.1. Defining the sustainability concept

Identifying the sufficiency predicates of sustainability and analyzing them from a logical point of view will make it possible to qualify a given entity as being sustainable. SS notation has been used to define the sustainability of a system, and $M(SS)$ represents the set of sufficiency predicates of sustainability.

The following sufficiency predicates for the sustainability concept of a system (SS) have been identified:

- P_1 : the replication of the own input of the system through the output;
- P_2 : the stability of the system reference parameter. This stability takes into account the variation of the value of the defining parameter of the system between certain previously established temporal and spatial limits. The system maintains its structure between these predetermined thresholds;
- P_3 : the numerical value reached by the reference parameter has to satisfy certain expectations of the observer;
- P_4 : the numerical value reached by the reference parameter has a global significance.

The logical analysis of the identified sufficiency predicates implies:

a) The analysis of independence - it will be taken into account that none of the four identified sufficiency predicates is the logical result of another predicate. Six possible cases are analyzed (C_4^2):

- P_1 and P_2 : P_1 does not result from P_2 nor vice versa;
- P_1 and P_3 : P_1 is not causally related to P_3 nor vice versa;

- P₁ and P₄: P₁ is not the logical result of P₄ nor vice versa;
 - P₂ and P₃: P₂ is not the logical result of P₃ nor vice versa;
 - P₂ and P₄: P₂ is not the logical result of P₄ nor vice versa;
 - P₃ and P₄: P₃ is not the logical result of P₄ nor vice versa;
- b) Consistency analysis - it will be shown that none of the identified sufficiency predicates is contradictory to another predicate. Six possible cases are analyzed (C₄²):
- P₁ and P₂: P₁ is not contradictory to P₂ nor vice versa;
 - P₁ and P₃: P₁ is not contradictory to P₃ nor vice versa;
 - P₁ and P₄: P₁ is not contradictory to P₄ nor vice versa;
 - P₂ and P₃: P₂ is not contradictory to P₃ nor vice versa;
 - P₂ and P₄: P₂ is not contradictory to P₄ nor vice versa;
 - P₂ and P₅: P₂ is not contradictory to P₅ nor vice versa;
 - P₃ and P₄: P₃ is not contradictory to P₄ nor vice versa;
- c) Analysis of completeness

Regarding the condition of completeness, the simultaneous relevance of the four identified sufficiency predicates for the concept of sustainability is considered.

The four identified sufficiency predicates fulfill the conditions of independence, consistency and completeness. Therefore, any entity that simultaneously verifies the four identified predicates is considered to be sustainable.

The logical expression of sustainability has the following form:

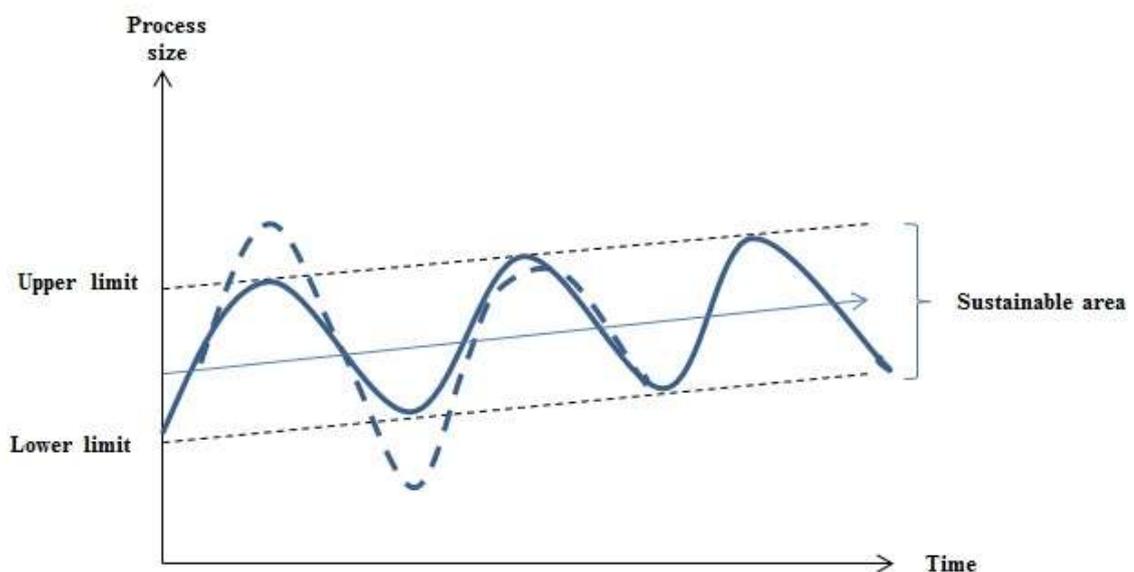
$$M(SS) = \{P_1, P_2, P_3, P_4\} \tag{1}$$

Or:

$$(P_1 \wedge P_2 \wedge P_3 \wedge P_4) \rightarrow SS \tag{2}$$

Thus, the sustainability of a system represents: *the property of the system to maintain its defining parameter on the desirable trajectory, within a predetermined interval, for a predetermined period of time and on a global space of accessibility, by restoring the input of the system through the output.*

Figure 1. System sustainability



2.2. Autopoiesis - a species of sustainability

The autopoiesis is part of the conceptual family of sustainability. Next, the concept of autopoiesis will be clarified. To define the autopoiesis concept, the sufficiency predicates identified for the sustainability concept are particularized for the autopoiesis concept. Thus, one or more additional sufficiency predicates will be introduced over the general case of the sustainability concept. The autopoietic system was noted with SA and $M(SA)$ represents the set of sufficiency predicates for the autopoietic system.

The following additional sufficiency predicates are considered:

PS_1 : the system's ability to self-observe and memorize its structure;

PS_2 : the self-restoration ability of the system after shocks to maintain its structure.

The logical analysis of the additional identified sufficiency predicates implies the analysis of independence, consistency and completeness of 15 possible cases (C_6^2). None of the 6 sufficiency predicates (4 sufficiency predicates identified for the sustainable system and 2 additional sufficiency predicates identified for the autopoietic system) is not the logical result of the other and is not contradictory to another predicate. The simultaneous relevance of the six identified predicates is also observed. Therefore, the complete verification of the sufficiency predicates identified by any entity gives it the qualification of autopoietic system.

The logical expression of the autopoietic system is:

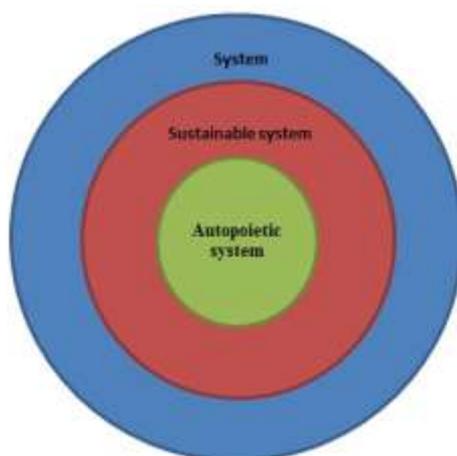
$$M(SA) = \{P_1, P_2, P_3, P_4, PS_1, PS_2\} \quad (3)$$

Or:

$$(P_1 \wedge P_2 \wedge P_3 \wedge P_4 \wedge PS_1 \wedge PS_2) \rightarrow SA \quad (4)$$

The definition of the autopoietic system according to the identified sufficiency predicates is: *a sustainable system that presents the capacity of self-observation and memorization of its structure, but also the self-restoration capacity of the system after shocks in order to maintain its structure.*

Figure 2. System – sustainable system – autopoietic system



3. The fiscal sustainability concept

Fiscal sustainability is a species of sustainability. The sufficiency predicates identified for the sustainability concept will be customized for the fiscal sustainability concept. This means that one or more additional sufficiency predicates will be introduced compared to the general case of the sustainability concept. The sustainable fiscal system

was noted SFS and M(SFS) represents the set of sufficiency predicates for the sustainable fiscal system.

The following additional sufficient predicates for the fiscal sustainability have been identified:

- PS₃: is addressed to the real economy;
- PS₄: targets the phenomena associated with public money.

The public money represents the monetary amounts belonging to the state, but also the monetary amounts from the private sector, which, by law, belong to the state.

The logical analysis of the identified additional sufficiency predicates implies the analysis of independence, consistency and completeness of 15 possible cases (C₆²). None of the 6 sufficiency predicates (4 sufficiency predicates identified for the sustainable system and 2 additional sufficiency predicates identified for fiscal sustainability) is not the logical result of the other and is not contradictory to another predicate. At the same time, the simultaneous relevance of the six identified predicates is observed. Therefore, completely verifying the predicates identified by any entity gives it the qualification of a sustainable fiscal system.

The logical expression of the sustainable fiscal system is:

$$M(SFS) = \{P_1, P_2, P_3, P_4, PS_3, PS_4\} \quad (5)$$

Or:

$$(P_1 \wedge P_2 \wedge P_3 \wedge P_4 \wedge PS_3 \wedge PS_4) \rightarrow SFS \quad (6)$$

The definition of the sustainable fiscal system according to the identified sufficiency predicates is: *a sustainable system that addresses the real economy, targets the phenomena associated with public money and describes phenomena that characterize the public system.*

4. Conclusions

Various approaches to the sustainability concept can be noticed, starting with 1987, when it was first used in the Brundtland Report. The most commonly used approach concerns intragenerational and intergenerational equity. Another controversy refers to the distinction between the sustainability concept and the durability concept. Some authors consider sustainability as synonymous to the concept of durability, while others make a clear difference between the two concepts.

The main contribution of this paper is to define the fiscal sustainability concept from a logical perspective. In order to define this concept it was first necessary to clarify the sustainability concept and the autopoiesis concept. For defining the three concepts, the sufficiency predicates and the additional sufficiency predicates were identified and their logical analysis was made. The logical formalization of the three concepts is another contribution of the paper.

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