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A systemic description of sustainable progress

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Abstract

The purpose of this paper is to shed light from a systemic perspective on the question: 'How can the sustainable progress of the real systems $S_R(t,c,g)$ in any space-time-resources domain $D_{str}(t,c,g)$ of Universe / Multiverse be defined?'. In the first part of the paper, within a traditional, limited, non-integrative and non-systemic approach, the manner of the concept and determinants of sustainable progress is established. In the second part, a systemic approach is applied to the elaboration of new principled models for defining and achieving the integrative sustainable progress $P_{sS}(t,c,g)$, through *c, c+1, ...* behavioural cycles and *g, g+1, ...* successive - parallel generations of entities $S_R(t,c,g)$. The principled model emphasizes the determinants categories of the progress $P_{sS}(t,c,g)$ in a domain $D_{str}(t,c,g)$: (1) *Sustainable resources and environments* $R_{Ms}(t,c,g)$; (2) *Sustainable competitive power* $C_{Ks}(t,c,g)$; (3) *Sustainable / self-sustainable stability* $S_{as}(t,c,g)$; (4) *Sustainable integrative innovation* $I_{is}(t,c,g)$; (5) *Competitiveness and sustainable competitiveness program / culture* $K_{cs}(t,c,g)$; (6) *Sustainable periodic welfare* $B_{ps}(t,c,g)$; (7) *Sustainable activation / entrepreneurship and mobility* $A_{ms}(t,c,g)$ in the domain $D_{str}(t,c,g)$ or / and in other domains $D_{str}(t,c,g)$, more favourable for the future progress. The determinants categories of the progress $P_{sS}(t,c,g)$ are detailed in a model of the sustainable progress cycle with more space-time-resources domains $\{D_{str}(t,c,g)\}$.

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Key words: systems, sustainable progress, determinants, general cycle of the sustainable progress.

1. Introduction

The 1950 decade was marked by the beginning of scientific integration in knowledge and action achieved by *Systemology* (includes: Cybernetics, General Systems Theory, Holistic Science, Complexity Science etc.) (Odobleja, 1938; Wiener, 1948; Bertalanffy, 1950; Bertalanffy, 1976; Hall, 1965; Kalman, 1969; Mesarović, 1970; Forrester,

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1971; Zadeh, 1975; Drujinin and Kontorov, 1976; Van Gigh,1978; Checkland, 1981; Churchman, 1984; Nikolaev and Bruk, 1985; Constantinescu, 1990; François, 1997; Hutchins, 1996; Hunt, 1999; Watson, 1999; Pouvreau, 2013).

The 2000 decade has significantly deepened the extension, the scientific integration in knowledge and action, through

- the evolution of Systemology and the development of *sustainable Progress concept* (Teilhard de Chardin, 1948; Mesarović and Pestel, 1974; Moore, 1994; Katseneliboigen, 1997; Banathy, 2000; Wright, 2001; Wright, 2005; Meadows, 2004; Gharajedaghi, 2005; Hughesa and Johnstonb, 2005; Moffatt, 2006; Senge, 2006; Skyttner, 2006; Beinhocker, 2007; Goosens, 2007; Meadows, 2008; Seddon, 2008; Castellani and Hafferty, 2009; Page, 2011; Romanian Government, 2008/1; Romanian Government, 2008/2; Romania Sustainable Society Index, 2008; Costanza, 2009; European Council, 2009; European Union, 2009; Giovannini, 2009; OECD, 2009; Stiglitz, 2009; Altili, 2010; Canada Sustainable Future, 2010; Hall, 2010; Popa and Cristea, 2010; Schepelman, 2010; Trewin D. and Hall, 2010; European Union, 2011; Meek Lange, 2011; Bergh and Hofkes, 2012; European Union, 2012; Randers, 2012; Sustainability Yearbook, 2012; Sustainable Society Index, 2012),
- the development of hypotheses and concepts advanced by the *Universe / Multiverse* (Kaku, 2006; Umpleby, 2007; Carr, 2009; Penrose, 2011; Greene, 2012; Turner, 2013).

These new concepts, theories and models have been too modestly approached from a systemic point of view, a fact that limits the ever deeper knowledge and more effective action, in terms of efficiency for the progress of Mankind in the 21st century. The long-lasting global economic crisis after 2007, with severe effects for the stagnation and relative decline of the European Union, is one of the most conclusive evidence of the effects on neglecting systemic, integrative innovative approach, during the last 50 years (European Union, 2000; European Union, 2010; Fischer, 2010; González Márquez, 2010; Study Group Europe, 2010; Roxburgh & Mischke, 2011; World Economic Forum, 2012; World Economic Forum, 2013).

The present work aims at deepening in a systemic manner the concept and the main cyclic determinants of sustainable progress $P_{sS}(t,c,g)$ of systems, by means of improved general models and methods of achieving progress in various $D_{str}(t,c,g)$ space-time-resources domains, in the succession of behavioural cycles *c, c+1, ...* and of real systems $S_R(t,c,g)$ generations *g, g+1, ...* that define the multitude of $\{D_{str}(t,c,g)\}$ domains under consideration.

2. A system of concepts about systems

A general concept and model of the categories of determinants for sustainable progress $P_{sS}(t,c,g)$ may be elaborated only by an advanced systemic approach, based on a system of systemology concepts, on the universal laws of systems (Bertalanffy, 1950; Zadeh, 1975; Bertalanffy, 1976; Kalman, 1969; Churchman, 1984; Forrester, 1971; Brandenburger and Nalebuff, 1996; François, 1997; Kauffman, 1997; Sterman, 2000; Umpleby, 2001; Popa, 2003; Meadows, 2008; Williams and Hummelbrunner, 2010; Pouvreau, 2013), valid in any domain of the Universe / Multiverse, in the behavioural cycles *c, c+1, ...* and generations *g, g+1, ...*

In general *System S* means a multitude of integrated components (elements E) in internal determined M_{dint} / self-determined M_{aint} environment which interact (through internal relationship R_{int}) and function (fulfil global function F_g of the system through internal R_{int} and external relationship R_{ext}) through *c, c+1, ...* behavioural cycles and *g, g+1, ...*, generations, through coopetition (cooperation and competition) under certain space-time-resources circumstances of proximate M_{pext} external environment, while producing some results R in his life cycle, within $D_{str}(t,c,g)$ space-time-resources domains considered.

In general the *cooperation* can be assimilated with attraction, cohesion, compromise, compatibility and *competition* with repulsion, confrontation, rivalry, incompatibility of the components within $D_{str}(t,c,g)$ space-time-resources domains considered.

Any $D_{str}(t,c,g)$ space-time-resources domain under consideration is complex and it is segmented in a structural-functional way in more environments / sub-domains useful to knowledge and action for the conscious achieving of sustainable progress.

The *Universe / Multiverse* are infinite hierarchical and co-ordinately integrated systems of systems $\{S_S\}$ (hierarchies, agglomerations, networks, and groups etc. of entities) governed by *universal / general / characteristic laws* which determine the cyclical becoming / change (….→ progress → stagnation → regress → stagnation → progress → ….), the continuous movement within any known $D_{str}(t,c,g)$ space-time-resources domains. The Universe / Multiverse can be consider an infinite hierarchy and diversity of $D_{str}(t,c,g)$ space-time-resources domains.

A $D_{str}(t,c,g)$ *space-time-resources domains* means a 'portion' of Universe / Multiverse, a supra-system within take place the specific becoming / change of the components [real systems S_R(t,c,g)] and his internal environment (milieu) $M_{int}(t,c,g)$. Specific interfaces separate the considerate $D_{str}(t,c,g)$ space-time-resources domains from his external milieu (environment) $M_{ext}(t,c,g)$, from others $D_{str}(t,c,g)$ of external environment. The systems laws (François, 1997; Kauffman, 1997; Lin, 1998; Lin, 1999; Popa, 2003; Skynner, 2006) allows Mankind the knowledge, foresight and, more and more, the control and foresight of phenomenon within $D_{str}(t,c,g)$ space-time-resources domains.

The results of interactions and working of $S_R(t,c,g)$ systems within $D_{str}(t,c,g)$ space-time-resources domains during its life cycle, characterised by specific $\{v\}$ variables and specific global functions $\{F_g(t,c,g)\}$, are as follows:

- *conscious results* R_{con} (for systems that include humans) are 'product' types, in which case the results represent the partial or total accomplishment of the *competitiveness* $K(t,c,g)$ (aim / mission / objectives) of the system S, contribute to progress (or, on the contrary, to stagnation / regress), to wellbeing (or, on the contrary, to bad-being) in internal environment $M_{int}(t,c,g)$ and in external proximal milieu $M_{pext}(t,c,g)$ of $D_{str}(t,c,g)$ space-time-resources domains,

- *unconscious results* R_{unc} (for systems that do not include aware humans), in which case the results represent the *finality* $F(t,c,g)$, the consequence of the system S interaction with other systems from external environment, contribute to the becoming / change (….→ progress → stagnation → regress → stagnation → progress → ….) within $D_{str}(t,c,g)$ space-time-resources domains.

Any *real autonomous system* $S_R(t,c,g)$ (natural and / or artificial):

- constitutes an integrated whole of its components and, at the same time,
- constitutes, (except for the Universe / Multiverse considered as infinite) a sub-system of a more complex system, respectively of a super-system (system of systems S_S) of a less complex component system, within $D_{str}(t,c,g)$ space-time-resources domains,
- identifies through a system of concepts (1) which characterize any type of system (Popa, 2003),
- has a structure [the multitude of its $E(t,c,g)$ components and the internal relations $R_{int}(t,c,g)$ among them which determines the system identity, connectivity and functioning in its life cycle] and has in its structure two interconnected functional-structural sub-systems:
  1) *execution sub-system* $S_{Rexe}(t,c,g)$ which achieves / ensures the transformation processes $P_t(t,c,g)$ of $\vec{U}$ entries (substance S, energy E, information I, field F) into $\vec{Y}$ exits 'products' (of a substantial, energetic, information type with a preponderance S / E / I / F, specific for the identity of system S_R),
  2) *command* $S_{Rcon}(t,c,g)$ / *self-command subsystem* $S_{Raco}(t,c,g)$, which achieves / ensures the command of functioning processes $P_f(t,c,g)$ of $S_R(t,c,g)$, through external $P_{fext}(t,c,g)$ or internal $P_{fint}(t,c,g)$ programs (consciously or unconsciously elaborated).

The system *hierarchy and diversity* is infinite in space-time-resources due to the dynamics of infinite interconnections '….- systems S – environment M – systems S -….' in the Universe / Multiverse:
(1) on the unlimited multitude of hierarchic levels $\{n=\infty\}$ (over-ordination / subordination of systems) and
(2) at the same hierarchic level n (by coopetition = cooperation & competition / coordination of systems).

The frontier of a system is the limit (limits L) by means of which an active and conscious observer separates, according to its own interests of knowledge / action / command / self-command etc., the internal environment / environments $M_{int}(t,c,g)$ of S of the external environment / environments $M_{ext}(t,c,g)$ of S.

The *environments* $M_S(t,c,g)$ *of systems* are delimited space-time-resources domain $D_{str}(t,c,g)$, from a structural-functional viewpoint, internally simultaneous (over-ordination) / external (subordination), by means of:

- *connexion interfaces* $L_I(t,c,g)$ (action / transfer / confrontation / cooperation / compromise), specific for the

systems and real environments considered,

- *frontiers* of identification $L_F(t,c,g)$ defined by a human observer (individual or collective) in accordance with the aims to be followed in the system modelling / knowledge / research / exploitation / command / self-command (frontiers do not always coincide with the system interfaces).

The *relations* R_{ext} *between the system and the external environment* are unfold directly and indirectly (feedback negative, positive, prospective) through the $L_I(t,c,g)$ *interfaces*, specific for each system and are called:

- $\vec{U}$ *inputs* (connexions / actions of external environment on the system), mainly expressing the demand (needs) of the system S for its external environment and, partially, the offer of the external environment,
- $\vec{Y}$ *outputs* 'products' (connexions / actions of external environment on the system), mainly expressing the offer of the system S for its external environment and, partially, the demands (needs) of the external environment.

The real systems $S_R(t,c,g)$ (natural and / or artificial) are identified basically by means of a system of concepts (1) which characterizes any category of existing system:

$$S_R(t,c,g) = \{E \,\&\, R_{int},\ P_f,\ P_t,\ U\&Y,\ v,\ F_g,\ L,\ M_{int} \,\&\, M_{ext},\ K,\ F,\ t,\ c,\ g\} \tag{1}$$

Universal laws of $S_R(t,c,g)$ *real systems* (François, 1997; Kauffman, 1997; Lin, 1998; Lin, 1999; Popa, 2003; Skyttner, 2006) can be formulated in a simple and intelligible manner for practical purposes:

- $S_R(t,c,g)$ real systems exist and function by means of *c, c+1, ….*, behavioural cycles, respectively by means of *g, g+1, …*, generations successively-parallel, inevitably imperfect and limited in space-time-resources,
- $S_R(t,c,g)$ real systems are in a continuous changing and by the results (products) of their behaviour achieve cyclic progress (through competitive products), stagnation, regress (through non-competitive products),
- $S_R(t,c,g)$ real systems are imperfect but perfectible through their competitive, generating progress results (products),
- $S_R(t,c,g)$ real systems are self-regulating within the hierarchy and diversity of internal and external environments specific to the many $D_{str}(t,c,g)$ space-time-resources domains of existence and changing in the Universe / Multiverse.

3. Sustainable progress

The sustainable progress of systems is at the same time a concept, a process and a performance of high complexity, fact that explains the delay in systemic defining, describing and evaluating at the beginning of the 21st century. The systemic approach of sustainable progress develops the systemic approach of sustainability (Goosens, 2007; Ciegis, Ramanauskiene and Martinkus, 2009; OECD, 2009; Stiglitz et al., 2009; Altili, 2010; Canada Sustainable Future, 2010; European Union, 2010; European Union, 2011; Deutsch, 2012; Sustainability Yearbook, 2012; Sustainable Society Index, 2012) aimed at clarifications in knowledge and action, with practical application to achieve sustainable progress of Humanity.

The *progress* in the Universe / Multiverse is a category of the becoming / change and it is achieved in the space-time-resources domain $D_{str}(t,c,g)$ of various dimensions, embedded hierarchic levels, characteristics and life durations, within the life cycle of the various $D_{str}(t,c,g)$ components [systems $S_R(t,c,g)$]. As a general rule (Popa, Pater and Cristea, 2008):

- progress is defined by the system evolution whose characteristics is the cyclic (through cycles *c* and generations *g*), optimal, temporary or lasting / sustainable increase of
  - competitiveness $K(t,c,g)$ (Competing capacity, Flexibility of products offer, Value of products offer, availability of Resources, Efficiency, Demand and / or Acceptance in the proximate external environment),
  - of the structural-functional complexity $W(t,c,g)$,
  - of the structural-functional diversity $Z(t,c,g)$,
  - of the structural-functional integration $J(t,c,g)$,
  - of the $B(t,c,g)$ welfare

  of entities in the hierarchy of the system internal and external environments in a domain $D_{str}(t,c,g)$,

- *stagnation* is defined by the system behaviour with cyclic temporary or lasting maintenance of K(*t,c,g*) competitiveness (Competing capacity, Flexibility of products offer, Value of products offer, availability of Resources, Efficiency, Demand and / or Acceptance in the proximate external environment), of the structural-functional complexity W(*t,c,g*), of the structural-functional diversity Z(*t,c,g*), of the structural-functional integration J(*t,c,g*) and of the B(*t,c,g*) welfare of entities in the hierarchy of the system internal and external environments in a space-time-resources domain $D_{str}(t,c,g)$,
- *regress* is defined by the system involution whose characteristics is the cyclic, temporary or lasting / sustainable decrease of K(*t,c,g*) competitiveness (Competing capacity, Flexibility of products offer, Value of products offer, availability of Resources, Efficiency, Demand and / or Acceptance in the proximate external environment), of the structural-functional complexity W(*t,c,g*), of the structural-functional diversity Z(t,c,g), of the structural-functional integration J(*t,c,g*) and of the B(*t,c,g*) welfare of entities in the hierarchy of the system internal and external environments in a space-time-resources domain $D_{str}(t,c,g)$.

Generally the *sustainable integrative competitiveness* $K_{is}(t,c,g)$ means the ability and the capacity of a (S_S) system of systems to optimise from an integrative-hierarchy perspective its internal environment, to be a winner in the coopetition (cooperation and / or coopetition in successive-parallel cycles *c* and generations *g*) of its external environment, without causing damage, to simultaneously achieve welfare, for a unlimited ('sustainable') period of time within $D_{str}(t,c,g)$ living domains.

Competitiveness K(*t,c,g*) of a conscious S_{cu} system is integrating in a Δt time period, in a space-time-resources domain $D_{str}(t,c,g)$ the following:

- *Competing capacity* $C_K(t,c,g)$ of the S_{cu} system,
- *Offer* $O_{Scu}(t,c,g)$ of the S_{cu} system for the proximal external environment $M_{pext}(t,c,g)$, offer that, in its turn, integrates: *Flexibility* F – the variety / diversity of Y exits or {i} products, the Q_i quantity, the T_{cai} assimilating times of {i} variety / diversity, the T_{pi} processing times of R(*t*) resources necessary for achieving the {i} variety / diversity; *Value* V – the N_{gi} level of {i} 'products' global quality of the S_{cu} system and the C_{ci} level of complete resource consumption (cost) necessary for achieving the {i} 'products';
- *Availability of* D_R(t,c,g) *resources* for the S_{cu} conscious system as a result of coopetition and the meeting of the real / effective demand of consumers in the proximal external environment $M_{pext}(t,c,g)$ by the offer of the conscious system (D_R is an effect of values exchange in the space-time-resources domain D_{str});
- *Efficiency* E(*t,c,g*) (energetic, ecological, economical, aesthetical, ergonomical, social etc.) of the creation, operation by regular restructuring and termination of S_{cu} system;
- *Demand* $C_{Mpext}(t,c,g)$ [(needs {i} & quality N_{gi} & quantity Q_i & duration T_i) and (exchange of available values)] of consumers in the proximal external environment $M_{pext}(t,c,g)$ of {i} 'products' in the S_{cu} conscious system;
- *Conjuncture characteristics* $I_p(t,c,g)$ (of proximal external environment M_{pext}) and $I_M(t,c,g)$ (of over-ordinate external environment hierarchy) specific for the external environments of the S_{cu} conscious system.

The determinant factors of becoming / change in a space-time-resources domain $D_{str}(t,c,g)$ are very numerous and extreme complex inter-connected. *The categories of sustainable progress* $P_{sS}(t,c,g)$ *factors* in a space-time-resources domain $D_{str}(t,c,g)$ are presented in principle relation (2) and are detailed in relation (3). The R_{Ms} (t,c,g), C_{Ks} (t,c,g) and $S_{as}(t,c,g)$ complex determinants may decompose and the relation (2) becomes (3):

$$P_{sS}(t,c,g) = f[R_{Ms}(t,c,g), C_{Ks}(t,c,g), S_{as}(t,c,g), I_{is}(t,c,g), A_{ms}(t,c,g), K_{cs}(t,c,g), B_{ps}(t,c,g), A_{ms}(t,c+1,g+1), \ldots.] \quad (2)$$

$$P_{sS}(t,c,g) = f[M_{Rs}(t,c,g), R_{sM}(t,c,g), C_{ps}(t,c,g), P_{is}(t,c,g), I_{cs}(t,c,g), F_{ss}(t,c,g), I_{is}(t,c,g), A_{ms}(t,c,g), K_{cs}(t,c,g), B_{ps}(t,c,g), A_{ms}(t,c,g+1), \ldots] \quad (3)$$

where:
R_{Ms} (t,c,g) - resources and sustainable environments,
C_{Ks} (t,c,g) – systems $\{S_R(t,c,g)\}$ structured with competitive capacity (sustainable +) / (no-sustainable -),
$S_{as}(t,c,g)$ – sustainable regular stabilization / self-stabilization,

$I_{is}(t,c,g)$ – sustainable integrative (hierarchical and coordinative) innovation,
$A_{ms}(t,c,g)$ - activation / sustainable entrepreneurship and mobility,
$K_{cs}(t,c,g)$ – competitiveness with programs / competitiveness culture and sustainable coopetition,
$B_{ps}(t,c,g)$ – sustainable regular internal and external welfare,
$A_{ms}(t,c,g+1)$ – activation / sustainable entrepreneurship and mobility in other domain of $\{D_{str}(t,c,g)\}$ multitude.

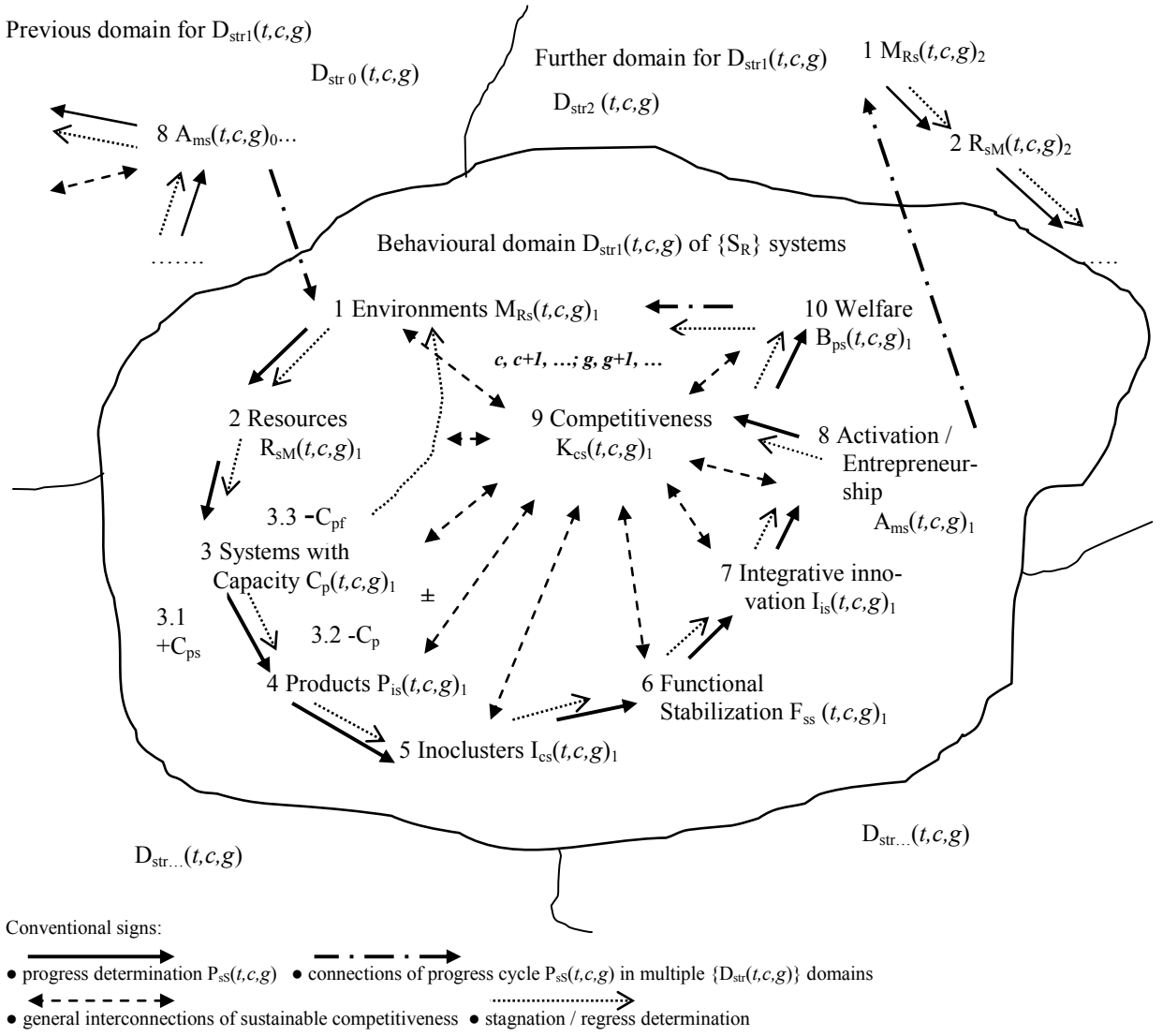

Fig. 1 Principle model for sustainable progress $P_{ss}(t,c,g)$ cycle of the real systems $\{S_R(t,c,g)\}$ in the domains space-time-resources $\{D_{str}(t,c,g)\}$ c – cycles *c, c+1, ...*; g – generations *g, g+1, ……*; $D_{str...}(t,c,g)$ – space-time-resources domains (internal / external environments, markets etc.) for existence and possible progress of real systems $\{S_R(t,c,g)\}$; 1 $M_{Rs}(t,c,g)$ – environments with sustainable resources in $\{D_{str}(t,c,g)\}$ domains; 2 $R_{sM}(t,c,g)$ – available sustainable resources in $M_{Rs}(t,c,g)$ environments in $\{D_{str}(t,c,g)\}$ domains; 3 $C_p(t,c,g)$ – structured systems $\{S_R(t,c,g)\}$ with processing capacity ($+C_p$ establishment / $+C_{ps}$ sustainable) / ($-C_p$ non-sustainable / $-C_{pf}$ liquidation) in $\{D_{str}(t,c,g)\}$ domains; 4 $P_{is}(t,c,g)$ – sustainable competitive integral products of $\{S_R(t,c,g)\}$ in $D_{str}(t,c,g)$; 5 $I_{cs}(t,c,g)$ – inoclusters with sustainable consumers and suppliers for $\{S_R(t,c,g)\}$ in $D_{str}(t,c,g)$; 6 $F_{ss}(t,c,g)$ – stabilization-based functioning / sustainable regular self-stabilization of $\{D_{str}(t,c,g)\}$; 7 $I_{is}(t,c,g)$ – sustainable integrative innovation (hierarchical and coordinative) in $D_{str}(t,c,g)$; 8 $A_{ms}(t,c,g)$ - activation / sustainable entrepreneurship and mobility in $\{D_{str}(t,c,g)\}$; 9 $K_{cs}(t,c,g)$ – competitiveness, programs / competitiveness culture and sustainable coopetition in $D_{str}(t,c,g)$; 10 $B_{ps}(t,c,g)$ – sustainable regular welfare in $D_{str}(t,c,g)$ in other domain of $\{D_{str}(t,c,g)\}$ multitude

The significance of detailed factors is:

R) resources and sustainable environments R_{Ms} (t,c,g), with the structure:

$M_{Rs}(t,c,g)$ – environments with sustainable resources $R_{sM}(t,c,g)$,

$R_{sM}(t,c,g)$ – sustainable resources in $M_{Rs}(t,c,g)$ environments,

C) C_{Ks} (t,c,g) structured systems $\{S_R(t,c,g)\}$ with competitive capacity (sustainable +) / (no-sustainable -), with the structure:

C_{ps} (t,c,g) –systems structured $\{S_R(t,c,g)\}$ with processing capacity ($+C_p$ establishment / $+C_{ps}$ sustainable) / ($-C_p$ non-sustainable / $-C_{pf}$ liquidation) and making of products $P_{is}(t,c,g)$,

$P_{is}(t,c,g)$ – sustainable competitive integral products,

S) sustainable regular stabilization / self-stabilization $S_{as}(t,c,g)$, with the structure:

$I_{cs}(t,c,g)$ – inoclusters (innovative clusters) with sustainable consumers and suppliers,

$F_{ss}(t,c,g)$ – stabilization-based functioning / sustainable regular self-stabilization.

4. The general cycle of sustainable progress

Models (2) and (3) allow the construction of a model of sustainable progress cycle in the $D_{str}(t,c,g)$ domain and in $D_{str}(t,c,g)$ related domains (Figure 1).

The model of sustainable progress cycle reflects the systems S *general life sub-cycles*:

- sub-cycle *'establishment'* (genesis) effected through stages 1 + 2 + 3.1 ($+C_p$), materialized by $\{S_R(t,c,g)\}$ systems structured with processing capacity $C_p(t,c,g)$ ($+C_p$ establishment / potential sustainable) and making of $P_{is}(t,c,g)$ products,

- sub-cycle *'work'* (without / with system regular restructuring) effected through stages 3.1 V 3.2 + 4 + 5 + 6+ 7 + 8 + 9 + 10, materialized by $\{S_R(t,c,g)\}$ systems structured with increasing processing capacity $C_{Ks}(t,c,g)$ ($+C_{ps}$ lasting / sustainable; or $-C_p$ temporary) and making of competitive products $P_{is}(t,c,g)$, or non-competitive products (3.2 + ….),

- final sub-cycle *'elimination'* (exit / death) effected through stages 3.2 ($-C_{pf}$) + 1 + 2, materialized by $\{S_R(t,c,g)\}$ systems structured with final, adverse processing capacity $C_{pf}(t,c,g)$ ($-C_{pf}$ non-sustainable / liquidation), with no $P_{is}(t,c,g)$ products making, followed by cease of functioning and incorporation of S systems in $M_{Rs}(t,c,g)$ environments with sustainable resources for the next $g+1$ cycle of the progress.

The principle systemic model of the general cycle of sustainable progress (Figure 1) can be particularized at an average level. When applying it to the knowledge, designing, establishment and sustainable functioning of $S_R(t,c,g)$ real systems, the following can be noticed:

- adaptability of the model to $W(t,c,g)$ complexity and $Z(t,c,g)$ diversity which defines the $D_{str}(t,c,g)$ domain and the $D_{str}(t,c,g)$ related domains, either by restriction for relatively simple cases (relation 2), or by development / thoroughness of the number of determinants (in greater number as in relation 3) for very complex cases,

- main role, priority over $K_{cs}(t,c,g)$ sustainable competitiveness in achieving sustainable progress of $P_{sS}(t,c,g)$ systems and its dependence on the most optimal / suboptimal integration of $M_{Rs}(t,c,g)$, $R_{sM}(t,c,g)$, C_{ps} (t,c,g), $P_{is}(t,c,g)$, $I_{cs}(t,c,g)$, $F_{ss}(t,c,g)$, $I_{is}(t,c,g)$, $A_{ms}(t,c,g)$, $B_{ps}(t,c,g)$ determinants in $D_{str}(t,c,g)$ domain,

- decisive role of $A_{ms}(t,c,g)$ activation / entrepreneurship and mobility in achieving sustainable progress of $P_{sS}(t,c,g)$ systems within other domains, related or not related to the $D_{str}(t,c,g)$ domain under consideration, the moment when $M_{Rs}(t,c,g)$ environments and $R_{sM}(t,c,g)$ resources of $D_{str}(t,c,g)$ domain are definitively exhausted.

5. Conclusions

This paper develops new general concepts and models in the knowledge and achievement of sustainable progress, under any circumstances of external and internal environments of real systems $S_R(t,c,g)$.

The concept of *sustainable progress* is introduced and defined in a systemic manner. The concept of 'sustainable progress' is more rigorous than the concept of 'sustainable development'. Development is inevitably limited by the size and resources of systems environments. Progress requires mobility, migration to other favourable environments.

The principle general model of *sustainable progress cycle* can improve the Sustainable Society Index to become Sustainable Progress Index.

The practical implications of the research results are important for defining and achieving 'Sustainable progress programs in Europe and Romania' in the horizon of years 2050 and 2100.

Future research will go deeper in the:

- identification, thoroughgoing study and optimization of new principle integrative models of sustainable progress in various domains: nature (non-living, living), society, country federation, country, sector, region, county, zone / area, locality, cluster, organization,
- improvement of sustainable progress evaluation methods at different hierarchical levels.

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