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THESES

Simulation Planning Methodologies of Sustainability

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PREAMBLE – ANTECEDENTS OF RESEARCH

Humanity has been concerned about the future since the acient times. At the beginnings this inquiry was limited to the understanding of the relationship between the individual and the world, but later in consequence of the knowledge dissemination in communities and the spread of samples kept in the collective memories also the relation of the society and environment came to front. Due to the more accurate cognition of physical phenomena and surmounting over the powers of nature, man was able to construct a system – called economy – between society and environment that was intended to realize an umbrella against the unpredictable events and dangers of the environment. Finally the system that was made for helping humanity overgrew beyond the level that endangers not only its own functioning but also the operation of society and nature. Mankind due to its faith in knowledge, inventiveness and optimism is often unable to recognize and handle these dangers, and in the consequence of the insistence to the tranditions or the problem solving methodoligies of long standing can hardly change its adaptation strategy even in case when it seems to be necessary. That is the reason why examination and understanding of questions overarching generations became the greatest challenge of humanity.

Although modern age has created the idea of sustainability, but only in theory and it is handled rather as the series of actions against the processes endangering the unchangingness than concerned as the necessity of adaptation to the unavoidable changes. Drastic mutations in the harmony of Planet Earth are stimulating today's man towards taking more effective actions and more intense cogitation. New scientific methodololgies and models – thought to be more accurate – try to give us such solutions that are soothing decision-makers by the illusion of control. Meanwhile we are using our most sophisticated evolutionary advantage: our ability of thinking, the utilization of our knowledge often doesn't happen at the rigth place nor in the right way. The result of our efforts are determined by the expectations, traditions, faith and sometimes the knownledge waken alive creates systems on its own that are not transparent to the individual. In such cases knowledge becomes evolutionary disadvantage of the humanity.

In such a strange medium, between the finiteness of science and the endlessness of human mind deadlock situation arose that characterize the systems of our society, economy and environment.

The methodical crisis that surrounds the possibilites of planning the sustainability can only be tempered by the whole re-evaluating of the practice. In a renewing methodology not only the phrasing of problem has to be repositioned into a new context but also the points of references must be arosen to the most objective levels even possible by the human gage. In order to reach this aim it is necessary to – beyond having scientific methodologies and tools – make physical experiences, accept religious convictions, question the technical development, take in sensitiviness of art, observe nature and mostly have self-recognition.

The novelty and importance of the subject is signified by the fact that in our days practical realization of sustainability is discussed more often than the failures of scientific guide-lines. As a primary cause, often difficulties and unproper execution is refered but it is also possible that we are not looking for the right answers, we are aiming wrong targets and we are using unadequate methodologies to confirm our ideas. The renewal of the planning methodologies of the sustainability is not only important in a scientific mean, but it is also the pledge of surviving for humanity for the next centuries.

OBJECTIVES

In my dissertation I point out the conflicts in the planning and analyzing methodologies of the sustainability that make the systematic desing of sustainability theoretically impossible. By the mean of the hierarchical structure of my work I do reposition on the scientific approach of sustainability and from the global intrepretation into the direction of details and by the help of simulation problemsolving methodology I reveal the maximal possible support that can be provided for the planning of sustainability. The dissertation does not aim to give concrete models according to the sustainability rather creates frames and methodologies that can lead to appropiate and more efficient modeling. The aim of my work is to reveal paradoxes that highlight the weak points of planning of sustainability and to suggest new methodologies in order to model and analyze these weak points giving more precise and effective planning of sustainability.

Objective 1: The objective of the dissertation is to reveal the “time-paradox” of sustainability using system theoretical approach.

Objective 2: The objective of the dissertation is to reveal the contradictory role of knowledge in sustainability and to provide new methodologies to resolve the “knowledge-paradox”.

Objective 3: The objective of the dissertation is to reveal the existence of the “part to the whole paradox” between the systems and subsystems of sustainability, and to provide new methodologies in order to model this phenomena.

Objective 3.1: The objective of the dissertation is to highlight a discrete simulation methodology that ensures the synthesis of models from the micro to the macrolevel connecting behaviours of the individual and the collective.

Objective 3.2: The objective of the dissertation is to provide a quality based methodology that ensures creating of models that can handle the relation of humaninty and environment in a natural way thus can moderate the consequences of the “part to the whole paradox”.

METHODOLOGY

After the survey of the theories of modelling of sustainability it can be determined that the planning methodologies are surrounded by uncertainty and are affected by general crisis. This conclusion was strictly derived based on system theoretical principles and for the proof a new methodology was found that can highlight the root of problems and can resolve the weak points of the crisis. Since there is no accepted methodology for validating methodologies therefore I chose the following way in order to proof the new solution: I was searching for paradoxes that are natural consequences of modeling the reality and that are often neglected in our planning methodologies. Examining the problems of sustainability I investigated the methodical reasons of paradoxes and suggested such solutions that can convert the contradictions into modelable and analyzable problems.

NEW SCIENTIFIC RESULTS

In my dissertation three main critical paradaxoses were investigated.

At first I supposed that the planning of sustainability is encumbered by time-paradox. In order to proove my hypotesis I gave an overview of the general possibilities of the system theoretical and complexity theoretical classifications and I positioned the place of sustainability within this aspect. I ascertained that the problems of sustainability can be described by predominantly non-polinomial

time models that are reasonable identificated having unestimatable number of connections between subsystems that are limitedly predictable. After that I revealed the constrained usage and the limits of the classical open-loop and closed-loop control solutions.

In my deduction I demonstrated that in order to realize the intentions of sustainability fast and effectively humanity uses such control techniques that lead to uncontrolled overshoots thus affect against sustainability. I aimed at finding the only proven controlling methodology that is able to handle to complex system of sustainability. Overviewing the possible methodologies I took cognizance of suitability of genetic algorithms for solving problems of sustainability as the only methodology proven by billions of years of evolution in Earth. I demonstrated also that the evolutionary control methodologies are different from the classical logic therefore they cannot be accepted and applied in the practice. Derived from these facts the presence of time-paradox was confirmed by the statement that huminaty is stucked in the duality of urgent problem solving – driven by exhausting natural resources and decreasing assimilative capacity of Earth – and the evolutionary logic as the single working but time-consuming solution for problems of sustainability. This contradiction and the phenomena of uncontrolled overshoots at unpredictable places caused by overpreferred usage of classical control methodologies state the presence of time-paradox.

Thesis Nr. 1. Planning of sustainability is aggravated by time-paradox

> *Genetic algorithms are the only proven methodologies for planning sustainability. On the other hand this evolutionary logic is hardly applicable in the practice because it is time-consuming and apparently illogical therefore cannot be fit into the fast working human logic.* (Related publications: S2, S5, S8, S13)

In the second section of my work I supposed the presence of knowledge-paradox in sustainability. In order to prove this hypothesis I examined the relation of enthrophy and information. By means of the hypotetical gas-experiment demonstrated by Leó Szilárd I derived that the formation of knowledge needs energy input, and releasing knowledge causes release of energy. Based on the knowledge pyramid and its enthropistic model I introduced the concept of phase changes of knowledge, where I revealed the unavoidable energy losses that occur during the conversion between data, information, knowledge, wisdom at social level processes.

I also presented that raising of enthropy is natural consequence of the human existence, but it can be reduced by the more efficient realization of the information conversion processes. Since increasing of

efficiency can be reached by connecting the manifestations of knowledge in a more tight form therefore I revealed the importance (and the disservice) of internet related to sharing of knowledge.

I highlighted also that the realization of sustainability is negatively influenced by the fact that the knowledge about our knowledge is treated mostly from economical view. According to my suggestion this asymmetry can be reduced by realizing the more tight connections between the forms of knowledge about our knowledge thus using internet in an efficient way.

Consequently I revealed a ditributed and efficient methodology for analyzing and planning sustainability in form of using web-services in order to share information and knowledge over the internet. Finally I illustrated the theory working in practice by the help of a fuzzy web-service developed by myself.

Thesis Nr. 2. Problems of sustainability are originated from our knowledge and this phenomena is treated mainly by our knowledge. That is the „knowledge-paradox" of sustainability.

> *The pledge of survival of humanity resides in the diversity of knowledge forms because – following the evolutionary logic – that ensures finding the proper behavior that can bring through humanity over the difficulties caused by its knowledge. This diversity can be reached and sustained by the more efficient conversions and tight connections of knowledge forms.*
>
> (Related publications: S3, S6, S11, S12)

The third hypothesis of my dissertation supposes that the theoretical modeling of sustainability is interfered by the „part to the whole paradox". I revealed that the whole spectra of the modeling methodologies of sustainability (including Peano Arithmetic and the Zermelo-Fränkel Set Theory with the axiom of choice) is concerned by consequences of the Gödel's Second Incompleteness Theorem stating that the uncontradictedness of our theories cannot be proven within the theory itself. This fact results that humanity cannot have an objective view about its own role within the system of sustainability. I also showed that this statement has the consequence that our models are forced to use categorically inadequate concepts that naturally include the „part to the whole paradox" according to their self-referencing.

I illustrated the „part to the whole paradox" through social examples and I also investigated the possibility of moderating the consequences of this paradox by systematic usage of given

methodologies. At first I suggested a new a particle-based modeling methodology: the concept of the Extended Knowledge Attributed Petri Nets (EKAPNs) that can describe – beyond integrating micro and macro-level modeling – the uncertainties of knowledge-intention-action process in a natural way so that group behavior of intelligent entities become modelable. In my dissertation – aiming at ensuring adequate posterior reference – I gave the formal description of EKAPNs in a standardized form.

Following that section I pictured the presence of the „part to the whole paradox" within the system of sustainability by the help of showing the difference between the number of pillars and the real numeric dimension of sustainability. Through the virtual experiment of the Chaos Game I demonstrated that the multifractal analysis can be used as an adequate methodology for analyzing the patterns of sustainability supposing that the problem can be investigated in a vector space spaned by indenpendent base indicators.

Based on the conservation of energy and materials I derived that this base indicators cannot have quantitative nature, because the three pillars of sustainability are mutually dependent upon each other. That is the reason why I turned to the qualitative models and I introduced a novel wave-based methodology invoking an adaptation of the dualist concept of TaijiQuan philosophy. In that approach I aimed at showing the possibility of internalization of the „part to the whole paradox" into the simulation modeling methodology. In order to reach this I delineated a new methodological approach by the help of a binary version of the „eight force" model (Fűr-Ijjas Model) that can support finding psychosocial causes of sustainability problems. The methodology transforms the challenge of sustainability into the quality of need – quality of action – quality of resource space therefore provides possibilty for analysis of the relation between the humanity and the environment by fractaldinamical means.

Thesis Nr. 3. „Part to the whole paradox" can be exhibited in the planning methodologies of sustainability due to categorical inadequateness and self-referencing.

> *Human is part of the environment, the society and the economy at the same time therefore its manifestations are often contradictory regarding to the aims and functioning of the individual and the collective. This conflict can be moderated by ensuring the better permeability of micro and macro-level models and by internalizing the „part to the whole paradox" into the planning methodologies of sustainability.*

Subthesis Nr. 3.1. The concept of the Extended Knowledge Attributed Petri Nets is adequate to describe the knowledge-intention-action uncertainty therefore is able to model the individual and the collective at both micro and macro-level.

Subthesis Nr. 3.2. Based on the principles of TaijiQuan philosophy models within the quality of needs, quality of actions and quality of resources space can be synthetized that can be analyzed by fractaldinamical methods and that can internalize the „part to the whole paradox" into models in a natural way.

(Related publications: S1, S2, S4, S7, S9, S10, S13)

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