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# **HOW TO USE THE REDUCTIONIST APPROACH FOR EVALUATING SUBSYSTEMS TO RESEARCH THE ELEMENTS OF THE DEVELOPMENT**

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**KEYWORDS:** system; sub-system, interactions; components general spider map theory; local community; network entropy; social physics

**RUNNING HEAD:** Reductionist approach for evaluating subsystems

## **ABSTRACT**

This study is based on a research period, which has been observed abroad in different countries. It introduces a new approach, which can be a solution to reduce the social and territorial inequivalently. This new approach based on three connecting theories like General System Theory, Fortune at the Bottom of the Pyramid Approach and the Holistic Integrated Approach. The new approach has been named General Spider Map Theory. It is not a real model it is more like new way of think of development. The essential of the theory is that with the tools of reductionist approach to observe and integrate the crucial elements of the Local Community. Let us see the local community, which is situated in the middle of the spider net, and the Local Community is connecting to five pillars. The pillars are the next: Tourism, Social Activity, and Economy, Infrastructure, and Agro-environmental economy. These five pillars give the spider net of the Local Community. Each pillar is an opened system so they are able to get input, make transformation and create outputs. Let us knit the pillars like a real net. This spider net is a new opened system the pillars are its subsystems. If we want to generate development in the Local Community, we shall not develop only one pillar otherwise the spider net will be broken. The harmony inside the net is sensitive and it will disappear if our interaction is not enough maintained. The development has to be a socio-economical influence, which brings together the community, involves the small entrepreneurs to the economical circulation, activates the local education, establishes unique attraction, raises the local heritages, creates equal opportunities for the inhabitants and brings the gap between the less developed and well developed areas.

## **INTRODUCTION**

To think in system does not mean to live in a box. Different studies and researches attempt to describe the best way of the development. The sustainability in the allocation and

distribution of the resources are always core problem between the developed and the less developed countries. Some people like creating an own system and individual way how to look at, observe the World the Universe. As developers we also need to create our system –frame-, if we want to generate something different. Without understanding the roles and the rules of the environment our impact can really easily influence our target in wrong way. The interaction can cause unchangeable manipulation, which could be worst if it had not done anything. The sensitivity of the human being systems is obvious.

The social sciences use several times the other sciences' terminologies. The sociology used to be called as the social physics. This result is the pleasure of the nature sciences. The results of the physics and the biology always have been used and adapted in other sciences terminology (Maródi, 2003).

The System Theory grew up from the biology, psychology and oology strongly interlinking with the Cybernetic. Plentiful scientist had been thinking of the System theory like: A. N. Whitehead, P. A. Weiss, Kenneth Boulding, A. Rapoport, Kenneth Boulding, Wiener Norbert, Neumann János, G. Bateson Margaret Mead. Most of them examined the organism, organization, cooperation, psychology, industrial planning and company systems. The General System Theory was invented and developed in the beginning of the 20th century; the father of this theory was Ludwig Von Bertalanffy. Formerly he proposed this theory at first in 1928. Ludwig von Bertalanffy used as important reference quite a lot of time in his several work the mystics' scientist. This study shows some of the assumptions of the theory which had been used and had been tired out. The General System Theory is not a guideline for the development and not even a tool; it is only the method how to look at the world in a different way.

### *The General System Theory's influence in the Social Sciences*

The General System Theory is the name of all of the systematic and cybernetic systems, which deals with connecting systems, researches the functions of the systems and the interaction between the elements of it and also concentrates on the different changes (Fröhlich, 1996). The aim of the System Theory is to understand and to describe the changes in the world.

Talcott Parsons was the first scientist who started to use the system and the subsystem to describe the social interactions. Parsons was analyzing Bertalanffy's General System Theory in the 1930 and from 1940 he started to adapt the theory in the social sciences. In 1951 Parsons published his book which was called „The Social System” and he described the society as a system. He said each function in a society could be named as a subsystem or elements, and these elements have input –output connection and through this connection the social system can work (Pokol, 2004). Niklas Luhmann, a German sociologist and he developed the theory of Parsons, he created an interesting type of the social system theory.

Since Dscartes, the „scientific method” had progressed under two related assumptions. A system could be broken down into its individual components so that each com-

ponent could be analyzed as an independent entity, and the components could be added in a linear fashion to describe the totality of the system. Bertalanffy proposed that both assumptions were wrong. On the contrary, a system is characterized by the interactions of its components and the nonlinearity of those interactions. In 1951, Bertalanffy extended systems theory to include biological systems and three years later, it was popularized by Lotfi Zadeh, an electrical engineer at Columbia University (McNeill and Freiburger, 1993). One common element of all systems is described by Kuhn. Knowing one part of a system enables us to know something about another part. The information content of a „piece of information” is proportional to the amount of information that can be inferred from the information. Systems can be either controlled (cybernetic) or uncontrolled. In controlled systems information is sensed, and changes are effected in response to the information. Kuhn refers to this as the *detector*, *selector*, and *effector* functions of the system. The detector is concerned with the communication of information between systems. The selector is defined by the rules that the system uses to make decisions, and the effector is the means by which transactions are made between systems. *Communication* and *transaction* are the only intersystem interactions. Communication is the exchange of information, while transaction involves the exchange of matter-energy. All organizational and social interactions involve communication and/or transaction (Kuhn, 1974).

### **Self organisation and endogenous development of systems**

The systems' development, the self-organisation and the self-creation are important parts of the general system theory. Dynamic balance and dynamic change have been mentioned in the previous chapters. To talk about endogenous development in a community as a system, we need to have the minimal criteria. The most basic condition is viability. As long as viability is not present in a community, it is difficult to talk about endogenous development. If viability is present in a community, the heuristic self-organisation theory needs to be adopted. This theory supposes that, in the case of complicated organisations and dynamically changing environmental conditions, the numerous factors that affect the behaviour of an organisational system, their relations and correlations cannot be known exactly and cannot be modelled. The lower level organisation tries to form its own environmental conditions so that, by the means of its own self-sufficient, self-initiative and self-developmental activities, it can react in the desired direction and to achieve the desired goal. The integrated effects, that can eliminate the incidentally false behaviours, function as feedback. If there are viable communities and the heuristic self-organisation theory is adopted, the endogenous development theory can be realised, that is the development does not have to be defined by external potencies (Szakál, 2004). The endogenous development has been already observed by numerous experts. The endogenous development has many

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<sup>1</sup> To define viability is not easy, Szakál (2004) stipulates it to minimal criteria like the composition according to the total number, age and employment structure, and skill. Of course it is more complicated what we mean by viability, but in this study we rely on Szakál's criteria when talking about viability.

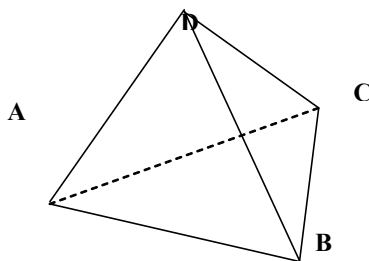
characteristic features. The most imported ones are as follows: the possible developments are defined at the local level, local supervision controls the development process, and the advantages deriving from the development are used at the local level. The endogenous development is based on local decision, maintains the profit returning on high level in the local economy and it respects the local heritage (Slee, 1994). The endogenous development are not based on external factors, but on the local content, local resources like the potential of the local economy, the local labour and knowledge, and all these relate to the larger production processes. The endogenous development approach is capable of dynamizing the local resources and of restoring the healthy processes. In practise, the endogenous development creates self-centred growing processes, and so it augments its role compared to the total sum, namely it will be able to allocate the resources properly (Long and van der Ploeg, 1994). Development exists even if we do not intervene into the changes outwardly. Systems and communities go through certain processes or are being changed. If they change in a positive way, then it is development, if the change is undesired, then it is decay or degradation. Development needs to be a conscious intervention, whose last purpose and result is improvement (Farkas, 2002). Improvements based on the endogenous development cannot disregard the external capacities. Isolation in the local capacities may block the ability to affect the external capacities. However, the development based on the wish of the outsiders may lead to dependency (Hoggart and Buller, 1994). It is important to achieve harmony between the two approaches. This question may be solved by the united application of The Holistic Integrated Approach and the General Spider Map Theory. The bottom-up-approach development supposes viability, heuristic self-organisation and a local community able to develop endogenously. Without these, it is very difficult to start any bottom-up development, as there is no instinct to survive in the local community. This principle has an exceptional role in the General Spider Map Theory. To construct the criteria of the endogenous development, we need to apply the principle of subsidiarity. Decisions have to be made on the level where there is an effect and where the interests of the local communities do not get damaged.

#### *System-approached developments in local areas*

Enyedi divides environment in his system-approach as follows. Physical environment (natural environment) is one of the sub-system of the environmental major system. Further sub-systems of that are the natural environment and the transformed environment. The social-economic environment is another sub-system of the environmental major system, and there are further three sub-systems of the social-economic environment: the artificial, the economical and the mental environment. It is ecology what deals with the integration, relation and interaction of live organisms and environmental systems. Ecology is considered as across sectional approach from the system observing, and as a holistic approach from the sub-system observing point of view. Consequently, ecology describes developments from a holistic approach, of which the key elements are the various environmental sub-systems and their relations (Enyedi, (2000).

The best-known system-based approach may be the tetraeder modell of Tóth. This special space-approached model was designed by Tóth József. It basically demonstrates the balance and the cooperation of the natural-social-economical and infrastructural spheres of a settlement. These four spheres are demonstrated with a tetraeder.

The tetraeder modell of settlements by Tóth



Source: Trócsányi – Tóth ( 2002)

$ABC\Delta$  – natural sphere,  $ABD\Delta$  – social sphere.  $BCD\Delta$  – economic sphere,  $ACD\Delta$  – infrastructural sphere. Less developed and more developed branches and regions are present along the sides of the tetraeder. Along the edges, where the spheres meet, interactions come into existence. In this way the tetraeder illustrates a living, harmonised settlement in a unity. If each spheres of a settlement are balanced, the construction of the tetraeder is stabile. If any of the spheres gets damaged, the development of the settlement slows down, the tetraeder becomes distorted, and consequently the other spheres' function will decrease (Trócsányi and Tóth, (2002).

In chemistry and biology, mechanical models are being substituted by holistic – dynamic models. James Lovelock and his Gaia Theory is a significant representative of the holistic - dynamic approach. The World is a uniform, self-regulatory system, and a community of mutually related systems on the level of planets (Komor, 2005). This change of paradigm is present in the social sciences as well.

Bassie Wessels (2003) explained the essence of this approach as follows. The holistic approach is based on the General System Theory and on cybernetic. It contains the holistic interactivity, flexibility, dynamics and multidisciplinary developments. This strategy gives a significant role to the enhancements of co-operations, by the help of which the holistic and sustainable development can be reached. The goal is, by mobilising the society, to create a plan and a vision on every level able to reach the integration, the unity and the economical increase in a community.

The holistic integrated method creates three-in- one partnership model. It starts to develop the model from inside to outside. The core of the model is this three-in-one concept and around this we put one more and more layer, “spikes”. The three elements are the: Services, Higher Education and the Communities. This establishes the heart of the model;

we can call it development network. If we think in deep of the message of the model we can understand what the reason of the three-in-one model is. As it has mentioned before to create sustainability and comparative advantages the human resource investments are crucial. Without the participation of the Higher Education the research and development, the health care is out of control, and there is no internal inspiration. The services partly can handle the financial control of the development. So we can say that the strong unity of these three sectors can generate a good foundation of the development. In sophisticated way we can say the Unity of the “Trinity”.

To understand the whole concept we have to open this model. The holistic integrated model consists of eight integrated steps which can be used in several subjects. According to the General System Theory this model can be adapted in numerous activities like: situation analysis and diagnosis, planning and policies, technological development and diffusion, micro and macro economical development. It shows the multidisciplinary of the model.

### *Community network*

Each community has an already existing network. It is the base of the development. The General Spider Map Theory concentrates of this step. To create a community means the people in a group bring together their each network. It will set up the community network. **Managers:** take care of the process of the development: they coordinate and manage it. They lead the different activities and take part of the planning and the implementation procedure. **Higher Education:** –academics, researchers- has key role of the development of the human capital capacity. They have the tools how to educate and train people. Their responsibility is to make applicable theories and help to the communities to put the theory in practice. The Higher Educations not only own the human capitals, they also have cash capital to influence the way of the development. **Local government:** The members of the local government are the formal managers who are elected by the community members. They have the role to create better infrastructure, local policies. They are the link between the state governments. During the planning process they are responsible for represent the top-down policies and also to represent the bottom-up needs. They can formulate the balance between the two approaches. **State Government:** The state government has several roles. According to the national policies the have to build clear legacy atmosphere to provide a social network for everyone, solidarity for the disadvantages people, comparativeness for the entrepreneurs. The state government should protect each citizen from the hunger, the poverty and the external enemy. They responsible the tax distribution, so financially their role also to assist in the underprivileged areas. **Private Sector:** The state government cannot solve all of the financial support. With the creative and innovate partnership is compulsory from the private sector part. The whole development cannot be possible without the Corporate Social Responsibility (CSR). **International partners:** In a specific stage the first six steps are enough to set up a sustainable development. The international partners can bring energy knowledge into the system. Their participation is es-

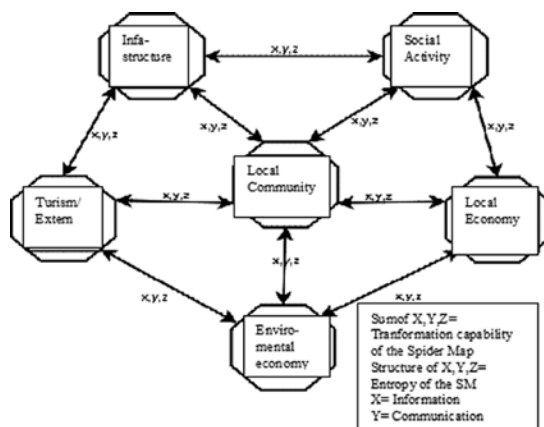
sential in the globalize World. Their input and invention can crystallize the development route. **Donors:** The situation of the donors is not always obvious. With a well developed holistic integrated system the donors can bring new input to the system and they can be sure that the money what they donate is like the seeds in a good soil (Wessels, 2003).

*Define the elements of the system by the General Spider Map Theory*

The methodology of the development should look like as a Spider map. The spider map contains five pillars –Tourism, Social Activity, Economy, Infrastructure, and Enviromental-economy - around the Social Community. These pillars are the fundaments of the development. All of the subsystems are open systems and they can interact and react to each others. The pillars are strung to each others like the spidernet. We must not develop only one segment –pillar- otherwise the spider map will be broken. The harmony inside the net will disappear. For the sustainable development we need the equivalent “stretching” – pushing, pulling -. All of the pillars are connected to each other and any interaction affects everything. So the spider map is a sensitive system like in the real spider net. “It has been said that something as small as a flutter of a butterfly’s wing can ultimately cause a typhoon halfway around the world.” Only the external request could destroy the sensitive circumstances inside the local system, it could create a buffer –“fluffy”- space, which will be not able to “sponsor” itself for longer period; it means the sustainability in a danger. It is important to put “energy” in the system but at first the local community has to have the starter needs.

There are three tools which connect to each other the elements of the system. The three tools are the information, communication and the cohesion. The sum of these three tools shows the capability of the transformation of the system. If the net is broken or one of the elements does not work properly the transformation capability of the system is lower. It does not mean that the system is not able to work it means that the condition of the system is not sustainable. Before starting the development process it is necessary to observe and research the elements of the system. To understand the mechanism of the spider map we need an entrance point into it. The entrance point could be the Social Activity pillar. Without local brave and needs, the whole development is a wasted time. We cannot develop a system without internal request. So if we want to entrance to the “net” we need relatively strong local wish to be develop. The decentralized local bodies and the bottom-up approach are necessary for the sustainable development.

The development has to be a socio-economical influence, which brings together the community, involves the small entrepreneurs to the economical circulation, activates the local education, establishes unique attraction, raises the local heritages, creates equal opportunities for the inhabitants and brings the gap between the less developed and well developed areas (Nagy and Káposzta, 2003).



Source: Own edition

**The System of External relation (tourism)** is an open system because of its relation to the environment. Since the tourism system is not just characterized by its environment, the tourism also effect its environment, the tourism has input and output relations. Each element is operated functional and spatial, the elements are related in physically, technologically, socially, culturally, economically and politically. The dynamic elements of the tourism system are the moving people (Fekete, 2006). The impotency of the tourism is the external capital which can come to the local community. It is a financial and social-mentally refreshment of the area. The financial refreshment means that from outside the community gains money –it is given “new energy” into the system-. The social-mentally refreshment means that the community gets new inputs, ideas. They won’t be isolated from the global economy and they can integrate to the global circulation, which helps them to increase their potential. The **Social Activity** is an abstract system which can be an entrance point to the Spider Map. The Social Activity could be a synonym of the capability of endogenous development. The Social Activity is like the spider spinning the net. This element is responsible for the equivalent development if something is wrong through this pillar we can fix the problem if the Local Community needs something, assisting with this channel we can reach the target point. The Social Activity produces the virtual internal energy, controlle and monitors the development process. The feedbacks can be materialized in that pillar. The Social Activity has to involve the local education to create long term developing plans. The Social Activity can work if the relations inside the Local Community are honest and carries the trust. **The Local Economy** has to involve the small firms, entrepreneurs and companies. It gives the pulsation of the Local Community and establishes the quality life. All of the activities are part of the economy which create own income, transform the money, give added value. The **Infrastructure** development is the most visible affect in an area. It is an important element but sometimes we think that only infrastructure development can cause better life style. Without good infrastructure it is hard to reach any better stage but only the development of this pillar

won't cause equivalent opportunities. This element strongly connects to the economy and tourism also. The infrastructure includes the followings: road (accessibility of the area), water, telecommunication, post office, local education and information centre (e.g.: library, internet coffee), health centre (ambulance opportunities) shops and entertainment facilities. The **Environmental Economy** strongly connects to the natural environment and the principals of it. To create profit maximalization, provision and models are the most difficult task in this pillar. The environmental economy can be useful in rural, semi urban and urban areas as well.

None of the pillars can be developed separately. If the development concentrates only one pillar the sustainability is in threat. Each pillars has an own spider map as we call „sub-spidernet”.

*Reductionist approach for evaluating the structure of the elements of the development, interpretation of Spider Map Entropy observation*

The entropy was used at first in the physics and in the thermodynamics. The entropy is the position variable of the homogenous thermodynamics systems. The entropy is standard in reversible process and changeable in irreversible process. All of the systems' entropy grows which have been left alone. The entropy is originally Greek word that means „inversion”, „conversion”. Clausius used this notion for describe the way of flow of energy (Bihari, 2001). Shannon worked out the entropy in the communication of information mathematics. He was mainly interested in the telephone lines systems. Warren Weaver expanded this notion for the whole information technology (Komor, 2005). The expression of entropy can be transform to the social systems as well. This system characterized by the interactions of human beings' information possession and the interaction of the subsystems. The social energy is materialized through these interactions. In these systems the entropy is the growing of the unordered symptoms. In an ordered structured system the symptoms are more calculable and safety. The difficulty of the social interaction raises the unordered symptoms and the softness decreases. The structure of the relation characterizes the system not the number of the elements (Bihari, 2001). The order of the sign of the information is the sign of the entropy. A system's entropy is the level of the system's unordered symptoms.

Let us consider the spider map-type system as a satisfactory structure where information streams properly and does not lead to disorder. If we accept this supposition, we have to observe those factors that after all can cause disorder in a spider map. The General Spider Map Theory claims that it is the sum of information, communication and cohesion that defines the transformative ability of the spider map. If we accept that the spider map structure is sufficient, we have to find what causes the system's disorder. Three states are distinguished in the process of the observation: low entropy, medium entropy and high entropy spider map.

**Low entropy:** those systems and sub-systems are considered to dispose low entropy, for which it is true that their spider map is not broken. The relations of the pillars are transparent and perceptible. There is total balance of sustainability in these systems.

There is no need for external development; they are able to adopt the inputs that assure the sustainability of the system constantly. There is no information, communication or cohesion disorder. These are the idealistic features of a spider map.

**Medium entropy:** those systems and sub-systems are considered to dispose medium entropy for which it is true that their spider map is partially broken. The relations of the pillars are not evident and sometimes non-perceptible. In these systems there is potential for sustainability, but they are in their present status not sustainable. A light dependency is perceptible when it comes to external development. Information, communication and cohesion disorder can appear.

**High entropy:** those systems and sub-systems are considered to dispose high entropy whose spider map is completely broken. The relations of the pillars are neither evident nor perceptible. There is potential for sustainability in these systems, but they cannot realise it in their present status. A strong dependency is perceptible when it comes to external developments. Mass disorder of information, communication and cohesion can appear. Spider Map entropy observations are based on empirical research. The qualitative observations need further research.

## REFERENCES

- BIHARI P. (2001): Technical thermodynamics (In Hungarian), Budapesti Műszaki és Gazdaságtudományi Egyetem, Budapest
- DÉNES T. (2000): Safety information society? (In Hungarian). [http://www.titoktan.hu/\\_raktar/\\_e\\_vilagi\\_gondolatok/4.GondolINFTARS.htm](http://www.titoktan.hu/_raktar/_e_vilagi_gondolatok/4.GondolINFTARS.htm)
- ENYEDI GY. (ed.) (2000): Rural environment of Hungary (In Hungarian). MTA, Budapest
- FARKAS T. (2002): Rural development in the view of developmental theories and development concepts (In Hungarian). Tér és Társadalom 1.
- FEKETE M. (2006): Tourism from theory to practice (In Hungarian). Nyugat-Magyarországi Egyetem Közgazdaságtudomány Kar Doktori Iskolája, Sopron, pp. 8.-24.
- FRÖHLICH, W. D. (1996): Psychological dictionary (In Hungarian), Springer Kiadó, Budapest
- HOGGART, K., BULLER, H. (1994): Rural Development (In Hungarian). In: Madarász I. (ed.): Szöveggyűjtemény a Vidékfejlesztés szociológiája tantárgy tanulmányozásához. Szent István Egyetem, Gödöllő
- KOMOR L. (2005): Psychology of economy (In Hungarian). Szent István Egyetem, Gazdaság és Társadalomtudományi Kar, Vezetéstudományi Tanszék, Gödöllő
- KUHN, A. (1974): The Logic of Social Systems. Jossey-Bass, San Francisco
- LONG, A., VAN DER PLOEG, J.D. (1994): Endogenous Development: Practice and Perspective. In: van der Ploeg, J.D., Long, A. (eds.): Born from Within, Practice and Perspective of Endogenous Rural Development. Van Gorcum, Assen, pp. 1.-7.
- MARÓDI M. (2003): Chaos in social sciences? (Mis)-interpretation of chaos theory in social sciences (In Hungarian) In: Fokasz N. (ed.): Káosz és a nem lineáris dinamika a társadalomtudományokban. Budapest, Typotex Kiadó, pp. 13-29.
- MCNEILL, D., FREIBERGER, P. (1993). Fuzzy Logic. New York, Simon & Schuster, New York, pp. 22.
- NAGY H., KÁPOSZTA J. (2003): The role of multifunctional environmental policy in the agricultural development. 10th Congr. Polish Assoc. Economists of Agriculture and Agribusiness, Kosalin, Poland. Annals Polish Assoc. Agric. Agribusiness Economists 5, (6) pp. 28-34.

- POKOL B. (2004): Dual structure of the society (In Hungarian). *Szociológiai Szemle* 3, 36.-51.
- SLEE, B. (1994): Theoretical Aspects of the Study of Endogenous Development. In: van der Ploeg J.D. and Long A. (eds.): *Born from Within, Practice and Perspective of Endogenous Rural Development*. Van Gorcum, Assen, pp.184.-195.
- SZAKÁL F. (2004): Environmental economy Part II. (In Hungarian), Szent István Egyetem Környezetgazdálkodási Intézet, Gödöllő, pp. 85.-131.
- TRÓCSÁNYI A., TÓTH J. (2002): Cultural geography of hungarians Part II. (In Hungarian), Pro Pannonia Kiadói Alapítvány, pp. 23.
- WESSELS, S.J.B. (2003): Case Study: An Holistic Integrated Approach as a possible modell to address the challenges faced. MUCPP, Bloemfontein