CASE STUDY OF A SPIDER WEB ENTROPY ANALYSIS

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ABSTRACT
In our paper we will present a part of a result of a complex research, which in we have examined ***five approaches of system analysis*** from the development aspects of rural areas. ***The cross-sectional system analysis approach*** helps us to understand the different outputs of relations and interactions between individual systems and underlines the importance of ***harmony*** between individual systems and the limits of growth regarding economic, social and environmental systems. ***The development system analysis approach*** emphasizes that an area can be defined as a system, too. The inappropriate interventions may cause distortions in the systems and the ideal tetraeder-like theoretical system will be upset. ***The functionalist system analysis approach*** tries to define the functions within the system. The definition of functions within the system is inevitable for drafting the development. In order to ensure the most efficient utilization of development sources, the functions of subsystems and their possibilities within the system should definitely be understood. ***The holistic system analysis approach*** focuses on the complexity of an area and helps to learn the system as a whole. The theory tries to consider all those elements that can be involved in the development and aims to describe these system elements in their complexity. ***The reductionist system analysis approach*** takes apart the system to its elements and aims to draft development concepts from the totality of the components. In our paper we will present the ***combination of the five approaches*** (***Spider Web Entropy Analysis***) through a case study.

INTRODUCTION

All the five system analysis methods that were examined are suitable from their own aspects to highlight the problems of an area and to provide basis for drafting the future developments. The detailed examination of individual models, however, showed clearly that they have weaknesses and they try to describe the problem not in its complexity but according to a randomly chosen logical system. On the basis of the above, such a situation analysis and strategy development attitude is required which is able to synthetize the individual system analysis methods appropriately. The general spider web theory can be regarded the synthetization of the five types of system analysis approach (GODA et al., 2008).
Based on the complexity of inequalities of the territories is not advantageous to do an examination only in one dimension NAGY- KÁPOSZTA (2006). KÁPOSZTA et al. (2008) highlight the subsystems of the development are in sum and part relationship with each other, and they act as a sensitive system. The entropy analysis is not unfamiliar way of the territorial researches. The phenomena of entropy come from the Information Theory, which can be used for comparing the distribution of two territories’ quantitative criterion (NÉMETH, 2005). Based on the researches of PESTI (2009), the agricultural production structure analysis of the entropy can be used in practice. The index that varies between the items "ordered" refers to the distribution. NEMES NAGY (1998, 2005, 2009) also deals in detail with the problem of orderliness in his number of scientific work, mainly in the order of the regional spatial structure understands. The abstract way of thinking the meaning of

entropy theory formed the so-called spider web-entropy analysis, which helps to find out how is the structure order between the pillars of the spider web.

SPIDER WEB ENTROPY ANALYSIS

Besides the examination of pillars one by one, the other objective of situation analysis is to map the relations between pillars. This objective can be fulfilled by spider web entropy analysis. The mathematical basis of spider web entropy analysis is provided by the objective, subjective and corrected cohesion. Objective cohesion indicates the strength of relation between the statistical data of pillars (basis of objective regional subindices). The correlations of indices within one pillar are not considered as the results of correlation matrix, because the objective is to determine the strength of relations between pillars and not to examine the strength of relations within a pillar. The „r_i" values received are regarded as weight in the determination of relations between two pillars. The relation between two pillars is expressed as the product of multiplication of individual objective regional subindices and the belonging „r_i" value. Thus the relation of two pillars can be described as the weighted average of objective regional subindex number „n", weighted with „r_i" value. On the basis of this, the objective cohesion of two pillars can be expressed with a calculation consisting of several steps.

Following the drafting of correlation matrix, the first step is the determination of average correlation of indices to another pillar. The determination of average correlation should be calculated with geometric mean, but due to the correlations outlined in the dissertaion, the average correlation can be calculated in two ways:

if it is true that $rp_{i_j}-p_{j_i} \in R_0^+$ és $rp_{i_j}-p_{j_i} \in Z^+$, then

$$\bar{r}p_{i_1}-p_j = \sqrt[n]{\prod rp_{i_1}-p_{j_k}}$$

if it is not true that $rp_{i_j}-p_{j_i} \in R_0^+$ és $rp_{i_j}-p_{j_i} \in Z^+$, then

$$\bar{r}p_{i_1}-p_j = \frac{\sum_{i=1}^{n} rp_{i_j}-p_{j_i}}{n}$$

where: $\bar{r}p_{i_1}-p_j$ is the average correlation of the first index of pillar i to pillar j

The average correlations and the formerly calculated objective regional subindices will help to draft the objective cohesion (OC) of two pillars, according to the following calculation:

$$\overline{OC}p_{i}-p_j = \frac{ORI_{p_{i1}} * \bar{r}p_{i_1}-p_j + \cdots + ORI_{p_{in}} * \bar{r}p_{i_n}-p_j + ORI_{p_{j1}} * \bar{r}p_{j_1}-p_i + \cdots + ORI_{p_{jn}} * \bar{r}p_{j_n}-p_i}{\sum \bar{r}p_{i_n}-p_j + \sum \bar{r}p_{j_n}-p_i}$$

where: $\overline{OC}p_{i}-p_j$ is the objective cohesion of pillar i and j

Subjective cohesion expresses the strength of relation between data of pillars coming from questionnaires (basis of subjective regional subindices). The theoretical process of calculating subjective cohesion is the same as the calculation of objective cohesion. Values „r_i" are calculated from the correlation matrix made of responses given to the questionnaire.

The relation between two pillars are given as the product of multiplication of individual subjective regional subindices and the belonging „r_i" values. Thus the relation between two pillars can be described as the average of SZT subindices number „n", weighted with given „r_i" value. The methodology of calculating „r_i" value is the same as the calculation used for objective cohesion.

The subjective cohesion (SC) of two pillars can be drafted with the help of average correlations and the formerly calculated subjective regional subindices, according to the following equation:

$$\overline{SC}p_i\text{-}p_j = \frac{SRI_{p_{i1}} * \bar{r}\, p_{i1}\text{-}p_j + \cdots + SRI_{p_{in}} * \bar{r}\, p_{in}\text{-}p_j + SRI_{p_{j1}} * \bar{r}\, p_{j1}\text{-}p_i + \cdots + SRI_{p_{jn}} * \bar{r}\, p_{jn}\text{-}p_i}{\sum \bar{r}\, p_{in}\text{-}p_j + \sum \bar{r}\, p_{jn}\text{-}p_i}$$

where: $\overline{SC}p_i\_p_j$ is the subjective cohesion of pillar i and j

The adjusted cohesion for the relation of two pillars can be given by the geometrical average of objective and subjective cohesion, by applying the following equation:

$$\overline{AC}p_i - p_j = \sqrt[2]{\overline{OC}p_i - p_j * \overline{SC}p_i - p_j}$$

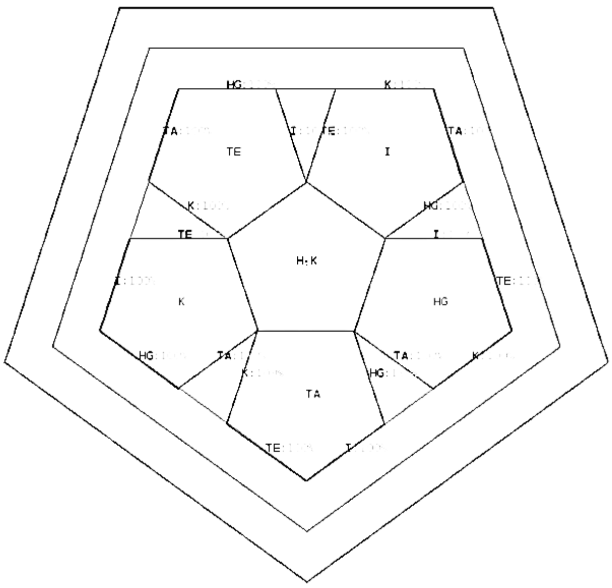
where :$\overline{AC}p_i\_p_j$ is the adjusted cohesion of pillars i and j
$\overline{OC}p_i\_p_j$ is the objective cohesion of pillars i and j
$\overline{SC}p_i\_p_j$ is the subjective cohesion of pillars i and j.

The conclusions in the examination of entropy are made from the cohesion outcomes. We distinguish three states: spider web of low entropy, medium entropy and high entropy. These states are determined as follows:

if, $\overline{AC}p_i - p_j \vee \overline{OC}p_i - p_j \vee \overline{SC}p_i - p_j = 1$, then the relation of the two pillars has ***low entropy***
$1 > \overline{AC}p_i - p_j \vee \overline{OC}p_i - p_j \vee \overline{SC}p_i - p_j \geq 0{,}5$, the relation of the two pillars has ***medium entropy***
$0{,}5 > \overline{AC}p_i - p_j \vee \overline{OC}p_i - p_j \vee \overline{SC}p_i - p_j = 0$, the relations of the two pillars has ***high entropy***
where:$\overline{AC}p_i\_p_j$ is the corrected cohesion of pillars i and j
$\overline{OC}p_i\_p_j$ is the objective cohesion of pillars i and j
$\overline{SC}p_i\_p_j$ is the subjective cohesion of pillars i and j.

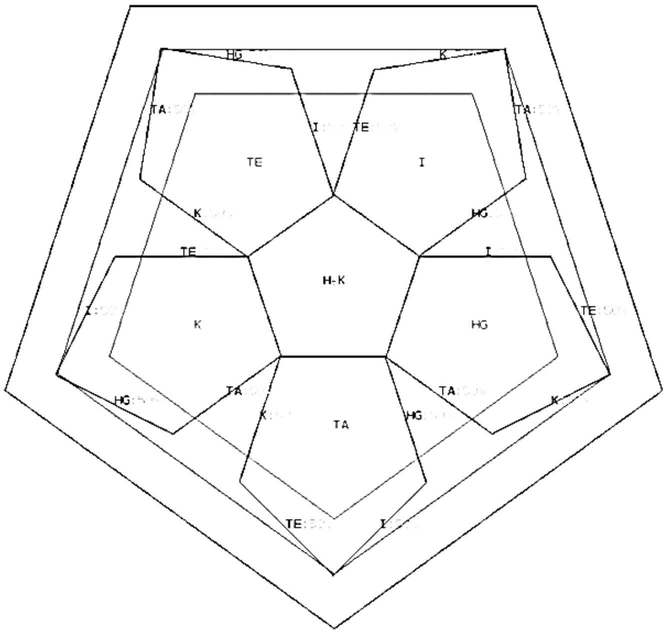
The examination of spider web entropy is assisted by a visualization method we developed. Each pillar is has four points of contact to the other pillars. The relation of pillars to themselves is not examined, therefore it always has fix value in the model. There are altogether sixteen contacts on the figure, which is equal to eight real contacts, because the relation between two pillars appears twice but contains the same information. The introduces the relation in an inverse proportion. If the tightness of relation is close to zero, the hole on the web can be observed.

The spider web with low entropy is a theoretical spider web in which the relation of all the pillars show ***low entropy.*** The relations between pillars can be seen and sensed clearly. Completely sustainable balance is formed in this system. The structure of the spider web is in order, there is no hole in it.



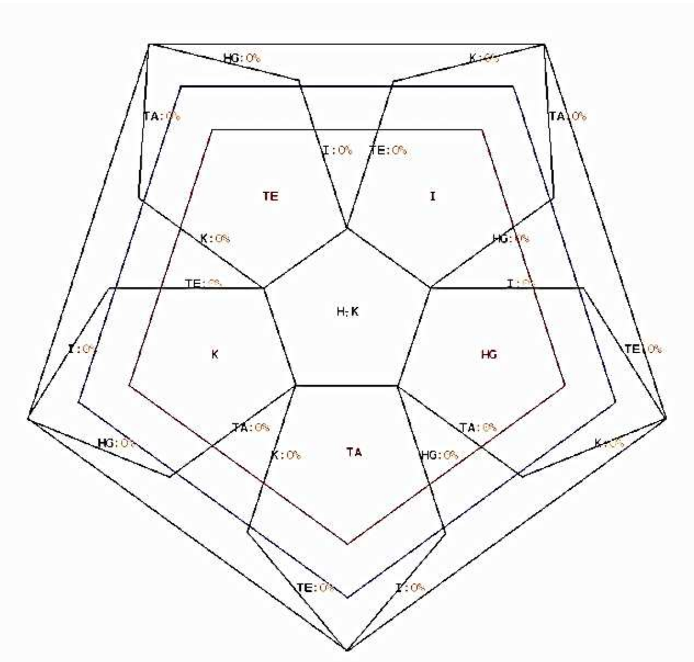
The spider web with low entropy
Source: GODA, 2012

The spider web of medium entropy is a theoretical spider web, in which the relations of all the pillars have ***medium entropy,*** there is a fractional hole on the spider web. The relations between pillars are not clear and sometimes cannot be detected. There is a potential for sustainability within the system, but not in its current state.



The spider web with medium entropy
Source: GODA, 2012

The spider web with high entropy is a theoretical spider web where the relations of all the pillars have ***high entropy,*** there is a full hole on the spider web. The relations between pillars are not clear and cannot be detected. There might be a possibility of sustainability within this system but in its current state, it is unable to enhance it.



The spider web with high entropy
Source: GODA, 2012

CONCLUSION

The spider web entropy examinations on *Figure 1,2,3* can be regarded theoretical cases. There are almost innumerable possibilities of variation for relations between pillars. The outlined figures are basic categories, with the combination of which we can meet during the research work. The variation opportunities of the relations among pillars is almost endless. We can meet the combinations of the above outlined basic categories in some regional research projects. The separate examination of pillars and the spider web entropy analysis should always be made collectively because the separate explanation can be misleading. Although a lot of information can be received from both outputs, the picture will be complete only if the analysis is made together.

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