

Possibilities of Applying of Subtle Sets in Qualitative and Quantitative Study of Information Relevance

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Abstract: A set of elements having certain valuable property from the different criteria, conditions, tests point of view, represents one of the simplified definitions of subtle sets. Information relevance is considered to be part of subtle sets which is giving the quality of managerial decision making. In this paper are presented some ideas concerning the possibilities to apply subtle sets on studying qualitative and quantitative relevance of information and the synergy of informational relevance of economical concepts. The information relevance is useful in decision making and could be a real tool for organization' management.

Keywords: Information. Subtle sets. Information relevance. Synergy of informational relevance

1. Introduction

The aim of every activity developed by economic agents is the gaining of a high profitableness through efficient use of available resources.

This is also the reason for which contemporary society is more and more dominated by the biome „information-scientific reasoning” in the disfavor of that already obsolete „experience-intuition”.

The base of gaining of pretty good solutions in acceptable time, delivered through solving of the right economic-mathematic models, is the existence of an informational set, decisional, cybernetic, corresponding, adapted to concurrent economy demands wherein it gains „the best”, „the fastest”, „the most flexible/adaptable”.

Calling at large scale of management systems, methods and techniques for decision basing, wholly relied on data self-conditioning becomes a need for all leading levels and domains.

2. Information – important element in decision process

The importance of information and informatics systems has been synthesized by J. Naisbitt from the result of a calculation that has tried to establish how many percents of working power of USA is directly engaged in making, using or delivery of information. Pointing that the study has been realized in the middle of the eighth decade of last century, the results are impressing, even to USA – the percent of so-called knowledge workers has proved to be about 70% from the whole.

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The development of information technology brought to the inclusion of information as the sixth organization resource, besides human resources, machines, financial resources, materials and management. Even in the condition of not-to-touch state, information represents an extremely economic and efficient way to rejoin the other resources of the firm. Additionally, information is used both to the assistance of the other five resources in the coordination of organization activities and for planning, direction and checking of these activities. In this context, informatics system building reliable for decision assistance, appears as priority for the new wave of managers.

In a classification of resource importance in management, in the second place, after human factor, there is the quality and repetition of information in business. Nowadays, even if information is no more under-evaluated, underestimated and under-used, like the last years, however, there is a series of problems joined to its use within decision process. Generally, these problems refer to the quality and value of information, to the amount of information sent to managers and to their cyclicity (Andreica,2000[1]).

Quality information is that information which creates value through use and is characterized by the following elements: it is relevant for its objective, is exactly enough for its objective, is complete enough for the problem whereat it refers, is from a trusty source for the user, is communicated at time for its objective, is suitably detailed, is communicated through a suitable channel and it is understood by user (Coculescu,2005[6]).

3. Possibilities of applying of subtle sets in qualitative and quantitative study of information relevance

A set of elements which have a namely characteristic checkable with several criteria, conditions, tests etc, represents one of the simplified definitions applied to the concept of subtle set. In the sense of this definition is also information relevance (Negoita and Ralescu,1974[11]).

Truly, in a following system implemented into an enterprise, there are used a series of characteristic economic concepts like, for example: efficiency, profit, demand, quality, realized production, production capacity, putting out of operation, indices of accomplish of contract items of range j, insurance level of the resource of range i etc.

These concepts are information sources which sustain management decision and which represent elements of the subtle set that we define in this context.

The property (characteristic) followed here is information relevance (IR) which gives decision quality and names the subtle set (Bel and Dubois,1985[2]).

IR can be considered from several quantitative and qualitative criteria marked as f_1, f_2, \dots, f_m whose it associates them senses marked g_{0j}, g''_{0j} etc.

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Thus, to the criterion f_1 there is associated the significance g_{0j} , which represents relevance degree of range $I(g_{0j})$ of an economic concept of range j which is computed by the means of relation:

$$g_{0j} = \frac{\sum_{t=1}^{n_j} \rho_{tj} + \sum_{z=1}^{m_j} \rho_{jz}}{n_j + m_j}$$

where:

ρ_{tj} - correlation coefficient between the concept of range t and the concept of range j ;

ρ_{jz} - correlation coefficient between the concept of range j and the concept of range z ;

n_j - number of economic concepts which influence the concept j ;

m_j - number of economic concepts that concept j influences them;

To the criterion f_2 , there is associated the significance g_{0j}'' which represents relevance degree of order $I(g_{0j}'')$ of an economic concept of range j which is computed by the means of the following relation:

$$g_{0j}'' = \frac{\sum_{(t,s) \in D_j} R_{j/ts} + \sum_{(j,u) \in E_j} R_{z/ju} + \sum_{(v,j) \in F_j} R_{w/vj}}{\text{card}D_j + \text{card}E_j + \text{card}F_j}$$

where:

$R_{j/ts}$ - whole correlation coefficient which measures the dependence between concept j and combination of two concepts t and s which influences it;

$R_{z/ju}$ - whole correlation coefficient between a variable z , which is influenced by the combination of concepts between v and j ;

D_j - manifold of concept pairs (t,s) which influences the concept j ;

E_j - manifold of concept pairs which contain concept j , combined to another concept u and that influence z ;

F_j - manifold of concept pairs (v,j) which influence concept w ;

$\text{card}D_j, \text{card}E_j, \text{card}F_j$ - the cardinal (number of elements) of the sets

D_j, E_j, F_j ;

As the like, we define the criteria:

f_3 - propagation speed of considered economic concept from the source wherefrom it was token or observed to the place where the decision is adopted;

f_4 - the consequences of considered process over decision process which can run according to different hypothesis:

f_{41} - decision blocking when the hypothesis of information absence is on;

f_{42} - decision errors, able to be quantified by value by evaluation when the hypothesis of the use of false information is on;

f_{43} - chaos generation in the case of a surprisingly fast propagation which has as effect a chain of fault decisions especially at the manipulation given by a rumor led by false forces („occult”);

f_5 - unfitness degree of information having existing data and knowledge base, using the relation:

$$g_c = \frac{mas(Iinc)}{mas(It)}$$

where:

Iinc - incompatible information set;

It - all information set;

mas - measure of a set;

For every concept j there are establish the consequences a_{ij} according to criterion f_i .

In some cases, like: f_1 , f_2 and f_5 , these consequences are evaluated at the range (0,1) and therefore they can be considered degrees of appurtenance of a fuzzy (fine) manifold (Goodwin and Wright,1991[9]).

In other cases, like f_3 , f_4 , consequence evaluation is considered using several measure units, as they are: the number of locations run in time step, value units etc. In this case, appurtenance degree μ_{ij} is found according to the consequences a_{ij} by the means of one of the relations:

$$\mu_{ij} = \frac{a_{i\max} - a_{ij}}{a_{i\max} - a_{i\min}}$$

when the criterion f_i must be maximized and

$$\mu_{ij} = \frac{a_{ij} - a_{i\min}}{a_{i\max} - a_{i\min}}$$

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when the criterion f_i must be minimized.

In manager's panel it needs to grant priorities to economic concepts used in taking decisions. For arrange the concepts which are the elements of this set, it needs to make aggregation operation over them. After aggregation running, it results the synergy of economic concept or information relevance that allows the foundation of these priorities (Dobre *et al.*,2000[8]).

In consequence, there is gained a set IR named information relevance whose shape is the following:

$$RI = \begin{pmatrix} 1 & 2 & \dots & j & \dots & n \\ \mu_{11} & \mu_{12} & \dots & \mu_{1j} & \dots & \mu_{1n} \\ \mu_{21} & \mu_{22} & \dots & \mu_{2j} & \dots & \mu_{2n} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ \mu_{m1} & \mu_{m2} & \dots & \mu_{mj} & \dots & \mu_{mn} \end{pmatrix}$$

where m is the number of considered criteria.

4.Information relevance synergy of economic concepts

For every economic concept j appurtenance degrees marked μ_{ij} to criterion I , can be used for quantify global relevance GR_j of the concept or information j .

Before running aggregation operation it needs to cancel the redundancy of some concepts or information (Haken,1983[10]). If between the concepts k and j there is a partial dependence through correlation coefficient ρ_{jk} , then, in the case of an aggregation operation of type Cobb-Douglas, the exponents are multiplied by $(1 - \rho_{jk})$. In this case, the exponents of the concept k remain unchanged (Cooke and Slack,1991[7]).

In these hypotheses, global relevance of the concept is:

$$GR_j = \sqrt[m]{\left(\mu_{1j}^{\alpha_{1j}} \cdot \mu_{2j}^{\alpha_{2j}} \cdot \dots \cdot \mu_{ij}^{\alpha_{ij}} \cdot \dots \cdot \mu_{nj}^{\alpha_{nj}}\right)^{1-\rho_{jk}}}$$

where α_{ij} are the exponents given by statistic correlation.

If the inequality:

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$$\left(\alpha_{1j} + \alpha_{2j} + \dots + \alpha_{ij} + \dots + \alpha_{mj}\right) \frac{1 - \rho_{jk}}{m} > 1$$

is true, then the concepts used by manager in the system of following, have a positive synergy of information relevance. This means mutual filling of used economic concepts and in consequence, adopted decisions are efficient.

If the restriction mentioned above isn't satisfied, then manager's following system has a negative synergy (or at least balanced) and this show either a big redundancy degree of information, or a big unfitness degree of them, case wherein the decision is hard to be adopted and with doubt results (Raczynski,2006[12]).

Similarly, the relevance synergy for the criteria f_1, f_2, \dots, f_m associated to subtle set R_I can be computed. For this, there is defined a new subtle set Φ_I whose elements are the criteria f_1, f_2, \dots, f_m . The criteria used for this subtle set remain those of the manifold R_I that is f_1, f_2, \dots, f_m . Appurtenance degrees X_{ij} are computed and results:

$$\varphi_I = \begin{pmatrix} f_1 & f_2 & \dots & f_j & \dots & f_m \\ x_{11} & x_{12} & \dots & x_{1j} & \dots & x_{1m} \\ x_{21} & x_{22} & \dots & x_{2j} & \dots & x_{2m} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ x_{j1} & x_{j2} & \dots & x_{jj} & \dots & x_{jm} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mj} & \dots & x_{mm} \end{pmatrix}$$

If it marks r_{jk} correlation coefficient between criteria f_j and f_k , it results global relevance of criterion j :

$$GRC_j = \sqrt[m]{\varphi_{1j}^{\beta_{1j}} \cdot \varphi_{2j}^{\beta_{2j}} \cdot \dots \cdot \varphi_{ij}^{\beta_{ij}} \cdot \dots \cdot \varphi_{mj}^{\beta_{mj}}}$$

where β_{ij} are exponents found using statistic methods.

If the inequality:

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$$\left(\beta_{1j} + \beta_{2j} + \dots + \beta_{ij} + \dots + \beta_{mj}\right) \frac{1 - r_{jk}}{m} > 1$$

is satisfied for every j , then the criteria f_j used in management have a positive synergy of relevance $GRC_j (j = \overline{1, m})$.

If there are criteria wherefore restriction isn't satisfied, it need the management to re-analyze the criteria of evaluation of relevance of used economic concept system.

5. Conclusions

For information to be used by an organization as the sixth resource, it must accomplish the following conditions:

- To answer as quickly as possible to the changes of competition conditions. This way can be worked faster the new opportunities and can be reduced the sensible competition points.
- To increase internal efficiency and productivity of organization, pointing managers' productivity; this think supposes a better coordination of functional elements of organization.
- To improve the creativity, productivity and the efficiency of particular and grouped decision stuff within the organization; this think supposes the insurance of suitable instruments for crop real and real time information, the improving of information analysis and decision quality and sending, assistance and monitoring of the implementation of actions and management decisions.

These three conditions are imposed to information for gaining the certitude that it will insure getting of competitive advantage for organizations and the improving of management productivity.

Information relevance is useful in management decisions and can be a real working instrument. The steps to follow are: the establishing of case factors or of economic concepts necessary to decision, evaluation of factors using criteria, relevance analysis of links (correlations) between factors and finally, the using of relevance factor matrix in decisions.

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